TRANSPARENCY AND MARKET QUALITY:

AN ANALYSIS OF THE EFFECT OF MIFID ON EURONEXT

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Abstract

MiFID is the latest and most important European Directive in the area of market microstructure. It came into force as an important step toward the creation of a competitive and efficient capital market. Although the implementation of this Directive was largely overshadowed by the recent financial crisis- whose effects we can still observe- this study aims to provide some insights into the impact of MiFID on the performance and quality of Euronext. Using a large sample of publicly listed companies in Europe, this empirical research examines the effect of pre-trade and post-trade transparency on market and order execution quality. The study measures, first, market quality in terms of efficiency (return volatility, return autocorrelation, and FITC) and liquidity (quoted spread, turnover and number of transactions). Secondly, the study investigates order execution quality using the EBEX indicator. The empirical results show, after controlling for some variables, an improvement in certain dimensions of market quality for most liquid stocks and a better order execution quality after MiFID implementation.

JEL Classification: G18, G14.

Keywords: market microstructure, transparency, market quality, order execution quality, efficiency, liquidity.

1. Introduction

The Markets in Financial Instruments Directive (MiFID) was first adopted in April 2004 and came into force on 1 November 2007. Despite it being recent and its shortcomings resulting from the institutional framework of the European Union, MiFID represents a significant regulatory overhaul and an important step toward the creation of a competitive and efficient capital market. It is an important initiative to provide the best organization of the competition among traditional stock exchanges and investment firms in an environment of enhanced transparency and market quality. This study aims to provide some insights into the impact of MiFID on the performance and quality of the financial market. Although the implementation of MiFID was largely overshadowed by the recent financial crisis with its disastrous consequences at all levels of the economy, we believe that it is worthwhile to investigate the effect of this Directive on the performance of Euronext, one of the largest international marketplaces. Using a large sample of publicly listed companies (205) for one pre event period and three post event periods, this empirical research examines the effect of pre-trade and post-trade transparency on market quality. The study measures market quality indicators such as volatility, autocorrelation, liquidity (quoted spread, turnover and number of transactions) and execution quality indicators according to EDHEC research.

Our research paper is organized as follows. After the introduction, an overview of MiFID is presented in the second section. Section 3 surveys the related theoretical and empirical studies conducted at international level. Section 4 presents data sources, sample selection and research design procedures. Section 5 presents empirical findings and analysis of results. Section 6 explains the contributions and shortcomings of the study. The final section gives a brief summary and concluding remarks.

2. Overview of MiFID

MiFID aims to substantially alter the structure of the European securities markets by introducing new concepts such as trade transparency and high quality reporting, and mitigating conflict of interest as a tool to promote investor protection to enhance market integrity, best execution and client suitability. By abolishing the 'concentration rule', investment firms and banks are allowed to create a market for shares by trading on their own account or acting as 'internalizers'. However they have some obligations in terms of disclosure and transparency. Firstly, at pre-trade transparency level, MiFID requires that regulated markets (Art. 44) and multilateral trading facilities (Art 29) provide quoted prices and trading size (bid, ask and depth) of securities that are continually trading throughout trading hours. Systematic Internalizers (SI) are subjected to such a rule only when they trade shares admitted to trading on a regulated market for which a liquid market[1] exists (Article 27). Secondly, for post-trade disclosure, MIFID requires all market intermediaries to publish details such as price, volume and time of share transactions they have undertaken in real time (regulated markets (Art. 45), MTFs (Art. 30) and investment firms (Art. 28)).

The mandatory disclosure of share trades and pre and post transparency requirements for liquid stocks through all trading venues is one of the fundamental conditions of market quality which should contribute to higher market liquidity and greater transaction volume. However, the fact that market quality depends on several other factors (structure, quality of information, monitoring and control mechanisms, etc.) and that there are also illiquid stocks traded in financial markets, makes it hard to advocate the positive effect of the transparency requirements of MiFID without conducting an investigation on this issue.

[1] A ccording to the implementing measures of MiFID, member states must define as "liquid" any shares with a free float of more than €500 million, and an average daily turnover higher than €2 million and/or an average daily number of transactions higher than 500.

The second most important concept introduced by MiFID is "Best execution". According to art.21, member states shall require that when executing orders, investment firms take all reasonable steps to obtain the best possible result for their clients taking into account price, costs, speed, likelihood of execution and settlement, size, nature or any other consideration relevant to the execution of the order. The article specifies that whenever, there is a specific instruction from the client the investment firm shall execute the order following the specific instruction. The best execution provision in MiFID is in line with the concept of fiduciary duty in the context of agency relationship between brokers and their clients. However, similar to other European Directives, MiFID offers a great degree of flexibility to firms in implementing their own best execution policies in accordance with their corporate strategies. Thus, the concept of best execution has been subject to serious criticisms in perfect competitive markets, particularly with regard to its application and monitoring mechanisms. Giraud and D'Hondt (2006) refer to a clear absence of consensus on what best execution means, a lack of conceptual framework for measuring the quality of execution and the difficulties associated with monitoring whether the executed transactions satisfy clients. Foucault and Menkveld (2008) also question the fair application of the principle of best execution in fragmented markets, as the brokers are not always willing to execute the customer's order in the best conditions. Comparing the stock prices in EuroSETS and Euronext for the Dutch market in 2004, they report that only 27% of the market orders are routed to former market (EuroSETS) even if it offers effectively better prices.

3. Theoretical background and related literature

Several research papers (Moinas 2009, Madhavan 1995 and Harris 1992) highlight the importance of market fragmentation[2] where people can trade the same securities in various

[2] "Fragmentation occurs when all orders relative to a given security do not interact with each other on a single execution system (Giraud and D'Hondt, p. 127)".

trading venues, which is one of the objectives of MiFID. In a review of literature, Moinas (2009) provides arguments in favor of fragmentation by referring to the heterogeneity in investors' preferences or characteristics, and the positive impact of fragmentation on inter-market and intra-market competition and innovation. MiFID contributes to the creation of new organized trading systems such as Multilateral Trading Facilities (MTFs) and Systematic Internalizers (SI) alongside regulated markets, which will result in the fragmentation of markets. Referring to the conditions in which fragmentation can contribute to market quality and information content of stock prices, D'Hondt and Giraud (2008) emphasize the importance of pre-trade transparency in the financial market. The authors refer to two conditions for a market to reach a trade-off between fragmentation and consolidation[3] (1): the easy access of market participants to trading conditions prevailing in each liquid poll, and (2) the availability of timely information regarding the trading conditions and stock prices in the other liquidity polls. Both these conditions depend on a high degree of transparency of trading information and free information circulation, fundamental factors in market efficiency.

The concept of pre-trade transparency (in terms of price, size, order type and trader identity) and post trade transparency regarding the quality and timeliness of publicly available information for a completed transaction has been the subject of several research papers. Bloomfield and O'Hara (1999) show that there is no discernible effects of market transparency on market performance by comparing market quality in three artificial markets characterized by different transparency levels (opaque, semi-opaque and transparent). By using similar methodology, Flood et al (1999) compare two markets, (the transparent and the opaque market) and find wider opening spreads and a lower trading volume in the opaque markets due to higher search costs. Hendershott and Jones (2005) by investigating the impact

[3] Markets are consolidated when all market participants trade on the same execution venue.

of compliance of the Island Electronic Communication Network (ECN) conclude that when 'Island goes dark' the market worsens in terms of price discovery and trading costs, fragmenting the market and when Island redisplays one year later its order book, market quality improves.

The effect of disclosed content of limit-order book on market performance has also been the subject of the theoretical studies of Baruch (2005) and Madhavan, Porter, and Weaver (2005) which report contrasting results. Baruch (2005) finds that increased transparency can improve the liquidity and informational efficiency of stocks markets. The study of Madhavan, Porter, and Weaver (2005) empirically examines the effect of changes of information disclosure rules on the Toronto Stock Exchange, where a computerized system to disseminate information about depth at the top four price levels in the limit-order book was implemented on April 12, 1990. By making a comparison between market performances before and after this date, the authors find that increased pre-trade transparency decreases liquidity of the market, and increases the execution costs and volatility after the limit order book is publicly displayed. Similarly, Boehmer, Saar, and Yu (2005) study the effect of the introduction of the OpenBook service on January 24, 2002 for all NYSE securities simultaneously, which provides market participants with much more information in the limit-order book. The authors conclude that the liquidity and informational efficiency of the market are both largely increased, with the favorable outcome that the market quality is improved. Chung and Chuwonganant (2009) analyze the effect of pre-trade transparency on liquidity and execution quality using data before and after the introduction of SuperMontage[4]. The authors observe that both quoted and effective spreads declined significantly after the implementation of

[4]SuperMontage is a fully integrated order display and execution system for Nasdaq-listed securities. Prior to its implementation in December 2002, traders could only observe the single best bid and offer (BBO), the information collected and displayed by Nasdaq from each market participant. In the absence of having access to untapped pools of liquidity below a single price level, the traders were not able to observe market participants' trading interests below this level.

SuperMontage, indicating that the transparent order display system resulting from such change encourages market participants to submit more aggressive quotes and orders. Similarly, having the possibility to submit multiple orders and quotes due to SuperMontage reduces the return volatility. Foucault and Menkveld (2008) report that the coexistence of multiple limit order books may increase the consolidated depth in the market.

Execution costs and execution quality have been subject to several studies in the US. Huang and Stoll (1996) provide evidence that, for large capitalization firms, execution costs are higher on NASDAQ compared to the NYSE. Similarly, by investigating the impact of the SEC trading rules of 1997 on Nasdaq, Bessembinder (1999) finds that trading costs have still been higher on Nasdaq than on the NYSE after reform implementation. Battalio, Hatch, and Jennings (2003) compare execution prices across trading venues and find evidence that retail market orders obtain better trade prices on the NYSE but faster executions and better depth at Trimark Securities. In Europe, the few studies which have so far been conducted mainly provide the theoretical arguments with respect to execution policy and limit order book. By using a theoretical model, Foucault (2002) investigates the complementarily between strict enforcement of best execution policy and active competition between trading venues and shows that since brokers compete to attract order flow they should minimize trading costs, and thus there is no need for regulatory intervention. Kiran (2007), try to benchmark best execution quality as a weighted average of five parameters: execution policy, special instructions, likelihood of execution, speed of execution and total consideration (price inclusive of all costs) attributing the greatest weight to the last parameter. This analysis may lack objectivity since it would be rather difficult to weight execution quality criteria. D'Hondt and Giraud (2008) propose a new execution quality benchmark called “EBEX”. This indicator helps to identify trader performance, but can also justify this performance by the directional EBEX which measures the quality of the market timing. 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. The results of their study show that the consolidated limit order book to be deeper and the Euronext depth to be larger after the entry of EuroSETS. This also shows that the coexistence of multiple order books may increase the consolidated depth in the market. 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.

4. Research design

4.1. Event period and sample

Clear evidence on market efficiency comes from event studies, which examine how fast stock prices adjust to specific significant economic events, for example the implementation of MiFID in the European market. The hypothesis maintained in an event study is that capital markets are informationally efficient in that security prices are quick to reflect the newly arrived information. Similar to other event studies, in this research paper inference is made about whether the implementation of MiFID conveys new information to market participants as reflected in changes in the level or variability of several trading indicators such as volatility, liquidity, turnover rate and number of transactions, autocorrelation and quoted spread over the time period around the event.

In event studies, the choice of event period is controversial as it would be possible to conduct empirical tests over a period of a few minutes to a few days (short-window test) or over a long horizon of one to five years (long-horizon test). As the objective of this research is to find whether the implementation of MiFID affects trading indicators and market performance, it would be desirable that the comparison be made before and after the event date, i.e., November 1, 2007, the effective date of MiFID implementation. To do this, we choose the pre- and post-event periods which depend on research objective, hypothesis or data

availability. For example, Boehmer, Saar, and Yu (2005) think that the traders' strategies would not be influenced too much before the event, whereas it would take a longer time for traders to accommodate the change after the event, so they choose the previous two weeks as the pre event period, and set four post-periods (every two weeks) which cover the four months after the event. Dong and Han (2005) choose one pre-event period and three post-event periods, and each period equals a month. We believe that the longer period would contain more information and because of data availability we have made calculations for 45 trading days before (from August 30 to October 31, 2007) and three post event periods, excluding the month of November, each including 45 trading days (the first is from December 3, 2007 to February 5, 2008, the second is from February 6 to April 9, 2008 and the third is from April 10 to June 12, 2008).

We use the Euronext database made up of the 250 securities with the highest market capitalizations traded on the official market of Euronext. This is divided into the Euronext 100 Index and the Next 150 Index. In order to be included in the indices, the securities must meet liquidity criteria that are specified in the rules of the indices. The data consist of two major groups of most active stocks (100) and the following 150 companies containing the mid and small cap stocks.

Stocks elimination in our sample was made on the basis of:

- 5-minute stock bid and ask prices- absence for pre and post event period.
- Stocks traded less than 15 times a day during the continuous trading session on the 45 trading days in both the pre and post event periods.

This reduces the sample to 205 firms including two groups of most active stocks (94) and mid and small cap stocks (111).

4.2. Descriptive statistics

Table 1 presents the descriptive statistics (closing price, intraday number of trades and volume), for the entire sample and market cap stratified sample. We can notice the same trend of change for the three post periods and for all stock sizes (all, large or small cap). As the table shows, there is a decrease in closing price and an increase in transaction number and volume, particularly in the second post period (the price decreases by about 20% but the transaction number and volume increase by about 20% and 18% respectively for all stocks for the second post period).

[Insert Table 1 here]

4.3. Hypothesis:

Several research papers provide contrasting results regarding the effect of information disclosure rules in terms of improving transparency and market quality. We test the following hypotheses with respect to the effects of MiFID:

H1: Does the introduction of MiFID have any positive effect on stock market quality?

We use several indicators to measure market quality in terms of (1) market efficiency and (2) market liquidity (detailed indicators are presented in table 2).

We investigate efficiency using intraday volatility, First-order return autocorrelation and Full Information Transaction Cost (FITC).

Secondly, to provide evidence on the impact of MiFID on market liquidity, we investigate quoted spread, number of trade and turnover rate.

[Insert Table 2 here]

H2: Does the introduction of MiFID best execution requirements have any positive effect on order execution quality as defined below?

As discussed in section 2 above, best execution is one of the core concepts of MiFID. The Regulation National Market System (Reg NMS) 'trade through' rule in the United States, which has practically the same objective[5] as MiFID in Europe, proposes that best execution should mainly be measured against a clear quantitative indicator, i.e. price. At the heart of both regulations is the introduction and specification of the best execution concept in securities transactions. However, in contrast to this US approach, MiFID introduces other factors into best execution requirements such as transaction costs, and the speed and likelihood of execution and settlement. In some cases, it would be possible to consider other criteria not necessarily relevant to price if the client provides this information to the broker. The concept of best execution has been broadly discussed by Giraud and D'Hondt (2006) and D'Hondt and Giraud (2007) with regard to the MiFID requirements. We use their approach and mathematical formula (EDHEC model) as we think it can be considered as a global performance measure.

$$EBEX_{abs,i} = 1 - \frac{\frac{\sum_{n=1}^{N} V_{n,day}^{p \prec AP_i}}{S_i}}{\frac{\sum_{m=1}^{M} V_{m,day}}{S_i}} \qquad (1)$$

$$EBEX_{abs,i} = 1 - \frac{\frac{\sum_{n=1}^{N} V_{n,day}^{p \succ AP_i}}{S_i}}{\frac{\sum_{m=1}^{M} V_{m,day}}{S_i}} \qquad (2)$$

We use EBEX for buy order and sell order as mentioned in formula (1) and (2) respectively. With $EBEX_{abs,i}$ is the absolute best execution indicator for order i during the day, day is the

[5] Reg NMS is more limited in scope than MIFID since it basically aims to protect the incumbent stock exchanges against competition from 'alternative' markets, whereas MIFID increases the competition between exchanges.

interval between the time the broker receives order i and the next market close, S_i is the size of order i, AP_i is the average trade price obtained for order i, N is the number of trades at a price better than AP_i during the time interval, $V_{n,day}^{p\succ(\prec)AP_i}$ is the size of trade n at a price higher (lower) than APi during the interval day, M is the total number of trades during the time interval day and $V_{m,\,day}$ is the size of trade m during the time interval day.

4.4. Research process:

For each analysis period (pre and post MiFID), we compute means of market quality measures and report both parametric test (t-test) and non parametric test (p-value from the Wilcoxon test) in order to make a comparison between the pre event period and every post event periods.

Because the deviations of market quality measures may not only result from the impact of MiFID, especially when considering the fact that implementation period was largely overshadowed by the recent financial crisis, we try to determine more accurately the impact of transparency on liquidity and efficiency using a regression model to control for volatility and trade number effect. This econometric model will be applied to price quartile and market cap stratified sample.

5. Empirical analysis

5.1. Market quality analysis:

In this section, we present a general analysis based on the hypotheses defined in the above section. Table 3 summarizes the results concerning market quality measures.

As shown in table 3, we observe a significant change for the two first post periods and for all market quality indicators which become, in some cases, non significant in the last post period. Starting with the return volatility, we can notice a significant increase for the three post periods which can reach 50% for all stocks at the first post period. When considering the

analysis with respect to market cap, we observe that the most volatile stocks are small cap but the change is more apparent for large cap (60% for the most liquid stocks and 41% for the small cap in the first post period). This supports the argument that after MiFID, the market is more volatile especially for large cap stocks. The empirical evidence of previous studies on the relationship between transparency and volatility does not always provide consistent results in terms of informational efficiency of prices, and as expressed by Eom, OK, and Park (2007), there is no clear cut consensus on this relationship. For example, Madhavan (1996) showed through theoretical market microstructure model that return volatility increases in pre-trade transparency. In contrast, other studies (Boehmer, Saar, and Yu (2005), and Dong and Han (2005)) show the positive effect of disclosure rules similar to those of MiFID. They promote pre-trade transparency, reducing volatility and improving the information efficiency of most stocks. The return autocorrelation shows a significant decrease (11% for all stocks in the first post period) for the three post periods. This indicates an improvement in terms of Euronext informative efficiency after MiFID. Our results are consistent with those reported by Boehmer, Saar, and Yu (2005) and Dong and Han (2005). However, we notice inverse results regarding FITC, as there is a significant increase (about 51% for the first post period) but at the last post period the change become non significant.

Concerning spread, Table 3 shows a non significant increase after MiFID for the three post periods and for all stocks. This increase became significant for the stratified cap sample and controversial for most liquid stocks as we notice, for those stocks, an increase (1^{st} post period) then a decrease (for the two last periods). Taking into account the relationship between spread and transaction cost, higher spread means an increase in transaction costs and lower market quality, which is in contrast to our hypothesis and the expected consequences of MiFID. Notwithstanding the limitations of this study, some other research papers also report an increase in quoted spread (e.g., Eom, OK, and Park (2007) and Madhavan (1996), Madhavan,

Porter, and Weaver (2005)) because of the monitoring cost associated with trade-transparency.

Finally, transaction number and turnover rate increase significantly after MiFID and results are more significant for large cap stocks.

We can notice that the results are mixed and can, in some cases, be inconsistent with the general expectation that MiFID improves market quality. This may be due to the fact that market quality indicators are affected not only by MiFID implementation but also by other factors, thus it would be interesting to investigate this in more depth.

[Insert Table 3 here]

5.2. Analysis with controlling for variables:

In the stock market several other variables can affect market quality measures. To examine whether the changes in our market quality measures were driven by changes in stock attributes, rather than MiFID effect, we measure the impact of regulation change on market quality after controlling for concurrent changes in stock attributes, we then control for the impact of correlated variables such as number of trades and return volatility. This econometric model will be applied on price quartile and market cap stratified sample as presented below:

$$X_{it} = \gamma_i + \beta_1 \text{AvgStdDev}_{it} + \beta_2 \text{ Trade Number}_{it} + \beta_0 \text{ Dummy}_{it} + u_{it} \quad (3)$$

$$\Delta X_i = \beta_1 \Delta\text{AvgStdDev}_i + \beta_2 \Delta\text{Trade Number}_i + \beta_0 + \varepsilon_i \quad (4)$$

X denotes one of the three market quality measures (return autocorrelation, FITC or spread) of stock i (i = 1, 2, … n) in time t (t = pre-event or post-event), γ^i is a stock-specific mean, AvgStdDev represents the average intra-day volatility, Trade Number is the average transaction number and Dummy is a dummy variable which equals zero before the event and one after the event. We estimate the equation (4) using OLS and compute test statistics based

on White's heteroskedasticity-consistent standard errors, and results are reported in table 4. Results are not similar to those obtained without controlling for relevant variables.

Spread shows a significant decrease after MiFID for most quartile and for most liquid stocks. Small cap analysis report a non significant increase for the 3 first price quartile and a non significant spread decrease for the lowest price quartile.

Return autocorrelation has the same trend as before, showing a significant decrease after MiFID. Thus, the market is more efficient after MiFID.

Concerning FITC, we notice, for most cases, a decrease after MiFID for liquid stocks but mixed results for the least liquid stocks, so there is no clear trend for those stocks.

We can conclude that after MiFID the market shows a significant improvement in terms of liquidity (spread, volume, number of trade and turnover rate) and efficiency (return autocorrelation and FITC) for most liquid stocks.

[Insert Table 4 here]

5.3. Comparison with other markets:

The expectation about the positive impact of MiFID or similar rules in terms of transparency is they should generally lead to a decreasing effect on the volatility of stock returns, which indicates the improvement in the informational efficiency of prices. However, stock price fluctuations are affected by different factors and not all can be identified or measured, particularly in the unstable market conditions during which this study has been conducted (the financial crisis). For return volatility, we have shown that there is a significant increase in the two post periods and then the market regains its pre event period level.

We attempt to study the trend of other markets in our analysis period (daily price and price volatility of different market indices). We choose the US market (Nasdaq Composite Index), German market (DAX Index), UK market (FTSE Index), Chinese market (SSE) and French

market (CAC 40) to reproduce the price trend, from July 1, 2007 to July 30, 2008, in figure 1. Prices show the same trend, as we can notice a decrease at the two first post periods, and then prices are nearly their initial value of before MiFID. Thus, after MiFID we are situated in declining markets which regain their level of pre event period.

[Insert figure 1 here]

We report daily return volatility for different markets in table 5. According to table 5 the daily return volatility index shows an increase for the two post periods and regains (decrease for FTSE and CAC40) their levels in the third post period.

Thus increased return volatility can be explained not only by MiFID but also by the general market trend, as other markets show the same trend for the same periods.

[Insert Table 5 here]

5.4. Best execution requirements

"Given a transaction handed over to a broker, trader or algorithm and executed for a given price at times that are recorded under given time constraints, to what extent have other brokers, traders or algorithms executed comparable volumes to this transaction, either before or after this transaction, at a better price?" [6]. This is the question raised in the study conducted by EDHEC. This study tries to answer this question by measuring the EBEX indicator (EBEX: EDHEC Best Execution) which allows the investor to evaluate the performance of the trader. We use this measure as an indicator of execution quality and retrieve EBEX for buy; sell and all (buy and sell orders).

[6] D'Hont, C. and Giraud, J.R. (2008), Transparency cost analysis A-Z: A step towards best execution in the post-MIFID landscape, November, Edhec Risk and Asset Management Research Centre.

The results of our study for the best execution requirement calculated on the basis of the EDHEC method are presented in Table 6. Results show an EBEX very near to 1, which indicates a good quality of order execution even before the implementation of MiFID, as shown by Foucault (2002) "brokers do not need regulator intervention to better execute orders because they compute to retain their client, and thus are incited to have better order execution". We can observe an increase in execution quality measures as results show a significant improvement in EBEX index after MiFID. These results are consistent to MiFID best execution requirements.

[Insert Table 6 here]

6. Contributions and limits of the study

This study is a contribution to academic literature because it is interested in the impact of MiFID as the latest and most important European Directive in the area of microstructure of financial market. It concerns the effect of this Directive on Euronext as one of the largest market in Europe.

This study has also academic implications in terms of number of selected variables, size of collected information (high frequency data) and the long analysis period (3 periods after MiFID each contains 45 days). It is conducted for a large number of European multinational companies. The study also takes into consideration several control variables effects (price, market cap, volatility and transaction number) providing the possibility to observe the real impact of MiFID on Euronext.

The study has several practical implications. First, it provides better insights into the effect of the European directives on the market. This may provide useful information for the regulatory bodies and the organizations in charge of the market when revising the proposed regulations and making recommendations. Despite continuous public debate on the creation

of the European financial market, there are still many differences among the national European markets resulting from environmental and structural factors. Finally, the study contributes to better understanding of market participants mainly the investors who do not always have access to sufficient information on market exchange mechanisms and trading.

However, our research study is also subject to several limitations which, in our opinion, may significantly affect the empirical findings. Firstly, as the objective of the study is to observe the effect of MiFID implementation on November 1, 2007, our research tests are based on data from 2007 and 2008 - a very unstable period due to the financial crisis which has significantly affected the performance of financial markets world-wide. Due to the significant impact of this crisis, it is not feasible to have a complete control of such effects during the event period.

Secondly, MiFID has stated several criteria to admit a share to trading on a regulated market. However, the regulators will determine which shares are defined as “liquid” within the meaning of MiFID. According to the implementing measures of MiFID, member states must define as "liquid" any shares with a free float of more than €500 million, and an average daily turnover higher than €2 million and/or an average daily number of transactions higher than 500. Because of the complexity of the MiFID implementing regulation, we do not identify the liquid and illiquid equities on our sample of the Euronext data base for 2007 and 2008 when comparing the largest and lowest capitalizations, knowing that this distinction may affect the empirical findings.

Thirdly, similar to other event studies, the results of this research may have been different were we able to control the effect of concurrent disclosures and client expectations associated with the implementation of MiFID. The concurrent disclosure problem cannot be avoided entirely in such studies because in some cases the disassociation of MiFID from other information, whether released by regulators or listed companies, is not practical. The market

indicators used in this research study (volatility, liquidity, quoted spread, number of transactions, etc.) are undoubtedly subject to changes resulting from various accounting and financial operations or the information disclosures of these operations.

7. Summary

The contribution of MiFID to greater competition between execution venues and higher market transparency trading volumes should lead to increasing trading volumes and lowering transaction costs. The empirical results reported in this study show an increase in return volatility FITC and quoted spread, a decrease of autocorrelation, and a higher turnover rate of transactions. The results particularly in the case of volatility, FITC and quoted spread do not support the contribution of MiFID to market efficiency. However, after considering the effect of price, market cap, volatility and number of transactions, we observe different results for most liquid stocks as spread and FITC show a general inverse trend (significant decrease) after MiFID. The volatility increase can be attributing to the instability of the study period as several other markets show the same trend of volatility during this period. Results from execution quality (EBEX indicators) confirm our assumptions as they show an increase after MiFID.

The overall analysis of the empirical tests suggests that there is a significant improvement of market quality after MiFID in term of market liquidity and efficiency, for most liquid stocks, and a significant improvement of execution quality that may be due to new competition between executions places.

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Markets in Financial Instruments Directive (MIFID) (2004)

Markets in Financial Instruments Directive (MIFID) (2007)

Appendix

Table 1. Descriptive statistics.

Table 1 reports descriptive statistics of sample firms stratified into each of three groups: all including the 205 firms, most active (N100) including 94 firms and least active firms (N150) including 111 firms. We analyze the average daily trading volume (in thousands of shares), average intraday number of trades, and average daily closing price.

Periods	***Entire sample (Number = 205)***		
	Closing price	**Nb of trade**	**Volume**
Pre MiFID	54,77	2394,6	1730,9
1st post MiFID	48,28	2989	1965,5
2nd post MiFID	44	2873	2039,1
3d post MiFID	45,77	2594	1659,6
	Most active stocks (Number = 94)		
	Closing price	**Nb of trade**	**Volume**
Pre MiFID	63,54	4373,1	3225,1
1st post MiFID	57,99	5487	3495,9
2nd post MiFID	52,91	5345	3362,5
3d post MiFID	55,62	4802	2667,3
	Least active stocks (Number = 111)		
	Closing price	**Nb of trade**	**Volume**
Pre MiFID	47,48	751,67	490,18
1st post MiFID	40,23	914,011	694,68
2nd post MiFID	36,59	820,30	940,24
3d post MiFID	37,30	761,11	822,81

Table 2. Market quality indicators.

Market efficiency	
Intraday volatility	We calculate intraday returns (every five minutes) for each day and the standard deviation of these returns. Intraday return = $\ln(P_{t+5}) - \ln(P_t)$ P_t is the stock price at t P_{t+5} is the stock price at t +5 minutes
Return autocorrelation	Based in the approach of Boehmer , Saar, and Yu (2005), we calculate intraday return for each stock every five minutes and first order autocorrelation of these returns to finally measure absolute value of return autocorrelation.
Full Information Transaction Cost (FITC)	The most known method used to measure market efficiency is Hasbrouck (1993)'s approach, which separates the efficient price from deviation introduced by the trading process. Based on the argument that the prices in efficient markets can incorporate all available information, Bandi and Russel (2004) use the FITC which corresponds to the difference between the observed transaction price (trading price) of an asset and the corresponding unobserved full-information price reflecting both public and private information at a given time. This measure can be estimated as the standard deviation of microstructure effect (Eoma, Ok, and Park (2007). Thus, smaller value predicts a smaller gap between trading price and full information price and more efficient market. $\sigma_n = \sqrt{\frac{(k+1)}{2}\left(\frac{\sum_{i=1}^{N} r_i^2}{N}\right) + \sum_{s=0}^{K-1}(s+1)\left(\frac{\sum_{i=K-s+1}^{N} r_i r_{i-k+s}}{N-k+s}\right)}$ K is the number of significant lags; we choose k= 8 after testing for the number of significant lags for each firm in our data sample. N is the number of observations and r_i is the daily return of trading price.
Market Liquidity	
Quoted spread	The difference between the best ask and the best bid price (percentage) weighted by number of executed shares per day.
Turnover rate	We divide daily trading volume for each company's stock by the number of shares outstanding of that company.
Transaction number	We collect the information regarding number of daily transactions for the sampled companies from the database of Euronext.

Table 3. Market quality analysis.

This table includes five measures reflecting market quality: return volatility, rotation, number of trade, spread, return autocorrelation and Full

	Entire sample (205)				*Most active stocks (N100) (94)*				*Least active stocks (N150) (111)*			
Return volatility	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***
Pre MiFID	0,0020	0,0018			0,00151	0,00143			0,0024			0,0022
1st post MiFID	0,0030**++	0,0028	-10,94	0,000	0,00243**++	0,0023	-12,34	0,000	0,0034++	0,0033	-8,12	0,000
2nd post MiFID	0,0026**++	0,0024	-7,724	0,000	0,00217**++	0,0021	-9,85	0,000	0,0030++	0,0028	-5,25	0,000
3d post MiFID	0,0021++	0,0019	-1,058	0,005	0,00172**++	0,00163	-3,63	0,000	0,0024	0,0022	0,27	0,41
Turnover rate	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***
Pre MiFID	0,0041	0,0034			0,00491	0,0042			0,0036	0,0027		
1st post MiFID	0,0051**++	0,0043	-2,55	0,000	0,00576++	0,0052	-1,87	0,000	0,0045++	0,0031	-1,83	0,000
2nd post MiFID	0,0049**++	0,0040	-2,04	0,000	0,00570++	0,0052	-1,75	0,000	0,0042++	0,0029	-1,29	0,001
3d post MiFID	0,0043++	0,0036	-0,25	0,622	0,00474	0,0043	0,42	0,079	0,0039	0,029	-0,67	0,789
Nb of trade	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***
Pre MiFID	2394,6	1203,04			4373,13	3760			751,67	536,6		
1st post MiFID	2989++	1535,22	-1,89	0,000	5487,78**++	4521	-2,17	0,000	914,011++	656,5	-1,48	0,000
2nd post MiFID	2873++	1327,82	-1,52	0,000	5345,04++	4522	-1,88	0,000	820,30++	628	-0,67	0,002
3d post MiFID	2594++	1187,9	0,104	0,001	4801,91++	4096,2	-0,94	0,000	761,11	596,5	-0,099	0,66
Spread	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***
Pre MiFID	0,235	0,1576			0,1343	0,091			0,3184	0,2298		
1st post MiFID	0,287	0,1951	- 1,64	0,74	0,1410++	0,113	-0,225	0,000	0,4095++	0,277	-1,85	0,000
2nd post MiFID	0,299	0,1997	-1,59	0,67	0,1327 ++	0,112	0,058	0,000	0,4374++	0,2683	-1,79	0,000
3d post MiFID	0,251	0,1541	0,48	0,36	0,1051	0,083	1,06	0,83	0,3719	0,2181	-0,799	0,87
autocorrelation	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***
Pre MiFID	0,1873	0,1807			0,1560	0,1452			0,2137	0,211		
1st post MiFID	0,1678**	0,1639	3,69	0,000	0,1493++	0,1433	1,074	0,042	0,1832++	0,18	4,27	0,000
2nd post MiFID	0,1692**++	0,1659	3,4	0,000	0,1484++	0,1432	1,19	0,041	0,1864++	0,1808	3,8	0,000
3d post MiFID	0,1691**++	0,1605	3,15	0,000	0,1429++	0,1346	1,90	0,000	0,1908 ++	0,1848	2,97	0,000
FITC	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***	***Average***	***median***	***Statistics t-stat***	***PV-W***
Pre MiFID	0,0349	0,0307			0,0327	0,028			0,0367	0,0322		
1st post MiFID	0,0531**++	0,0480	-4,96	0,000	0,0467**++	0,045	-3,26	0,000	0,058**++	0,0492	-2,9	0,000
2nd post MiFID	0,0456**++	0,0425	-3,313	0,000	0,0415**++	0,045	-2,56	0,000	0,049**++	0,0441	-2,9	0,000
3d post MiFID	0,0346	0,031	-0,17	0,094	0,0318	0,0296	0,25	0,17	0,037	0,0338	-0,066	0,328

***** paired t-test statistical significance at 5% level, and ++ Wilcoxon signed-rank test significance at 5%, level***

Table 4. Market quality analysis with controlled variables.

Most active stocks (N100)

Price quartile	***1***				***2***				***3***				***4***			
Spread	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**
1st post MiFID	-0,015	0,49*	-0,58*	92	0,49	-0,64*	-0,44*	52	-0,17*	0,80*	-0,10	74	-0,053	0,48*	-0,54*	60
statistics	(-1,38)	(5,18)	(-6,1)		(0,8)	(-4,13)	(-2,8)		(-3,35)	(6,28)	(-0,8)		(-1,14)	(3,54)	(-3,76)	
2nd post MiFID	-0,24*	0,55*	-0,52*	92	0,37*	-0,61*	-0,39*	49	-0,02*	0,55*	-0,52*	84	-0,039*	0,64*	-0,62*	86
statistics	(-2,18)	(5,69)	(-5,4)		(2,79)	(-3,2)	(-2,41)		(-2,75)	(5,2)	(-5,9)		(-3,3)	(10,1)	(-9,8)	
3d post MiFID	-0,012*	0,26*	-0,83*	84	-0,220	0,20	-0,39	25	-0,012*	0,26*	-0,83*	84	-0,027	0,37*	- 0,47*	65
statistics	(-2,19)	(2,94)	(-9,36)		(-1,17)	(-1,03)	(-1,96)		(-2,19)	(2,9)	(-9,21)		(-1,14)	(2,7)	(-2,5)	
Autocrrelation	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**
1st post MiFID	-0,033*	0,36	-0,29	25	-0,038*	0,57*	-0,22	42	-0,004	0,12	-0,52*	35	-0,007	0,11	-0,68*	71
statistics	(-2,33)	(0,9)	(-1,54)		(-2,4)	(3,3)	(-1,2)		(-0,3)	(0,5)	(-2,59)		(-0,57)	(0,71)	(-4,1)	
2nd post MiFID	-0,04*	0,41*	-0,22	55	-0,03*	0,58*	-0,36*	52	-0,001	0,14	-0,72*	58	-0,001	-0,64*	0,09	67
statistics	(-2,4)	(2,84)	(-1,5)		(-2,3)	(3,7)	(-2,3)		(-0,12)	(0,97)	(-4,7)		(-0,1)	(-3,9)	(0,59)	
3d post MiFID	-0,17	-0,04	-0,66*	61	0,007	0,21	-0,35	10	-0,017	- 0,04	-0,78*	61	-0,016	0,28	-0,6*	78
statistics	(-1,6)	(-1,63)	(-5,96)		(0,7)	(0,17)	(-1,42)		(-1,17)	(1,37)	(-5,13)		(-1,7)	(1,8)	(-3,87)	
FITC	**β0**	**β1**	**β2**	**R2**	**β0**	**β1**	**β2**	**R2%**	**β0**	**β1**	**β2**	**R2%**	**β0**	**β1**	**β2**	**R2%**
1st post MiFID	-0,003	0,48*	0,54*	22	-0,02	0,25	-0,12	10	0,007	0,60*	0,33	54	0,03*	-0,14	-0,058	6
statistics	(-1,3)	(2,59)	(2,3)		(-1,2)	(1,18)	(-0,43)		(1,66)	(2,84)	(1,56)		(2,48)	(- 059)	(-0,8)	
2nd post MiFID	-0,006	0,55*	0,58*	35	-0,02	0,30	-0,08	10	-0,006	0,55*	0,58*	35	0,001	0,67*	0,61*	61
statistics	(-1,4)	(4,06)	(4,4)		(-1,05)	(1,43)	(-0,03)		(-0,87)	(2,9)	(2,8)		(0184)	(5,05)	(4,96)	
3d post MiFID	-0,007*	0,63*	0,56*	80	0,024	0,36	- 0,17	13	0,003	0,46*	0,54	46	-0,002	0,71*	0,40*	53
statistics	(-4,05)	(4,6)	(4,08)		(0,99)	(1,66)	(-0,64)		(0,13)	(2,2)	(3,2)		(-1,19)	(4,55)	(2,5)	

Least active stocks (N150)

Price quartile	***1***				***2***				***3***				***4***			
Spread	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**
1st post MiFID	-0,05*	0,70*	-0,53*	52	0,43*	-0,27	-0,48*	51	0,084	0,26	-0,29	40	-0,054	0,15	-0,31	39
statistics	(-3,21)	(11,6)	(-8,88)		(2,26)	(-1,56)	(-2,8)		(1,14)	(1,44)	(-1,6)		(-0,51)	(0,8)	(-1,6)	
2nd post MiFID	0,08	0,24	-0,34	19	0,19	- 0,18	-0,37	35	0,12	0,23	-0,20	32	-0,003	0,108	-0,56*	58
statistics	(0,52)	(1,36)	(-1,9)		(1,28)	(-0,90)	(-1,8)		(0,67)	(1,2)	(-1,09)		(-0,38)	(0,6)	(-2,99)	
3d post MiFID	0,18	-0,15	0,18	27	0,02	- 0,41*	-0,43*	44	0,095	0,016	-0,16	25	-0,141	0,94	-0,366	37
statistics	(0,98)	(-0,71)	(0,92)		(0,16)	(-2,04)	(-2,17)		(0,80)	(0,83)	(-0,83)		(-1,67)	(0,5)	(-1,95)	
Autocorrelation	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**
1st post MiFID	-0,05*	0,289*	-0,39	58	-0,054*	0,56*	-0,07	58	-0,41*	0,36*	-0,26	45	-0,042*	0,264*	-0,36	46
statistics	(-4,14)	(2,26)	(1,67)		(-3,29)	(3,37)	(-0,45)		(-2,6)	(2,03)	(-1,5)		(-2,8)	(2,1)	(-1,95)	
2nd post MiFID	-0,03*	0,30	-0,33	20	-0,03*	0,51*	-0,26	65	-0,41*	0,38*	-0,38*	57	-0,4*	0,39*	-0,38*	66
statistics	(-3,3)	(1,73)	(-1,87)		(-3,3)	(3,16)	(-1,6)		(-3,2)	(2,29)	(-2,3)		(-3,3)	(2,35)	(-2,33)	
3d post MiFID	-0,19*	0,38*	-0,29	55	-0,013	0,47*	-0,42*	77	-0,24	0,58*	-0,34	53	-0,027	0,214	-0,38*	46
statistics	(-2,83)	(2,24)	(-1,68)		(-1,15)	(3,29)	(-2,95)		(-1,92)	(2,08)	(-1,97)		(-1,6)	(1,2)	(-2,17)	
FITC	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**	**β0**	**β1**	**β2**	**R^2%**
1st post MiFID	0,01	0,27	0,48*	20	0,012*	0,26	0,27	12	-0,001	0,22	0,23	32	0,0022	0,20	0,052	52
statistics	(0,41)	(1,48)	(2,26)		(2,42)	(1,38)	(1,41)		(-0,05)	(1,18)	(1,2)		(0,6)	(1,05)	(0,25)	
2nd post MiFID	0,07	0,37*	0,53*	40	0,011*	0,22	0,147*	22	-0,001	0,01	-0,5*	44	0,014	0,13	0,54*	51
statistics	(1,80)	(2,39)	(3,41)		(3,48)	(1,08)	(0,7)		(-0,002)	(0,07)	(-2,9)		(1,067)	(0,6)	(2,8)	
3d post MiFID	-0,002	0,10	0,49*	48	0,002	0,3	0,53*	48	0,01	0,26	0,13	29	0,02	0,24	0,53*	56
statistics	(-0,58)	(0,57)	(2,69)		(0,69)	(1,48)	(2,73)		(0,07)	(1,34)	(0,7)		(0,72)	(1,45)	(3,22)	

Figure 1. Index price evolution.

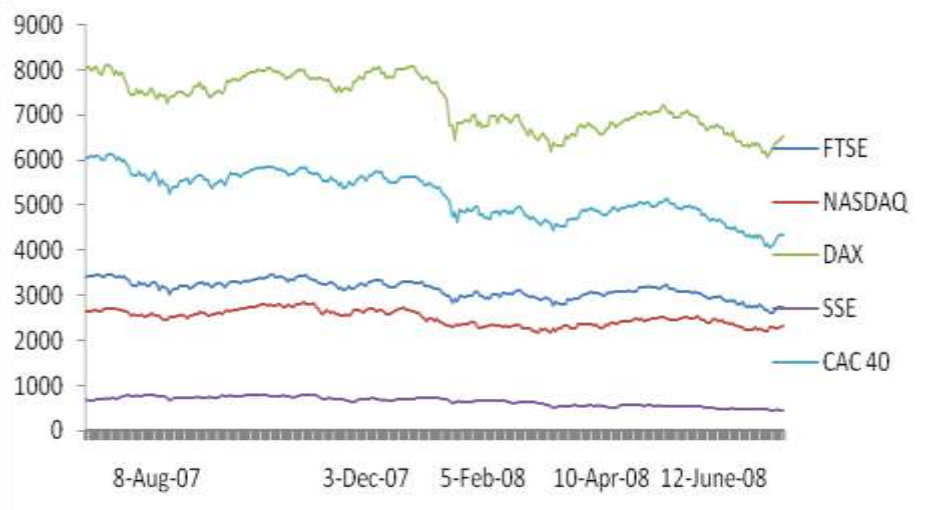

Table 5. Return volatility.

Periods	*FTSE*	*NASDAQ*	*DAX*	*SSE*	*CAC40*
Pre MiFID	0,01401	0,01160	0,00925	0,02022	0,01315
1st post MiFID	0,01659	0,01475	0,01851	0,02250	0,01922
2nd post MiFID	0,01552	0,01633	0,01540	0,02467	0,01543
1th post MiFID	0,00976	0,01258	0,00961	0,02142	0,01048

Table 6. Execution quality measures.

	Entire sample				Most active stocks (N100)				Least active stocks (N150)			
EBEX B[1]	***Average***	***median***	***Statistics***		***Average***	***median***	***Statistics***		***Average***	***median***	***Statistics***	
			t-stat	***PV- W***			***t-stat***	***PV- W***			***t-stat***	***PV- W***
Pre MiFID	0,966	0,9995			0,969	0,99971			0,9644	0,9992		
1st post MiFID	0,992**	0,9995	-2,17	0,908	0,993	0,9996	-1,44	0,16	0,9919	0,9992	-1,62	0,4
2nd post MiFID	0,998**++	0,9997	-2,7	0,001	0,998	0,999	-1,76	0,14	0,9983**++	0,99	2,03	0,026
3d post MiFID	0,998**++	0,9997	-2,69	0,046	0,9978	0,999	-1,77	0,32	0,9981 **	0,9995	-2,02	0,099
EBEX S[2]	***Average***	***median***	***Statistics***		***Average***	***median***	***Statistics***		***Average***	***median***	***Statistics***	
			t-stat	***PV- W***			***t-stat***	***PV- W***			***t-stat***	***PV- W***
Pre MiFID	0,99761	0,9995			0,997	0,99977			0,9976	0,9991		
1st post MiFID	0,9970	0,9994	0,56	0,177	0,996	0,9995	0,77	0,068	0,9979	0,9990	-0,63	0,73
2nd post MiFID	0,9979++	0,9996	-0,78	0,000	0,998++	0,9996	-0,95	0,000	0,9976 ++	0,9993	-0,08	0,018
3d post MiFID	0,9980	0,9995	-0,89	0,067	0,9984	0,9996	-1,07	0,176	0,9976	0,9993	-0,103	0,24
EBEX ALL[3]	***Average***	***median***	***Statistics***		***Average***	***median***	***Statistics***		***Average***	***median***	***Statistics***	
			t-stat	***PV- W***			***t-stat***	***PV- W***			***t-stat***	***PV- W***
Pre MiFID	0,9982	0,9995			0,9983	0,99971			0,9981	0,9992		
1st post MiFID	0,9983	0,9995	-0,48	0,75	0,99849	0,9995	-0,25	0,496	0,9982	0,9992	-0,45	0,43
2nd post MiFID	0,9982++	0,9995	-0,18	0,000	0,99856++	0,99975	-0,42	0,004	0,9980	0,9994	0,31	0,49
3d post MiFID	0,9984++	0,9996	-0,43	0,008	0,99859	0,9997	-0,45	0,56	0,9981	0,9994	-0,153	0,11

(1)EBEX buy, (2) EBEX sell, (3) EBEX all (sell and buy), ** paired t-test statistical significance at 5% level, and ++ Wilcoxon signed-rank test significance at 5%, level