Gains from Stock Exchange Integration: The Euronext Evidence

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Section 1

Executive Summary

1.1 The integration of stock exchanges produces a number of significant efficiency gains, some of which are passed on by the exchanges to their users (intermediaries, investors and issuers) in the form of lower fees, and some of which accrue directly to users:

- The integration of exchanges eliminates the duplication of costly infrastructure, thus reducing the average cost of processing a trade. The competitive constraints imposed by other trading mechanisms and the bargaining power of users induce the integrated exchange to pass on those cost savings to its members by reducing trading fees. Final investors can then benefit from this reduction in the explicit costs of trading in the form of lower brokerage fees.

- Exchange consolidation also benefits users directly:
  - First, accessing a single trading platform instead of two (or more) allows market professionals to save on the hardware, software and skilled human capital necessary to access and monitor separate trading platforms.
  - Second, integration allows investors to trade more diversified portfolios, in some cases overcoming the fact that they were previously unaware of the existence of some securities, in others avoiding the costs of having to trade through a correspondent and thus providing cheaper and more efficient access to markets.
  - Third, the integration of national exchanges and the ensuing increase in cross-border trading increases liquidity, as reflected by lower bid-ask spreads.
  - Fourth, the increase in liquidity can reduce the price concession an investor may be forced to accept for executing a relatively large order, and may be associated with a lower volatility of the securities listed on the exchange.

1.2 This paper seeks to quantify these efficiency gains and their impact on users by studying the evidence from the integration between the French, Belgian, Dutch and Portuguese stock exchanges to form Euronext, which took place between September 2000 and November 2003. This experiment makes it possible to (a) evaluate the cost savings achieved through the integration process; (b) investigate the pass-through of those savings; (c) identify other sources of direct user benefits, and (d) test the impact of integration on liquidity and, hence, on the implicit trading costs faced by the users of the exchange. This evidence is of interest also because it points to the possible effects that further integration of stock exchanges may have.
Cost savings

1.3 We find that the integration of the cash trading platforms of Amsterdam, Brussels, Lisbon and Paris into a single trading platform allowed Euronext to rationalize its operations and significantly reduce its operating costs.

1.4 Overall, the total annual costs of Euronext's continental operations fell by 137 million euros between 2001 and 2004. Ignoring certain exceptional costs incurred in 2001 as a result of the merger, the annual costs of Euronext's continental operations fell by 25% between 2001 and 2004. These cost reductions resulted from, in particular:

- **IT cost savings**: In 2003, IT costs represented 26% of Euronext's total costs and 35% of the costs of its cash trading business. The creation of a single trading platform made it possible for Euronext to eliminate the duplication of infrastructure and IT investments across the individual exchanges. This resulted in significant IT cost savings. Euronext's total continental IT costs fell by 29% between 2001 and 2004. A large proportion of that reduction is attributable to the integration of the cash trading platforms.

- **Headcount reductions**: The integration of Euronext's continental operations, in particular its cash trading platforms, also allowed the rationalisation of staff costs. In 2003, staff costs represented 37% of Euronext's total costs. Euronext reduced the staffing levels of its continental operations by 24% between 2001 and 2004.

Merger specificity

1.5 Euronext would not have been able to achieve these cost savings in the absence of a full merger between the Amsterdam, Brussels, Lisbon and Paris exchanges.

1.6 The exchanges could have entered into some form of "implicit merger" or alliance instead of a full merger. However, this would have involved either:

- a more limited form of platform integration that would not have achieved the same cost efficiencies as a full merger; or

- the same degree of platform integration and common trading rules, which would have had the same effect on competition among exchanges as a full merger, but most likely would not have secured the same cost reductions, due to the difficulty of coordinating the investment decisions of independent exchanges and fewer opportunities to reduce the duplication of corporate functions.

Pass on to final investors

1.7 The evidence shows that the average trading fee charged in Paris fell by about 30% (in real terms) in the period from December 1999 to December 2004. Average trading fees also fell in Brussels and Amsterdam. From January 2002 to December 2004, the average trading fee in Brussels fell by 30%. From January 2001 to December 2004, the average trading fee in Amsterdam fell approximately 45%.

1.8 We use standard regression techniques to investigate the impact of Euronext's integration process on the average fees per trade charged to users of the Paris, Brussels and Amsterdam stock exchanges.

1.9 Our regression estimates indicate that the creation of Euronext had a statistically significant and economically material impact on the average trading fees charged in Paris and Amsterdam. The estimates show that integration led also to a reduction in the average
trading fee charged in Brussels, but this effect is not statistically significant (possibly due an insufficient number of observations).

- **Paris fees.** The reduction in the average trading fee in Paris due to the creation of Euronext is both statistically and economically significant: according to our estimates the effect of integration on the average trading fee in Paris was a reduction of 15%, controlling for observed changes in trading volume. In other words, this effect is independent of the concomitant increase in volume, which led to an additional reduction in average trading fees in Paris.

- **Amsterdam fees.** The average trading fee in Amsterdam fell by approximately 31% as a result of the creation of Euronext. This effect is both statistically and economically significant and, again, is net of the effect of changes in volume.

**Direct user benefits**

1.10 Users of the Euronext exchanges also benefited directly from the integration of these markets, in several ways.

**Improved access**

1.11 We interviewed a number of Euronext members in order to understand how the integration of the Euronext markets has affected their businesses. We found that users of Euronext have benefited directly from the integration of its constituent exchanges. In particular:

- Integration has allowed Euronext members directly to access all the different Euronext markets. For example, a member located in Amsterdam that before the merger could access directly only the Amsterdam market, can now directly access also the Brussels, Lisbon and Paris markets, without incurring the costs of multiple exchange memberships or operating in multiple locations. In 2002, the members of the Amsterdam exchange undertook 8% of their trades on other Euronext exchanges; that number was 24% in 2004. Similar results obtain for Paris (from 9% to 18%) and for Brussels (20% to 36%).

- The process of integration has expanded the set of securities accessible to a Euronext member. For instance, for a member of the Paris exchange who was not active in other Euronext markets prior to integration, the integration of Paris with the Brussels and Amsterdam markets increased the number of tradable cash securities from 9,311 at the end of the first quarter 2001 to 13,163 in December 2001. For a member of the Brussels or Amsterdam exchanges, the increase in the number of directly tradeable securities was much larger.

- Similarly, users that previously had only indirect access to the other markets through members of the local exchange now enjoy direct access, and avoid the previous intermediation costs. This reduction in the costs of access has been particularly beneficial to those members who were not previously active across different exchanges, and can now provide their clients with a wider range of trading opportunities. Investors now benefit from access to a wider range of brokers offering trading opportunities across the Euronext markets, and therefore also from the resulting greater inter-broker competition.
• Members have benefited also from reduced internal operating costs, since now they need to interface with a single trading system and with harmonised trading rules for all the Euronext markets.

Increased liquidity

1.12 The integration process has also increased the liquidity of the merging exchanges and, therefore, reduced the implicit costs of trading. This increase in liquidity is reflected in lower bid-ask spreads, greater volume and lower volatility.

1.13 We have used standard regression techniques to investigate the impact of the Euronext integration process on these various measures of liquidity. We find that:

• The bid-ask spreads of the securities included in the main Paris index (CAC 40) fell as a result of the creation of Euronext. This effect is statistically significant for all specifications of the regression model, and cannot be attributed to a downward trend common to other European exchanges, such as the London Stock Exchange and Deutsche Börse. It is also material from an economic viewpoint: the reduction in bid-ask spreads following integration was between 40% and 48% when measuring the bid-ask spread using Bloomberg data, and 38% when using the weighted average bid-ask spread constructed by Euronext for the Paris exchange.

• The regression analysis also shows that integration led to a reduction of the bid-ask spreads of the securities in the main indices of Brussels and Amsterdam. In Brussels the effect of integration was a reduction in bid-ask spreads of 23%-30% using Bloomberg data. This effect is found to be statistically significant for all specifications of the econometric model. The effect of integration in Amsterdam was smaller (4%-11.5%) and statistically significant only under some specifications of the econometric model. In Lisbon, spreads increased following the merger but this effect is statistically significant only under some specifications.

• Trading volume in Paris, Brussels, and Amsterdam increased as a result of the creation of Euronext. This effect is statistically significant and cannot be attributed to an upward trend common to other European exchanges, such as the London Stock Exchange and Deutsche Börse. According to our estimations, the creation of Euronext led to an increase in the traded volume of the main securities listed on the Paris, Brussels and Amsterdam exchanges of approximately 40%.

• The volatility of the large-cap securities traded in Paris, Brussels, Amsterdam and Lisbon fell as a result of the creation of Euronext. The impact of integration on volatility is statistically significant and cannot be attributed to a downward trend common to other European exchanges, such as the London Stock Exchange and Deutsche Börse. The reduction in volatility following integration was between 9% and 18% of the initial levels.
2.1 The integration of two or more stock exchanges can produce a number of efficiency benefits, which can accrue directly or indirectly to the users of the integrated exchange: intermediaries (brokers), final investors and issuers (listed companies).\(^1\)

2.2 Users face two types of trading costs: (a) **explicit costs**, such as, for example, exchange fees, commissions, and the costs of clearing and settlement; and (b) **implicit costs**, which include the bid-ask spread and the price impact of orders, to the extent that large orders cause an adverse change in security prices.\(^2\) The brokers that are members of the exchange pay exchange fees as well as clearing and settlement fees, and incur IT and staff costs to access the exchange. Investors accessing the exchange through brokers face both explicit costs (broker fees and commissions) and implicit costs. The integration of exchanges can reduce both the explicit and implicit costs of trading.

2.3 Integration can reduce the **explicit** costs of trading for at least three different reasons:

- Integrating the operations of the exchanges can eliminate duplication of their fixed costs and thereby reduce the average cost of a trade for the exchange. There is evidence that these economies of scale can be substantial.\(^3\) Competitive constraints from other trading platforms and from users will induce the exchange to pass on these cost reductions to the members of the exchange in the form of reduced exchange fees.

- These efficiency gains extend to the post-trading phase as well: stock market integration results in a larger volume of trading activity (see below) which increases the efficiency of the clearing and settlement mechanism; in particular, by allowing the netting of a larger volume of trades.\(^4\) Again, these reductions in costs can be passed through to users in the form of lower fees charged by the relevant platform.

- Accessing a single trading platform instead of two (or more) allows market professionals to save on the hardware, software and skilled human capital necessary to access and monitor separate trading platforms. These savings can be passed-on to final investors in the form of reduced commissions.

2.4 Stock market integration can also reduce the **implicit** costs of trading:

- *First*, by fostering trading activity, it tends to reduce bid-ask spreads insofar as it:

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\(^1\) This paper focuses only on the costs borne by investors and intermediaries.

\(^2\) See Section 3 in M. Pagano and A. J. Padilla, *The Economics of Cash Trading: An Overview*, May 2005, for a more complete description of these cost concepts.


− helps intermediaries to defray fixed order processing costs—namely, the costs of access to the trading platform and of maintaining a continuous market presence;

− reduces adverse-selection costs, due to the presence of informed traders, provided that the additional order flow comes mainly from uninformed traders or elicits more aggressive competition between informed ones;

− reduces the inventory-holding costs of market makers, as it makes the order flow more predictable and lowers the costs of rebalancing market-makers' inventories after the execution of large orders; and

− induces entry by market professionals (brokers and market-makers), and thereby leads to greater competitive pressure both in quote-setting and in brokerage fees.

▪ Second, the increase in liquidity can reduce the price concession an investor have to accept to execute a relatively large order. Greater liquidity may be associated also with lower price volatility, insofar as a larger and more stable order flow reduces the noise induced by individual orders, and a lower bid-ask spread lowers the "bid-ask bounce" of transaction prices.

2.5 Focusing on the implications of the integration of exchanges for investors—the end-users of the exchange—they can benefit from: (a) lower brokerage fees and commissions, to the extent that the reductions in exchange fees and the lower costs of accessing the market are passed on to them by brokers and market makers; (b) access to more diversified portfolios, in some cases overcoming their former unawareness of the existence of some securities, in others avoiding the costs of having to trade through a correspondent and thus providing cheaper and more efficient access to markets; and (c) lower implicit trading costs, as a result of the increase in market liquidity.

2.6 Existing studies of the gains from integrating exchanges rely on international evidence on their cost structure or on its evolution over time. These papers show that exchanges feature substantial economies of scale and scope, and thus suggest that integration is likely to result in significant cost efficiencies.

2.7 This paper adds to this literature by providing evidence on the integration between the French, Belgian, Dutch and Portuguese stock exchanges to form Euronext, which took place between September 2000 and November 2003. The evidence from such an experiment is valuable for several reasons:

▪ First, since the process of integration was triggered by an exogenous policy decision of the exchanges concerned, it is warranted to place a “causal interpretation” on the econometric results, with the causality running from the policy shift to the estimated changes in trading costs, volumes or volatility, provided other changes in the economic environment are adequately controlled for.

▪ Second, it is based on a case where an integration process actually took place, rather than reflecting the counterfactual experiment that one could base on estimates of the cost function of stock exchanges.

▪ Third, the integration process under analysis involved sequentially several exchanges with different characteristics. This allows the empirical analysis to control to some extent

for spurious correlations, which could lead to biased estimates of the impact of integration.

- *Fourth,* the evidence makes it possible to investigate the extent to which users benefited from the integration both via lower fees (owing to the cost savings obtained by exchanges) and via increased liquidity and, hence, lower implicit trading costs.

- *Fifth,* and more generally, it provides some guidance as to the possible effects that further integration of stock exchanges may have in the future, as European financial integration gains pace also in the equity market, in the wake of the integration of the money market and the bond market.⁶

**Structure of the paper**

2.8 The paper is structured as follows. We start by describing the basic characteristics of the stock exchanges that eventually became part of Euronext and the timeline of the integration process (Section 3). Next, we examine the cost savings resulting from the integration of the Paris, Brussels, Amsterdam and Lisbon exchanges, detailing both their sources and magnitude, and we assess the extent to which these cost savings were passed on to users in the form of lower exchange fees (Section 4). We then identify and, to the extent possible, quantify the direct benefits of integration for the users of the exchange. We first consider the impact of integration on the costs of accessing the exchange and the securities listed on it. Then we investigate the impact of integration on the implicit costs of trading. In particular, we estimate the increase in liquidity associated with integration (Section 5). We conclude with a brief discussion of the potential implications of our analysis for the assessment of efficiency gains in the context of Euronext’s announced interest in the London Stock Exchange (Section 6). We present some additional econometric results meant to test the robustness of our main results in an annex (Section 7).

The creation of Euronext

3.1 The creation of Euronext in September 2000 resulted in the integration of the French, Belgian, Dutch and Portuguese stock exchanges into a single platform. Prior to the creation of Euronext, there were separate trading and clearing platforms in each geographic market, and in each of those markets the trading and clearing functions were vertically integrated. Since November 2003, the users of the Paris, Brussels, Amsterdam and Lisbon exchanges have operated on a single trading platform and a single clearing platform, which are not vertically integrated.

3.2 This process constitutes, therefore, a valuable test case to: (a) evaluate the cost savings that can be obtained following the integration of exchanges; (b) investigate the degree of pass-through of those cost savings; (c) identify and measure other sources of direct user benefits resulting from the consolidation of exchanges, and (d) test the impact of integration on liquidity and, hence, on the implicit trading costs faced by the users of the exchange.

The integration process: an overview

3.3 The creation of Euronext was the result of a process that began with discussions among eight European stock exchanges. The subject of those discussions was the possibility of a more integrated European equity market. Those discussions broke down and that group did not proceed with any concrete proposals for integration. Instead, some of its members—the Amsterdam, Brussels and Paris exchanges—decided to pursue a separate integration initiative.

3.4 Initially, this was intended to involve only the integration of their clearing arrangements. The three exchanges were vertically integrated in trading and clearing services, and therefore decided to investigate the potential benefits of integrating their back-office clearing operations. However, the three exchanges soon realised that greater efficiencies could be obtained if they also integrated their trading functions. The result was a more wide-ranging proposal for the full merger of the three exchanges—i.e., the integration of both their trading and clearing operations.

3.5 Integrating these exchanges was not an easy task. The trading platforms in Brussels and Paris were relatively similar, but differed significantly from the platform used in Amsterdam. For example, while in Brussels and Paris cash trading took place through an electronic public limit-order book where orders were matched together, the Amsterdam cash market relied on the “Hoekman”, whose role was similar to that of the specialist found on the New York Stock Exchange.7

3.6 The integration process involved the following initial stages:

Cash trading: it was decided to use the Paris market’s NSC system as the platform for all three cash markets, although some changes were made to the existing Paris Bourse arrangements. Cash trading fees were subsequently harmonized across the three markets.

Derivatives trading: the Amsterdam market moved from a floor-based to an electronic system known as Switch in August 2002. It was intended that the Brussels and Paris derivatives markets would also adopt this system, but this did not occur due to the impact of the acquisition of LIFFE, the London-based derivatives market (see below).

Clearing: the Paris market had adopted the externally sourced Clearing 21 system for the clearing of its trades for both derivatives and cash, which were integrated in September 2000 and January 2001, respectively. Clearing for the Amsterdam and Brussels cash and derivatives markets was migrated to the Clearing 21 system and clearing operations across the three locations were consolidated into Clearnet SA. However, while users already benefit from netting across the three markets, fees for clearing have yet to be harmonized across the three markets.

3.7 The integration process was affected by two subsequent transactions: (a) the merger with the Lisbon and Porto Stock Exchange (henceforth, the Lisbon stock exchange), and (b) the acquisition of LIFFE. Both transactions took place in 2002.

3.8 Following the merger with LIFFE, Euronext decided to use LIFFE’s Connect platform for all derivatives activities. As a result, derivatives trading in Amsterdam migrated first to Switch and then to LIFFE.Connect in November 2004, while derivative trading in Brussels and Paris migrated straight to LIFFE.Connect in March and April 2003, respectively. LIFFE’s trades were cleared with the London Clearing House (LCH Ltd)—although CREST Co was also involved in the settlement process.

3.9 LCH Ltd merged with Clearnet SA to form the LCH.Clearnet Group (LCH.Clearnet). At that point the trading and clearing platforms of the Euronext exchanges were vertically separated. This merger has not yet resulted in the full integration of all clearing operations, which is expected to be completed by 2007. For example:

- Clearing operations are still handled by separate subsidiaries of LCH.Clearnet—LCH.Clearnet Ltd (LCH) for LIFFE trades and LCH.Clearnet SA (Clearnet) for trades on the Amsterdam, Brussels and Paris markets.

- LCH does not at present use the Clearing 21 platform. Migration of LCH and Clearnet to a common clearing platform is scheduled to occur in the second half of 2006.

- Members active on all Euronext markets need separate connections to LCH and Clearnet.

- The process for clearing trades has remained different on the two systems. In London, trades are communicated to Crest, which processes the transactions. This involves calculating net positions and passing this information to LCH, which acts as the central counterparty. On the Amsterdam, Brussels and Paris markets, Clearnet undertakes the role performed in London by Crest.

3.10 Following the merger with the Lisbon stock exchange in February 2002, the Portuguese cash and derivatives markets were migrated to the NSC platform (in November 2003) and the Connect platform (in March 2004) respectively. Clearing was migrated to LCH.Clearnet’s Clearing 21 platform in March 2004.
3.11 Settlement on the Euronext markets is handled by Euroclear, which has developed a non-exclusive partnership with Euronext. The Euroclear system is operated by Euroclear Bank SA, a Belgian credit institution that was set up in 2000 for this purpose. In 2001, Euroclear acquired 100% of the capital of Sicovam, the French CSD and operator of the settlement system Relit and RGV, and in 2002, 100% of the Dutch CSD. In 2002, Euroclear also obtained a 20% stake in Clearnet. CIK, the Belgian CSD, is expected to join Euroclear in 2005. In September 2002, Euroclear Bank SA acquired 100% of CRESTCo, the British CSD that operates the CREST System, the settlement system used for LIFFE and LSE trades.

The time line of the Euronext integration process

3.12 This paper investigates the efficiency gains resulting from the integration of exchanges. To achieve this goal we consider the natural experiment provided by the creation of Euronext. In particular, we focus on a particular area of integration: the migration of cash trading and clearing on the Amsterdam, Brussels, Paris and Lisbon markets onto common (though vertically separated) trading and clearing platforms. The timing of that integration process is depicted in Figure 1 and Figure 2 below.

Figure 1: Chronology of integration of cash trading business

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Figure 2: Chronology of integration of clearing platform

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3.13 We shall conduct a simple “before and after” analysis around three integration milestones: the first is the integration of the clearing and trading functions of the Paris and Brussels stock exchanges (March 2002); the second is the integration of the Amsterdam trading and clearing system into Euronext (October 2002); and the third is the integration of the Lisbon stock exchange (November 2003).

3.14 We focus on the integration of the trading and clearing functions, rather than only on trading, because to operate on a given market users need to purchase both trading and clearing services. As long as clearing was not integrated, users of the Euronext single trading platform had to bear the costs of dealing with separate clearing systems, and could not benefit from the netting and cross-margin benefits of dealing with a single CCP. Thus, only after the horizontal integration of clearing were the users of Euronext able to fully realise the benefits
of the integrated trading markets. In other words, the benefits of the integration were likely to materialize after the horizontal integration of both the trading and the clearing platforms. Hence, our “before and after” analysis will be conducted using the three key dates in Figure 2. (Yet, we will test the robustness of our results by employing the dates in Figure 1 in a set of separate regressions presented in Section 7.)

3.15 In the remainder of this paper we first analyse the cost savings that resulted from the multi-stage integration process of the cash trading operations of the Amsterdam, Brussels, Lisbon and Paris exchanges by comparing costs before and after the integration of the various exchanges onto a common trading platform. We then consider whether those savings were passed through to the members of Euronext, thus reducing their explicit trading costs, by comparing average exchange fees before and after the integration. Lastly, we investigate the impact of each stage of the integration process on the implicit costs of trading. This involves a study of the reductions in users’ direct costs and an analysis of the evolution of various liquidity measures (bid-ask spreads, volume and volatility) before and after the various integration milestones.
Section 4

Cost savings

4.1 The consolidation of two or more cash trading platforms into a single platform can deliver significant cost savings. These are achieved primarily by eliminating duplication in IT infrastructure and in marketing and customer support teams.

4.2 From a merger-control perspective, what matters is whether those cost efficiencies created by consolidation of the cash trading platform are: (a) sizeable, so as to offset any anti-competitive effects resulting from the disappearance of an actual or potential competitor; (b) timely, so that their effects on consumer welfare are felt soon after the integration; (c) merger-specific, that is, caused by the merger and unlikely to occur without the merger; and, finally, (d) passed on to end users.

4.3 In this Section we first describe the cost structure of Euronext’s cash trading platform. We then consider the cost reductions achieved by Euronext since its creation in September 2000. We conclude with an assessment of those synergies from the viewpoint of merger control. That is, we investigate whether they were substantial, timely, merger-specific and passed on to users via lower exchange fees.

Euronext’s cost structure

4.4 Euronext’s total costs are largely driven by its:

- **Information Technology (IT) costs**: IT platforms are used to support a central order book and provide trade-matching services. Euronext has outsourced the provision of much of its IT requirements to a third-party supplier, AtosEuronext—a 50-50 joint venture between Euronext and AtosOrigin.

  AtosEuronext owns and operates much of the IT hardware and software used by Euronext, and provides the staff resources needed to maintain, support and develop those IT systems. AtosEuronext charges Euronext for the provision of those services. These fees cover AtosEuronext’s:

  - IT running costs, which comprise: (i) hardware production costs, (ii) software licence and maintenance costs, (iii) staff production servicing costs, and (iv) network IT costs.
  - Office automation costs, comprising all expenses incurred to provide IT assets and tools to the exchange’s employees.
  - IT internet costs.
  - Development expenses.
In 2003, Euronext paid 167 million euros to AtosEuronext for the provision of IT services.\(^8\)

According to Euronext's published accounts, in 2003 Euronext's aggregate IT costs amounted to 188 million euros, or 26% of Euronext's total costs.\(^9\) Lastly, 35% of the total costs of Euronext's cash trading business were IT costs in 2003.\(^10\)

- **Staff costs:** Staff costs represented 37% of Euronext's costs in 2003.\(^11\) At the end of 2003, excluding GL Trade, Euronext had 1,843 employees (and 1,789 full time equivalents (FTEs)).\(^12\) Of those, 1,110 employees were part of its continental operations, comprising the Amsterdam, Brussels, Paris and Lisbon markets, excluding LCH.Clearnet.\(^13\)

Euronext's personnel provide various services, which can be grouped in four categories:

- **Market operations.** This includes operating and managing the market and providing related services to users of the market. It also includes planning development of the market and its trading platform and providing technical support to customers.

- **Sales and marketing.** This includes the acquisition of new customers and maintaining relationships with existing customers.

- **Business development, strategy and communication.** These activities aim to develop and promote the exchange's products and services.

- **Support and corporate functions.** This involves activities such as finance and human resources.

### Cost savings from integration

**4.5** The consolidation of two (or more) cash trading platforms into a single platform creates opportunities for significant cost savings, primarily from the elimination or reduction of duplication across trading venues. As shown below, the integration of the cash trading platforms of Paris, Brussels, Amsterdam and Lisbon into a single trading platform has indeed allowed Euronext to rationalize its operations and significantly reduce the operating costs of its continental markets.

### IT costs: gross savings

**4.6** Figure 3 shows the reductions in continental IT costs resulting from the integration of the Amsterdam, Brussels, Paris and, more recently, Lisbon exchanges. We consider the period from 2001, when the cash trading platforms of the Paris, Brussels and Amsterdam exchanges were integrated, to 2004.

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\(^8\) Source: Euronext's 2004 Annual Report, p.121, 4.3.1.4. This includes the cost of clearing services.

\(^9\) Source: Euronext's 2004 Annual Report, p. 121, 4.3.1.4.

\(^10\) Source: Euronext Finance.

\(^11\) Source: Euronext's 2004 Annual Report, p.108, 4.1.1. In 2003, the expense category “Salaries and employee benefits” represented 268 million euros while total costs were equal to 717 million euros. Furthermore, staff costs represented 25% of the costs directly attributable to the cash trading business unit, i.e., excluding the costs of support services and those of the corporate structure (Source: Euronext Finance).

\(^12\) Source: Euronext Finance (for employees) and Euronext's 2004 Annual Report (for FTEs). GL Trade SA is a software solution provider in which Euronext retains a 40% share. If it is included, the number of FTEs would reach 2,726 (Source: Euronext's 2004 Annual Report, p.121, 4.3.1).

\(^13\) Source: Euronext Finance.
4.7  As shown in Figure 3, the continental IT costs of Euronext have fallen by 29% between 2001 and 2004—from 143 million euros to 103 million euros.\(^{14}\) This reduction in IT costs has affected the cash trading business of Euronext: its IT costs have fallen by 35% between 2001 and 2004—from 70 million euros to 45 million euros.\(^{15}\) These reductions in IT costs may not fully represent the impact of integration on the IT costs of Euronext's continental operations overall and of its cash trading business in particular.

- On the one hand, they may underestimate the true impact of integration on IT costs. This is because, for instance, the comparison of the IT costs of the cash trading business unit before and after the integration does not control for the increase in the scope and quality of the IT services provided by Euronext to its users. Also, the costs reported above exclude the costs of clearing, which have fallen between 2001 and 2004.\(^{16}\)

- On the other hand, they may overestimate that impact. A fraction of the reduction in the continental IT costs of Euronext's cash trading business unit since 2001 has no direct relationship with the integration of the cash trading platforms. For example, during this period, Euronext transferred its continental derivatives trading activity onto the LIFFE.Connect platform. This caused a reduction in IT costs that is not related with the integration of the trading platforms. Also, the IT costs incurred in 2001 by the cash

\(^{14}\) Source: Euronext Finance. These figures exclude the IT costs of the Clearnet platform and exclude also the IT costs of the derivatives platform LIFFE; besides the IT costs of cash trading, they include the IT costs of continental derivative activities, information services, settlement and custody (CIK) and other IT costs. Clearnet was divested from Euronext at the end of 2003 following the merger with LCH. To provide a consistent basis of comparison between the IT costs of Euronext before and after the LCH.Clearnet merger, we do not include Clearnet's IT costs in Figure 3. We do not include the IT costs of LIFFE either, since we are assessing the cost synergies associated with the integration of the continental operations of Euronext and of its cash trading platforms in particular.

\(^{15}\) Source: Euronext Finance. These figures include the running costs and the development costs incurred by the cash business.

\(^{16}\) Source: Euronext Finance. The IT costs of clearing charged by AtosEuronext to Euronext fell from 72 million euros in 2001 to 58 million euros in 2002 and 51 million euros in 2003. These figures include running and development expenses. The former fell from 53 million euros in 2001 to 35 million euros in 2003.
trading business include some “exceptional” development costs due to the integration itself; so the 2001 IT costs may be overestimated by that amount.

4.8 According to Euronext’s own calculations, after adjusting for reductions in continental IT costs that are not directly caused by its integration, Euronext’s continental IT costs are expected to fall by 25%, or 46 million euros, between 2000 and 2005.17

4.9 The IT cost savings in cash trading can be explained as follows:

▪ First, Euronext adopted a single software platform for all its cash trading operations, irrespective of location. Since users on different exchanges tend to require the same basic functionality, there was no need for significant changes to the existing NSC software to allow its use in Amsterdam, Brussels and Lisbon. Standardisation on a single platform meant that only a single set of software development projects was needed, fewer licence fees for the use of third-party software were required, and software maintenance requirements were reduced.

▪ Second, for a given platform, the size of the operation, maintenance and development teams (and of the corresponding external suppliers or support resources) is to a large extent independent of the volume of activity. The creation of a single trading platform eliminated the duplication of these costs.

▪ Third, the integration also led to a reduction in Euronext’s non-IT staff numbers. This reduced the level of IT activity, and associated costs, required to support these staff.

▪ Fourth, some further savings were achieved following the acquisition of the LIFFE derivative market. While the NSC cash trading platform and the LIFFE.Connect trading platform have remained separate, the backbone networks of the cash and derivatives platforms were rationalised, generating savings in cash trading IT costs.

Staff costs: gross savings

4.10 Euronext reduced the size of its staff from 2001 to 2004. This was achieved by reorganising the activities of the constituent exchanges into a series of horizontal strategic business units: (a) listing and cash trading, (b) derivatives trading, and (c) information services.18 Each of these business units was made responsible for activities across all Euronext locations, supported by functional directorates at the corporate level.

4.11 The integration of all the continental operations of Euronext, and of its cash trading activities in particular, led to a significant reduction in the number of employees. Since the number of FTEs required to support a cash trading business does not vary in proportion to the volume of trade or the number of members of the exchange, fewer employees were needed after integration.

4.12 Some indirect savings in corporate support functions were also achieved by downsizing the business units. For example, integration has made it possible to reduce the number of FTEs in the legal and human resources departments.

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17 Source: Euronext, Analysts and investors workshop, January 2004. This presentation reports the evolution of Euronext’s pro-forma continental IT costs assuming that Euronext’s scope of activities and organisation remains unchanged from 2000 to 2005.

4.13 As shown in Figure 4 below, over the period 2001-2004, overall continental staff numbers fell from 1,338 employees to 1,012 employees, a reduction of 24%.19

Figure 4: Euronext continental staff numbers 2001-2004 *

* Excluding LCH.Clearnet and UK/LIFFE.
Source: Euronext

4.14 The reorganisation of Euronext led to staff reductions across all continental locations, including Paris where many of the central functions were located. This is shown in Figure 5.

Figure 5: Euronext continental staff numbers by location

* e.g. Foreign offices
Source: Euronext

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19 Source: Euronext. These are pro-forma headcount figures that exclude Clearnet and UK/LIFFE headcounts but include the Lisbon headcount (although Lisbon became part of Euronext in February 2002). Reported figures are end-of-year headcounts.
Migration processes and costs

4.15 The integration process involved a number of one-off costs. At the time of Euronext's initial flotation in July 2001, net synergies (that is, cost savings minus one-off costs of change) were predicted to become positive in 2005 only.\(^{20}\) However, by early 2004, net synergies were already expected to become positive by the end of that year.\(^{21}\) Euronext has been able to migrate at a lower cost than originally expected, for the following reasons.

- First, the outsourcing of IT systems and activities to AtosEuronext reduced the staff severance costs that might otherwise have been incurred. For example, staff employed in Amsterdam were transferred to AtosEuronext and then transferred to its parent company AtosOrigin and redeployed to other activities, rather than being made redundant.

- Second, a significant proportion of the costs of migrating trading in Amsterdam and Brussels to the NSC platform were covered by funds originally allocated to the ongoing development of the existing platforms. The costs of migrating trading from Brussels were relatively low because the existing Brussels platform shared several features with the NSC platform.

- Lastly, migration took place relatively quickly: over a period of 14 months.\(^{22}\) This happened in several steps. First, users were consulted on the proposed model, including the trading rules and functionalities to be included in the new system. Second, following this consultation with users, Euronext developed its platform. Third, a "test" platform was made available to users for a limited period of time. Once testing was complete, and feedback from users had been considered, the exchange froze its specifications, completed the development of the platform and launched it.

Implications for merger control

4.16 An efficiency gain will be taken into account in a merger assessment only if it is verifiable, substantial and timely. It must benefit consumers and "accrue as a result of the creation of the relevant merger ... and [be] ... unlikely to accrue without the creation of that situation."\(^{23}\) Below we show that the efficiencies discussed above are verifiable, substantial, materialised in a short period of time, could not have been achieved without the merger, and were passed on to users via lower trading fees.

Magnitude and timing

4.17 The creation of Euronext and the integration of its constituent exchanges led to significant reductions in IT costs and staff costs. As a result, the total costs of Euronext's continental operations have been significantly reduced. Using the scope of Euronext's continental activities in 2004 as the basis of comparison and excluding GL Trade,\(^{24}\) Euronext's total

\(^{21}\) Source: Id. According to Euronext Finance, these actual net synergies have indeed been positive in 2004.
\(^{22}\) Euronext was formed in September 2000. The IT integration of Amsterdam was completed in October 2001, while that of Brussels was completed in May 2001.
\(^{23}\) Competition Commission, Merger References: Competition Commission Guidelines, June 2003, paragraph 4.38.
\(^{24}\) In contrast, total cost figures, as stated in Euronext's Annual Reports, would have (a) included LIFFE from 2002 onwards (b) included Clearnet costs until 2003 and (c) included GL Trade figures. For comparison purposes, Euronext's 2004 total costs reported in its 2004 Annual Report are €645 million.
costs per annum fell from 442 million euros in 2001 to 305 million euros in 2004—a reduction in annual costs of 137 million euros (31%) achieved in three years.

Figure 6: Euronext total annual continental costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Continental Costs (m€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>442</td>
</tr>
<tr>
<td>2002</td>
<td>382</td>
</tr>
<tr>
<td>2003</td>
<td>326</td>
</tr>
<tr>
<td>2004</td>
<td>305</td>
</tr>
</tbody>
</table>

These figures exclude Clearnet, GL trade and UK/LIFFE.

Source: Euronext.

4.18 Exceptional, one-off costs were incurred in 2001 as a result of the integration process. These include the costs of Euronext’s flotation (16 million euros) and early retirement provisions (24 million euros when excluding Clearnet).\(^{25}\) Excluding these exceptional items from the 2001 continental costs—so that they do not bias the comparison between the 2001 and 2004 continental costs—one obtains a reduction of 97 million euros, or 25%, in the costs of Euronext’s continental operations between 2001 and 2004. The savings created by the integration have, therefore, been significant.

4.19 These cost reductions are consistent with the findings of several recent empirical studies on the cost efficiency of exchanges.

- Malkamäki (1999) analyses scale and scope economies in the trading activities of exchanges, using cost and output data from 38 exchanges over the period 1996-1998.\(^{26}\) He finds that cash trading services exhibit significant scale economies: for an average-sized exchange in his sample, doubling the volume of transactions would result in an increase in the costs of trading operations of only 40%. This scale effect is more pronounced when exchanges are larger, so the further expansion of large exchanges will produce significant cost efficiencies. On the basis of his results, Malkamäki argues that integrating trading systems should lead to cost reductions.

- Schmiedel (2001) analyses a panel data set for all major European financial exchanges over the period 1985-1999.\(^{27}\) He finds that these exchanges have been operating at costs that were 20-25% above efficient levels, but that the largest exchanges were the

\(^{25}\) Source: Euronext Finance.

\(^{26}\) M. Malkamäki, supra note 3.

\(^{27}\) H. Schmiedel, supra note 3. Schmiedel uses a stochastic cost frontier analysis to generate exchange inefficiency scores. Among other factors, the size of an exchange, its diversification into derivative trading, the automated nature of its trading mechanism and a for-profit, rather than user-owned, governance structure tend to limit the exchange’s relative inefficiency vis-à-vis the benchmark.
least inefficient. This suggests that consolidation should be expected to increase cost efficiency.

Merger specificity

4.20 The cost savings identified above will be a relevant factor in a merger assessment only if it would not have been possible to create the same efficiencies without a merger taking place.

4.21 The creation of Euronext is part of a trend towards exchange consolidation in Europe. In addition to formal mergers of exchanges, this consolidation has included so-called "implicit mergers" or alliances. These arrangements primarily aim to provide investors with opportunities to trade securities offered by all participating exchanges on the basis of a single membership, avoiding the costs of membership of multiple exchanges in multiple locations. For example, Deutsche Börse's Xetra platform has been used by the Vienna Stock Exchange since November 1999 and the Irish Stock exchange since June 2000. In addition, Deutsche Börse and the Vienna Stock Exchange have created a joint-venture to support their common Newex market for central and eastern European stocks. The Scandinavian and Baltic stock exchanges have set up a common IT platform, whose costs have been shared among participating exchanges. The aim of this venture is to build an integrated Scandinavian trading system, with harmonized rules, processes and procedures.

4.22 The existence of these implicit mergers raises the question of whether the savings achieved by the Euronext explicit merger could have been achieved through other arrangements, such as an implicit merger or alliance, which may in principle (though not necessarily) have a lesser impact on competition. We conclude that this would not have been possible.

4.23 First, we note that where an implicit merger involves a high degree of co-operation between the exchanges involved—so that the products and services offered, the costs of providing those services and the quality of service provided do not vary between participating exchanges—then the impact of any such arrangement on competition is likely be the same as we would see from a full merger. The possibility that the exchanges that merged to form Euronext might have achieved similar cost savings through such an implicit merger (a conclusion that, in any case, we would not support for the reasons given below) is irrelevant for the purposes of this analysis if it would have led to the same impact on competition as the creation of Euronext.

4.24 Second, if the implicit merger involves a much looser alliance where each participant retains a significant degree of commercial independence, then it would not be possible to achieve

29 Which include: the creation of Euronext, the merger of DeutscheTerminBörse with SOFFEX (merger of the German and the Swiss derivatives markets) and the merger between OM and HEX.
30 The term "implicit merger", was first used in a 1995 study by Domowitz on derivative exchanges, where it was used to describe front-end integration (integration from the viewpoint of users), rather than back-end integration. See I. Domowitz, Electronic Derivatives Exchanges: Implicit Mergers, Network Externalities and Standardization, Quarterly Review of Economics and Finance, 1995. "[Implicit mergers] … consist of a set of derivative products, offered by at least two existing exchanges and sharing a common membership for the purpose of trading via direct access to the market".
31 The actual implementation of the NOREX alliance involved a mixture of formal mergers between exchanges—illustrated by the merger of the Swedish OM and the Finnish HEX exchanges, and the proposed merger of the resulting exchange with the Danish Stock exchange (a letter of intent was signed in November 2004)—and a number of cooperation agreements.
32 To echo this point, Malkamäki (1999), supra note 3, notes that "... if complete centralization of the trading system is to be carried out, there will have to be agreement on the principle for sharing costs and income between stock exchanges". Thus, a complete integration of trading systems is expected to lead to a strong coordination of the exchanges' policies.
the cost savings. For example, if each participating exchange uses a different market model it is not possible to use a single software for all participating exchanges and the cost savings that arise from eliminating duplication in software development would not be achieved.

4.25 Third, an implicit merger may give rise to various coordination and hold-up problems. An implicit merger requires that the participants enter into contracts that specify, for example, how the costs of any investments to upgrade the platform would be shared. Each participant, however, has an incentive to minimise its own contribution to development costs and free-ride on the investments made by others. This is likely to lead to under-investment in the absence of a clear ex-ante commitment on how such costs will be shared. However, creating a fully-specified contract that covers all possible contingencies will be very difficult.

4.26 Fourth, even if it is possible to anticipate all future events, the participating exchanges will have different incentives depending on the likely effect of investments on their revenues. Short of a full merger, therefore, it will be difficult for the participating exchanges to agree on the level of investment to be made or how the shared platform should be developed.

4.27 Lastly, a significant part of the overall cost savings achieved by Euronext resulted from headcount reductions. These occurred in IT-related, commercial, support and corporate functions of the exchange. An alliance is unlikely to achieve the same level of staff-cost savings as a merger, for example, because each exchange will be likely to retain its own corporate and head-office functions.

4.28 In summary, we conclude that the level of cost savings achieved by Euronext through the integration of trading on the Amsterdam, Brussels, Paris and Lisbon cash markets into a single trading platform could not have been achieved through a contractual arrangement that fell short of a full merger.

Pass on to final investors

4.29 We have investigated the impact of Euronext’s integration process on the average fees per trade charged to users of the Paris, Brussels and Amsterdam stock exchanges. One would expect to see a decline in average fees in response to the reductions in fixed costs resulting from the integration of the exchanges. If they did not decline after integration, the most likely conclusion would be that users and final investors did not benefit from the cost synergies achieved by Euronext. If, on the contrary, they did fall following integration, then the evidence would be consistent with the conclusion that they were passed on to the members of the exchange, and thereafter on to investors in the form of lower brokerage fees.

4.30 We have controlled for the effect of cash trading volume traded in each of those exchanges during the period under analysis. An increase in overall volume is likely to cause a fall in fees, as it allows the exchange to spread its fixed costs across a greater number of transactions. We have also controlled for a series of events unrelated to the integration of the Paris, Brussels, Amsterdam and Lisbon exchanges that may have had an impact on volume and fees. It should be noted, however, that these volumes effects are, at least in part, driven by the increase in cross-border trading that results from integration (see below).

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33 See for instance, R. Lee “The Future of securities exchanges”, Financial Institutions Centre, The Wharton School, University of Pennsylvania, 26 February 2002. Lee states that: “Of the many attempts at cooperation between exchanges that have been proposed, few have been implemented, however, and of those that have been realized, most have failed. This will continue to be the case because of a problem that is unavoidable in linkages, as opposed to mergers, between securities exchanges, namely the difficulty of creating credible contractual commitments between cooperating partners.”
Data

4.31 We investigate the impact of the integration of the Euronext exchanges on the average fee charged per trade to users of the Paris, Brussels and Amsterdam stock exchanges. This variable is defined by dividing the total cash trading fee revenue of the exchange by the number of charged (cash) trades in that market. Data on fees have been provided by Euronext on a monthly basis for the period between December 1999 and December 2004 for the Paris exchange, between January 2001 and December 2004 for Amsterdam, and between January 2002 and December 2004 for Brussels. We have 61 observations for Paris, 48 for Amsterdam and 36 for Brussels. The average fee per trade has been expressed in real terms (January 2005 = 100), using the French, Belgian and Dutch Harmonized Indices of Consumer Prices from Eurostat.34

Descriptive analysis

4.32 Figure 7 (next page) displays the evolution of the average fee per trade in the Paris stock exchange from December 1999 to December 2004. The vertical red lines indicate the three integration milestones that form the basis of the integration process considered in this paper (see Figure 2 above). The Figure shows a decrease of about 30% in the average trading fee (in real terms) charged in Paris during this period. Average trading fees also fell in Brussels and Amsterdam during the period under analysis. From January 2002 to December 2004, the average trading fee in Brussels fell by 30%. From January 2001 to December 2004, the average trading fee in the Amsterdam exchange fell by 45.5%.

Figure 7: Evolution of the average fee per trade on the Euronext Paris cash market (in real terms), Dec 1999 - Dec 2004.

Empirical methodology

4.33 To estimate the impact of the integration of the Euronext exchanges on the average trading fee charged in Paris, Brussels and Amsterdam, we have conducted for each market a simple multiple regression analysis that relates the average trading fee with an integration dummy,

34 The Harmonized Index of Consumer Prices is available at http://www.europa.eu.int/comm/eurostat.
while controlling for changes in volume and other exogenous factors that may affect the 
average trading fee in that market.\textsuperscript{35}

4.34 More formally, we have estimated the following econometric model for each of the three 
markets:

\[ y_t = \alpha + \beta_1 \text{Integration}_t + \beta_2 \text{Number of trades}_t + \beta_3 X_t + \lambda + \epsilon_t \]

where:

\begin{itemize}
  \item $y_t$ is the natural logarithm of the average trading fee in the market at period $t$. The 
average trading fee is in euros and has been deflated using the Harmonized Index of 
Consumer Prices from Eurostat for that market (source: Euronext).
  \item $\text{Integration}_t$ is a dummy variable that takes the value of 1 for any period $t$ after 
the integration of the trading and clearing platforms of the relevant exchange (i.e., the 
integration of Paris and Brussels for the regressions concerning Paris and Brussels fees, 
and Paris, Brussels and Amsterdam for the regression on Amsterdam average fees) and 
0 otherwise. In other specifications, we define three different integration dummies: Phase 
1$_t$ (1 for any period $t$ after the integration of Brussels with Paris), Phase 2$_t$ (1 for any 
period $t$ after the integration of Amsterdam within Euronext), and Phase 3$_t$ (1 for any 
period $t$ after the integration of Lisbon within Euronext). The purpose is to analyze the 
time evolution of the impact of integration on fees. Note that these three variables are 
correlated and hence a regression including the three may have problems of multi-

collinearity. Consequently, we have employed this alternative specification in the Paris 
regression only, because the smaller number of observations for Amsterdam and 
Brussels make multi-collinearity less pronounced. A negative coefficient in these 
integration dummies would indicate that average trading fees in the market decreased as 
a result of integration.
  \item $\text{Number of trades}_t$ is the natural logarithm of the total number of trades observed in the 
market at period $t$. We include this variable to control for volume effects (source: 
Euronext).\textsuperscript{36}
  \item $X_t$ is a vector of dummy variables that controls for some relevant economic and political 
events which could have an impact on the evolution of fees over time. The events 
considered here are:
    \begin{itemize}
      \item April 2000: Crash of high-tech share values.
      \item May 2001: New economic regulation in France - financial, competition and 
enterprise regulations.
      \item September 2001: Terrorist attacks in New York and Washington D.C.
    \end{itemize}
\end{itemize}

\textsuperscript{35} The average fee charged in any of these exchanges may change over time as a result of (a) changes 
in the corresponding fee schedule (e.g., fee schedules in Brussels, Amsterdam and Paris changed 
significantly in 2004); (b) changes in volume; and (c) changes in the degree of concentration of users 
as a result of the non-linear structure of fees).

\textsuperscript{36} This variable is endogenous, as the number of trades is a function of fees. This may bias the 
estimates of the variables of interest in the fee regressions. However, as explained in footnote 37 below, 
this endogeneity problem (a) is small and (b) biases downwards the estimate of the impact of integration 
on the average fees charged in Brussels, Amsterdam and Paris—i.e., the true impact of integration on 
fees was larger than estimated. This is another reason why our estimates of the pass on effect are 
conservative.
October 2001: Invasion of Afghanistan.
October 2002: Bali terrorist attack.
March 2003: Invasion of Iraq.
March 2004: Terrorist attacks in Madrid.

- $\lambda_t$ is a vector of monthly fixed effects. These are meant to control for monthly specific shocks that may have affected trading fees in the market under analysis.
- The model was estimated using ordinary least squares (OLS) with monthly and event dummies, calculating robust standard errors.

**Estimated results**

Table 1 presents the results of our empirical analysis for the Paris cash market.

**Table 1: Impact of integration on the average fee per trade in the Euronext Paris cash market (in real terms). Dec 1999 - Dec 2004.**

<table>
<thead>
<tr>
<th>Ln Average Trading Fee (Paris)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>-0.171*** [0.000]</td>
<td>-0.150*** [0.000]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>-0.033 [0.157]</td>
<td>-0.008 [0.499]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>-0.098*** [0.001]</td>
<td>-0.082*** [0.000]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>-0.144*** [0.000]</td>
<td>-0.165*** [0.000]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Number of charged Trades</td>
<td>-0.238* [0.060]</td>
<td>-0.329*** [0.000]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.286*** [0.000]</td>
<td>0.785*** [0.004]</td>
<td>0.299*** [0.000]</td>
<td>0.988*** [0.000]</td>
</tr>
</tbody>
</table>

Notes:
(1) Robust p values in brackets
(2) * significant at 10%; ** significant at 5%; *** significant at 1%
(3) Average Trading Fees for the Paris market.
(4) The Average Trading Fees have been provided by Euronext. We have data for the period between December 1999 and December 2004, on a monthly basis.
(5) The Average Trading Fees are in euros and have been deflated using the French Harmonized Index of Consumer Prices from Eurostat.

Column (1) describes the impact of integration on the average cash trading fee charged in Paris without controlling for volume. Column (2) repeats the same analysis but introducing volume as a control. Column (3) is identical to Column (1), but it now disaggregates the impact of integration to consider the changes in the average trading fee charged in Paris resulting from each of the three steps in the integration of Euronext's cash trading business. Column (4) repeats the analysis in Column (3) but controlling for changes in volume. The specifications in Columns (1)-(4) include monthly dummies and dummies controlling for the above-mentioned salient events that may have affected the fee-setting policy of the exchange.
We focus on Columns (2) and (4), since it turns out that volume is indeed a relevant variable for the analysis of average trading fees in Paris. According to Column (2), a 10% increase in the number of trades would result in a reduction of 2.38% in the average trading fee (a point estimate of −0.238). 37

We find that the average trading fee in Paris fell as a result of the creation of Euronext. This effect is statistically significant in all specifications. It is also material from an economic viewpoint. According to the estimate in Column (2), the average trading fee in Paris in the period after the integration was 15% lower than before (a point estimate of −0.15 for the Integration dummy). This effect is net of the reduction in the average fee caused by the increase in volume that occurred during the same period, since we are controlling for volume.

Column (4) shows that the decline in the average fee charged per trade in Paris occurred after the integration of Amsterdam (Phase 2, see paragraph 0 for a definition of each of these phases) and not immediately after the integration of Brussels (Phase 1). As noted above, the full effects of integration on costs took time to materialise.

Table 2 presents the results of the average fee regressions for the Brussels and Amsterdam markets. Column (1) in each of the two charts describes the impact of integration on the average trading fee charged in the market without controlling for volume. Column (2) repeats the same analysis but introducing volume as a control. The specifications in Columns (1) and (2) include monthly dummies and dummies controlling for the above-listed salient events that may have affected fee-setting policies in these markets.

<table>
<thead>
<tr>
<th>Brussels</th>
<th>Amsterdam</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>ln Average Trading Fee (Brussels)</td>
<td>(1)</td>
</tr>
<tr>
<td>Integration</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>(0.477)</td>
</tr>
<tr>
<td>ln Number of charged Trades</td>
<td>-0.178</td>
</tr>
<tr>
<td></td>
<td>(0.087)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.237***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>Monthly dummies</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic events dummies</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>36</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amsterdam</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln Average Trading Fee (Amsterdam)</td>
<td>-0.376***</td>
<td>-0.306***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>ln Number of charged Trades</td>
<td>0.118</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.360)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.425***</td>
<td>0.317***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Monthly dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic events dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.58</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Notes:
(1) Robust p values in brackets
(2) * significant at 10%; ** significant at 5%; *** significant at 1%
(3) Average Trading Fees for the Brussels market.
(4) The Average Trading Fees have been provided by Euronext. We have data for the period between January 2002 and December 2004, on a monthly basis.
(5) The Average Trading Fees are in euros and have been deflated using the Belgian Harmonized Index of Consumer Prices from Eurostat.

We find that integration had no statistically significant effect on the average cash trading fee in Brussels. The coefficients of the Integration dummy in Columns (1) and (2) are not

37 As explained in footnote 36 above, the number of trades is endogenous. This endogeneity problem may cause the estimate of the impact of volume on fees to be biased upwards in absolute terms (as it captures both the direct effect of volume on fees, but also the feedback of fees on volume). If that were the case, the estimate for the integration dummy would be biased downwards in absolute terms, as an excessively large proportion of the decline in fees over the period would be attributed to volume effects. So, the estimate of the impact of integration on fees in columns (2) and (4) should be considered a lower bound of the true effect in absolute terms. In any event, the biases introduced by this endogeneity problem are bound to be small. Note first the small difference in the point estimates for the integration dummy in columns (1) and (2). Also, note the small discrepancy in the R squares of the regressions (1) and (2).
statistically significant. In contrast, the impact of integration in the average trading fee charged in Amsterdam is estimated to be –30%. This effect is statistically significant, and cannot be attributed to the reduction in the average fee caused by the increase in volume that took place during the same period.

4.42 The lack of statistical significance of the impact of integration on the average trading fee in Brussels is likely to be due to the smaller number of observations available for that market (36 versus 48 for Amsterdam and 61 for Paris) and, more importantly, to the very small number of observations available prior to integration in Brussels.
Section 5

Direct user benefits

5.1 In addition to creating cost savings that are passed on to users in the form of reduced trading fees, a merger between exchanges can directly benefit their users and final investors in several ways. First, a merger broadens brokers' and investors' trading opportunities by offering them direct access to several markets at a lower cost. This reduces ‘home bias’ effects by facilitating cross-border trading and allowing investors to hold more diversified portfolios. Second, it may benefit final investors by lowering their implicit trading costs through the provision of greater liquidity as reflected by lower bid-ask spreads and higher trading volume. The greater liquidity may also be associated with lower volatility of stock prices.

5.2 In this Section we describe and, to the extent that this is possible, quantify the benefits that accrued directly to users and final investors as a result of the integration of the cash trading business of the Paris, Brussels, Amsterdam and Lisbon exchanges into single cash trading and clearing platforms.

More efficient and cheaper access to Euronext markets

5.3 We interviewed a number of Euronext members in order to understand how the integration of the Euronext markets onto a single trading platform affected their businesses. We found that users of Euronext have benefited directly from the integration of its constituent exchanges. In particular, integration now allows users cheaper and easier access to the different Euronext cash markets. The benefits of integration appear to vary between members, in particular depending on their size and on whether they were formerly direct members of all the separate exchanges.

Wider trading opportunities

5.4 First, for local users that were formerly members of one exchange only, integration and unified membership has provided them with greater and cheaper access to all securities traded on the various Euronext cash markets. For instance, for a member of the Paris exchange who was not active in other Euronext markets prior to integration, the integration of Paris with the Brussels and Amsterdam markets increased the number of cash securities that could be traded from 9,311 at the end of the first quarter of 2001 to 13,163 at the end of 2001. For a member of the Brussels or Amsterdam exchanges, the increase in the number of directly tradable securities has been larger.

Direct, cheaper access to markets

5.5 In many cases, integration has led users to change the way in which they interact with the Euronext markets. Since all members of Euronext can now directly access all of its markets,
members who previously traded only on one market, or traded cross-border only indirectly (through a local member), are now more likely to trade directly in all Euronext markets.

5.6 One effect of this has been a partial disintermediation of brokerage services. Before integration, indirect access through a local member was a common feature of cross-border trading in the Euronext markets. For example, a Belgian broker who was not a member of the Paris exchange but wished to execute a French equity order on behalf of a Belgian retail client would have had to channel the order through a French broker. In addition, the trade would need to have been cleared by a local clearing member, possibly the same French broker. After integration, the same order could be executed directly by the Belgian broker, saving the intermediation costs charged by the French broker.

5.7 While this change in cross-border order execution has mattered mainly for small brokers, it has affected also some large users that before integration were accessing non-domestic markets through intermediaries, because the volume of transactions performed on these markets did not justify the cost of a full membership. For instance, BNP was accessing Brussels through an intermediary.

5.8 In summary, Euronext’s integration contributed to an increase in direct, non-intermediated trading and more generally to an overall increase in cross border trading. The consequent elimination of intermediation costs has lowered the cost of accessing the various Euronext market for Euronext members. This is illustrated in Figure 8 below, showing that in each Euronext market, the fraction of active cross-members (members of other Euronext markets that submit at least one cross-border order in the month considered) has steadily increased since the integration; remote membership has also grown.

Figure 8: Evolution of user cross-membership on Euronext markets, 2002-2004.

These figures exclude Lisbon. Figures based on the number of orders entered in the system (LP and NLP activity).

Source: Euronext.

5.9 This disintermediation process had a second, indirect effect since it affected the structure of each local brokerage market. It led to a loss of intermediation business for local brokers—for example, the loss of opportunities for Belgian brokers to execute trades on the Brussels market on behalf of French or Dutch institutional investors. Some local brokers lost market

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39 Some users were trading members but not clearing members of some of the Euronext’s markets.
share and were acquired by larger brokers or institutional investors. Overall there has been a
reduction in the number of active members since the creation of Euronext.40 This is shown in
Figure 8 above: the number of active local members of each of Euronext’s markets has fallen
since integration. This appears to have fuelled competition in brokerage services by making
the large institutional investors direct competitors of the incumbent brokers on their domestic
markets.

5.10 The savings in explicit costs brought about by integration have been very significant. A
medium-sized Belgian broker interviewed by us reported that its pre-integration total unit cost
of trading in Amsterdam was in the range of 15 euros to 25 euros per transaction, for a first
execution.41 This same cost has fallen to 5.45 euros now that the member is in a position to
access Amsterdam directly.42 In other words, for that broker, bypassing intermediaries has
allowed a decrease in the cost of trading on some of the Euronext markets by a factor of at
least three.

5.11 Users have exploited this cheaper and more direct access to a wider range of trading
opportunities: on average, members based in one location have increased their trading in
securities listed in other locations. This is shown in Figure 9 below:

Figure 9: Share of cross-border trade undertaken by Euronext members (% of total trades of
members at each location)

Source: Euronext

5.12 For example, Amsterdam members carried out 8% of their trades on the Paris and Brussels
stock exchanges in 2002 and 92% in Amsterdam. In contrast, by 2004 they carried out 24%
of their Euronext trades outside of Amsterdam.

5.13 Increased cross-border trading is likely to have contributed to a reduction of the “home-bias”
in portfolio selection, which refers to the tendency of investors to predominantly hold locally-

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40 According to data provided by Euronext, there were 273 active members on Euronext in October
2001, immediately after the integration of the Amsterdam market; which fell to 212 in December 2004,
despite the merger with the Lisbon exchange at the end of 2003. In a given month, a member is
considered active if it is invoiced.

41 Source: Interview with this broker. This total cost includes the explicit cost of trading, clearing and
settling trades, at the level proposed by local intermediaries. The first execution is the most expensive,
due to higher settlement costs in particular. However, the gap remains significant for a second execution
as well.

42 Source: Id.
listed securities, thereby foregoing opportunities to diversify their portfolios by holding foreign assets.\textsuperscript{43} The existence of a home bias is usually explained as resulting in part from the cost of cross-border trading and from the unawareness of trading opportunities available in other markets. By reducing both of these obstacles to international diversification, the integration of the Euronext exchanges should have diminished “home bias”.

5.14 Indeed, the share of Belgian equity investment funds with a Europe-wide investment strategy increased from 47 to 56 percent from 2001 to 2003, although this increased diversification may not have been only in the direction of French, Dutch and Portuguese equities, and is part of a trend dating at least since 1997.\textsuperscript{44}

5.15 Euronext and the Bank of France perform a regular survey of the asset holding of French customers, based on panel data. The holding of foreign shares is tracked specifically since 2001, right after the creation of Euronext. This survey shows that the holding of foreign equities by French investors has increased steadily since the creation of Euronext. The survey estimates that less than 1 million French individuals above 15 year age were holding foreign equities in their asset portfolio in 2001 (or 2\% of that population). By contrast, 2.1 million individuals (or 4.7\% of that population) were holding foreign equities in their portfolio in 2004, among which 2 million were holding European equities.\textsuperscript{45} This increase in the holding of foreign securities has been much faster than the general increase in the estimated number of individuals holding equities, which has gone from 6.1 million in 2001 to 6.7 million in 2004. Thus, this survey shows that French investors have diversified their asset holdings towards European equities since the creation of Euronext.

\textit{User internal cost savings}

5.16 For large members, which were already active on the different Euronext exchanges, unified membership has provided the opportunity to rationalise their membership policy and, more broadly, to re-organise their trading activities. Reducing the number of separate memberships required to trade on the Euronext markets has reduced their membership costs.

5.17 We found that integration has allowed some members to rationalise their back-office functions by concentrating these operations in a single location. Whereas prior to integration it was necessary to maintain these functions in each location, integration allowed users to consolidate their back-office functions in a single location.\textsuperscript{46}

5.18 In addition, users, especially the trading units of large banks, have been able to save on some of the significant IT resources they use. While the bulk of these resources are devoted to developing and running programs supporting trading strategies, significant resources are also required to provide access to the various exchanges on which they operate. Staff in these areas have to ensure that their bank’s systems and software are compatible with the platforms of each of the exchanges of which it is a member. These teams can employ

\footnotesize\textsuperscript{43} See Pagano and Padilla, supra note 2 and references therein.

\footnotesize\textsuperscript{44} The same figure in 1997 was only 32\% percent. See Chart 34 in L. Baele et al. (2004), supra note 6. Unfortunately that study does not provide data for French and Dutch equity investment funds over the 2001-03 interval. Also, we are not aware of household-level data about the extent of diversification of Belgian, French and Dutch investors over this interval.


\footnotesize\textsuperscript{46} A medium-sized Belgian broker interviewed by us was able to save the equivalent of three FTEs, out of a total of 10 staff employed in middle-office operations, through the consolidation of its operations.
several dozen employees.\textsuperscript{47} When several exchanges consolidate their trading activity onto a single platform, the staff resources required to perform these operations can be reduced.

5.19 Similar benefits arose from the integration of clearing and settlement onto a single platform, reducing the number of separate platforms with which members need to connect, and with which they need to ensure that their systems are compatible. Users have indicated that the benefits resulting from the integration of the different clearing and settlement platforms, and in particular from the ability to net transactions across the different Euronext markets, can be substantial.

5.20 Members therefore experienced lower costs of accessing and operating on Euronext markets, as a result of their integration. Some of these savings will have been passed on to final investors, as members compete to attract and retain these investors.

Benefits related to the harmonization of rules and procedures

5.21 The harmonization of rules and procedures across the Euronext markets has simplified members’ processes and operations. This has reduced compliance and staff-training costs, since members and investors now only have one set of rules to comply with where previously there were different rules for each market.

5.22 Harmonisation was particularly beneficial for the smallest markets (e.g., Brussels and Lisbon). Prior to integration, each market had local idiosyncrasies in its trading rules (e.g., specific trading hours or local rules). For the smallest markets, this tended to deter large foreign investors from participating in these markets. This penalised issuers, traders and final investors on these markets. Following integration, all markets use the same rules, thus eliminating an obstacle to foreign investment in the smallest markets.

Cost of migration

5.23 For many users, the costs of migration do not appear to have been significant. To the extent that these users were mainly operating on the NSC platform (Paris) and/or a similar platform (Brussels), the migration process formed part of the normal investment cycle that would have arisen in the absence of the merger. The cost of migration may have been larger for the smallest members, which had to divert scarcer IT resources to handle several successive migrations, and for members previously active only in Amsterdam or Lisbon.

Impact on liquidity

5.24 In the remainder of this section we investigate the impact of the creation of Euronext on the liquidity of the Paris, Brussels, Amsterdam and Lisbon cash trading businesses, and hence on the implicit trading costs of those investing in securities listed on those markets.

Empirical methodology

5.25 In order to assess the impact of the creation of Euronext on liquidity, we estimate a security-level panel-data model\textsuperscript{48} that relates several liquidity measures with an integration dummy

\textsuperscript{47} A large French bank interviewed by us reported around 50 employees active in that ‘market access’ capacity worldwide, of which 30 were active in Europe.

\textsuperscript{48} We chose to use a panel data approach because this allows us (1) to avoid complex aggregation issues, (2) to estimate the impact of integration on all the exchanges of the Euronext platform in a single regression, and (3) to obtain estimates for the impact of integration in the various exchanges of Euronext that can be readily compared.
that equals 1 after the integration of the trading and clearing platforms of Brussels and Paris and 0 before integration. Liquidity is proxied using three different variables: (a) the bid-ask spread (the higher the liquidity, the lower the spread); (b) volumes traded (a more liquid market is one with greater volume); and (c) volatility (more liquidity being associated with less volatility).

5.26 More formally, we have estimated the following econometric model:

\[ y_{it} = \alpha + \beta_1 \text{Integration}_{it} + \beta_2 Z_{it} + \beta_3 X_{it} + \eta_i + \lambda_t + \epsilon_{it} \]

where:

- \( y_{it} \) is the natural logarithm of a liquidity measure of security \( i \) at period \( t \). The liquidity measures analyzed in this report are:
  - Bid-ask spread: measured as the natural logarithm of the (normalized) difference between the daily closing ask-price and the daily closing bid-price of security \( i \) on day \( t \) (source: Bloomberg).
  - Weighted average spread of the CAC40 index component securities (quoted in the Paris market) at period \( t \) in natural logarithms (source: Euronext). \( ^{49} \)
  - Volume, measured as the natural logarithm of the total number of shares traded of security \( i \) in period \( t \) (source: Bloomberg).
  - Volatility, measured as the natural logarithm of the historical (20 days) volatility of security \( i \) at period \( t \). This variable is constructed using daily closing prices of each security, corrected for stock splits and dividend payments (source: Bloomberg).
  - For each liquidity measure, we estimate a separate model.

- \( \text{Integration}_{it} \) is a dummy variable that takes the value of 1 for any security \( i \) and period \( t \) after the integration of the trading and clearing platforms of the exchange where security \( i \) is traded, and 0 otherwise.

In some specifications, we define three different integration dummies: Phase 1\(_i\) (1 for any security \( i \) and period \( t \) after the integration of Brussels with Paris if security \( i \) is traded either in Brussels or Paris and 0 otherwise), Phase 2\(_i\) (1 for any security \( i \) and period \( t \) after the integration of Amsterdam if security \( i \) is traded either in Brussels, Paris or Amsterdam, and 0 otherwise), and Phase 3\(_i\) (1 for any security \( i \) and period \( t \) after the integration of Lisbon if security \( i \) is traded either in Brussels, Paris, Amsterdam or Lisbon, and 0 otherwise). The purpose of this is to analyze the time evolution of the impact of integration on liquidity.

We have also constructed four additional integration dummies: Paris\(_i\) (1 for any security \( i \) traded in Paris and period \( t \) after the integration of Brussels with Paris and 0 otherwise), Brussels\(_i\) (1 for any security \( i \) traded in Brussels and period \( t \) after the integration of Brussels with Paris and 0 otherwise), Amsterdam\(_i\) (1 for any security \( i \) traded in Amsterdam and period \( t \) after the integration of Amsterdam in the Euronext platform and 0 otherwise), and Lisbon\(_i\) (1 for any security \( i \) traded in Lisbon and period \( t \) after the integration of Lisbon in the Euronext platform and 0 otherwise). These last variables are meant to capture possible differences in the effects of integration on the Paris, Brussels,

\(^{49}\) We do not conduct similar analyses for the other Euronext exchanges for lack of available data.
Amsterdam and Lisbon markets, which differ among other things on their size, depth and breadth.

The sign of the coefficient of the integration dummies reflects the relationship between the liquidity measure and the integration of the Euronext exchanges into a single platform. For example, a positive sign in the volume regression would indicate that volume (and thus liquidity) increased as a result of the creation of Euronext. A negative sign on the bid-ask spread equation would indicate that the effect of the integration was to lower the bid-ask spread (and thus to increase liquidity).

- $Z_t$ is a vector of variables that controls for other determinants of the liquidity of the market. These variables depend on the measure of liquidity under examination:
  - In the bid-ask spread regression using Bloomberg data, we include 20 days' historical volatility of the FTSE100 and DAX indices (source: Bloomberg). These controls are meant to capture common trends of a global or pan-European nature that could have affected the bid-ask spreads of the large-cap securities listed in the Euronext exchanges and that have nothing to do with the process of formation of Euronext. (source: Bloomberg).\(^{50}\)
  - In the volume regression, we include a linear trend and the number of shares traded in non-integrated markets. This last variable is calculated for securities included in the FTSE100 index and the DAX index (source: Bloomberg).
  - In the volatility regression, we include the 20 days' historical volatility of the corresponding index (Paris, Brussels, Amsterdam and Lisbon), and also 20 days' historical volatility of the FTSE100 and DAX indices (source: Bloomberg).

- $X_t$ is a vector of dummy variables that controls for some relevant economic and political events. These events may have affected the liquidity of the Euronext exchanges before and after the creation of Euronext. The events considered here are:
  - April 2000: Crash of high-tech share values.
  - October 2001: Invasion of Afghanistan.
  - October 2002: Bali terrorist attack.
  - March 2003: Invasion of Iraq.
  - March 2004: Terrorist attacks in Madrid.

\(^{50}\) We have not included bid-ask spread controls for other exchanges for lack of appropriate data. We have the daily closing bid-ask spread data for the securities listed in the DAX and the FTSE100 indices and have daily information on the number of shares traded per security on a daily basis, but have no information on the volume trades at the close of day. There is another reason not to control for FTSE spreads: they were affected during this period by the implementation of SETS, the LSE’s electronic order book, which led to a significant reduction of the bid-ask spreads for the securities listed in the FTSE 100.
- $\eta_i$ is a vector of fixed effects: one per security. These dummies are introduced to capture security-specific factors that may influence the liquidity of those securities and that are independent of the process of integration.

- $\lambda_t$ is a vector of monthly fixed effects. These dummies control for monthly-specific shocks that may have affected liquidity in the stock exchange markets under consideration and that have nothing to do with the process of integration.

- These models were estimated using ordinary least squares (OLS) with monthly and event dummies and fixed security effects. We have calculated robust standard errors, clustering at the security level to allow for heteroskedasticity and autocorrelation of the errors.

**Impact on bid-ask spreads**

5.27 The integration of cash trading platforms should lead to greater liquidity and this in turn should be reflected in a reduction of the bid-ask spread—i.e., the difference between the highest available ask price charged to buyers and the lowest available bid price offered to sellers.

**Data**

5.28 We use two different measures for spread: a bid-ask spread calculated by Bloomberg and a measure of the weighted average spread provided by Euronext:

- **Bloomberg's bid-ask spread:** the difference between the daily closing ask price and the daily closing bid price normalized as follows:

\[
\text{Bid - Ask Spread} = \frac{(P_a - P_b)}{\left((P_a + P_b)/2\right)},
\]

where

- $P_a$, denotes the current ask price in the market,\(^{51}\) and
- $P_b$, denotes the current bid price.\(^{52}\)

This bid-ask spread measure has been calculated using bid and ask prices provided by Bloomberg for the securities included in the main indices of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX, and PSI, respectively. We have data on a daily basis for the period between 3rd January 2000 and 31st December 2004. We have 111,338 observations.

- **Euronext's weighted average spread.** The weighted average spread has been provided by Euronext for securities listed in Paris that are included in the CAC40 index. We have data on a daily basis for the period between 3rd January 2000 and 28th February 2005.

This variable is constructed in two steps: (1) for each security in the CAC40 index, we derive on a daily basis the weighted average of its bid-ask spread, expressed as a percentage of its average price, weighted by the time spent in the best limit; and (2) we

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\(^{51}\) Bloomberg, Ask Price, Field Name: RQ004, Mnemonic: Ask.

\(^{52}\) Bloomberg, Bid Price, Field Name: RQ002, Mnemonic: Bid.
calculate the average of those spreads across securities, weighted by their daily volumes. We have 1,313 observations.

**Descriptive analysis**

5.29 Table 3 provides descriptive statistics regarding the bid-ask spreads for large cap securities in Paris, Brussels, Amsterdam and Lisbon provided by Bloomberg.


<table>
<thead>
<tr>
<th>Index</th>
<th>Observations</th>
<th>Average</th>
<th>Stand. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris</td>
<td>49,683</td>
<td>0.002</td>
<td>0.003</td>
<td>0.000</td>
<td>0.273</td>
</tr>
<tr>
<td>Brussels</td>
<td>24,135</td>
<td>0.006</td>
<td>0.006</td>
<td>0.000</td>
<td>0.099</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>30,463</td>
<td>0.003</td>
<td>0.005</td>
<td>0.000</td>
<td>0.098</td>
</tr>
<tr>
<td>Lisbon</td>
<td>22,801</td>
<td>0.008</td>
<td>0.009</td>
<td>0.000</td>
<td>0.537</td>
</tr>
</tbody>
</table>

Source: Bloomberg

5.30 Figure 10 displays the temporal evolution of the weighted bid-ask spread for the CAC40 provided by Euronext. It shows a decline of the weighted average bid-ask spread after the integration.

**Figure 10. Evolution of the weighted-average spread for the CAC 40, Jan 2000 – Feb 2005.**

![Weighted Average Spread](source: Euronext)

5.31 Table 4 presents the results of our empirical analysis using the Bloomberg measure of the bid-ask spread for the securities included in the main indices of the Paris, Brussels, Amsterdam and Lisbon stock exchanges.

**Estimated results—Bloomberg data**

5.31 Table 4 presents the results of our empirical analysis using the Bloomberg measure of the bid-ask spread for the securities included in the main indices of the Paris, Brussels, Amsterdam and Lisbon stock exchanges.

<table>
<thead>
<tr>
<th>Ln Bid-Ask Spread</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>-0.270***</td>
<td>-0.215***</td>
<td>-0.158***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>-0.203***</td>
<td>-0.259***</td>
<td>-0.230***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>-0.098*</td>
<td>-0.140***</td>
<td>-0.081</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.004)</td>
<td>(0.111)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>-0.299***</td>
<td>-0.076*</td>
<td>-0.128***</td>
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<td></td>
</tr>
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<td></td>
<td>(0.000)</td>
<td>(0.073)</td>
<td>(0.111)</td>
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<tr>
<td>Ln Historical 20 days Volatility DAX</td>
<td>0.380***</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.000)</td>
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<td>Ln Historical 20 days Volatility FTSE100</td>
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<tr>
<td></td>
<td>(0.000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-6.742***</td>
<td>-6.752***</td>
<td>-6.044***</td>
<td>-5.931***</td>
<td>-6.129***</td>
<td>-6.128***</td>
</tr>
<tr>
<td></td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Monthly dummies</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic events dummies</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.40</td>
<td>0.42</td>
<td>0.43</td>
<td>0.43</td>
<td>0.45</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Notes:
1) Robust p values in brackets, clustered by security to allow for heteroskedasticity and autocorrelation within securities.
2) * significant at 10%; ** significant at 5%; *** significant at 1%
3) The Ln Bid-Ask Spread is the natural logarithm of the difference between the daily closing ask price and the daily closing bid price. In our analysis Bid-Ask Spread is measured as a percentage, and is calculated as follows:

\[ \text{Bid - Ask Spread} = \frac{(P_a - P_b)}{(P_a + P_b)/2} \]

4) The sample is composed by 104 large caps. In particular, we include securities that compose the main index of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX and PSI respectively.
5) The ask price and the bid price has been provided by Bloomberg. We have data for the period between 3rd January 2000 and 31st December 2004, on a daily basis.

5.32 Column (1) describes the impact of integration on the average bid-ask spread of the securities listed in those exchanges. Column (2) repeats the same analysis, but it disaggregates the impact of integration to consider the changes in bid-ask spreads resulting from each of the three steps in the integration of Euronext’s cash trading business. Columns (3) and (5) replicate the models in Columns (1) and (2) controlling for changes in the volatility of the DAX index; and Columns (4) and (6) do the same but this time controlling for changes in the volatility of the securities listed in the FTSE100 index.

5.33 The regressions in all Columns include monthly dummies, security dummies (that is, fixed effects) and dummies controlling for a few salient events that may have affected the behaviour of bid-ask spreads in the relevant exchanges.

5.34 We focus on Columns (3) to (6), since the controls for changes in the volatility of the securities listed in the DAX and FTSE100 indices introduced in the analysis are statistically significant.

5.35 We find that the average bid-ask spreads of the securities included in the main indices of the Paris, Brussels, Amsterdam and Lisbon stock exchanges fell as a result of the creation of Euronext. This effect is statistically significant in all specifications. It is also material from an economic viewpoint. According to the estimation in Column (3), the reduction in bid-ask spreads following integration was on average 21.5%, and according to the estimation in Column (4), approximately 16%. Columns (5) and (6) show that such a decline occurred soon after the creation of Euronext.
5.36 Table 5 repeats the analysis of Table 4 but it now introduces a series of new integration variables that are meant to capture the differential effect of integration on the Paris, Brussels, Amsterdam and Lisbon markets (see paragraph 5.26 above).


<table>
<thead>
<tr>
<th>Ln Bid-Ask Spread</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris</td>
<td>-0.515***</td>
<td>-0.488***</td>
<td>-0.406***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Brussels</td>
<td>-0.302***</td>
<td>-0.300***</td>
<td>-0.235***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>-0.162**</td>
<td>-0.115</td>
<td>-0.043</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.125)</td>
<td>(0.576)</td>
</tr>
<tr>
<td>Lisbon</td>
<td>0.046</td>
<td>0.250***</td>
<td>0.270***</td>
</tr>
<tr>
<td></td>
<td>(0.418)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Ln Historical 20 days Volatility DAX</td>
<td>0.434***</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>Ln Historical 20 days Volatility FTSE100</td>
<td>0.393***</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-6.801***</td>
<td>-5.991***</td>
<td>-5.906***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Security dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Monthly dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic events dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>111,338</td>
<td>105,673</td>
<td>108,132</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.41</td>
<td>0.45</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Notes:
(1) Robust p values in brackets, clustered by security to allow for heteroskedasticity and autocorrelation within securities.
(2) * significant at 10%; ** significant at 5%; *** significant at 1%
(3) The Ln Bid-Ask Spread is the natural logarithm of the difference between the daily closing ask price and the daily closing bid price. In our analysis Bid-Ask Spread is measured as a percentage, and is calculated as follows:

\[
\text{Bid-Ask Spread} = \frac{P_A - P_B}{P_A + P_B} 
\]

(4) The sample is composed by 104 large caps. In particular, we include securities that compose the main index of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC40, BEL20, AEX and PSI respectively.
(5) The ask price and the bid price has been provided by Bloomberg. We have data for the period between 3rd January 2000 and 31st December 2004, on a daily basis.

5.37 Column (1) describes the average impact of integration on the bid-ask spreads of the securities of the Paris, Brussels, Amsterdam and Lisbon markets. Column (2) repeats the same analysis, but controlling for changes in the volatility of the DAX index; and Columns (3) does the same but controlling for changes in the volatility of the FTSE100 index.

5.38 We find that the negative effect of integration on the average bid-ask spread identified in Table 4 above is largely driven by the effect of integration on the liquidity of the securities listed in the CAC40 and in the BEL20. From Columns (2) and (3) we observe that the average bid-ask spread of the securities in the CAC40 fell between 40% and 48% as a result of integration. The bid-ask spread of the securities in the BEL20 fell between 23.5% and 30% as a result of integration. These effects are not only material but also statistically significant.

5.39 The results for Amsterdam are not so clear cut. We find that the impact of integration on the bid-ask spreads of the securities listed in the Amsterdam index was to reduce the spreads between 4% and 11.5%. This effect is, however, not statistically significant. This is partly due to the very conservative approach adopted in this paper for the calculation of standard errors. If instead of using robust p values clustered by security to construct confidence intervals, as we have done above, we were to use standard robust p values, the effect of integration on
the bid-ask spreads of the securities in the Amsterdam index would be statistically significant at the 1% level.\textsuperscript{53} Finally, we note that integration had a surprising negative effect on liquidity in Lisbon.

\textit{Estimated results—Euronext data}

5.40 Table 6 presents the results of the econometric analysis of the impact of integration on the weighted average bid-ask spread calculated by Euronext for the securities in the CAC 40 index.\textsuperscript{54}

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|}
\hline
Ln Weighted Average Spread & (1) & (2) \\
\hline
Integration & -0.380*** & [0.000] \\
Phase 1 & -0.093*** & [0.000] \\
Phase 2 & -0.140*** & [0.000] \\
Phase 3 & -0.395*** & [0.000] \\
Constant & -1.905*** & -1.850*** \\
& [0.000] & [0.000] \\
Monthly dummies & Yes & Yes \\
Economic events dummies & Yes & Yes \\
Number of Observations & 1,313 & 1,313 \\
R-squared & 0.45 & 0.70 \\
\hline
Notes: \\
(1) Robust p values in brackets \\
(2) * significant at 10%; ** significant at 5%; *** significant at 1% \\
(3) The Ln Weighted Average Spread is the natural logarithm of the difference between the best quoted ask price and the best quoted bid price, weighted by transaction size. In our analysis Weighted Average Spread is measured as a percentage. \\
(4) The Weighted Average Spread is only available for the index CAC40 quoted in Paris stock exchange. \\
(5) The Weighted Average Spread has been provided by Euronext. We have data for the period between 3rd January 2000 and 28th February 2005, on a daily basis.
\end{tabular}
\end{table}

5.41 Column (1) describes the impact of integration on the Paris weighted-average bid-ask spread. Column (2) repeats the same analysis, but it disaggregates the impact of integration to consider the changes in bid-ask spreads resulting at each of the three steps in the integration of Euronext's cash trading business. The regressions in both Columns include monthly dummies, securities dummies and dummies controlling for a few salient events that may have affected the behaviour of the Paris, Brussels, Amsterdam and Lisbon stock exchanges.

5.42 We find similar results to those obtained for Paris using Bloomberg bid-ask spread data (Tables 4 and 5). The weighted average bid-ask spread of the securities included in the Paris index fell as a result of the creation of Euronext. This effect is statistically significant. It is also material from an economic viewpoint. According to the estimation in Column (1), the

\textsuperscript{53} These results can be seen in Section 7, Annex: Additional econometric results. \\
\textsuperscript{54} Note that in contrast with the panel data regressions using Bloomberg bid-ask spread data, this regression is a pure time series regression.
reduction in bid-ask spreads following integration was approximately 38%. Column (2) shows that such a decline occurred soon after the creation of Euronext.

5.43 The empirical results on the impact of integration on the average bid-ask spread of the securities listed in Euronext’s exchanges is consistent with the results of a similar analysis conducted by Professors Arnold, Hersch, Mulherin and Netter, who studied the effects of three successive mergers between regional US stock exchanges in the 40’s and 50’s.55

Impact on volume

5.44 The integration of formerly separate stock exchanges should have a positive impact on volume through increased cross-border trading. This is a virtuous circle since increased volume should lead to lower implicit costs, which in turn leads to increased volume.

Data

5.45 We analyse the impact of integration on volume, measured for the purposes of this analysis by the number of shares traded for the securities included in the main indices of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX, and PSI, respectively. The number of shares traded for these securities has been provided by Bloomberg. We have data on a daily basis for the period between 3rd January 2000 and 31st December 2004. The number of observations is 127,286.

5.46 Table 7 provides descriptive statistics regarding the number of shares traded for the equities included in the analysis.


<table>
<thead>
<tr>
<th>Index</th>
<th>Observations</th>
<th>Average</th>
<th>Stand. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris</td>
<td>49,690</td>
<td>2.1</td>
<td>3.3</td>
<td>0</td>
<td>89.6</td>
</tr>
<tr>
<td>Brussels</td>
<td>24,147</td>
<td>0.3</td>
<td>0.6</td>
<td>0</td>
<td>56.9</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>30,685</td>
<td>4.0</td>
<td>5.2</td>
<td>0</td>
<td>141.6</td>
</tr>
<tr>
<td>Lisbon</td>
<td>22,764</td>
<td>1.5</td>
<td>3.8</td>
<td>0</td>
<td>147.8</td>
</tr>
</tbody>
</table>

Source: Bloomberg

5.47 Figure 11 displays the evolution of the number of shares traded for the largest caps in Paris, Brussels, Amsterdam and Brussels from Jan 2000 to December 2004. The Figure illustrates an increase in volume for each of those exchanges following integration.

Estimated results

5.48 The descriptive analysis shown in Figure 11 is confirmed by the results of the multiple regression analysis presented in Table 8. Column (1) describes the average impact of integration on the volume of the Euronext exchanges. It includes monthly dummies, security dummies, and dummies controlling for a few salient events that may have affected the behaviour of the Paris, Brussels, Amsterdam and Lisbon exchanges. It also incorporates a linear trend to control for potential deterministic non-stationarity. These controls are also included in all other specifications of the volume model in Table 8. Columns (2) and (3) repeat the same analysis but introducing two additional controls: the number of shares traded

in the FTSE100 index (Column 2) and the DAX index (Column 3). These controls are added because we want to isolate, to the extent possible, the effect of integration on volume from other confounding factors: shocks to the global or European economy, etc. Columns (4) – (6) are identical to Column (1) – (3), but disaggregating the impact of integration to consider the changes in volume resulting from each of the three steps in the integration of Euronext’s cash trading business.

Figure 11. Evolution of the number of shares traded for large caps in Paris, Brussels, Amsterdam and Lisbon, Jan 2000 – Dec 2004.


<table>
<thead>
<tr>
<th>Ln Number of Shares Traded</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>0.431***</td>
<td>0.399***</td>
<td>0.432***</td>
<td>0.339***</td>
<td>0.298***</td>
<td>0.320***</td>
</tr>
<tr>
<td>Phase 1</td>
<td>0.339***</td>
<td>0.298***</td>
<td>0.320***</td>
<td>0.215***</td>
<td>0.271***</td>
<td>0.277***</td>
</tr>
<tr>
<td>Phase 2</td>
<td>0.215***</td>
<td>0.271***</td>
<td>0.277***</td>
<td>0.106*</td>
<td>0.248***</td>
<td>0.345***</td>
</tr>
<tr>
<td>Phase 3</td>
<td>0.106*</td>
<td>0.248***</td>
<td>0.345***</td>
<td>[0.008]</td>
<td>[0.01]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>Ln Number of Shares Traded in FTSE100</td>
<td>0.514***</td>
<td>0.572***</td>
<td>0.514***</td>
<td>0.422***</td>
<td>0.521***</td>
<td></td>
</tr>
<tr>
<td>Ln Number of Shares Traded in DAX</td>
<td>0.514***</td>
<td>0.572***</td>
<td>0.514***</td>
<td>[0.00]</td>
<td>[0.00]</td>
<td></td>
</tr>
<tr>
<td>Time trend</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Constant</td>
<td>15.657***</td>
<td>5.026***</td>
<td>8.241***</td>
<td>15.748***</td>
<td>3.956***</td>
<td>6.652***</td>
</tr>
</tbody>
</table>

Notes:
(1) Robust p values in brackets, clustered by security to allow for heteroskedasticity and autocorrelation within securities.
(2) * significant at 10%; ** significant at 5%; *** significant at 1%
(3) The sample is composed by 104 large caps. In particular, we include securities that compose the main index of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX and PSI respectively.
(4) The number of shares traded has been provided by Bloomberg. We have data for the period between 3rd January 2000 and 31st December 2004, on a daily basis.
5.50 We find that the volume in Paris, Brussels, Amsterdam and Lisbon increased as a result of the creation of Euronext. This effect is statistically significant. It is also material from an economic viewpoint. According to the estimations in Columns (2) and (3), volume increased by approximately 40% in the period after the integration. Columns (4) and (6) show that this effect occurred as early as the integration of the clearing and trading platforms of Brussels and Paris.

5.51 Table 9 repeats the analysis of Table 8 but it now considers the differential effect of integration on the traded volume of the Paris, Brussels, Amsterdam and Lisbon markets, by introducing a series of new integration variables (see paragraph 5.26 above). Column (1) describes the average impact of integration on the traded volume of the securities of the Paris, Brussels, Amsterdam and Lisbon markets. Column (2) repeats the same analysis, but controlling for the number of shares traded in the FTSE100 index; and Columns (3) does the same but controlling for the number of shares traded in the DAX index.

5.52 Table 9 shows that the impact of integration on volume was positive and statistically significant in Paris, Brussels and Amsterdam. We also find a positive effect in Lisbon, but is not statistically significant in 2 out of 3 specifications, and when it is significant it is only at the 10% level (i.e., weakly). The largest effect is found in Brussels (48% - 51%), followed by Paris (47%-49%) and then Amsterdam (34% - 37%).


<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ln Number of Shares Traded</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paris</td>
<td>0.520***</td>
<td>0.468***</td>
<td>0.497***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Brussels</td>
<td>0.529***</td>
<td>0.479***</td>
<td>0.509***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>0.364***</td>
<td>0.341***</td>
<td>0.370***</td>
</tr>
<tr>
<td></td>
<td>[0.005]</td>
<td>[0.009]</td>
<td>[0.005]</td>
</tr>
<tr>
<td>Lisbon</td>
<td>0.183</td>
<td>0.216</td>
<td>0.264*</td>
</tr>
<tr>
<td></td>
<td>[0.218]</td>
<td>[0.151]</td>
<td>[0.079]</td>
</tr>
<tr>
<td>Ln Number of Shares Traded in FTSE100</td>
<td></td>
<td></td>
<td>0.500***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.000]</td>
</tr>
<tr>
<td>Ln Number of Shares Traded in DAX</td>
<td></td>
<td></td>
<td>0.407***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.000]</td>
</tr>
<tr>
<td>Time trend</td>
<td>0</td>
<td>-0.000***</td>
<td>-0.000***</td>
</tr>
<tr>
<td></td>
<td>[0.327]</td>
<td>[0.001]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Constant</td>
<td>15.696***</td>
<td>5.359***</td>
<td>8.534***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Security dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Monthly dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic events dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>127,286</td>
<td>125,422</td>
<td>126,431</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.85</td>
<td>0.86</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Notes:
(1) Robust p values in brackets, clustered by security to allow for heteroskedasticity and autocorrelation within securities.
(2) * significant at 10%; ** significant at 5%; *** significant at 1%
(3) The sample is composed by 104 large caps. In particular, we include securities that compose the main index of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX and PSI respectively.
(4) The number of shares traded has been provided by Bloomberg. We have data for the period between 3rd January 2000 and 31st December 2004, on a daily basis.
Impact on Volatility

5.53 *Ceteris paribus*, thin markets are more volatile than thick markets, i.e., markets with a large number of traders. In a thick market, a larger and more stable order flow reduces the noise induced by individual orders, since they tend to average out and therefore to exert less pressure on prices. Moreover, a tighter bid-ask spread lowers the “bid-ask price bounce” induced by small orders, and the greater likelihood of finding a trading counterparty reduces the price concession necessary to execute a large order. As a result, transaction prices vary less due to the impact of any given order. For all these reasons, a merger between exchanges that results in a thicker market should lead also to lower volatility.

Data

5.54 We analyse the impact of integration on volatility using data on (20 days’) historical volatility for the securities included in the main indices of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX, and PSI, respectively. We have data on a daily basis for the period between 3rd January 2000 and 31st December 2004. The number of observations is 111,793.

5.55 The historical 20 days’ volatility is calculated using the stock closing prices provided by Bloomberg. This variable is defined as the natural logarithm of the annualized standard deviation for close-to-close stock returns over a 20-day interval, and is given by the following expressions:

\[
\text{Stock return} = x_t = \ln\left(\frac{P_t}{P_{t-1}}\right)
\]

\[
X(\text{mean of } x_t) = \frac{1}{N} \sum_{t=1}^{N} x_t
\]

\[
\text{Historical 20 days Volatility} = \sqrt{250 \times \frac{\sum_{t=1}^{N} (x_t - X)^2}{(N - 1)}}
\]

where: \(P_t\) denotes the closing price in period \(t\), \(P_{t-1}\) denotes the closing price in period \(t-1\), and \(N\) denotes the period of observation, that is 20 days.

Descriptive analysis

5.56 Table 10 provides descriptive statistics on the historical volatility of the securities included in the analysis.


<table>
<thead>
<tr>
<th>Index</th>
<th>Observations</th>
<th>Average</th>
<th>Stand. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris</td>
<td>44,657</td>
<td>0.22</td>
<td>0.13</td>
<td>0.03</td>
<td>1.35</td>
</tr>
<tr>
<td>Brussels</td>
<td>21,655</td>
<td>0.19</td>
<td>0.12</td>
<td>0.02</td>
<td>1.45</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>26,832</td>
<td>0.27</td>
<td>0.25</td>
<td>0.04</td>
<td>4.06</td>
</tr>
<tr>
<td>Lisbon</td>
<td>18,649</td>
<td>0.20</td>
<td>0.16</td>
<td>0.01</td>
<td>1.74</td>
</tr>
</tbody>
</table>

Source: Bloomberg
5.57 Figure 12 displays the evolution of historical volatility for the largest caps in Paris, Brussels, Amsterdam and Brussels from January 2000 to December 2004. The Figure illustrates a sharp decline in volatility for each of those exchanges.


Estimated results

5.58 Table 11 presents the results of our empirical analysis. Column (1) describes the impact of integration on historical volatility. It includes monthly dummies, security dummies, and dummies controlling for a few salient events that may have affected the behaviour of the Paris, Brussels, Amsterdam and Lisbon exchanges. Column (2) repeats the same analysis but introducing the historical volatility of the CAC 40, BEL 20, AEX, and PSI indices as controls. These controls are added because we want to isolate, to the extent possible, the effect of integration on volatility from other confounding factors: shocks to the global or European economy, or shocks that are idiosyncratic to the exchanges considered but are not related to integration.

Column (3) is identical to Column (1), but it now disaggregates the impact of integration to consider the changes in volatility resulting from each of the three steps in the integration of Euronext's cash trading business. Column (4) repeats the analysis in Column (3) but controlling for changes in the historical volatility of the CAC 40, BEL 20, AEX, and PSI indices. Columns (5)-(8) repeat the analysis in Columns (2) and (4) but controlling for changes in the volatility of the DAX (Columns (5) and (7)) and the FTSE100 (Columns (6) and (8)). The estimations in Columns (2)-(8) also include monthly dummies, security dummies, and dummies controlling for a few salient events that may have affected the behaviour of the Paris stock exchange.

5.59 In what follows we focus on Columns (2) and (4) and (5) – (8), since it turns out that the historical volatility of the CAC 40, BEL 20, AEX, PSI, FTSE100 and DAX indices are statistically significant controls.
We find that the historical volatility of the large-cap securities traded in Paris, Brussels, Amsterdam and Lisbon fell as a result of the creation of Euronext. This effect is statistically significant in all specifications. It is also material from an economic viewpoint. According to the estimation in Columns (2), (5) and (6) volatility on average fell between 9% and 18% in the period after the integration. Columns (4), (7) and (8) show that this effect occurred as early as the integration of the clearing and trading platforms of Brussels and Paris.

In Table 12 we consider the differential effect of integration on the volatility of the Paris, Brussels, Amsterdam and Lisbon markets, described in Table 11, by introducing a series of new integration variables (see paragraph 5.26 above). Column (1) describes the average impact of integration on the volatility of the securities of the Paris, Brussels, Amsterdam and Lisbon markets. Column (2) repeats the same analysis, but controlling for changes the historical volatility of the CAC 40, BEL 20, AEX and PSI indices. Columns (3) and (4) do the same, but controlling for historical volatility of the DAX index and FTSE100 index, respectively.

We find that integration led to reductions in volatility in all Euronext markets. This effect is both statistically and economically significant in the case of the Paris for all possible specifications. For Brussels, Amsterdam and Lisbon, the magnitude and statistical significance of the effect depends on the specification considered.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris</td>
<td>-0.261***</td>
<td>-0.180***</td>
<td>-0.252***</td>
<td>-0.152***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Brussels</td>
<td>-0.207***</td>
<td>-0.216***</td>
<td>-0.197***</td>
<td>-0.089*</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.083]</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>-0.209***</td>
<td>-0.174***</td>
<td>-0.122**</td>
<td>-0.028</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.003]</td>
<td>[0.035]</td>
<td>[0.629]</td>
</tr>
<tr>
<td>Lisbon</td>
<td>-0.374***</td>
<td>-0.109**</td>
<td>-0.053</td>
<td>-0.021</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.030]</td>
<td>[0.301]</td>
<td>[0.678]</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.780***</td>
<td>-0.472***</td>
<td>-0.456***</td>
<td>-0.220***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Security dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Monthly dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic events</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>111,793</td>
<td>111,793</td>
<td>108,065</td>
<td>110,742</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.36</td>
<td>0.59</td>
<td>0.54</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Notes:
(1) Robust p values in brackets, clustered by security to allow for heteroskedasticity and autocorrelation within securities.
(2) * significant at 10%; ** significant at 5%; *** significant at 1%
(3) The Ln Historical 20 days Volatility is the natural logarithm of the annualized standard deviation for closing stock prices returns observed on a time period of 20 days, and is calculated as follows:
\[
\text{Historical 20 days Volatility} = \sqrt{\text{Volatility days Historical}} = \sqrt{\sum_{t=1}^{N} \left( x_t - \overline{x} \right)^2 / (N-1)}
\]
(3) The sample is composed by 104 large caps. In particular, we include securities that compose the main index of the Paris, Brussels, Amsterdam and Lisbon stock exchanges: CAC 40, BEL 20, AEX and PSI respectively.
(4) The closing prices has been provided by Bloomberg. We have data for the period between 3rd January 2000 and 31st December 2004, on a daily basis.

Conclusion

To sum up, the evidence shows that the creation of Euronext increased the liquidity of the merging exchanges and, therefore, reduced the implicit costs of trading. This increase in liquidity is reflected in lower bid-ask spreads, greater volume and lower volatility. Table 13 below summarises these results.
<table>
<thead>
<tr>
<th>Impact of integration</th>
<th>Bid-ask spread</th>
<th>Volume</th>
<th>Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bloomberg data</td>
<td>Euronext data</td>
<td>Bloomberg data</td>
</tr>
<tr>
<td><strong>Paris</strong></td>
<td>Negative</td>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Statistically significant always 40%-48%</td>
<td>Statistically significant always 38%</td>
<td>Statistically significant always 46%-50%</td>
</tr>
<tr>
<td><strong>Brussels</strong></td>
<td>Negative</td>
<td>n.a.</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Statistically significant always 23%-30%</td>
<td></td>
<td>Statistically significant in most specifications 48%-50%</td>
</tr>
<tr>
<td><strong>Amsterdam</strong></td>
<td>Negative</td>
<td>n.a.</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Statistically significant in some specifications 4%-11.5%</td>
<td></td>
<td>Statistically significant in most specifications 34%-37%</td>
</tr>
<tr>
<td><strong>Lisbon</strong></td>
<td>Positive</td>
<td>n.a.</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Statistically significant in some specifications 0%-27%</td>
<td></td>
<td>Statistically significant in some specifications (weakly) 0%-25%</td>
</tr>
</tbody>
</table>
Section 6

Concluding remarks

6.1 This paper has investigated the efficiency effects of the horizontal integration of the cash trading and clearing platforms of the French, Belgian, Dutch and Portuguese stock exchanges that took place between September 2000 and November of 2003.

6.2 We find that:

▪ Integration allowed Euronext to rationalise its operations and reduce its costs. Euronext’s continental IT costs fell by 29% between 2001 and 2004. Euronext estimates that, comparing the same set of activities, its total continental IT costs will have fallen by 46 million euros (or 25%) between 2000 and 2005. Euronext reduced its staffing levels by 24% between 2001 and 2004.

▪ Users have shared in these cost reductions through lower trading fees. The evidence shows that the average trading fee (in real terms) charged in Paris fell about 30% in the period from December 1999 to December 2004. Average trading fees also fell in Brussels and Amsterdam. From January 2002 to December 2004, the average trading fee in Brussels fell by 30%. From January 2001 to December 2004, the average trading fee in the Amsterdam exchange fell by approximately 45%.

▪ Our econometric analysis shows that the impact of integration on the average trading fee in Paris was a reduction of 15%. The average trading fee in Amsterdam fell approximately by 31% as a result of the creation of Euronext. Both reductions are statistically significant, and are net of the impact of increased trading volumes on fee levels (which in itself is associated with a further reduction of average trading fees).

▪ Integration of the Euronext markets has allowed all members of the exchange to directly access all of the different markets that Euronext provides. In 2002, the members of the Amsterdam exchange undertook 8% of their trades on other Euronext exchanges; that number was 24% in 2004. Similar results obtain for Paris (from 9% to 18%) and Brussels (from 20% to 36%).

▪ The process of integration has expanded the set of securities accessible to a Euronext member. For instance, for a member of the Paris exchange who was not active in other Euronext markets prior to integration, the integration of Paris with the Brussels and Amsterdam markets increased the number of cash securities which it can trade from 9,311 at the end of the first quarter of 2001 to 13,163 at the end of 2001. For an member of the Brussels or Amsterdam exchanges, the increase in the number of directly tradable securities was larger.

▪ The integration process has also increased the liquidity of the merging exchanges and, therefore, reduced the implicit costs of trading. This increase in liquidity is reflected in lower bid-ask spreads, greater volume and lower volatility.
- The *bid-ask spreads* of the securities included in the main Paris index (CAC 40) fell as a result of the creation of Euronext. This effect is statistically significant for all specifications of the regression model, and cannot be attributed to a downward trend common to other European exchanges, such as the London Stock Exchange and Deutsche Börse. It is also material from an economic viewpoint: the reduction in bid-ask spreads following integration was between 40% and 48% when measuring the bid-ask spread using Bloomberg data, and 38% when using the weighted average bid-ask spread constructed by Euronext for the Paris exchange.

- The regression analysis also shows that integration led to a reduction of the bid-ask spreads of the securities in the main indices of Brussels and Amsterdam. (The impact on Lisbon has the opposite sign.) In Brussels the effect of integration was a reduction in bid-ask spreads of 23%-30% using Bloomberg data. This effect is found to be statistically significant for all specifications of the econometric model. The effect of integration in Amsterdam was smaller (4%-11.5%) and statistically significant only under some specifications of the econometric model.

- Traded *volume* in Paris, Brussels, and Amsterdam increased as a result of the creation of Euronext. This effect is statistically significant and cannot be attributed to an upward trend common to other European exchanges, such as the London Stock Exchange and Deutsche Börse. According to our estimations, the creation of Euronext led to an increase in the traded volume of the main securities listed on the Paris, Brussels and Amsterdam exchanges of approximately 40%.

- The *volatility* of stock returns for the large-cap securities traded in Paris, Brussels, Amsterdam and Lisbon fell as a result of the creation of Euronext. The impact of integration on volatility was statistically significant and cannot be attributed to a downward trend common to other European exchanges, such as the London Stock Exchange and Deutsche Börse. The reduction in volatility following integration was between 9% and 18%.

6.3 The results of this paper have implications for the competitive assessment of the proposed consolidation of Euronext and the LSE.

6.4 **Explicit costs of trading.** The cost efficiencies created by the integration of exchanges identified in the literature are not merely hypothetical. As shown in Section 3 above, the savings attained by Euronext through the integration of the trading platforms of its constituent exchanges are verifiable and material. They have been the result, in particular, of the elimination of duplications in IT activities and staff cost savings.

6.5 Looking at the first of these, *IT activities*, we note that LSE has its own SETS trading platform on which cash trading in the London market takes place. SETS is comparable in size to Euronext's NSC platform and involves significant ongoing development costs.\(^56\) It handles larger volumes of trade than the combined trading volumes in Amsterdam, Brussels and Lisbon, and the scope for costs savings by migrating trading from SETS and NSC onto a single cash trading platform can therefore be expected to be at least as high as those described in Section 3 above.

6.6 Looking at the second area, *staff costs*, a merger between Euronext and the LSE should provide opportunities for savings as well. On the one hand, these may be expected to be more limited than the situation we describe in Section 3 above, since a merger between Euronext and the LSE involves the merger of two exchanges rather than four. On the other, it

\(^{56}\) See London Stock Exchange, Annual Report 2004, pp. 24 and 25, for a description of the IT projects that the LSE is currently sponsoring.
may create more opportunities for savings in staff costs, since Euronext (through LIFFE) already has operations in London, which may create more opportunities to rationalise support functions than it was the case within Euronext, where none of the merging exchanges were located in the same country and it has been necessary to maintain a presence in each of these separate countries.

6.7 Importantly, Euronext has passed these cost savings on to users in response to the existence of competitive constraints on its behaviour. These constraints are likely to be largest where users are large, well-organised and can make use of alternative trading mechanisms, i.e., internalisation, OTC trading, and alternative multi-lateral trading platforms. Arguably these factors are stronger in the case of the LSE than in the case of Euronext's users.

▪ First, there is significant user concentration on the LSE, with a small number of very large investment banks representing the bulk of on-exchange trading activity. In addition, these users act through powerful pressure groups, in particular LIBA.

▪ Second, LSE members make significant use of alternative methods of trading, such as internalisation and OTC trading. They might be expected to use the threat of making greater use of these methods as a means to ensure that the merged exchange passes on the benefits of cost efficiencies to its users.

▪ **Implicit costs of trading.** In addition to the pass-through of the cost savings resulting from integration in the form of lower explicit trading costs, Euronext's members and investors have benefited directly from the impact of the creation of Euronext on the cost of cross-border trading. Most importantly, the integration of exchanges appears to have a significant impact on market liquidity.

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57 See Pagano and Padilla, Section 4, *supra* note 2.
58 The LSE produces trading statistics on all trades, including the trades that are not conducted on-exchange but are reported to the LSE. According to data reported by the Federation of European Stock Exchanges, in February 2005, SETS, the LSE's electronic order book, accounted for only 32% of the traded value reported to the LSE.