AUTORITÉ DES MARCHÉS FINANCIERS

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MIFID II: IMPACT OF THE NEW TICK SIZE REGIME AFTER SEVERAL MONTHS OF IMPLEMENTATION

Risks & trends

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MIFID II: IMPACT OF THE NEW TICK SIZE REGIME AFTER SEVERAL MONTHS OF IMPLEMENTATION

This study proposes, after several months of implementation, an additional analysis to complete that published by the AMF in March 2018 on the impact of the new tick size regime introduced by MiFID II.

The previous paper[1] presented the impact of this new regime over a limited observation period (between December 2017 and January 2018) which was marked by extremely stable, low volatility. During the weeks that followed this period, the market was rattled by strong tensions leading to a deterioration in liquidity. In this context, it seemed relevant to analyse the new regime, this time taking volatility into account in order to separate the respective impacts of each of the factors on liquidity, i.e. the new tick size on one hand, and market-related stress on the other hand.

The new study covers a period of 10 months: five months preceding and five months following the entry into force of the regime, i.e. from August 2017 to May 2018.

The scope of instruments remains unchanged and is composed of more than 500 securities split into three major categories depending on their market capitalisation (CAC 40 securities, SRD securities and SME securities).

Over this extended observation period covering various volatility regimes, the impact of the new tick size regime seems to have had the desired effect on market quality.

We note first of all that the positive impact of tick size on the depth available at the best limits is confirmed despite the deterioration of this indicator due to significant market stress. The tick increase also results in a slight widening of the spread for the most liquid securities, reflected in profits for passive participants and additional costs for aggressive participants. We then observe a reduction in the effective transaction cost for client accounts while the effective transaction cost for HFT and market maker accounts has risen. This is also due to the increased aggressiveness of HFTs during periods of stress. Furthermore, overall, most market quality indicators line up on the various capitalisation categories.

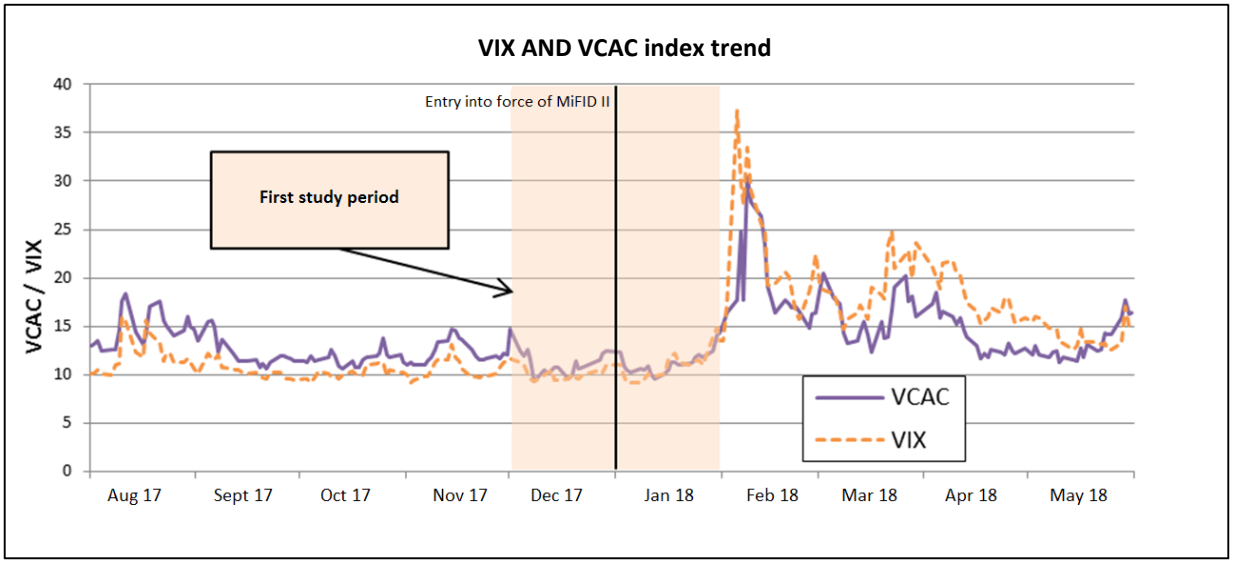
The study also confirms an improvement in micro-structure indicators. The reduction in the number of messages shows that order books are more stable (frequency of changes in best prices, order lifetime, OTR) and consequently, better legibility of the price formation process. For SME securities, the setting up of a more appropriate tick size, previously set uniformly at €0.01, resulted in more dynamic trading activity and larger volumes traded.

[1] See Appendix 2 for the conclusions of the first study.

1. DOES THE DETERIORATION IN MARKET QUALITY STEM FROM THE NEW REGIME?

1.1. NEW CONTEXT OF MARKET STRESS

Unlike the previous analysis period which lasted two months, the new period covered August 2017 to May 2018 (10 months) and experienced several distinct volatility regimes, as shown below:



The beginning of February was marked by a spike in volatility, which left the markets in turmoil until mid-April when volatility finally returned to previous levels. This episode was triggered by the publication in the United States of a macroeconomic statistic that raised fears of a rise in interest rates and led to a correction on US equity markets and markedly a spectacular increase in volatility.[2]

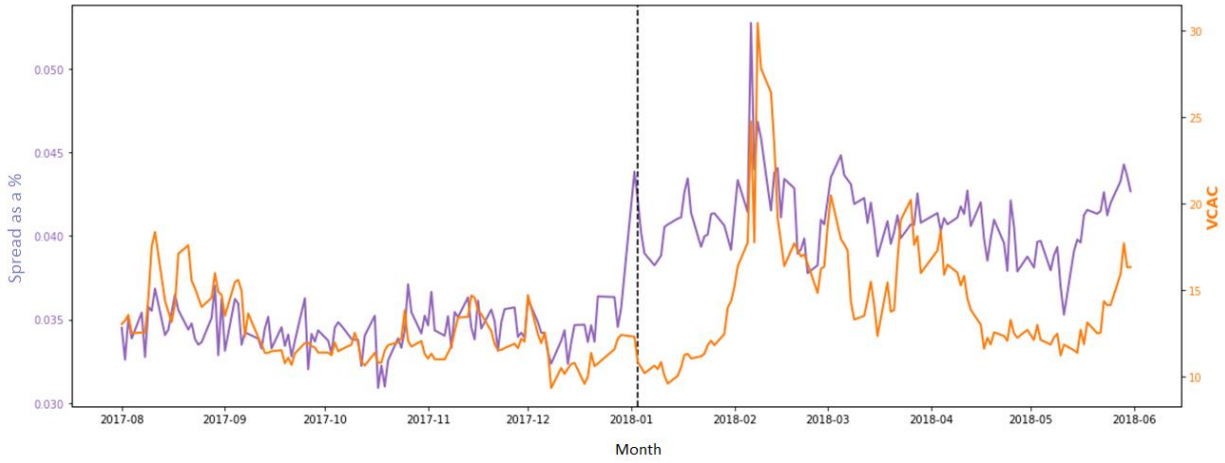
1.2. OVERVIEW OF THE TREND IN THE MAIN MARKET QUALITY INDICATORS

The main market quality indicators, depth at the best limit and spread, as seen in the previous study, had been impacted at the entry into force of the new regime, seem also to have reacted strongly to the change in volatility as of February.

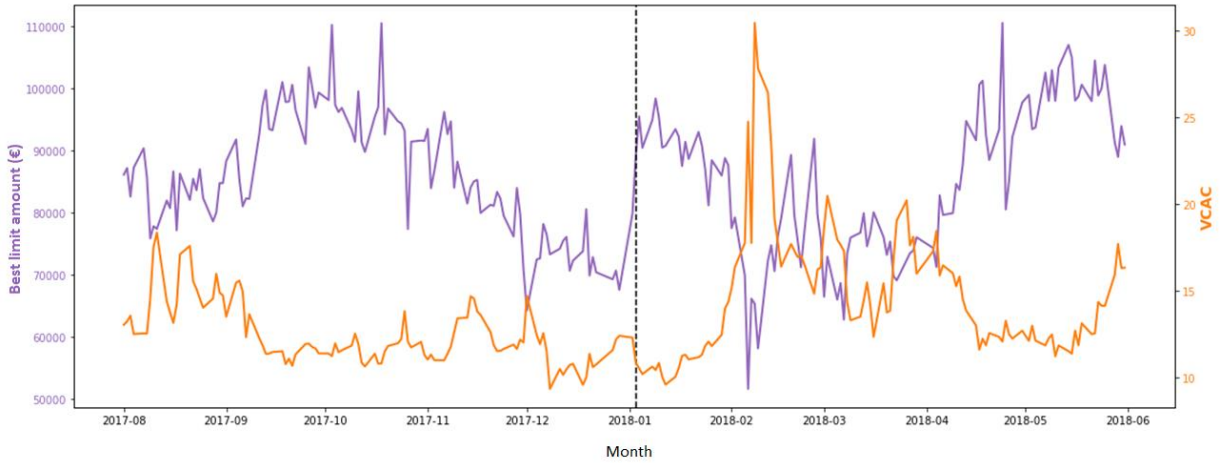
For example, an increase in tick size and volatility tends to increase the spread. The depth available at the best limit, which had risen immediately after the new regime was established, deteriorated significantly from end January 2018.

[2] This episode has been the subject of an in-depth study, published by the AMF on 19 April 2018 (Heightened volatility in early February 2018: the impact of VIX products).

Spread as a % of price on CAC 40 stocks



Depth available at the best limit on CAC 40 securities (in euros)



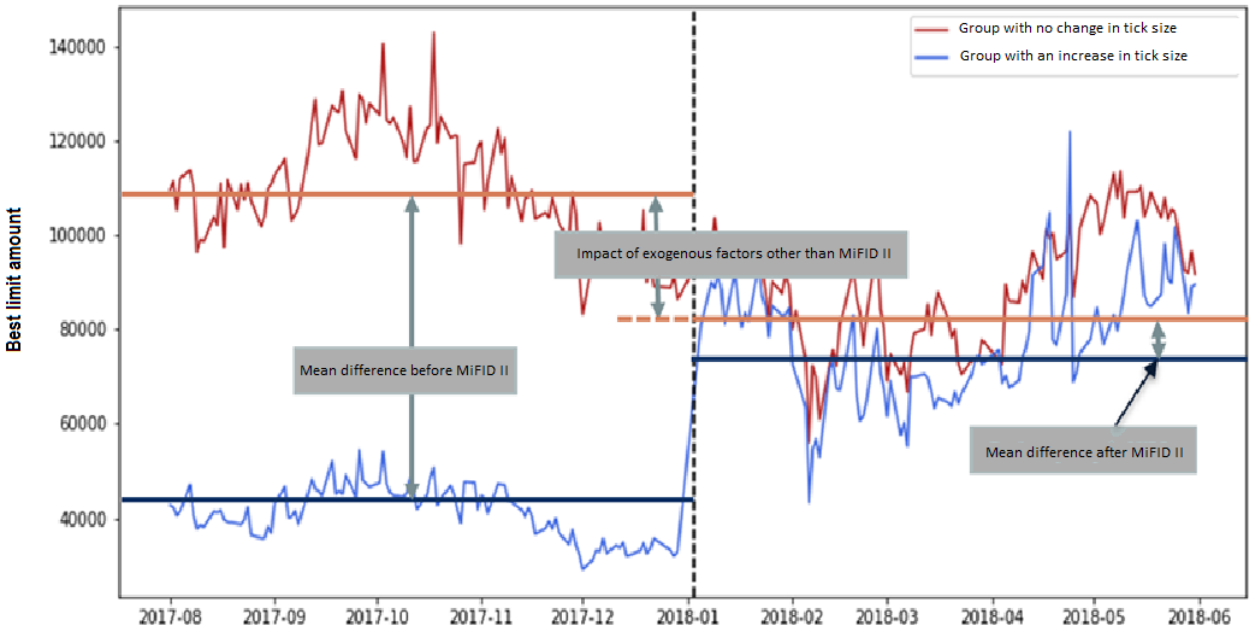
There is clearly a very close correlation between the VCAC index and these two market quality indicators. The spread and available depth trend over the study period seems to be due to the combined effects of the new tick size regime and the volatility increase,[3] which the rest of this study tries to distinguish.

[3] The previous paper had determined that the new tick size regime had not disrupted volatility (see the March 2018 paper "Impact of the new tick size regime" - Part 4 "Analysis of the impact of the new tick size regime on the micro-structure").

1.3. PRESENTATION OF THE QUANTITATIVE ANALYSIS METHODOLOGY OF IMPACTS ON MARKET QUALITY

1.3.1. Principle of the analysis

The study of the change in indicators on the group[4] for which there is no change in tick size will enable us to assess the impact of factors other than change in tick size (exogenous factors). The first exogenous factor is volatility. More specifically, the impact of these exogenous factors will be determined, such as the difference of the average values of the various indicators between the pre-MiFID II and post-MiFID II periods on the groups for which there was no change in tick size (see graph below).



The impact of the tick will be calculated as the difference between the average of the indicator on the group for which there is a change in tick size and the group for which it is constant, all the while taking into account the spread that originally existed between the two groups before the regime was introduced:

$$Impact\ of\ tick = Average\ spread\ after\ MiFID\ II - Average\ spread\ before\ MiFID\ 2 \qquad (1)$$[5]

The $Average\ spread\ after\ MiFID\ II$ (respectively $before\ MiFID\ II$) is measured as the average spread between the two groups on all the days of the post-MiFID II period (respectively pre-MiFID II).

Lastly, it must be noted that we did not include 2 January 2018 in the model resolution domain after observing that market participants had strongly anticipated the impact.

[4] In the rest of this paper, for simplicity's sake, the terms "groups" will be used to refer to the sub-groups of selected securities, see Section 1.2.2.

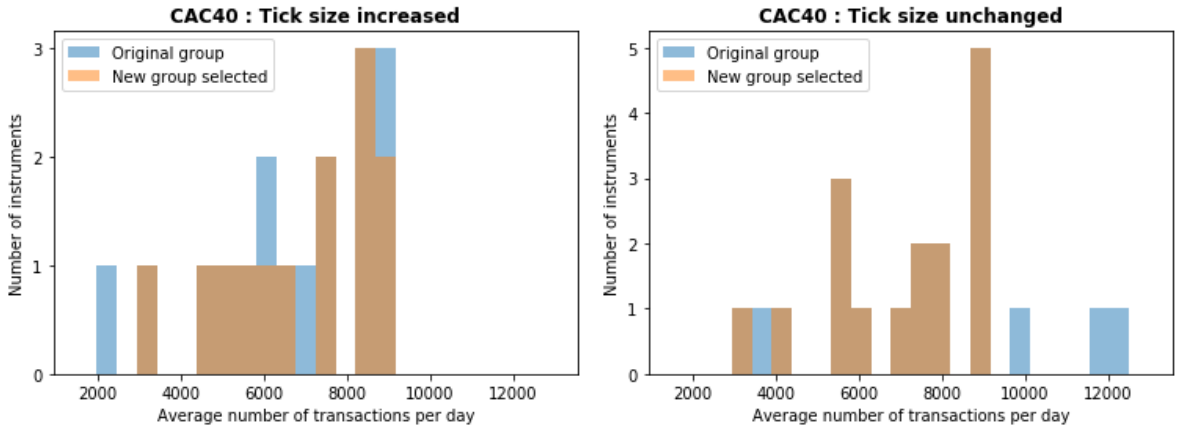
[5] This equation is solved in an equivalent manner by a linear regression model as set out in Appendix 3.

1.3.2. Selection of study groups

The equation (1) in the previous section assumes that the two groups (no change in tick and change in tick) react in the same way to exogenous factors (other than the new tick size regime). With this assumption, these exogenous factors cancel themselves out in the term "*Average spread after MiFID II*".

However, it appears that this assumption cannot be verified. This is because, among these other factors, the impact of volatility generally differs depending on the liquidity of securities. And yet, there are significant differences between the two groups of instruments in terms of liquidity: the groups with an increased tick size are less liquid than those for which the tick size remains unchanged (in terms of the average daily number of transactions (ADNT) see below). In order to offset this problem, it is preferable, for the quality of the analysis, to select study sub-groups from the initial groups so as to make them homogeneous in terms of liquidity. This selection aims at ensuring an identical impact of volatility on the two sub-groups, and will thus make it possible to identify the impact of the tick size more precisely.

The graphs below show, for CAC 40 securities, the breakdown of their average number of transactions and the results of the selection for all securities (the process was not applied to SMEs because the group was homogeneous).



After making this selection, we made the assumption that the impact of other factors (such as volatility) on market quality indicators is the same for the selected sub-groups (tick size increased, tick size reduced, tick size unchanged) within the same group of securities (CAC 40, SRD or SME) and that the impact of the tick size can be measured as shown in 1.3.1.

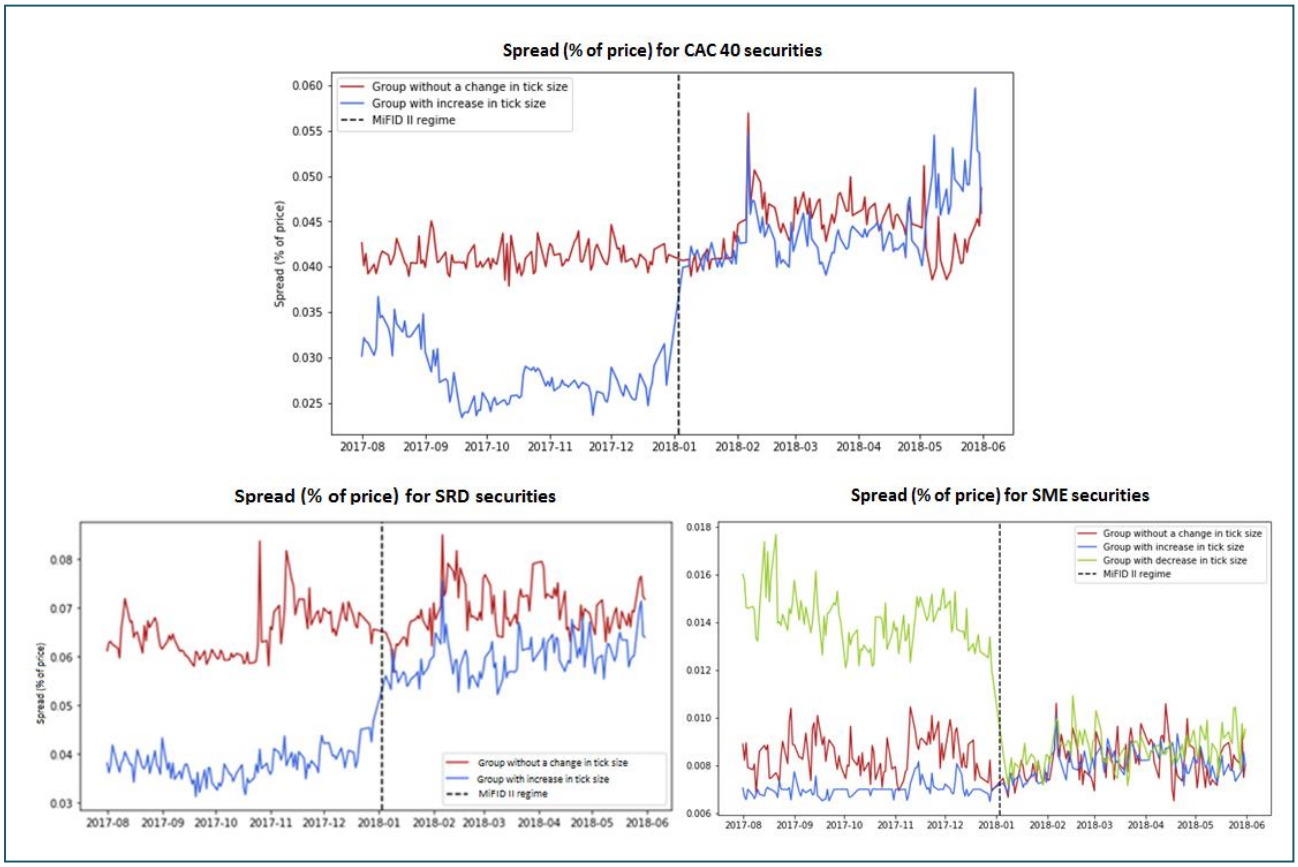
1.4. RESULTS OF THE ANALYSIS

Since this study covers only French securities traded on Euronext Paris, we cannot generalise to the rest of Europe the impacts measured.

With the study over the extended analysis period, we can observe that most of the impacts of the new tick regime remain unchanged compared with the impacts measured in the previous paper. This is because the deteriorations observed over the period (notably relating to the depth available at the best limit) are more likely to be explained by volatility than by the new tick regime.

1.4.1. Measurement of impacts on the spread

The graphs below[6] show the change in the spread (as a percentage) for the groups of securities studied. Although the increase in the tick is largely responsible for the increase in the spread, it must be noted that the share of other factors, such as volatility, on this increase is nevertheless non-negligible.



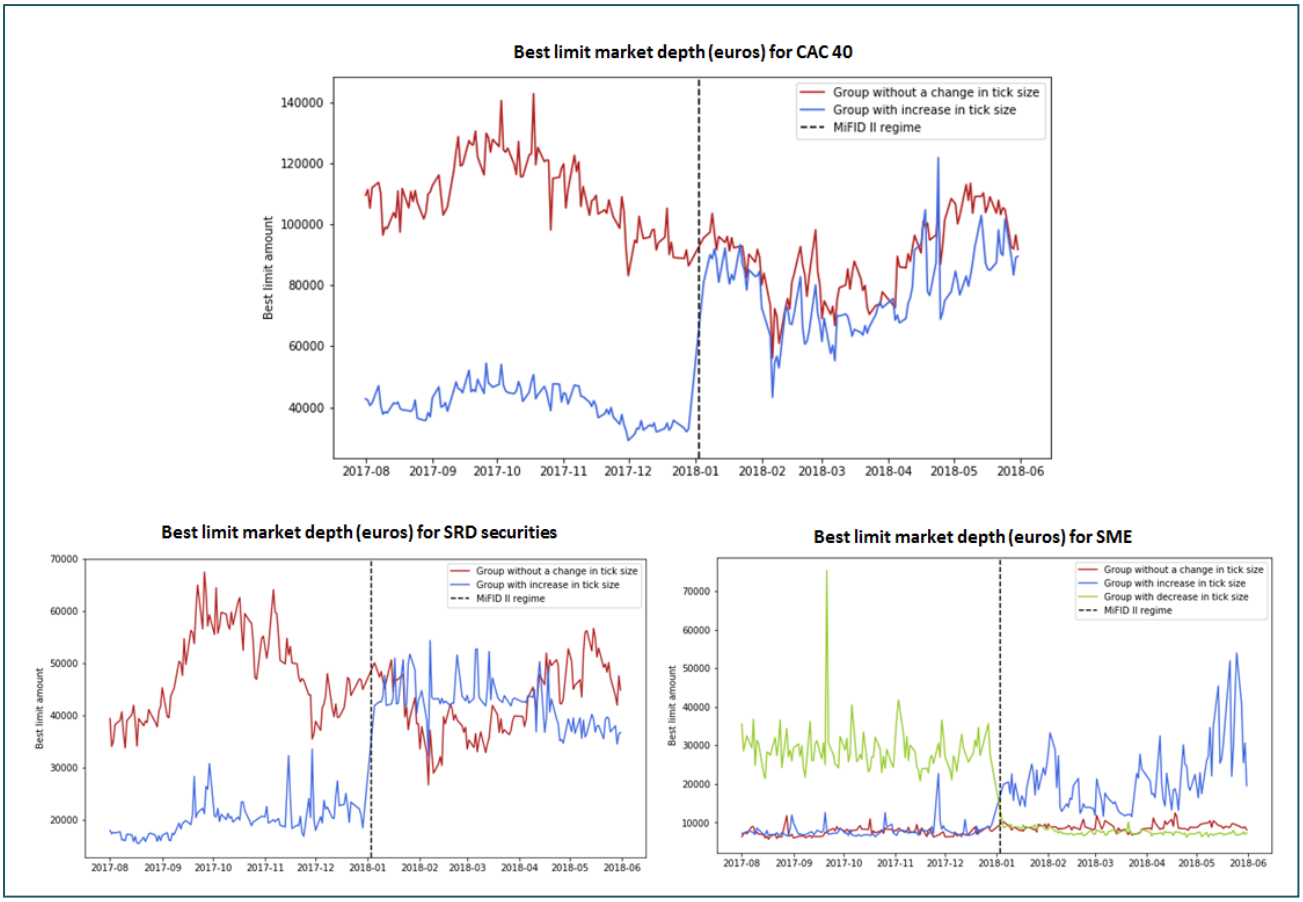
- For CAC 40 securities, the spread rose 45% for securities where the tick was increased, compared with 8% for the other securities.
- For SRD securities, the spread rose by 44% for securities whose tick was increased and we observed an impact of 7% resulting from volatility on the group where there was no change in tick.
- On SME securities, the average spread stabilised around 80 bps for the three groups, decreasing by 36% on securities whose tick decreased and increasing by 19% on securities whose tick increased.

[6] Throughout the study, the paper illustrates each result obtained from the statistical analysis with the help of graphs that make it possible to visualise the impact of the tick change. The definition of the indicators and the detailed results are presented in Appendix 1 and Appendix 4 respectively.

Though the increase in spread is reflected in a gain for passive participants, it represents an equivalent additional cost for aggressive transactions. The assessment of the effective cost per type of participant will be developed later in part 2 of this paper "Transaction costs".

1.4.2. Measurement of the impacts on the amount available at the first limit

The following graphs[7] show the change in the available depth at the best limit for the groups of securities studied.



- For CAC 40 securities, the impact of the increase in tick size on the amounts available at the best limit was measured as +77% (+138% for SRD securities, +150% for SME securities). **The change in tick size has therefore had a favourable impact on depth for CAC 40 securities, even if this effect is only slightly perceived in the comparison of the average depth over 2017 and 2018 for all CAC 40 securities (section 2.2.) due to events not related to the entry into force of the new tick regime.** The model for calculating the impacts thus gives a 77% increase in depth arising from the change in tick size and a 19% drop based on other factors, driven in all likelihood by volatility.

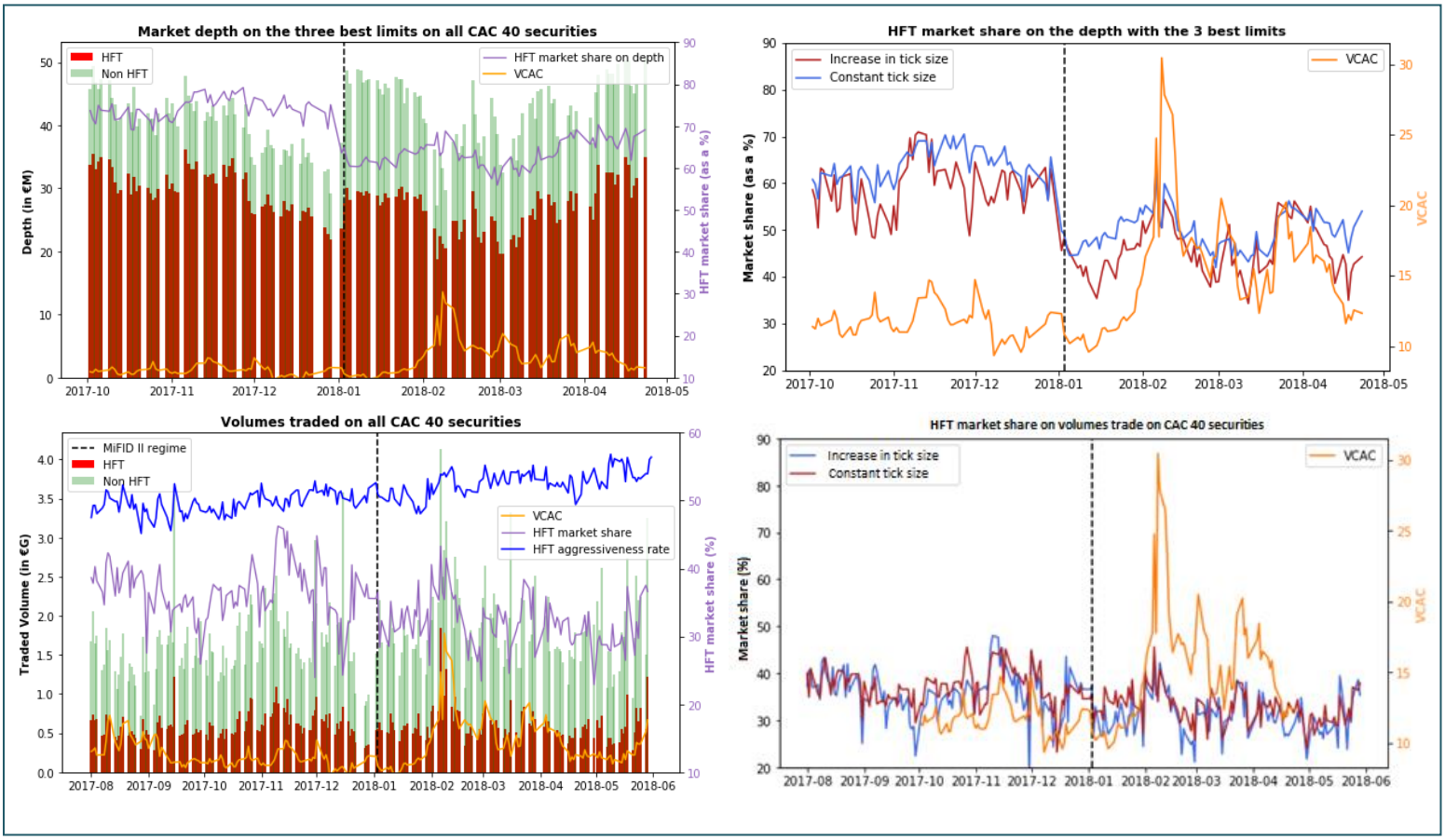
[7] Throughout the study, the paper illustrates each result obtained from the statistical analysis with the help of graphs, which make it possible to visualise the impact of the change in tick size. The definition of the indicators and the detailed results are presented in Appendix 1 and Appendix 4 respectively.

- For SRD securities, we observed a pronounced increase in depth (58%) as a result of the new regime. Volatility resulted in a 12% drop for the best limit on the group.

The new tick size regime ultimately offers a more homogeneous micro-structure between securities in terms of spread as well as available depth.

1.4.3. HFT market makers' market share on CAC 40 securities

For the depth available on CAC 40 securities, we observed a sustained drop in the HFTs' market share, which proves that the additional liquidity provision comes from non-HFT participants. We observed this drop in HFTs' market share in terms of depth (from 73.9% to 63.5%) on all CAC 40 securities, but it was slightly more pronounced on securities whose tick size increased (see graphs below).



The previous study showed that the HFT market share in volumes traded remained constant for securities where the tick size remained unchanged, but dropped slightly on securities with an increased tick size. The analysis over the extended period also demonstrated a slight drop in market share in traded volumes. However, unlike the first study, we observed the same drop in securities with increased tick sizes as with securities where the tick size remains unchanged. This attrition of high frequency trading seems in reality to reflect an underlying trend that has been observed for several years now and falls within a context of heightened competition among participants in a mature market, driven by consolidations.

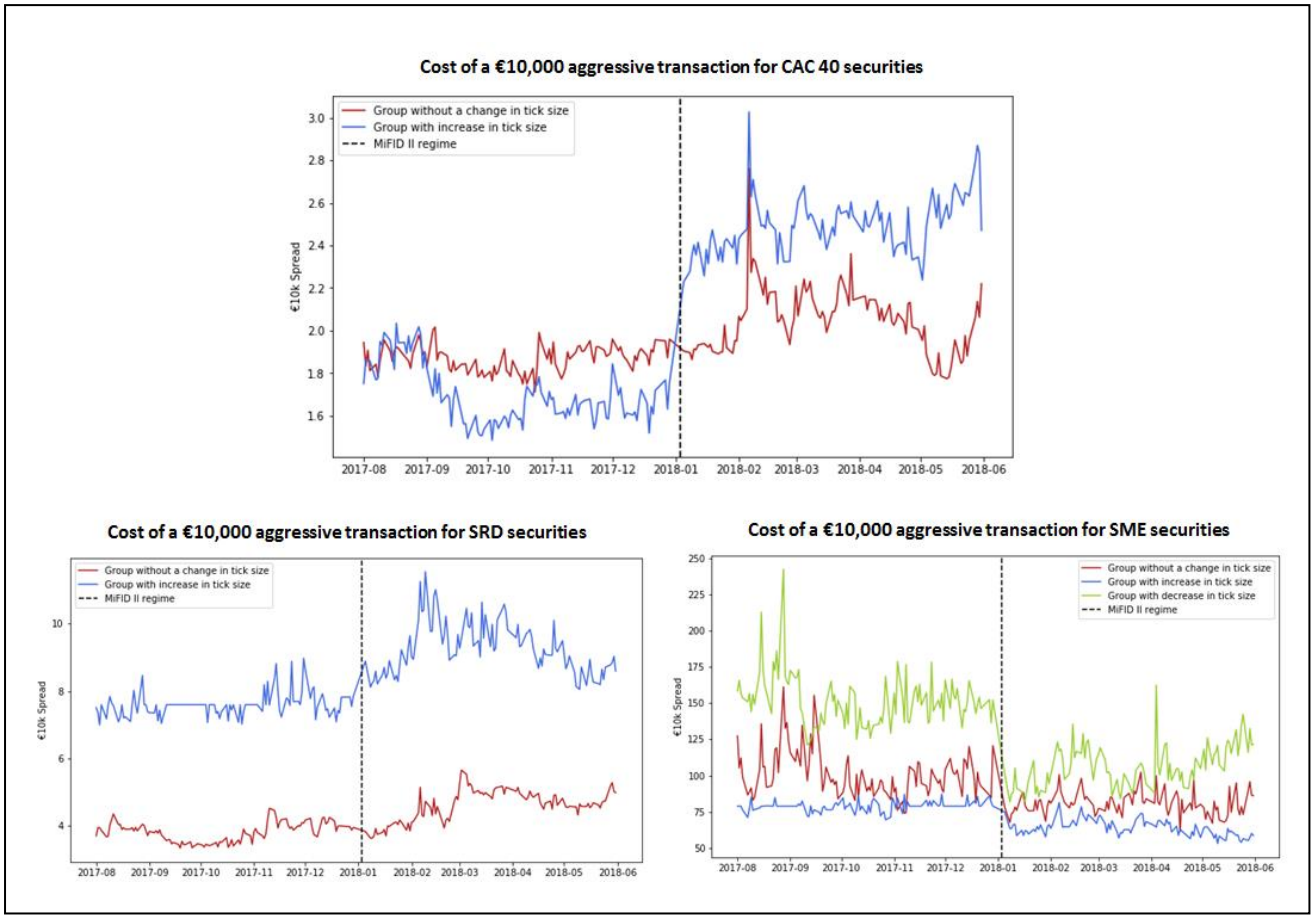
The fact that the drop in HFT market share in traded volumes is less pronounced than the drop in market share in terms of depth can be explained by higher aggressiveness during periods of stress (see blue curve – Aggressiveness level of HFTs) similar to the increase in their market share of traded volumes in February 2018 which coincided with a volatility peak and an increased aggressiveness rate.

2. TRANSACTION COSTS DROPPED IN FAVOUR OF NON-HFT INVESTORS

Although the widening of the spread is reflected in the increase in the cost of aggressive transactions, on the other hand, this widening is offset by an increased depth at best limits on the less liquid securities. It is essential, moreover, to take the aggressiveness of participants into account in order to evaluate the “effective” transaction cost.

2.1. THEORETICAL COST OF AGGRESSIVE TRANSACTIONS

The graph that follows shows the change in transaction cost combining spread and market depth, for an aggressive transaction of €10,000 (close to the average transaction size) compared with the mid-price on the three groups of securities.



It is important to point out that this cost measured with reference to the mid-price is borne only by the counterparty initiating the transaction with its aggressive order. Over the total activity of an investor, this may be more than offset by prices derived from passive transactions (given the widening of the spread, prices are more advantageous when the tick size increases). The average transaction cost for a given participant must therefore take into account its aggressive/passive transaction ratio (see below, Analysis of the impact on the effective cost).[8]

For mid-sized transactions, the impact of the change in tick size (i.e. the additional costs for aggressive transactions) is quite visible for CAC 40 securities (+36%), while it remains low on SRD securities (+11%) and considerably reduced, on average, for SME securities (-23%). This is explained by the increase in the cost of the spread for securities where there is an increase in tick size, possibly offset by an increase in market depth. The market depth factor is all the more significant when the security is not very liquid. This is because, since for CAC40 securities, a €10,000 transaction rarely reaches the second best limit, the spread is therefore the determining factor. Conversely, for securities that are less liquid, the increase in market depth can offset the widening of the spread and result in a decrease in transaction cost, as we can observe on SME securities where the aggressive transaction cost only rises by 15% on the sub-group with an increase in tick size.

It should also be pointed out that for CAC 40 and SRD securities, volatility tends to drive up the transaction cost substantially (logically because it pushes the spread to widen and market depth to drop). We therefore observe that for securities for which there is no change, there is a 9% impact of volatility on the transaction cost for

[8] A participant with a 50% level of aggressiveness will not be sensitive to spread variations, all things being equal.

CAC 40 securities and 21% for SRD securities. For the SRD group, the impact of the other factors is nearly double the impact of the new regime.

Although the increase in depth does not always fully offset the widening of the spread, the impact remains nevertheless extremely limited: it is restricted to small transactions involving the most liquid securities and is estimated at an additional cost of €0.70 for an average transaction of €10,000, i.e. 0.7 bps (which is on the whole equivalent to transaction costs on Euronext).

2.2. EFFECTIVE TRANSACTION COST

Lastly, it is worth noting that the effective additional cost varies depending on the market participant category. This is because aggressive participants are more impacted. Conversely, a passive participant will be less impacted. When a participant carries out an aggressive transaction, it loses the theoretical transaction cost. Likewise, a passive participant gains the theoretical transaction cost. Thus, if we take the level of aggressiveness of a player into account, we can measure its effective transaction cost. If G represents the level of aggressiveness of a participant, its effective cost can be inferred from the aggressive theoretical transaction cost as follows:

$$C_e = (2G - 1)C_{th}$$

where C_e represents the effective cost and C_{th} the aggressive theoretical transaction cost. The aggressiveness rate is calculated by amounts traded on the session, excluding fixing, for transactions amounting to €10,000[9] (average transaction size).
We identified three categories of participants and calculated their respective aggressiveness levels:

- client accounts,
- HFTs/market makers made up of participants in Euronext's SLP/RLP[10] programmes,
- proprietary accounts.

The table below sums up the effective costs resulting from the new regime according to three participant categories:

Effective cost of a €10,000 transaction per type of participant

Account type	Before MiFID II			After MiFID II			Difference in cost (€)
	Market share	Aggressiveness level	Effectif cost (€)	Market share	Aggressiveness level	Effectif cost (€)	
Client	23%	49,80%	-0.0028	24%	48,8%	-0.0168	-0.0140
Proprietary account	41,8%	50,20%	0.0028	42.10%	49,82%	-0.0025	-0.0053
HFT market maker	35,2	49,90%	-0.0014	33,90%	51,1%	0.0154	0.0168

For a given participant, the effective cost prior to MiFID II (respectively after MiFID II) is calculated according to the aggressiveness of this player over the pre-MiFID 2 period (respectively post MiFID II). Contrary to their reputation as market-makers, we note that most HFTs (51.1%) have been aggressive over the post-MiFID II period whereas they were rather passive before the new regime was established. The increase in HFT aggressiveness could be a result of significant market stress (see level of aggressiveness of HFTs – section 1.4.3) and of the new tick regime.[11] This increase in aggressiveness has led to additional costs for these participants. Conversely, we observe that client accounts and proprietary accounts benefitted from a lower level of

[9] Transactions comprised between €8,000 and €12,000.

[10] Supplemental Liquidity Providers (SLP) and Retail Liquidity Providers (RLP) are schemes offered by Euronext that grant preferential prices to liquidity providers that meet certain conditions.

[11] The assessment of the weight of each of these two factors could be studied more thoroughly at a later date.

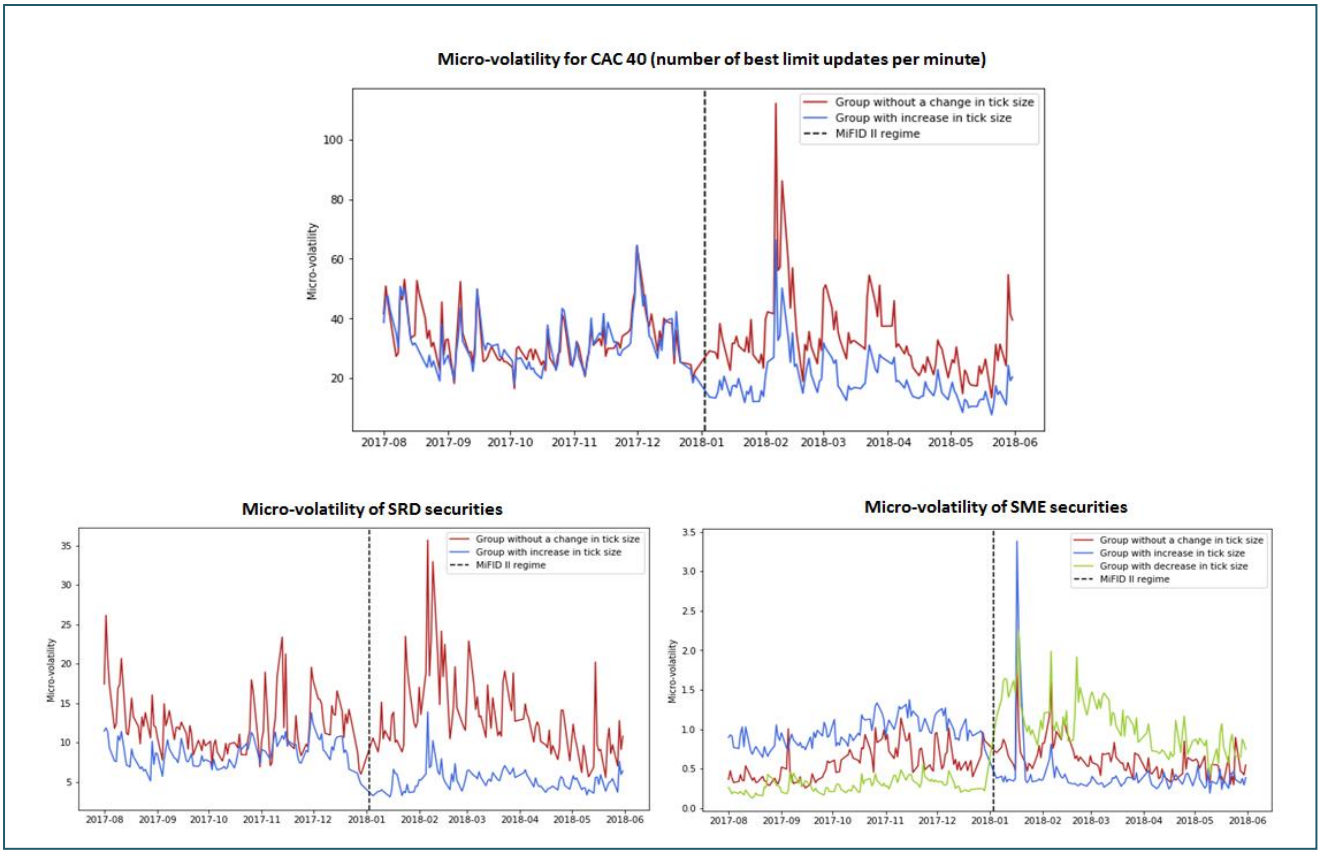
aggressiveness over the period following the new regime and thus recorded savings on their effective transaction costs.

3. THE BENEFICIAL IMPACTS OF THE NEW REGIME ON HIGH-FREQUENCY METRICS AND PRICE FORMATION ARE CONFIRMED OVER THE EXTENDED ANALYSIS PERIOD.

The benefits for order book viscosity observed in the previous study remain valid, although the high volatility seen over the first six months of 2018 had a rather negative impact on the indicators used in assessing order book stability.

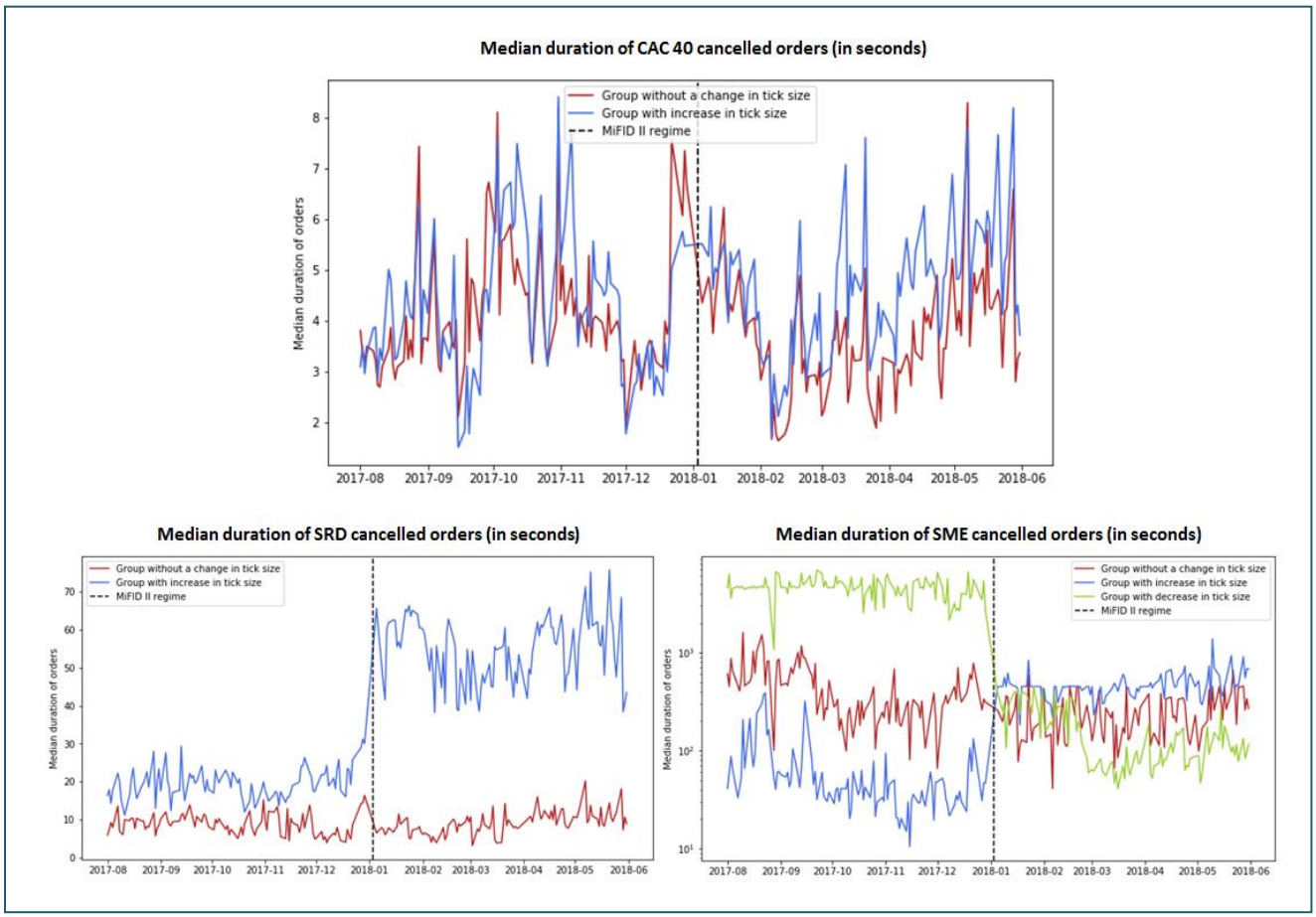
3.1. BEST LIMIT UPDATES

The frequency of change of best limits dropped by 40% on CAC 40 securities and by 52% on SRD securities (impacts of the new regime). On SME securities, we noted a 61% drop in the number of updates for securities where the tick size was increased and a sharp increase (best limit update frequency multiplied by 3) for securities where the tick size was decreased. On CAC 40 securities, we measured a very slight effect of volatility (+2%) whereas it remained more substantial for SRD and SME securities (+9% and +10% respectively). We observed an increased stability of best limits for all French securities.



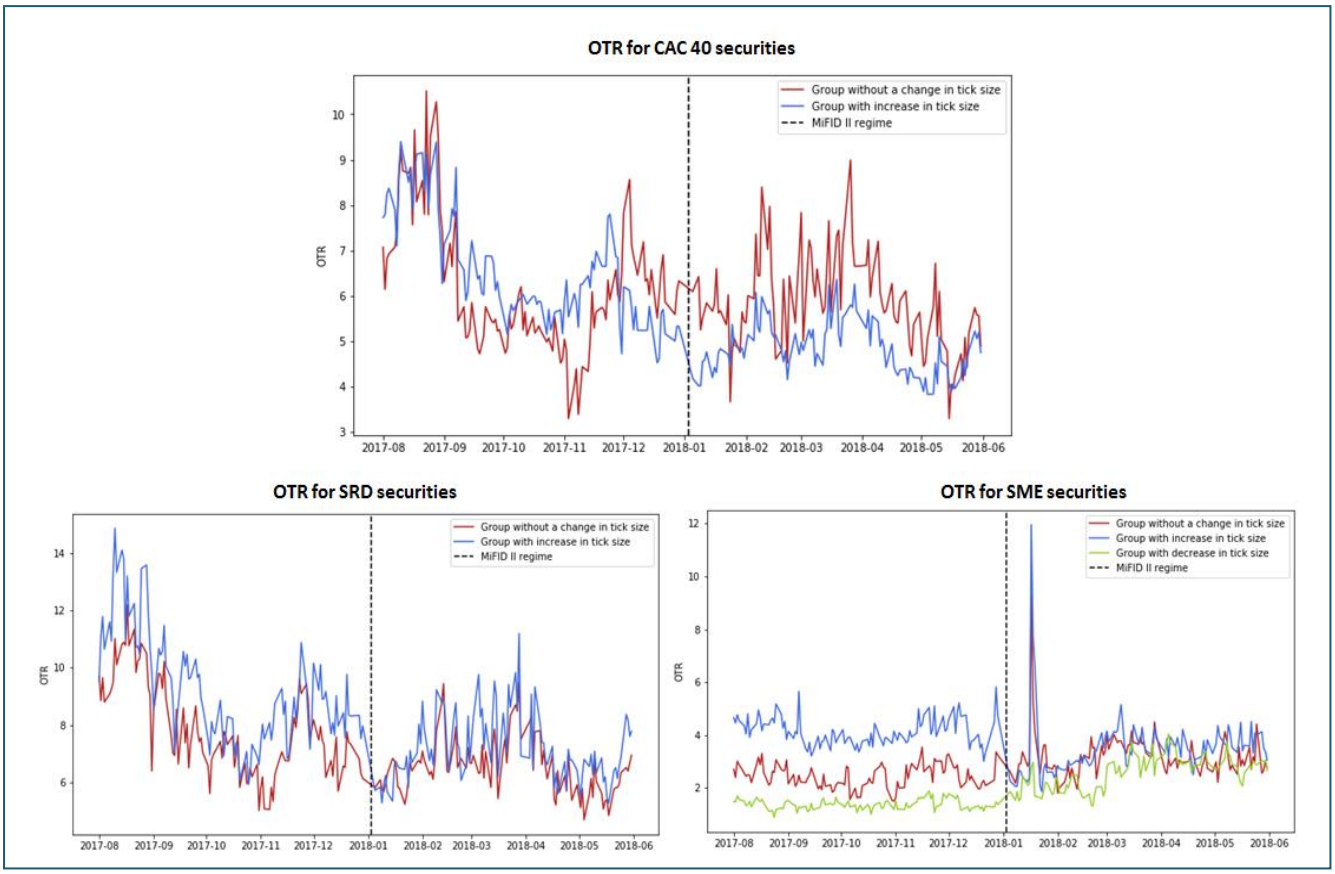
3.2. MEDIAN LIFETIME OF CANCELLED ORDERS

The lifetime of orders has risen significantly with the increase in tick size for SRD securities (multiplied by 2) and SME securities where the tick size was increased (multiplied by 9). For CAC 40 securities, the long-term impact was more moderate with a 20% increase (compared with 43% in the previous study), which is ultimately almost imperceptible because of the impact of stress (-12%). Conversely, the median lifetime of orders decreased by 94% for SME securities for which there has been no decrease in tick size. This resulted in effective harmonisation of the indicator for this group.



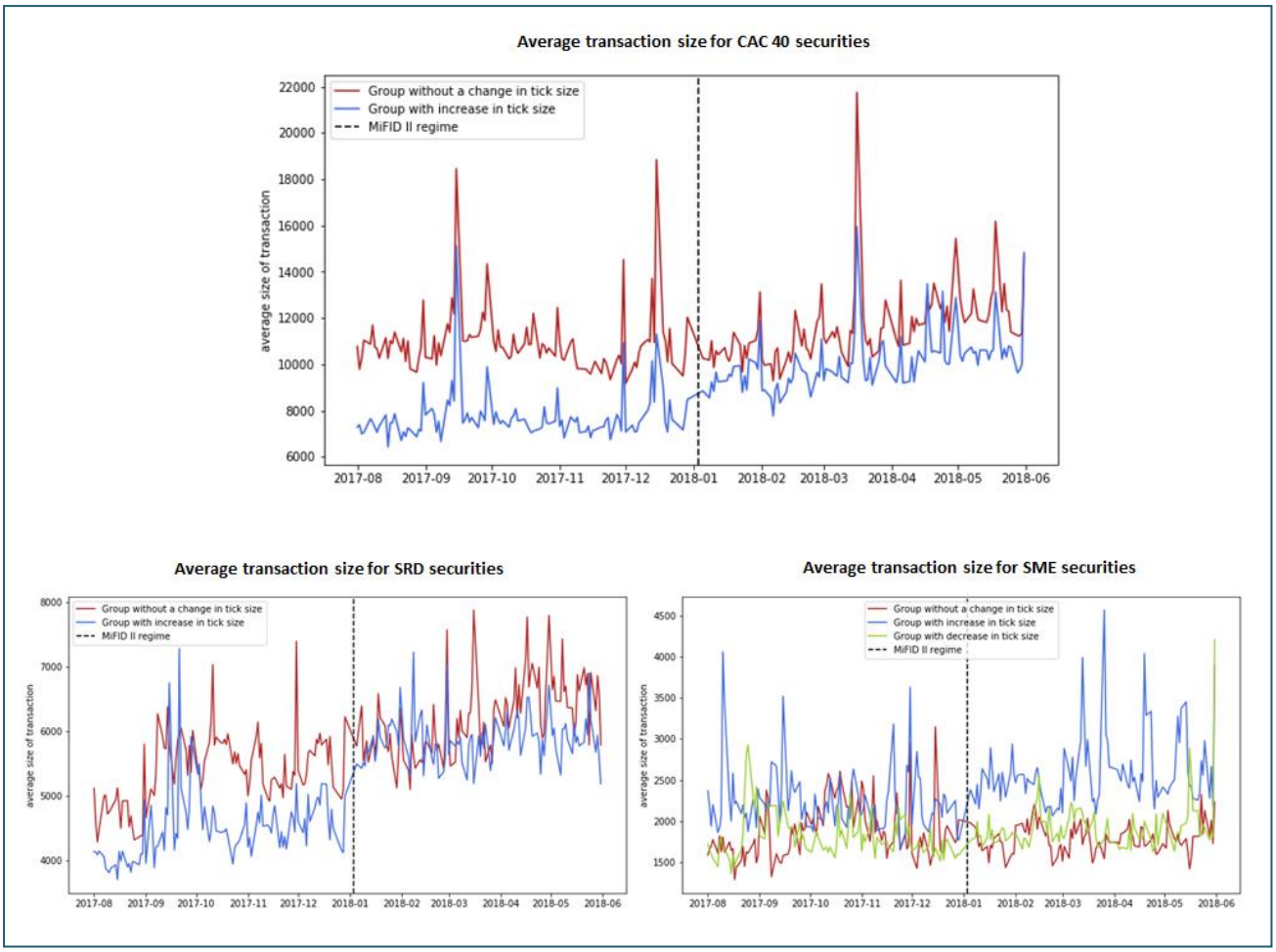
3.3. ORDER-TO-TRADE RATIO

The order-to-trade ratio (OTR) changed in a manner consistent with the change in tick size. In the first study, we measured a 15% drop in OTR for CAC 40 securities in the first month of the year. The long-term impact was more moderate, since the drop was now only 8%. For SRD securities, the impact of the change in tick size on the OTR was -21%, a substantial drop that was not observed in the previous study. For SME securities, the impacts were comparable on the whole to the short-term impacts, with a sharp drop in the OTR when the tick increases (-32% compared with -50% during the previous study) and, conversely, an increase in the OTR when the tick size is reduced (+33% against +40% during the first study).



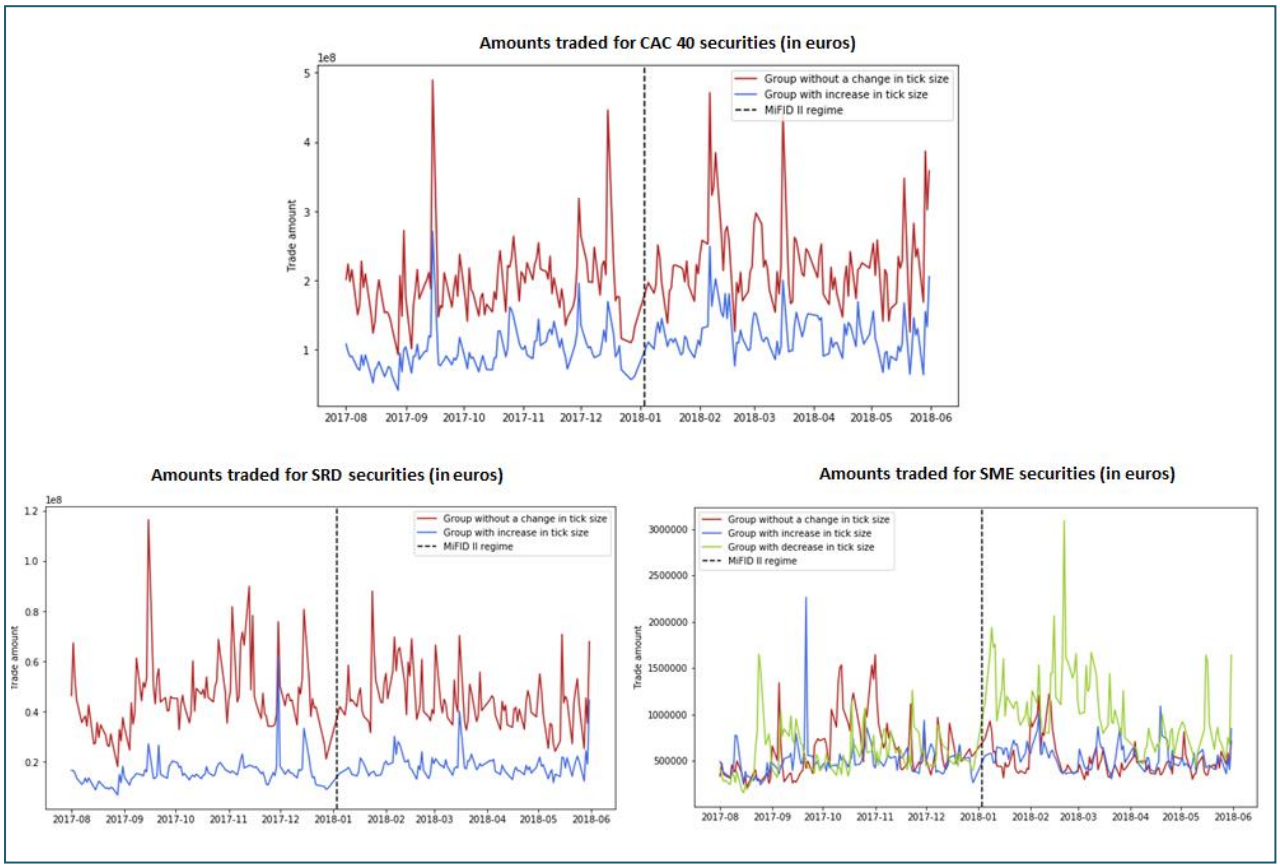
3.4. AVERAGE TRANSACTION SIZE

Lastly, the conclusions related to the average transaction size remain unchanged with a marked increase in transaction sizes, ranging between 10% and 20%, on all securities where the tick size is changed (CAC, SRD or SME). For SME securities with reduced tick size, the transaction size also rises slightly although we might have expected a drop in size (in this case 11%). By virtue of a ripple effect, participants were able to follow the same behaviour on these SME securities as on securities that underwent an increase in tick size, much more than those where there was a decrease in tick size (64% against 21% respectively).



Overall, the increase in tick size has had the desired effect on micro-structure: increased viscosity (longer order lifetime and larger transaction size) in order to reduce noise in the order book (smaller OTR) to enable a clearer price formation process.

The following graphs show the trend of the amounts traded for the different groups of securities:



For SRD and CAC 40 securities, the change in tick size does not seem to have had a significant impact on amounts traded.
Conversely, for SME securities, we observe that an adapted tick size substantially improved liquidity since the volumes traded on securities where the tick size has been reduced doubled.

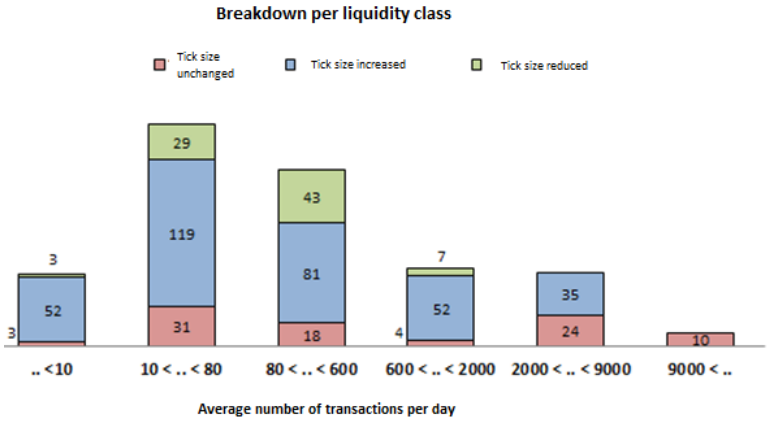
APPENDIX 1: DEFINITIONS OF METRICS

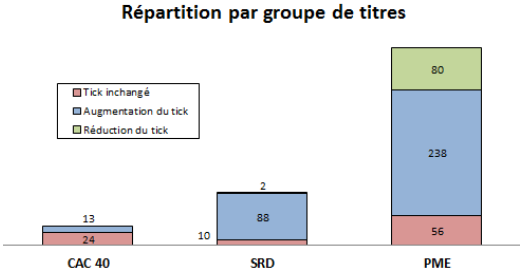
The metrics are calculated based on both order and transaction data, which enabled us to rebuild the order book. It is important to point out that, for ease of process and so as to simplify calculations, we only took into account "good for the day" orders in rebuilding the order book (i.e. orders were taken into account only on the day they were entered or modified) and that this might marginally impact the metrics, especially for SME securities. Nevertheless, as all the metrics are the same for securities whether there is a change in tick size or not, this should have a negligible impact on the metrics.
The details of the various metrics calculations are presented below:

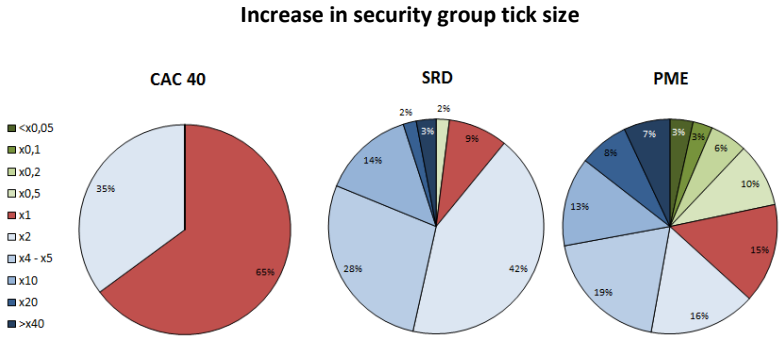
- **Spread in %:** median of average spread compared to the price per minute per security for each group;
- **Spread in ticks:** median of average spread in ticks per minute per security for each group;
- **Amount available (depth) at the *n*th limit:** average of average market depths cumulated at the bid and ask per minute per security on each group;
- **Cost of a transaction for €*x* (spread at €*x*):** average of transaction costs per security for each metric (a maximum of one metric per minute). This metric under-weights securities with very low activity, (i.e. securities with no activity over several minutes);
- **Frequency of update of best limits**: average of the average number of bid-ask updates per minute per security for each group;
- **OTR:** total number of orders divided by the total number of trades for each group;
- **Median lifetime of orders:** median of median lifetimes of cancelled orders per security for each group;
- **Average trade size:** average trade size on all the trades for each group;
- **Amount traded:** average amount traded per security for each group.

APPENDIX 2: RECAP OF THE PREVIOUS STUDY

It should be remembered that, for French blue chips and mid-caps, the tick size regime has led to an increase in the tick size for 74% of the instruments and left the remaining 26% unchanged. For small caps, the regime has led to a reduction of tick size for 15% of the instruments, an increase for 21% of the instruments while for the remaining 64% the tick size regime left the tick unchanged. The changes in tick size per security category are listed below.







The AMF's first study published in March 2018 offers an assessment of the initial impact of the new regime on market liquidity and quality. By analysing a series of indicators spanning more than 500 securities listed on the Paris Stock Exchange, divided into three separate groups, before and after the implementation of MiFID II, the study revealed in particular a sharp increase in market depth, albeit to the detriment of a widening of the spread for the more liquid securities. By combining these effects, there is a slight additional cost for market participants crossing the spread, while passive participants benefitted directly from the wider spread. On the other hand, the increase in tick size reduced noise in the order book, measured by a significant reduction in the number of messages. For small caps, implementing appropriate tick sizes (compared with the constant €0.01 tick previously applicable on these securities) had led to more dynamic order book and improved liquidity.

APPENDIX 3: REGRESSION MODEL

To quantify the impact of the new tick size regime, we resolve the following equation over the 10-month period analysed using the least squares method and for each of the three study groups (CAC 40, SRD and PME):

$$Magnitude_{change\ in\ tick\ size}(\mathrm{d}) - Magnitude_{constant\ tick\ size}(\mathrm{d}) = a\,\mathbb{1}_{MIFID\ II}(\mathrm{d}) + b$$

With

$$\mathbb{1}_{MiFID\ II} = \begin{cases} 1 & after\ entry\ into\ force\ of\ MiFID\ II \\ 0 & before\ the\ entry\ into\ force\ of\ MiFID\ II \end{cases}$$

Where

- $Magnitude_{Change\ in\ tick\ size}(d)$ corresponds to the average on a given day of the indicator[12] on all the securities where the tick size has been changed;
- $Magnitude_{Constant\ tick\ size}(d)$ corresponds to the average on a given day of the indicator on all the securities where the tick size has not been changed.

Since volatility impacted the selected groups in the same way, it results that the equation coefficient a represents the impact of the new tick regime. b represents the difference - before the introduction of the new regime - between the average for securities for which the tick size has not been changed and the average for the securities for which the tick size has been changed.

[12] Refers to the studied measurements: spread, market depth, transaction cost, frequency of update of best limits, etc.

APPENDIX 4: SUMMARY OF THE TABLES OF IMPACTS

The first columns (in blue) show the average of indicators on all the securities of each group of instruments. The following columns (in violet) show the average values calculated only on the group for which the tick has been changed (in the case of an impact from the tick) and on the group for which the tick has not been changed (in the case of an impact from other factors).

↗ CAC 40

Quantities Measured	On all securities			On groups alone					
	Values under MiFID I	Values under MiFID II	Relative deviation (%)	Values under MiFID I	Values under MiFID II	Impact of MiFID II	Impact of other factors	Impact of other factors (%)	Determination coefficient
Spread in bps of price	3.648	4.425	+ 21 %	2.807	1.267	+ 45 %	0.331	+ 8 %	0.78
Spread in ticks	1.632	1.592	- 2 %	2.010	-0.570	- 28 %	0.166	+ 12 %	0.91
Best limit amount (€)	85 851	75 979	- 11 %	41 099	31 683	+ 77 %	-20 922	- 19 %	0.72
Best three limits amount (€)	400 621	357 334	- 11 %	140 358	122 416	+ 87 %	-85 490	- 16 %	0.58
€10k spread (€)	1.812	2.202	+ 22 %	1.704	0.619	+ 36 %	0.174	+ 9 %	0.82
Best limit update frequency	32.619	28.675	- 12 %	31.658	-12.770	- 40 %	0.537	+ 2 %	0.55
OTR	8.279	6.772	- 18 %	9.144	-0.720	- 8 %	-1.256	- 16 %	0.13
Median duration of orders (µs)	4 189 951	3 966 281	- 5 %	4 307 276	842 675	+ 20 %	-515 707	- 12 %	0.18
Average size of transaction	9 683.685	10 924.384	+ 13 %	7 731.269	1 700.868	+ 22 %	673.865	+ 6 %	0.39
Amount traded (€)	159 782 139	189 597 641	+ 19 %	98 346 798	-8 256 558	- 8 %	32 704 486	+ 17 %	0.34

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↗ SRD

Quantities Measured	On all securities			On groups alone					
	Values under MiFID I	Values under MiFID II	Relative deviation (%)	Values under MiFID I	Values under MiFID II	Impact of MiFID II	Impact of other factors	Impact of other factors (%)	Determination coefficient
Spread in bps of price	4.082	6.055	+ 48 %	3.810	1.681	+ 44 %	0.465	+ 7 %	0.740
Spread in ticks	10.297	2.141	- 79 %	11.252	-9.121	- 81 %	0.110	+ 6 %	0.972
Best limit amount (€)	23 019.998	42 332.974	+ 84 %	20 163.505	27 841.255	+ 138 %	-5 677.086	- 12 %	0.719
Best three limits amount (€)	78 751.105	160 651.380	+ 104 %	65 668.047	99 403.020	+ 151 %	-7 023.945	- 4 %	0.635
€10k spread (€)	7.205	8.785	+ 22 %	7.592	0.860	+ 11 %	0.790	+ 21 %	0.354
Best limit update frequency	8.983	6.056	- 33 %	8.615	-4.458	- 52 %	1.068	+ 9 %	0.285
OTR	6.485	4.921	- 24 %	6.518	-1.341	- 21 %	-0.341	- 6 %	0.339
Median duration of orders (µs)	18 712 125.021	49 873 554.577	+ 167 %	19 834 538.255	34 015 637.198	+ 171 %	324 022.389	+ 4 %	0.848
Average size of transaction	4 609.569	5 917.797	+ 28 %	4 520.521	559.623	+ 12 %	773.284	+ 14 %	0.196
Amount traded (€)	18 692 383.119	21 268 791.630	+ 14 %	15 668 518.322	3 414 479.744	+ 22 %	-421 505.250	- 1 %	0.245

↗ **SME (tick increased)**

Quantities Measured	On all securities			On groups alone					
	Values under MiFID I	Values under MiFID II	Relative deviation (%)	Values under MiFID I	Values under MiFID II	Impact of MiFID II	Impact of other factors	Impact of other factors (%)	Determination coefficient
Spread in bps of price	87.189	82.014	- 6 %	69.990	13.062	+ 19 %	0.000	- 3 %	0.854
Spread in ticks	28.409	5.753	- 80 %	42.549	-38.078	- 89 %	0.567	+ 11 %	0.941
Best limit amount (€)	12 264.565	16 375.217	+ 34 %	7 875.488	11 800.947	+ 150 %	1 352.522	+ 18 %	0.857
Best three limits amount (€)	37 523.409	44 963.313	+ 20 %	26 208.449	26 034.885	+ 99 %	2 905.100	+ 11 %	0.900
€10k spread (€)	97.742	75.637	- 23 %	78.902	5.076	+ 6 %	-20.326	- 20 %	0.338
Best limit update frequency	0.759	0.590	- 22 %	0.959	-0.584	- 61 %	0.054	+ 10 %	0.564
OTR	3.292	3.272	- 1 %	4.127	-1.329	- 32 %	0.736	+ 30 %	0.497
Median duration of orders (µs)	1 518 737 997.601	374 280 748.628	- 75 %	71 853 204.829	607 595 049.564	+ 846 %	-200 884 631.722	- 45 %	0.671
Average size of transaction	2 099.941	2 329.564	+ 11 %	2 239.519	453.100	+ 20 %	-94.366	- 5 %	0.182
Amount traded (€)	534 454.396	641 264.299	+ 20 %	498 487.261	154 950.408	+ 31 %	-110 937.745	- 18 %	0.312

↗ **SME (tick decreased)**

Quantities Measured	On all securities			On groups alone					
	Values under MiFID I	Values under MiFID II	Relative deviation (%)	Values under MiFID I	Values under MiFID II	Impact of MiFID II	Impact of other factors	Impact of other factors (%)	Determination coefficient
Spread in bps of price	87.189	82.014	- 6 %	114.043	-51.189	- 36 %	-0.026	- 3 %	0.848
Spread in ticks	28.409	5.753	- 80 %	2.620	5.316	+ 203 %	0.567	+ 11 %	0.391
Best limit amount (€)	12 264.565	16 375.217	+ 34 %	28 632.802	-22 428.011	- 78 %	1 352.522	+ 18 %	0.847
Best three limits amount (€)	37 523.409	44 963.313	+ 20 %	78 990.845	-55 785.865	- 71 %	2 905.100	+ 11 %	0.881
€10k spread (€)	97.742	75.637	- 23 %	151.418	-24.688	- 16 %	-20.326	- 20 %	0.344
Best limit update frequency	0.759	0.590	- 22 %	0.294	0.703	+ 239 %	0.054	+ 10 %	0.657
OTR	3.292	3.272	- 1 %	1.386	0.460	+ 33 %	0.736	+ 30 %	0.088
Median duration of orders (µs)	1 518 737 997.601	374 280 748.628	- 75 %	6 573 081 947.569	-6 197 582 443.986	- 94 %	-200 884 631.722	- 45 %	0.555
Average size of transaction	2 099.941	2 329.564	+ 11 %	1 833.483	197.225	+ 11 %	-94.366	- 5 %	0.059
Amount traded (€)	534 454.396	641 264.299	+ 20 %	578 665.138	577 438.946	+ 100 %	-110 937.745	- 18 %	0.313