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ABSTRACT

With the Markets in Financial Instruments Directive in effect since November 2007, new trading venues have emerged in European equities trading, among them Chi-X. This paper analyzes the impact of this new market entrant on the home market as well as on consolidated liquidity of French blue chip equities, newly tradable on Chi-X. Our findings suggest that owing to this new competition the home market's liquidity has enhanced. This is apparently due to the battle for order flow which results in narrower spreads and increased market depth. These results imply that overall liquidity in a virtually consolidated order book is in the French case higher than without the new competitor.

Keywords

Electronic Market, Trading, Liquidity, Fragmentation, Exchanges

INTRODUCTION

Following intensive discussions and circumstantial preparations across the financial industry, a new era began for European equity trading in November 2007 when the Markets in Financial Instruments Directive (MiFID) became applicable across Europe. By establishing a single market and a homogenous regulatory regime for investment services across the European Economic Area, MiFID has been expected from its origins to trigger fundamental changes in the European equities trading landscape. Indeed, there is consensus among traders that by the time of its first anniversary, MiFID has been successful in its main objective: to lead to more competitive equity markets in Europe (Jeffs and Fairless 2008). Its consistent classification of execution venues (i.e. equal treatment of multilateral trading facilities (MTFs) and regulated markets, which implies the abolition of formerly existing concentration rules that obliged investment firms to route orders exclusively to stock exchanges) is the central enabler for the emergence of new electronic trading venues. Examples of such MTFs include Chi-X, Turquoise and NasdaqOMX. From a technical perspective, the high degree of electronification found in European equity markets and their trading participants favors competition. The creation and operation of new trading venues is facilitated once a trading system has been developed or acquired and the burdens of participating in these markets have been lifted, as nowadays traders' physical presence at the trading venue is not required anymore.

MiFID's best execution requirements oblige investment firms to make adequate provisions including processes and IT systems for order routing to achieve the best possible result for the client. Against this background, new technologies like e.g. Smart Order Routing systems (SOR) enable investors to efficiently make use of liquidity available in more than one market. Though not mandated by MiFID, SOR is one possibility to access multiple liquidity pools, i.e. exchanges or MTFs, to identify the best destination and apply proprietary algorithms to optimize order execution (Hallam and Idelson 2003). SOR engines continuously gather real-time data from the respective venues concerning their order book situations, i.e. current quoted volumes and prices. Based on this information, they slice incoming orders and decide where to route individual suborders in respect of the best prices available in that logical second.

The new regulatory environment triggered by MiFID has also increased fragmentation among execution venues in Europe[1]. So far, equity trading mainly focused on a stock's home market, while other trading venues had very little market share although blue-chip stocks have been cross-tradable in European exchanges for some ten years already.

[1] A number of concepts have recently been developed that shed light on fragmentation and market shares in European equity trading: The *Fidessa Fragmentation Index* (FFI) reports on a weekly basis the post-trade fragmentation, i.e. market shares of selected European exchanges (see http://fragmentation.fidessa.com/). Equiduct's *Liquidity Fragmentation Index* (OrangeLFI) calculates a stock's pre-trade fragmentation, i.e. the theoretical market share based on where an order should have been routed (see http://www.equiduct-trading.com/).

UK-based Chi-X Europe is one of the new market entrants and has gained a considerable market share in European blue-chip stocks, which amounted to 5.8% of all European equities trades in November 2008 (Fairless 2009). Chi-X launched its fully electronic trading system in March 2007 and currently serves 13 European markets. German and Dutch stocks from the DAX-30 and AEX-25 index were the first to be made available for trading, with the other markets following successively and two future markets currently being under investigation. Business commenced rather sluggishly in the beginning as new members needed to be connected first in order to be able to trade.

While there is convincing evidence that competition for equity trading flow has increased in 2008 (cf. FFI or OrangeLFI), its impact on market liquidity remains unclear and needs to be investigated. Liquidity is known to be the most important determinant of market quality. It has an effect on the transaction costs for investors, and it is a decisive factor for order flow among execution venues. In view of MiFID's best execution requirements, academics and practitioners are reasoning that the test for MiFID is whether competition will increase liquidity and efficiency or whether the benefits of competition for investors will be lost to the increase in fragmentation. This paper contributes to this discussion by an analysis of the impact of new execution venues on the liquidity of incumbent European equity markets. We analyze the cost of a round-trip trade of a certain size (denominated in Euros) as indicator for overall liquidity for a set of French blue-chip stocks before and after the entry of a new competing execution venue, Chi-X, both for the home market and for a virtually consolidated market consisting of both order books. Against the background of initial sluggish trading contingent upon a too little number of connected members, we chose French stocks for our analysis. Chi-X had positioned itself a competitor of Euronext Paris for stocks in the French blue-chips index CAC-40 since September 28, 2007 – i.e. six months after going live with the first market.

The remainder of this paper is structured as follows: The next section surveys the relevant literature on market fragmentation and competition between markets. The market structures of both Euronext Paris and Chi-X are presented followed by a description of our dataset and methodology. The subsequent section reports our findings, while the last section provides conclusions.

RELATED LITERATURE

Our work as outlined in the introductory section addresses and contributes to two topics in academic literature: firstly in a general way the impact of market fragmentation and competition between markets on quoting behavior in dealer markets as well as on overall liquidity in order driven markets, and secondly in a more concrete way the topic of empirical market liquidity event analyses where market liquidity before and after the emergence of a new competitor is compared. This section will outline some of the studies relevant to our research purpose and their findings.

In one of the first papers on the effects of market fragmentation Hamilton (1979) analyses the off-board trading of NYSE-listed stocks on regional exchanges and in the third market, the over-the-counter (OTC) trading of listed securities among institutional investors and broker/dealers for their own accounts. When studying the NYSE specialist bid-ask spreads (the prices of marketability) and the daily returns variance, Hamilton finds the competitive effect of several markets to reduce both the NYSE specialist spreads and the daily stock variances by more than the fragmentation effect tends to increase them, although this net effect is not seen to be large.

Barclay, Hendershott and McCormick (2003) study the competition between Nasdaq market makers and electronic communication networks (ECNs) in US equities. Their results show that informed trades more likely occurred in an ECN and that the lower bound for permanent price effects was 50 percent higher for ECNs than for Nasdaq market makers. Their conclusions suggest the majority of aggregated price discovery to occur in ECNs.

The quotation behavior of dealers at the Nasdaq market is also focused by Bessembinder (2003). His hypothesis of competitive quotes helping increase a dealer's market share on Nasdaq is analyzed after the introduction of new trading platforms such as SuperSOES and SuperMontage. As a result, SuperSOES is shown to increase the size elasticity, and SuperMontage to increase even both the size and price elasticity of dealer market share. A positive effect from the market participants' perspective represents the fact that market centers tend to provide greater price improvements and faster executions when they post competitive quotes.

The competitive impact of ECNs on the Nasdaq is studied in Fink, Fink and Weston (2006) and found to have a positive effect on market liquidity as the development of these alternative trading platforms is associated with tighter quoted, effective, and relative bid-ask spreads, greater quotation depths and less concentrated markets. On the other hand the increase in ECN trading may have caused some traditional market makers (wholesalers and national retail dealers) to exit the market for market making as their profits tend to decrease with lowered bid-ask spreads.

Battalio, Hatch and Jennings (2004) examine a sample of actively traded, multiply listed US equity options against the background of growing competition for order flow in actively traded options during August 1999, followed by the introduction of payment for order flow thereafter and the launch of the International Securities Exchange in May 2000. They document substantial reductions in quoted and effective spreads between June 2000 and January 2002.

In their study, Boehmer and Boehmer (2002) examine the change in liquidity for 30 AMEX-listed exchange-traded funds (ETFs) upon being traded under unlisted trading privileges on the NYSE. The evidence presented indicates a substantial increase in liquidity following the NYSE entry.

The bid-ask spreads and volumes in options markets during the competition for listings in 1999 between the CBOE, the American Stock Exchange (AMEX) and the Pacific Exchange (PCX) are examined in DeFontnouvelle, Fishe and Harris (2003). Their findings indicate that effective and quoted bid-ask spreads decrease significantly after multiple listing, and that spreads generally maintain their initial lower levels one year later. Consequently, they reject that economies of scale in market making cause the decrease in spreads and support the view that inter-exchange competition reduces implicit transaction costs.

Foucault and Menkveld (2008) investigate the competition between Euronext and EuroSETS, which is operated by the London Stock Exchange (LSE), in the Dutch stock market. They compute the consolidated limit order book to be deeper and the Euronext depth to be larger after the entry of EuroSETS. They trace back the increased Euronext depth to the fact that Euronext responded to the EuroSETS entry with a fee reduction on limit order submission.

The case of the ECN Island reducing its market transparency in September 2002 is addressed in Hendershott and Jones (2005). Before this event, the trading of ETFs in the US was concentrated on Island. With a higher degree of market fragmentation after this event, Island's effective and realized spreads increased, while effective and realized spreads fell in other markets. The net effect is determined a substantial increase in overall effective and realized spreads and therefore a worsening in overall ETF market quality.

As one can see from the outline above, the majority of studies support the hypothesis that the potential negative impact of market fragmentation on liquidity and overall market quality is overcompensated by the increase of liquidity resulting from a more competitive landscape.

EMPIRICAL ANALYSIS

In this section our research approach will be presented. The basic characteristics of the Euronext Paris and Chi-X market structures will be examined first followed by the description of our dataset and resulting limitations. Eventually, we will elaborate on our hypotheses and methodology.

Euronext Paris and Chi-X market structures

Euronext Paris (ENP) is a centralized hybrid market (i.e. quote- and order-driven) using an electronic trading system, where securities that are liquid enough or securities with a designated liquidity provider are traded continuously following price-member-time priority. The stocks we study are constituents of the blue-chip index CAC-40 and thus are traded continuously without a designated liquidity provider. All orders are anonymous on the order book. The pre-opening starts at 07:15 CET and orders are collected for the opening auction at 09:00 CET. After the opening auction, continuous trading immediately commences and lasts until 17:30 CET. Finally, a closing auction at 17:35 CET closes the trading day. The minimum tick size (price increment) is .01 Euros for all stocks. In order to avoid extreme price fluctuations, ENP has a built-in safety measure in continuous trading. If a price exceeds a specified limit, this mechanism automatically interrupts continuous trading and subsequently an auction begins.

Chi-X is a trading platform operated by Instinet Chi-X Ltd., an independent subsidiary of Instinet Europe Ltd. It is authorized and regulated as an MTF by the UK's Financial Services Authority. Securities can be traded on Chi-X but cannot be listed. Trades on Chi-X are matched in price-time priority by a fully electronic proprietary matching. All Chi-X orders are anonymous on the order book. Chi-X's trading day starts with a pre-market continuous trading period from 07:35 to 09:00 CET. During that time, orders are matched and unexecuted orders are automatically transferred to the subsequent continuous trading session which lasts from 09:00 to 17:30 CET. The opening auction period lasts from 08:00 to 09:00 CET with the opening price being established at 09:00 CET onwards using the primary market opening price which is passed back upstream as a trade correction from 09:00 CET (Chi-X 2007). For the purpose of price continuity, Chi-X conducts price tolerance checks for orders. Those orders that breach the price checks will automatically be rejected by the system. Stocks are traded in their official local currency, i.e. Euros for our CAC-40 stocks. The minimum tick size for Eurozone stocks depends

on a respective stock's price range and varies between .001 Euros for a share price of less than one Euro to .005 Euros for a share price that equals at least 10 Euros.

As presented above, both market structures exhibit similar market design characteristics for our sample of CAC-40 stocks in a way that they are traded continuously in an electronic order book and trading is organized order-driven. Both exchanges feature visible as well as non-displayed order types whereby the latter imposes a limitation in our dataset which will be addressed in the next subsection.

Dataset

On September 28, 2007 Chi-X commenced to provide trading services for French instruments with an initial selection of 19 stocks, all of them constituents of the CAC-40 blue chip index. That range of tradable instruments was extended by another 18 CAC-40 stocks on October 12, 2007. Those 37 French stocks will form our sample instruments, split up into panels A and B.

For these 37 instruments, order book data of the ENP and Chi-X markets have been retrieved from a Reuters Data Scope Tick History terminal. Those data include quoted prices and respective volumes for the first ten limits on each side of the electronic order book, i.e. the ten highest bid and ten lowest ask limits. Time stamps provided in our data are based on milliseconds, and each change in the order book within the first ten limits generates an update in the dataset.

Although ENP and Chi-X both feature non-displayed order types in their market models, publicly available order book data lack this hidden liquidity. Thus, we can measure the change in displayed liquidity following the Chi-X market entry, not the change in overall (hidden and displayed) liquidity. The change in displayed liquidity could therefore underestimate or overestimate overall liquidity changes when e.g. order flow has been shifted from displayed to hidden. Moreover, we do not have any secured information on volatility interruptions, but this is not a severe issue in our case (as will be shown in the next subsection on methodology).

Methodology

For our study on the impact of a new competitive market on liquidity we have selected two sample periods for each panel. The first period includes the last 60 days before a respective stock was made available for trading on Chi-X and thus we will refer to it as our pre-entry period. These data will be applied to retrieve a robust estimate for the Euronext liquidity level before the Chi-X market entry. The second period includes the 30 days following the entry of Chi-X and will be referred to as post-entry phase. For all 37 sample stocks we have checked if any of them have dropped out and been replaced in the CAC-40 index during any of the sample periods.

For our purposes we use limit order book snapshots. The snapshot data contain the ten best bid and ask quotes and the number of shares offered at these quotes, sampled every five minutes in both ENP and Chi-X. We also aggregate these data across both markets and create a snapshot of the consolidated limit order book. Time triggered auctions, i.e. opening and closing auctions, are excluded from computations as we intend to study continuous trading only. Additionally, we excluded the first and last five minutes within each continuous trading session to avoid typical distortions. The duration of event-triggered auctions in ENP induced by a violation of price continuity is only a few minutes and therefore the probability of capturing a snapshot coincidentally in an auction seems to be negligible. Besides, given our setup of order book snapshots and the number of observations, a single snapshot has very little weight in our dataset and thus a snapshot captured involuntarily during an auction period potentially has little bias on our results.

In order to illustrate possible changes in order book liquidity before and after the Chi-X entry we will apply three variables, namely (i) the relative quoted spread, i.e. the ratio of the bid-ask spread and the midpoint, (ii) the value at the top of the book, i.e. the number of shares at the top of the book for both sides multiplied by the associated quote and (iii) the Exchange Liquidity Measure (XLM) for a value of 100,000 Euros as developed in Gomber, Schweickert and Theissen (2004). We use the third measure to capture order book depth, i.e. the order book liquidity beyond the best bid and ask. The XLM measures the execution costs of a round-trip transaction and uses the information about all the orders in an order book to calculate the weighted average price at which an order of given size (Euro-denominated in our case) could be executed immediately at time t. Denote these prices by $P_{B,t}(V)$ and $P_{S,t}(V)$ where the index (B, S) indicates the type of the transaction (buyer-initiated or seller-initiated) and V denotes the order size. Let M_{Qt} denote the quote midpoint at time t. Execution costs for a buy and a sell order in basis points are calculated by

$$XLM_{B,t} = \frac{P_{B,t}(V) - MQ_t}{MQ_t} \cdot 10{,}000$$

$$XLM_{S,t} = \frac{MQ_t - P_{S,t}(V)}{MQ_t} \cdot 10{,}000$$

For the execution costs of a round-trip transaction at time t both measures are added up. A similar measure has been suggested in Irvine, Benston and Kendal (2000), as they considered spreads not to be sufficient measures for market liquidity. For the XLM, we will assume round-trip transactions of V=100,000 Euros.

In our setup we estimate the means of these variables, changes in these means, and test for the statistical significance of these changes applying panel data techniques. For testing the significance of changes in the means we assume that a dependent variable $y_{i,t}$ for stock i and day t can be expressed by adding up a stock-specific mean μ_i, an event effect δ_i, potential control variables $X_{i,t}$ and an error term $\varepsilon_{i,t}$:

$$y_{i,t} = \mu_i + \delta_i I_{[t \text{ in post-entry period}]} + \beta' X_{i,t} + \varepsilon_{i,t}$$

$$\varepsilon_{i,t} = \xi_t + \eta_{i,t}$$

where $I_{[t \text{ in post-entry period}]}$ is an indicator variable which equals 1 if t lies within the post-entry period. The error term consists of a factor common to all stocks and a stock-specific term. We will compute the changes within the quartiles of our two panels A and B as

$$\mu_p = \frac{1}{N_p} \sum_{i \in I_p} \mu_i$$

$$\delta_p = \frac{1}{N_p} \sum_{i \in I_p} \delta_i$$

where p is the quartile index, N_p is the number of stocks in the respective quartile and I_p contains the indices of the stocks in quartile p. δ_p will indicate the impact of the Chi-X entry on a respective dependent variable.

RESULTS

Table 1 presents the mean daily turnover in the stocks from panel A and panel B, respectively. We observe that the set of stocks that were made available for trading at the earlier date (panel A) exhibits a significantly higher mean daily turnover than the stocks from panel B. We clustered the stocks within each panel according to their mean turnover into four quartiles (Q1 to Q4) in order to obtain subgroups as homogenous as possible for later comparisons[2].

As mentioned earlier, XLM captures the depth of the order book. Calculating the XLM for a volume of 100,000 Euros requires the order book to exhibit sufficient depth to theoretically fill a round-trip order of that size. Typically, this is not the case at all times, leading to a number of instances where XLM cannot be computed due to insufficient order book depth. We were unable to compute XLM(100,000) during the pre-entry phase for ENP in 11.1% (panel A stocks: 4.9%, panel B stocks: 17.7%) of our observations and during the post-entry phase in 13.6% (panel A stocks: 5.9%, panel B stocks: 21.8%) of the observations.

When examining two execution venues, the possibility for arbitrage situations exists. Arbitrage is defined as "the simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices" (Sharpe and Alexander 1990). In a perfect world without transaction costs, an arbitrage situation would instantly be resolved by traders simultaneously buying at the one market and selling at the other, thereby realizing a riskless profit. However, when virtually consolidating the order books of two markets during an arbitrage situation, no orders are

[2] The basic characteristics of our dataset are presented in Tables A1 and A2 in the Appendix.

matched. The result thus is the hypothetical situation of a crossed order book, i.e. a situation where the highest bid is lower than the lowest ask price. Computing the XLM in such a situation will result in an XLM<0, which is economically not justifiable. Consolidated order books exhibit on average 49.9% of negative XLMs (panel A stocks: 56.3%, panel B stocks: 43.2%), which is a strong indicator for aggressive quoting behavior of the new entrant.

	Panel A			Panel B		
Quartile	RIC	Instrument	Mean	RIC	Instrument	Mean
Q1	SOGN	SOCIETE GENERALE	266.0	VLLP	VALLOUREC	82.1
	TOTF	TOTAL	263.0	SCHN	SCHNEIDER ELECTRIC	82.0
	BNPP	BNP PARIBAS	238.0	CAGR	CREDIT AGRICOLE	80.8
	AXAF	AXA	170.0	ALSO	ALSTOM	73.2
	FTE	FRANCE TELECOM	169.0	LAFP	LAFARGE	69.2
Q2	SGOB	SAINT GOBAIN	149.0	CAPP	CAP GEMINI	51.7
	SASY	SANOFI-AVENTIS	143.0	EAD	EADS	51.5
	LYOE	SUEZ ENVIRONNEMENT	128.0	VIE	VEOLIA ENVIRON.	50.8
	ALU	ALCATEL-LUCENT	113.0	EDF	EDF	50.1
	CARR	CARREFOUR	102.0	BOUY	BOUYGUES	43.6
Q3	RENA	RENAULT	97.9	ACCP	ACCOR	42.0
	DANO	DANONE	90.9	UNBP	UNIBAIL-RODAMCO	38.9
	VIV	VIVENDI	87.4	PRTP	PPR	37.9
	SGEF	VINCI (EX.SGE)	76.7	DEXI	DEXIA	33.9
	LVMH	LVMH	65.5	AIRF	AIR FRANCE -KLM	33.5
Q4	OREP	L'OREAL	63.4	PERP	PERNOD RICARD	32.0
	AIRP	AIR LIQUIDE	59.1	GAZ	GDF SUEZ	27.7
	PEUP	PEUGEOT	52.7	ESSI	ESSILOR INTL.	18.6
	STM	STMICROELECTRONICS	39.6			

Table 1. Quartiles (by daily turnover in million Euros) in panels A and B[3]

Following the comprehensive discussion of appropriate standard errors for panel data regressions found in Petersen (2009) for testing of significances of changes in the means (of pre- and post-entry), we apply Rogers standard errors which control for commonalities across stocks, heteroscedasticity, and non-zero stock-specific autocorrelation to our model as described in the methodology section. First, we ran our regressions in a univariate setup without any controls and found the event to have a significant impact on ENP market liquidity for most stocks. As liquidity changes might be associated with factors other than the Chi-X market entry, we isolate its effect on market liquidity by running our regression with control variables price level (defined as the average daily midpoint quote), traded volume and volatility (defined as the standard deviation of midpoint quotes over a respective trading day). Only the findings from the multivariate approach will be presented in the following. Table 2 reports the changes for the liquidity variables relative spread, XLM(100,000), and quoted value at best bid and ask in the quartiles of panels A and B for the incumbent market ENP.

Here, *Change Qi (δi)* denotes the regression coefficient (as denoted in the previous section) associated with the Chi-X market entry for stock quartile i. *Rel. Change* reports a variable's change relative to its pre-entry level. With the control variables described before, our findings for the liquidity changes are more heterogeneous than in the univariate setup, particularly across panels A and B. Liquidity in terms of relative spread and XLM, which denotes the transaction costs of a round-trip trade, improves statistically significantly (by 19.11 percent and 16.58 percent respectively at the maximum) for stocks in panel A except for quartile 2, while the quoted volumes at the best bid and ask experience only slightly positive changes after the Chi-X entry. These facts should be interpreted as a more aggressive quoting behavior in the incumbent market ENP induced by its new competitor's market entry. As quoted volumes remain mostly unchanged, aggressiveness here relates mainly to the quotes themselves rather than their associated numbers of stocks posted in the central limit order book. Nevertheless, these changes result in reduced trading costs for investors investing in those stocks. For stocks in panel B our findings are different. As described before, stocks included in panel B have been made available for trading on Chi-X a few weeks later than those in panel A and in general exhibit less trading activity. As reported in table 2, when controls for price level, traded volumes and volatility are included, Chi-X entry induced changes are not statistically significant for ENP with only a few exceptions. While for quartiles 2 to 4 relative spreads and XLMs are found to decrease, this does not hold for the first quartile. For stocks included in quartile 1 relative spreads and XLMs even increase after the event (although not

[3] RIC = Reuters Identification Code

significantly). Surprisingly and in contradiction to our findings for panel A, the (visible) volumes posted at the best bid and ask decrease in the post-event period for all quartiles in panel B, although changes are not statistically significant.

Consolidating over ENP and Chi-X electronic order book snapshots in the post-period resulted in large part in crossed order book situations. In consequence those situations should have been eliminated from our dataset when measuring post-entry period market liquidity in a hypothetical consolidated order book as spreads and XLM values turn to be negative. Therefore we refrain from reporting regression results for the consolidated order book. Nevertheless, we presented evidence that liquidity in the incumbent market ENP has significantly increased for the majority of stocks in panel A after the Chi-X market entry. These findings can be combined with the fact that consolidated order books are crossed in many cases due to an apparently aggressive quotation behavior from traders on the new competitor Chi-X. Necessarily, it appears that overall liquidity available to investors has increased even more in those stocks, when they make use of appropriate technologies to access both markets and route their order flow at best conditions.

CONCLUSIONS

With the introduction of MiFID, equities trading in Europe moved from national concentration rules to a fragmented and competitive landscape of trading venues that have investors adopt new technologies such as SOR systems in order to efficiently make use of liquidity available in more than one market. This paper contributes with an analysis of the impact of new execution venues on the liquidity of incumbent European equity markets.

We investigated the impact of new competitive equity market entrant Chi-X on the incumbent market's liquidity as well as on the liquidity consolidated in a hypothetical order book for a set of French blue-chip stocks from the CAC-40 index. In order to derive general results we formed homogeneous groups of stocks by arranging them by their daily turnover. Consequently, we applied a regression approach to determine the significance of the competitor's entry on the incumbent's market liquidity. In summary, our findings are heterogeneous across the groups of stocks, but suggest that the emergence of the new competitor generates a significant stimulus for the liquidity of the most actively traded stocks in the CAC-40 index while this does not hold true for stocks with lower trading turnover. This can be attributed to a positive liquidity effect in the incumbent market after the event on the one hand and an aggressive quoting behavior from investors trading in the new marketplace on the other hand. One potential explanation for our heterogeneous findings is that trading activity in the new market Chi-X appears to be focused on the top liquids of the CAC-40 stocks and thus the competitive pressure and resulting liquidity improvement for the incumbent market ENP is limited to those stocks. This implies that the mere emergence of a competitor does not have an impact on the incumbent's liquidity as long as the trading activity in the new market is relatively low.

This field of research may be extended into two dimensions: First, Chi-X has expanded into other European markets and it is to be determined if similar findings could be documented for those markets, too. Hypothetically speaking, the impact of a new competitor on the incumbent's liquidity might be positively correlated with the concentration of stock trading before the market entry. Second, besides Chi-X other MTFs have been established in Europe, for instance Turquoise, and it might be of interest to analyze their liquidity impact.

	Panel A				Panel B			
	Relative spread	XLM	Depth BB	Depth BA	Relative spread	XLM	Depth BB	Depth BA
Change Q1 (δ1)	-0.51 *	-0.91 **	8.97	9.99	-0.07	0.41	-3.01	-5.06 *
Rel. Change Q1	-11.32%	-13.30%	5.50%	5.11%	1.44%	5.83%	-7.63%	-10.17%
Change Q2 (δ2)	-0.58	-1.09	-2.44	4.5	-0.47	-0.21	-4.03	-1.71
Rel. Change Q2	-9.36%	-11.26%	-4.35%	1.08%	-9.71%	-6.58%	-5.09%	-1.02%
Change Q3 (δ3)	-1.36 **	-1.85 **	1.18	4.72	-0.92	-0.41	-6.91 *	-4.95
Rel. Change Q3	-19.11%	-16.58%	-0.35%	4.75%	-9.01%	-2.01%	-10.67%	-7.14%
Change Q4 (δ4)	-1.06 *	-1.51 **	12.13	14.72	-1.05	-1.92	-0.87	0.12
Rel. Change Q4	-14.65%	-14.08%	14.45%	17.03%	-9.97%	-10.47%	-3.10%	-1.02%
Change All Quartiles	-0.81 **	-1.34 **	8.48 *	11.95 **	-0.66 *	-0.55	-4.00 **	-3.08 *
Rel. Change All Quartiles	-13.66%	-13.87%	2.78%	5.81%	-6.97%	-3.20%	-7.19%	-5.51%
R2	0.28	0.18	0.54	0.56	0.05	0.11	0.25	0.24
No. of Observations	1216	1216	1216	1216	1216	1216	1216	1216

* / ** significant at 95 / 99 percent level

Table 2. Liquidity changes with controls for volume, price level and volatility for Euronext Paris

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APPENDIX

The following two tables report the basic characteristics of our dataset where qVolBB and qVolBA represent the value at the top of the book's bid and ask side respectively. XLM and relative spread are denoted in basis points, qVolBB and qVolBA in '000 EUR and volume represents the number of shares.

		pre-Entry					post-Entry				
		min	max	median	mean	SD	min	max	median	mean	SD
Q1	XLM	4.96	14.48	7.85	7.97	1.71	3.94	9.99	7.05	6.91	1.32
	Relative Spread	2.93	10.24	5.27	5.36	1.19	2.68	6.86	4.70	4.75	0.98
	qVolBB	54.29	309.37	112.79	124.79	50.84	57.79	342.34	126.20	131.67	47.72
	qVolBA	52.38	448.06	114.91	125.05	52.75	55.21	337.89	128.39	131.43	51.59
	Volume	1,308,275	28,876,199	8,898,096	9,689,307	5,435,985	2,259,545	46,964,691	8,385,150	8,548,450	5,912,812
Q2	XLM	5.14	23.28	10.52	11.59	3.98	4.91	21.40	8.81	10.28	4.37
	Relative Spread	3.57	18.04	6.64	8.09	3.66	3.17	17.70	5.59	7.33	4.38
	qVolBB	43.22	582.23	90.58	135.50	107.38	32.29	424.46	92.74	129.60	93.17
	qVolBA	37.98	535.80	94.16	135.95	103.73	47.34	480.04	101.52	137.43	92.51
	Volume	1,084,911	116,170,333	5,138,585	9,355,473	12,357,243	1,210,844	41,587,734	4,910,076	7,174,101	6,487,202
Q3	XLM	5.71	19.57	11.72	11.98	2.43	6.79	17.52	9.76	9.99	1.92
	Relative Spread	3.50	12.39	7.27	7.46	1.63	3.71	13.89	5.93	6.04	1.36
	qVolBB	28.83	210.60	68.17	76.60	27.15	38.63	244.16	69.31	76.33	30.36
	qVolBA	38.48	225.43	66.51	72.20	22.06	36.03	166.20	67.78	75.63	25.66
	Volume	533,928	14,270,761	2,548,933	3,303,105	2,223,462	703,891	13,419,742	2,269,470	3,032,305	2,157,156
Q4	XLM	5.13	22.68	13.28	13.26	2.92	6.54	17.06	11.16	11.40	2.49
	Relative Spread	2.93	14.63	8.52	8.47	2.39	3.80	12.07	6.41	7.23	2.40
	qVolBB	33.77	327.14	60.01	92.57	66.40	33.69	323.53	62.79	105.95	81.74
	qVolBA	28.15	303.97	62.12	89.78	61.21	35.25	342.70	62.18	105.06	84.26
	Volume	471,507	14,511,912	1,669,533	2,529,652	2,143,166	452,228	20,677,472	1,462,309	2,548,646	2,927,529
All Quartiles	XLM	4.96	23.28	10.76	11.09	3.48	3.94	21.40	8.87	9.55	3.23
	Relative Spread	2.93	18.04	6.64	7.28	2.69	2.68	17.70	5.59	6.29	2.84
	qVolBB	28.83	582.23	85.27	108.14	73.50	32.29	424.46	85.39	111.14	70.87
	qVolBA	28.15	535.80	83.31	106.59	71.79	35.25	480.04	85.39	112.77	72.19
	Volume	471,507	116,170,333	4,271,302	6,413,581	7,803,556	452,228	46,964,691	3,842,466	5,472,045	5,455,570

Table A1. Descriptive statistics for the stocks in panel A

		pre-Entry					post-Entry				
		min	max	median	mean	SD	min	max	median	mean	SD
Q1	XLM	5.95	26.38	11.85	12.47	3.59	4.85	20.40	12.80	13.20	2.77
	Relative Spread	3.59	18.29	7.21	7.66	2.34	2.66	12.10	7.63	7.77	1.76
	qVolBB	35.21	142.41	60.99	65.37	20.42	24.76	138.45	54.57	60.38	21.68
	qVolBA	29.22	142.69	59.07	64.06	19.98	27.88	128.47	54.27	57.54	18.18
	Volume	204,189	20,332,035	1,320,584	2,249,137	2,568,278	330,489	10,784,938	1,212,677	2,040,620	2,230,651
Q2	XLM	6.90	27.62	14.01	14.90	4.07	7.21	23.27	13.69	13.92	3.46
	Relative Spread	3.58	15.21	7.84	8.17	2.23	3.85	11.30	7.23	7.38	1.68
	qVolBB	25.17	134.34	56.84	59.05	15.23	27.16	98.91	54.38	56.04	13.55
	qVolBA	33.18	114.57	56.30	59.22	15.25	27.63	111.66	56.56	58.61	14.82
	Volume	542,793	8,684,514	1,856,401	2,154,809	1,320,405	742,909	12,070,193	1,612,004	2,356,490	1,757,616
Q3	XLM	8.79	27.45	15.85	16.30	3.74	9.06	27.69	15.32	15.98	3.61
	Relative Spread	4.93	19.72	9.15	9.74	2.77	4.69	13.81	8.52	8.86	1.98
	qVolBB	27.06	116.88	57.73	61.44	18.43	21.42	130.56	48.85	54.88	20.78
	qVolBA	30.87	157.39	57.28	60.55	18.39	30.29	183.97	51.56	56.23	23.11
	Volume	187,769	5,940,314	1,273,588	1,619,830	1,270,323	247,427	9,055,829	1,284,867	1,718,704	1,537,569
Q4	XLM	8.80	37.63	18.42	18.74	5.31	6.78	26.62	16.57	16.78	3.35
	Relative Spread	5.48	21.33	9.79	10.19	2.63	3.79	14.39	9.08	9.11	1.84
	qVolBB	20.63	82.85	47.88	48.43	12.56	20.96	83.44	44.79	46.93	12.69
	qVolBA	19.44	112.46	47.04	48.75	13.46	26.10	78.55	45.53	48.26	11.87
	Volume	161,283	5,146,900	756,054	965,774	833,144	223,706	1,829,738	828,908	847,880	435,139
All Quartiles	XLM	5.95	37.63	14.55	15.25	4.61	4.85	27.69	14.45	14.77	3.58
	Relative Spread	3.58	21.33	8.41	8.80	2.68	2.66	14.39	8.04	8.19	1.94
	qVolBB	20.63	142.41	56.45	59.70	18.19	20.96	138.45	51.76	55.41	18.58
	qVolBA	19.44	157.39	55.71	59.19	18.00	26.10	183.97	53.04	55.93	18.31
	Volume	161,283	20,332,035	1,341,871	1,834,233	1,756,635	223,706	12,070,193	1,304,678	1,840,151	1,779,156

Table A2. Descriptive statistics for the stocks in panel B