

Submission for the purpose of the
US Securities and Exchange Commission's roundtable on tick sizes
(5 February 2013)

I. Tick size regimes in the European Union: the general background

1. As from today, the tick size regimes that have developed throughout the different European trading venues are not fully harmonised. As a matter of fact, there is currently no common legal framework prescribing any harmonised rules in relation thereto. An initiative was nonetheless taken in 2009 by the Federation of European Securities Exchanges (FESE)¹ in order to stop the race to extra-granularity (the so-called "tick size war"). Under this initiative, four common tick size tables were proposed². However, these tables are not prescriptive.
2. Pursuant to the European Commission's proposal³ dated 20 October 2011 for a directive on markets in financial instruments (usually referred to as MiFID II⁴), tick sizes shall be regulated under European Union (EU) law. Indeed, pursuant to Article 51(3) of the aforementioned MiFID II proposal, regulated markets shall be required by EU Member States "*to have in place effective systems, procedures and arrangements to ensure that algorithmic trading systems cannot create or contribute to disorderly trading conditions on the market including systems [...] to limit the minimum tick size that may be executed on the market*". The final text of the MiFID II proposal shall only be known once the trilogues currently taking place between the European Commission, the Council of the European Union and the European Parliament⁵ come to an end (which is expected to be in the course of 2013).
3. Subject to the outcome of the aforementioned trilogues, the European Securities and Markets Authority (ESMA) shall either elaborate delegated acts to the European Commission or regulatory technical standards⁶.

¹ Which is the professional body of the operators of the European regulated markets.

² Further to FESE's negotiations with the Association for Financial Markets in Europe (AFME – formerly the London Investment Banking Association (LIBA)) and four multilateral trading facilities (MTFs – namely BATS, Chi-x, NASDAQ Europe and Turquoise), and further to market consultation. Please note that BATS and Chi-x have since merged to become BATS Chi-X Europe, and that NASDAQ OMX has since closed its pan-European Equity MTF.

³ COM(2011) 656 final – 2011/0298 (COD).

⁴ The purpose of MiFID II is to repeal Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments (MiFID).

⁵ It is noteworthy that the European Parliament's version (adopted on 26 October 2012) also provides for a specific Article which extends the scope of tick size tables (notably to all shares, and to depositary receipts, exchange traded funds, certificates and any other similar financial instruments), provides for a calibration of tick sizes not only according to price but also to the liquidity profile of the financial instrument in different markets and the bid-ask spread, and also provides for the elaboration of draft technical standards by ESMA to specify minimum tick sizes or tick size regimes.

⁶ In particular, in order to specify minimum tick sizes or tick size regimes for specific shares, depositary receipts, exchange-traded funds, certificates and other similar financial instruments where this is necessary to ensure the orderly functioning of markets, in consideration of the conditions relating to the calibration and the appropriateness of the tick size regimes, and the price, spreads and depth of liquidity of the instruments.

II. Preliminary proposal for a new tick size regime

4. In the context of the future elaboration of MiFID II, the *Autorité des marchés financiers* (AMF) has developed a new tick size regime approach in the EU. The AMF has shared its proposed approach (Proposal) with many interested parties and in particular, with other national competent authorities (securities regulators) in the EU, representatives of trade associations such as the Association for Financial Markets in Europe (AFME) and the Association for French Financial Markets (AMAFI), academics and scientists (notably at roundtables organised by ESMA, at conferences such as the Intermarket Surveillance Group (ISG)'s fall 2012 conference), the AMF's Markets & Exchanges Consultative Commission (whose members are mainly representatives of investment firms, legal firms, and of the regulated market), ESMA and representatives of trading venues including members of FESE. The AMF's Proposal has received encouraging comments on the part of the regulators, the market operators and participants that it has consulted on a preliminary basis.
5. The Proposal is **based on both the price and the liquidity** (whereas the FESE tick size tables are determined according to the share price). In fact, for the purpose of efficiency, it is considered that a tick size should govern a homogeneous class of stocks: therefore, the share price itself is not enough to appropriately cluster the different stocks by "optimal tick size". And the liquidity appears to be a relevant criterion to refine the clustering. Hence, pursuant to the Proposal⁷, the liquidity has to be taken into account and the level of granularity of the table has to be proportionate. The Proposal therefore provides for a two dimensional tick size regime, the first dimension being the price and the second being the number of transactions per day⁸. It results from the Proposal that the more liquid the share, the thinner the spread, and therefore the smaller the tick size.
6. Pursuant to the Proposal, the optimal tick size is therefore the result of **the trade-off between constraining the spread to allow liquidity to aggregate without increasing viscosity**:
 - ▶ **The tick size must be small enough to avoid increasing viscosity.** Too big, a tick size can discourage investors from placing orders at the best bid/offer prices as the queuing time at these limits becomes longer, which in turn increases the implementation risk.

⁷ For further details, please see the attached presentation "Tick Size: the "Nouveau Régime"", dated October 2012.

⁸ It is noteworthy that the turnover could also be another relevant indicator of liquidity, but as the table has the price on the x axis, using the turnover (Average Traded Size * Price * Number of Transactions) on the y axis would use the price twice. For further details, please also see the attached document "New tick size proposal: the average number of transactions per day is the best proxy for liquidity".

The consequences of a smaller tick size are as follows⁹: a smaller tick size influences the lifetime and the rate of execution of the orders. As it decreases the cost to place a higher bid, it decreases the probability of being executed at best price¹⁰, it urges market participants to modify their orders more frequently and **the median lifetime of cancelled/modified orders is nearly halved** from 3.3 seconds to 1.9 seconds. Moreover it significantly **decreases the execution rate of orders** from 5.5% for the 0.005€ tick size to 2.6% for the 0.001€ tick size.

A smaller tick size, expressing the spread as a larger number of ticks, increases the room to overbid, and reduces the cost of overbidding. After the opening auction, the beginning of the trading day is usually characterized by large spreads and the order book becomes a playing field for high frequency traders (HFT). The number of “manipulative” orders with an extremely short lifetime (less than 600 μ s) dangerously increases before 9:15 AM compared to the rest of the day. Therefore a large spread (expressed as a number of ticks) may lead to noise in the order book, in particular **noise generated through escalation by cheap overbidding**.

Using the distribution of the lifetime of the orders, the market participants can be divided into three categories, HFT, Mixed (global brokers with a strong HFT activity) and the “Rest-of-the-World” (RotW), mainly agency brokers. That split, combined to changes in the lifetime of orders, execution rate of orders and number of orders sent per tick, shows different interactions amongst the participants and improved predation done by the HFT when the tick size is smaller. As a result, the smaller tick size seems to **discourage market participants to post orders** in the order book.

All investors are not equally impacted by the change in tick size. **HFT activity increases when the tick size decreases**. The smaller tick size dramatically reduces the proportion of orders sent by RotW participants, from 4% to 1%. The smaller tick size also significantly changes the proportion of the volumes traded by RotW participants from 19% to 9%, as HFT participants find more opportunities to intermediate for profit non HFT transactions.

Amongst HFTs, strategy may change when the tick size decreases. While some HFTs adapt very well to a change in tick size, some are subjected to a simple scale effect and some don't take the change in tick size into account. Logically, orders of agency traders are more impacted in the “HFT predation zone”, for their orders with a lifetime below one second.

⁹ To estimate the impact of a small tick size on market microstructure, the AMF focused on three liquid stocks (Axa, France Telecom and Veolia Environnement) that traded around 10€ and had **intraday changes** of tick size over a three months period (April to June 2012) on Nyse Euronext. The study is based on over 30 million orders (time stamped to the microsecond) on these three stocks over this period, roughly half of which traded under 10€ (tick size 0.001€) and the other half of which traded at 10€ or above (tick size 0.005€).

¹⁰ The execution rate at the touch is 33% less for the 0.001€ tick size than for the 0.005€ tick size. In this regard, it is important to mention that the US national market system rule for equity securities (“Regulation NMS”) that forces a trading venue to automatically reroute an order to another trading venue if and where the latter offers a better price, does not exist in the EU (where investment firms only are responsible for the best execution of clients' orders). As a matter of fact, the Smart Order Routers developed by market participants in the EU have a price component that overrides all other components. As a result, an equivalent tick size may have a different impact on market microstructure in the US and in the EU.

► **The tick size must be big enough to ensure that there is a relevant cost to overbidding.** Excessively granular tick sizes in securities have a detrimental effect to market depth as it is almost cost free to overbid and may discourage liquidity providers from posting orders.

The consequences of a larger tick size are as follows: a larger tick size will **increase queuing** and the **average traded size**. The waiting time necessary for an order to be executed at the “touch” nearly doubles when the tick size increases from 0.001€ to 0.005€, while the average traded size increases by 25%, forcing the HFT market participants to adjust their risk envelop accordingly. The trade-off between the capture of the spread and the implementation risk is changed and thus the **proportion of orders executed when placed at the touch increases**¹¹.

A larger tick size will also **increase viscosity**. If the tick size constrains the spread too much, the viscosity added to the order book will **favour OTC trading and reduce liquidity in the Lit order books**. Losing or gaining the spread would then represent an important part of the transaction costs and trading at mid-spread in the Dark would be incentivized.

7. Hence, it results from the above that the optimal tick size should be **a function of the average spread** and should be large enough to constrain the spread and at the same time small enough to keep the transaction costs unaffected. Collected data shows that a spread between 1.4¹² and 2¹³ ticks should maintain a **good balance between constraints and transaction costs**. Therefore the optimal tick size should be established as a proportion maintained between 1.4 and 2 average spread¹⁴.
8. Determination of the new tick size table: The proposed new table clusters the stocks by number of transactions on the primary venue per day and price so that the spread is homogeneous for each cluster. Under the Proposal, **four liquidity bands** have been identified: very liquid (5000 trades/day), fairly liquid (2001 to 5000 trades/day), liquid (500 to 2000 trades/day) and poorly liquid (up to 500 trades/day). Also, **new price levels and tick size levels** have been added so that each increment is maximized to 2.5 times the previous increment (1€, 2€, 5€, 10€, 20€, 50€,…) ¹⁵. The following table was optimised to maintain a spread between 1.4 and 2 ticks over 339 trading days on 123 stocks in the French market:

¹¹ If a venue offers significant rebates to one category of market participants only it will change the trade-off for that category and increase the proportion of orders from that category in the order book. If that proportion becomes too important, it will force the market participants (who do not benefit from this particular rebate) to fire more aggressive orders and to lose the spread more often.

¹² When the spread is 1.4 ticks it is constrained a little more than half of the time, and constraints increase significantly when the average spread is under 1.4 ticks.

¹³ When the spread is 2 ticks or more it is not constrained. Moreover a strong divergence between the transaction costs of HFTs and other market participants can be noticed when the average spread is over 2 ticks.

¹⁴ The analysis of real transaction costs over the 120 stocks subjected to the FESE tick size table confirmed this assumption. A linear regression of the transaction cost over the spread (as a number of ticks) shows that the cost of transaction is a decreasing function of the spread for a spread less than 1.4 ticks and an increasing function of the spread for a spread larger than 2 ticks. Hence increasing the tick (i.e. reducing the spread) for an average spread larger than 2 ticks will reduce the cost of transaction, and decreasing the tick (i.e. enlarging the spread) for an average spread smaller than 1.4 ticks will reduce the cost of transaction.

¹⁵ The results would be similar if the levels 1, 2.5, 5, 10, 25, 50, ... were to be used.

Number of transactions per day	FESE table 4																	
	<0.5	0.5 - <1	1 - <2	2 - <5	5 - <10	10 - <20	20 - <50	50 - <100	100 - <200	200 - <500	500 - <1000	1000 - <2000	2000 - <5000	5000 - <10000	10000 - <20000	20000 - <50000	>50000	
	0.001				0.005			0.01	0.05									
>5000	0.0001	0.0002	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	
2001 - 5000	0.0002	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	
501 - 2000	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	100	
0 - 500	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	100	200	

Note: For very liquid stocks the tick size table only partially modifies the FESE table 4

9. Implementation of the proposed new tick size table on European stocks: Applying this table to the Euro Stoxx600 stocks will reduce the overall median spread from 2.31 ticks to 1.57 ticks, and will reduce the standard deviation of the median spread from 1.76 to 0.49.
10. Advantages of the proposed new tick size table: It is believed that the proposed new tick size table has several merits to the benefit of market participants (including market operators and investors) and national competent authorities (for the purpose of their supervisory mission).

In particular, it should be **easy to implement** notably as all stocks already belong to a liquidity band. Also, the proposed new tick size levels and the related increments resemble the levels used for common cash money (e.g., bank notes and coins of 2 cents, 20 cents, 2 euros, 20 euros, 200 euros¹⁶) with which market participants are familiar as such levels are based on an intuitive understanding.

Moreover, the proposed new tick size table should be **quite easy to adjust** (by simply moving the liquidity bands up or down). Also, the dynamic calibration on which the proposed new tick size table is based makes it of a **predictable nature for market participants** (notably with regard to the automatic process for band changes pursuant to which when a stock remains twenty consecutive trading days within a liquidity band, then that new band is used). As a result, adjustments no longer need to be made through the price¹⁷.

Another advantage is that the proposed new tick size table allows to **systematically maintain a control sample**, that-is-to-say a sample of unaffected stocks which allows to compare objectively the changes made to market microstructure. It is highlighted that no other method to adjust market microstructure provides for such control sample. For all these reasons, the proposed new tick size table therefore appears to be a straightforward and appropriate way to harmonise tick sizes across all European trading venues.

¹⁶ This is also the case for quarters (1/4th of US dollars).

¹⁷ Notably, if the bands are not constraining enough then the bands can be moved upward, and if the bands are too constraining then the bands can be moved downward. Also a yearly revision process of the liquidity bands is provided.

11. By way of conclusion, it is believed that the tick size Proposal that is presented in this paper is an appropriate and relevant tool for the purpose of the fair and orderly functioning of financial markets and of their integrity. However, it is worth mentioning that this Proposal does not purport to be exclusive and can be combined with other tools. Indeed, the AMF has also identified other possible tools which could prove relevant for the same purpose. For the purpose of illustration, the AMF supports the invoicing of modifications and cancellations of orders in proportion to their lifetime, which allows to calibrate the market structure by using both time and price¹⁸. Needless to say, for this last tool to be efficient, it obviously has to apply to all trading venues without any distinction.

* * *

For further details with regard to the AMF's Proposal, please see the attached documents:

- "Tick Size: the "Nouveau Régime"" (October 2012)
- "New tick size regime proposal: the average number of transactions per day is the best proxy for liquidity".

Any question in relation to this document and its two attachments may be submitted to Philippe Guillot, Executive Director in charge of Markets, AMF:
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Disclaimer:

This submission is intended only for the US Securities and Exchange Commission. Its sole purpose is to contribute to the roundtable on tick sizes that is organised by the US Securities and Exchange Commission on 5 February 2013. It shall therefore not be used for any other purpose. Notably, it shall not be retransmitted / disseminated / relied upon by persons or entities other than the intended recipient.

¹⁸ A contemplated option is to provide for different fees according to the orders' lifetime.

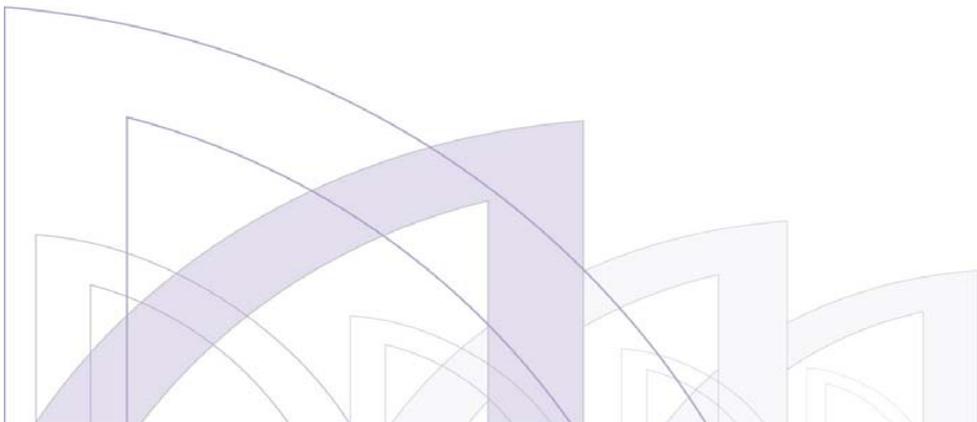
Tick Size: the “Nouveau Régime”

An abstract graphic consisting of several overlapping, semi-transparent purple and light purple shapes, including curved lines and rectangular blocks, creating a layered, architectural effect.

October 2012

Philippe Guillot – Direction des Marchés

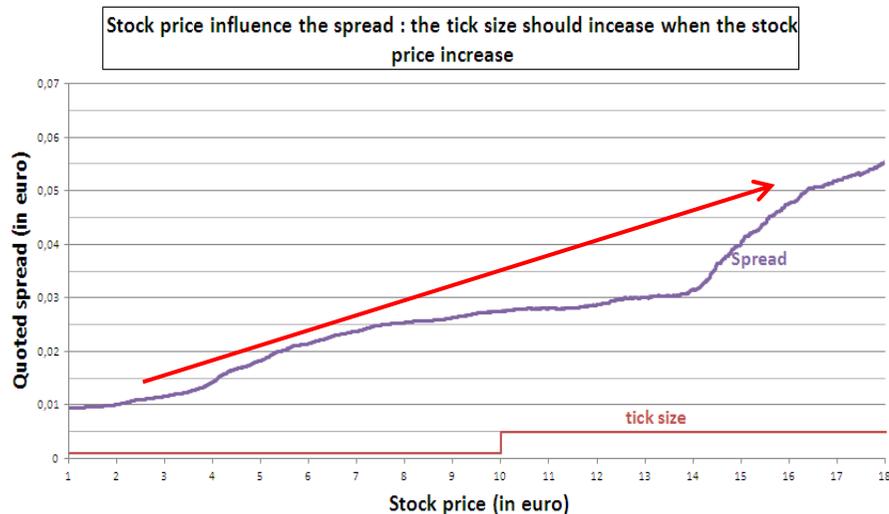
I. Improving the current FESE Tick Size tables regime by taking liquidity into account



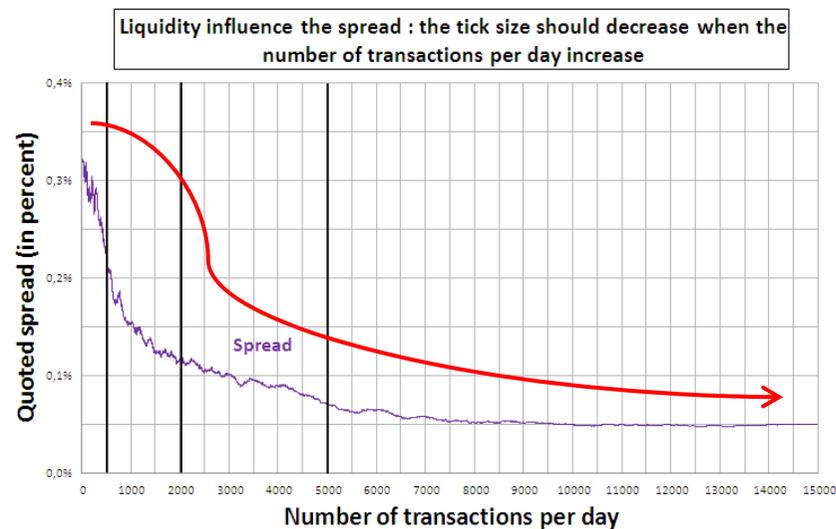
Introducing a new tick size regime

- **The current tick size regimes used in Europe are based on FESE Tables:**
 - http://www.fese.be/_lib/files/UPDATED_FESE_TICK_SIZE_TABLES_AS_OF_SEPT_2011.pdf,
 - The tick size regimes are not harmonised for all venues in Europe.
 - Most of them are based on these FESE tables.
 - Which only takes into account the share price to define the tick size.
- **The objective of this study is to work out an optimal tick size table:**
 - A tick size should govern an homogeneous class of stocks.
 - The share price by itself is not enough to efficiently cluster the different stocks.
 - Liquidity is the relevant criteria.
 - The price combined to the liquidity class defines the optimal tick size for a stock.
 - The optimal tick size is the result of the tradeoff between constraining the spread to allow liquidity to aggregate without increasing viscosity:
 - The tick size must be small enough to avoid increasing viscosity. Too big, a tick size can discourage investors from placing orders at the best bid/offer as the queuing time at these limits becomes longer, which in turn increases the implementation risk.
 - The tick size must be big enough to ensure that there is a relevant cost to overbidding. Excessively granular tick sizes in securities have a detrimental effect to market depth as it is almost cost free to overbid. Consequently the risk of a nearly instantaneous higher bid may discourage liquidity providers from posting orders.

By taking liquidity into account



The quoted spread expressed in € is an increasing function of the share price.

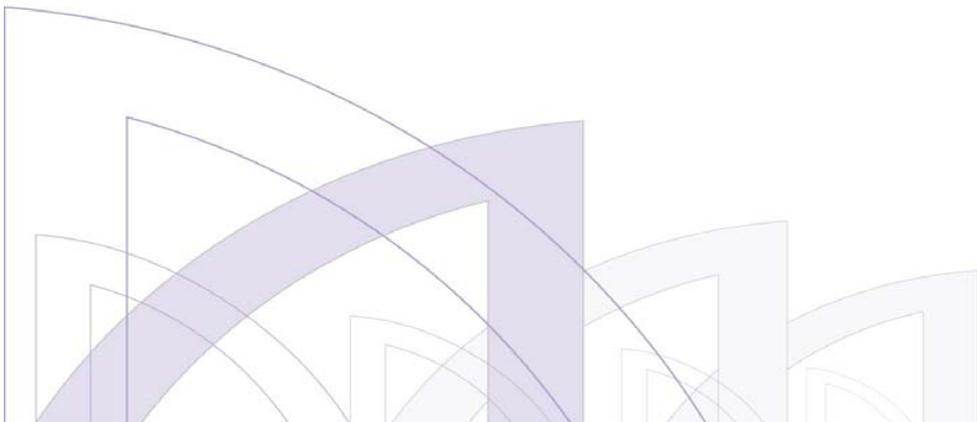


The quoted spread expressed in % is a decreasing function of the number of daily transactions.

An adequate tick size table must be based on these two parameters:

- the higher the price, the larger the tick size,
- the more liquid the stock, the smaller the tick size.

II. Same stocks, different tick sizes: facts

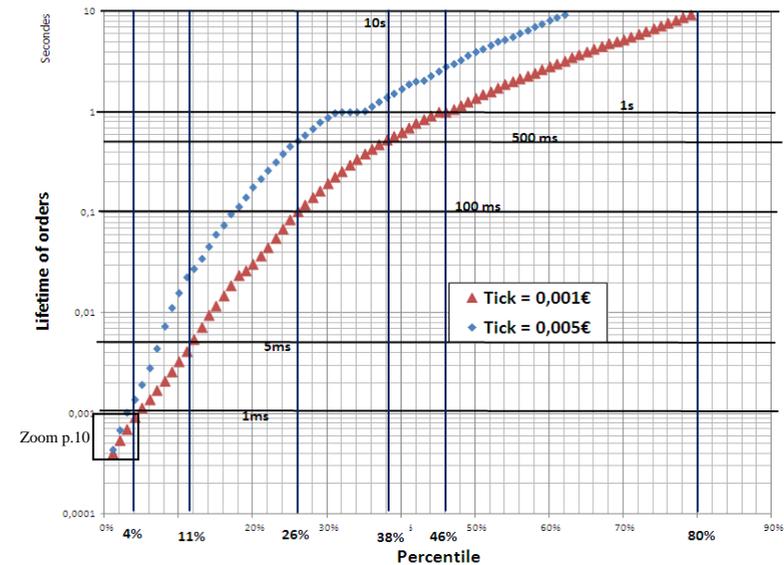


Scope of the study

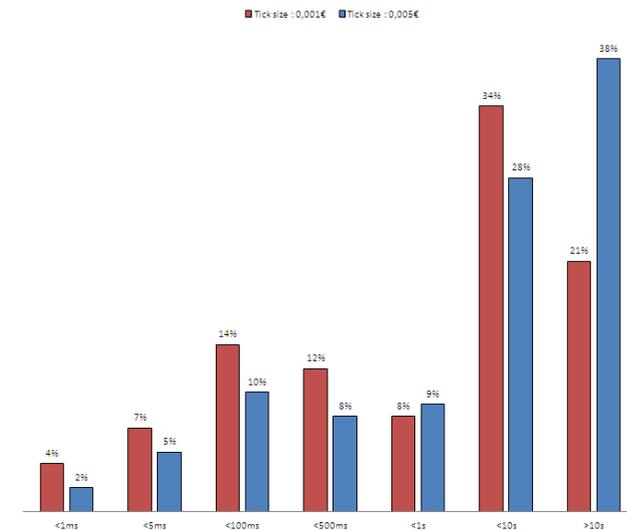
- **Data:**
 - To estimate the impact of a small tick size on market microstructure, the AMF focused on three liquid stocks (Axa, France Telecom and Veolia Environnement) that traded around 10€ and had **intraday changes** of tick size over a three months period (April to June 2012) on Nyse Euronext.
 - The AMF analysed over 30 million orders (time stamped to the microsecond) on these three stocks over this period, roughly half of which traded under 10€ (tick size 0.001€) and the other half of which traded at 10€ or above (tick size 0.005€).
- **Consequences of a smaller tick size on market microstructure:**
 - Influence on presence time at best bid/offer of orders:
 - A smaller tick size, expressing the spread as a larger number of ticks, increases the room to overbid, hence reduces the cost of overbidding.
 - The issues raised by small tick sizes are comparable to those raised by large spreads.
 - Influence on the lifetime and the rate of execution of the orders:
 - A smaller tick size decreases the probability of being executed at the best price.
 - A smaller tick size incentivises market participants to modify their orders more frequently.
 - A smaller tick size may discourage market participants to post orders in the order book.
 - Influence on HFT:
 - HFT activity increases when the tick size decreases.
 - HFT strategies may change when the tick size decreases.

Consequences of a smaller tick-size (1/6)

- A smaller tick size, expressing the spread as a larger number of ticks, increases the room to overbid, hence reduces the cost of overbidding.
- The median lifetime of a non-executed order in our sample is:
 - 1.89 seconds for the 0.001€ tick size.
 - 3.29 seconds for the 0.005€ tick size.
- The lifetime of a non-executed order is below 100ms for:
 - 1 out of 4 orders for the 0.001€ tick size.
 - 1 out of 6 orders for the 0.005€ tick size.
- A smaller tick size is especially favourable to High Frequency Traders, as some of their strategies may require them to actualise the positioning of their orders more frequently if they are to stay best bid/offer.
- The “noise” produced by orders with a very short lifespan may discourage investors from posting orders or may blur their investment strategies.

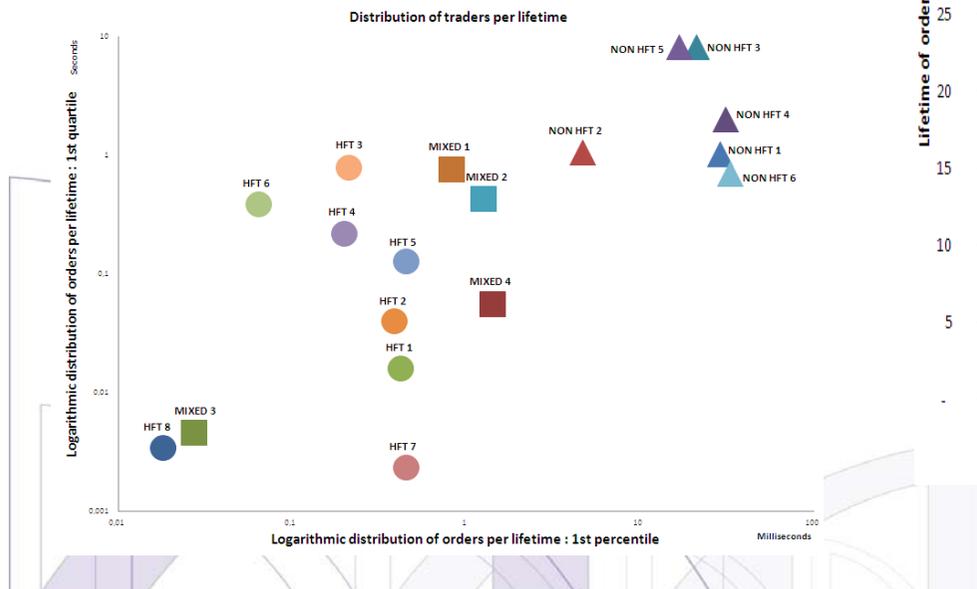
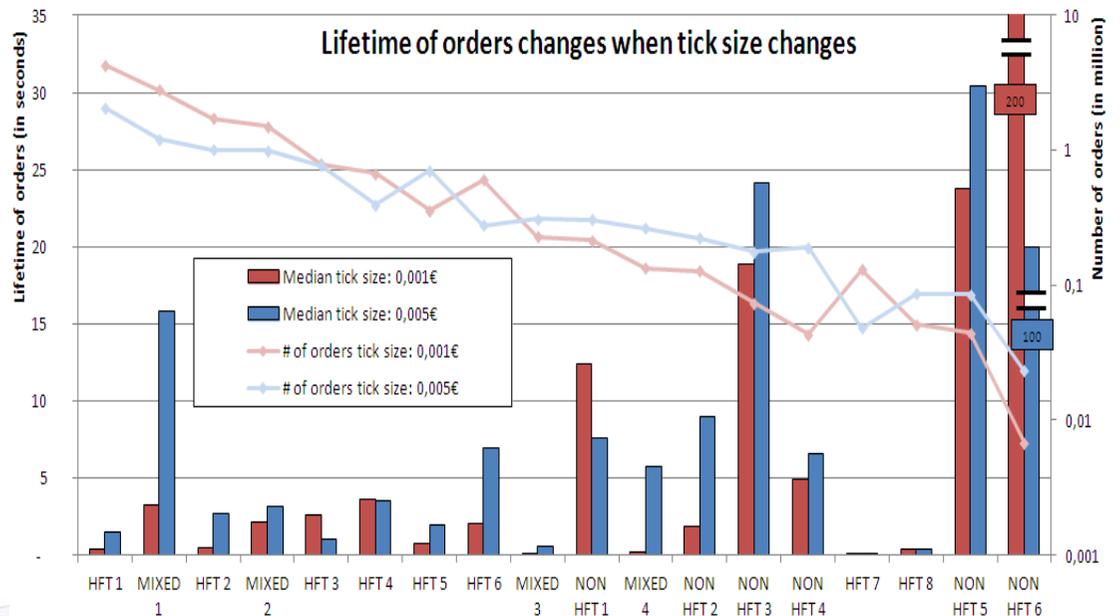
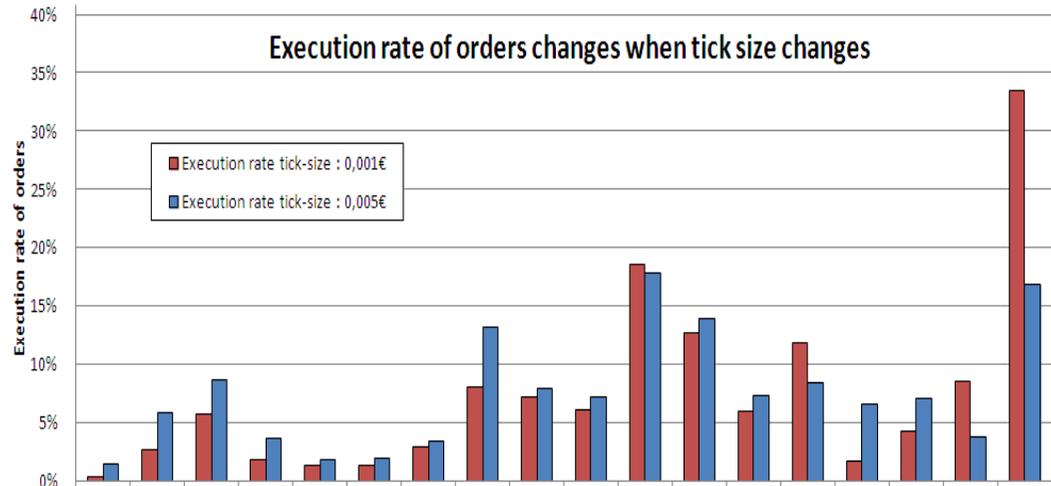


Lifetime of orders depending on the tick size

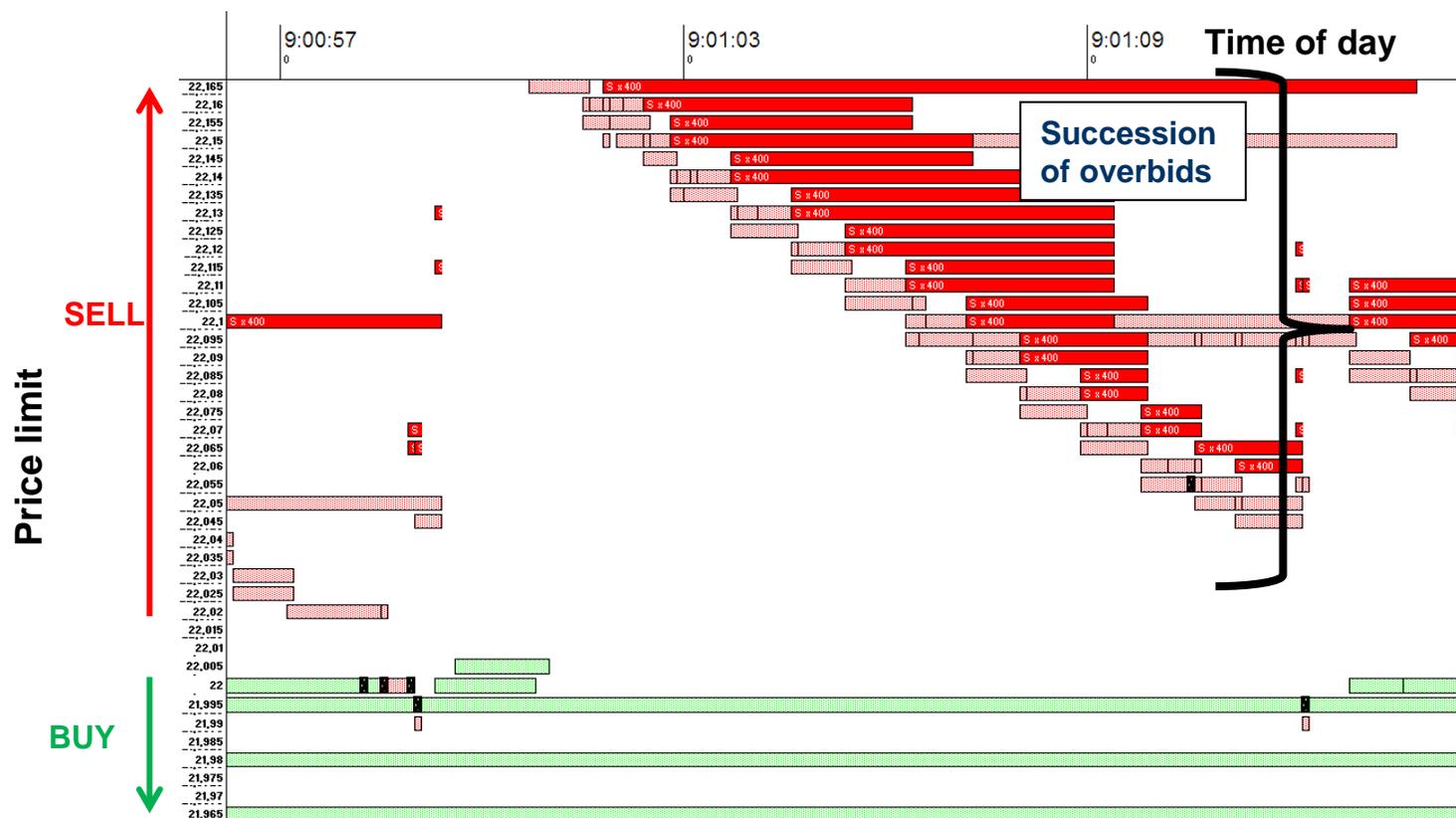


Consequences of a smaller tick-size (2/6)

- For most market participants, when the tick size decreases:
 - The number of cancelled orders increases.
 - The median lifetime of a cancelled orders decreases.
 - The execution rate of orders decreases.
- Change in tick size is especially reflected through HFT market participants' data.
- A smaller tick size may prove to be detrimental to the market microstructure.



Consequences of a smaller tick-size (3/6)



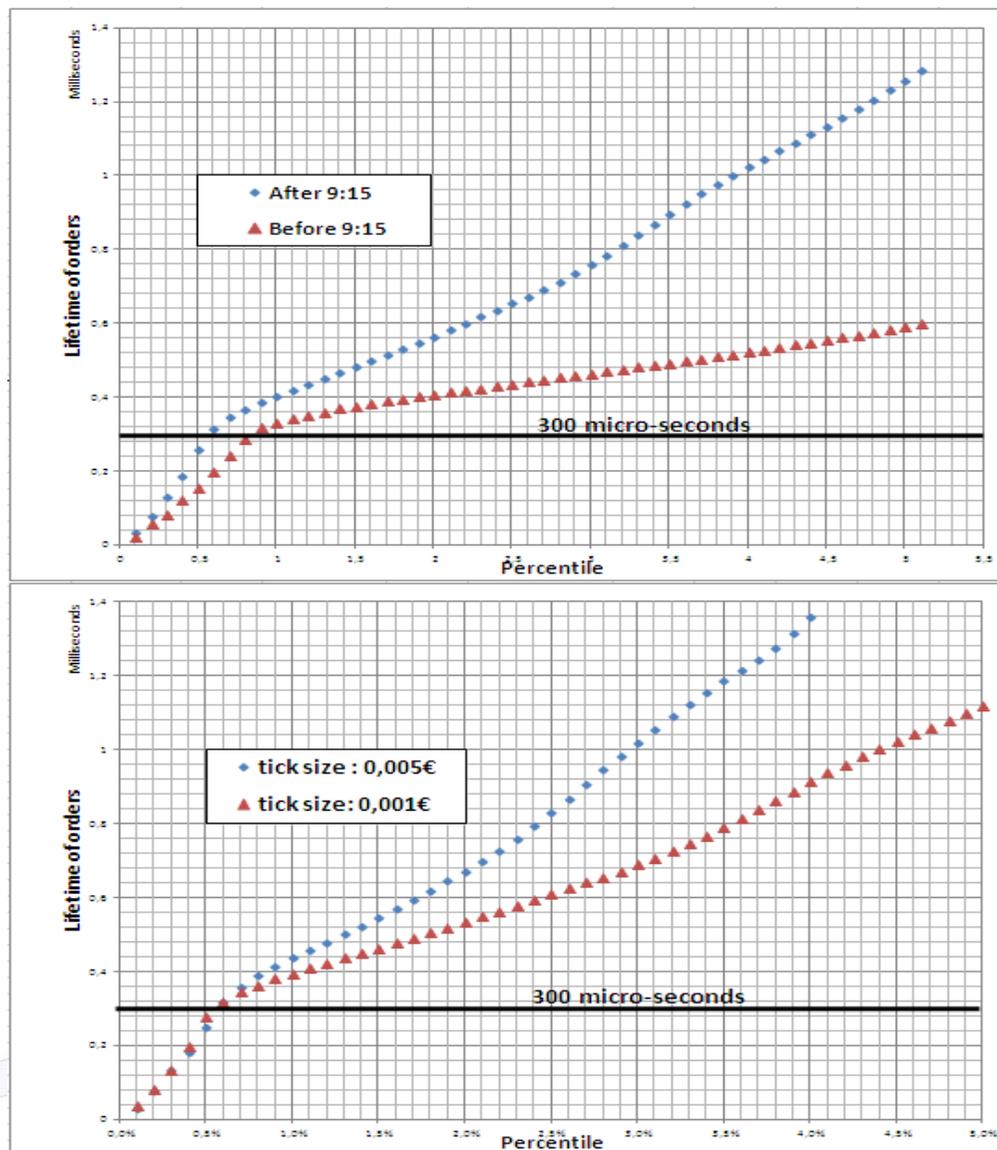
The opening auction leads to a larger spread, and results in rapid sequences of overbidding by HFT market participants:

- In the first seconds after the opening auction, the order book is relatively empty, the spread in ticks is larger and consequently more space for orders to fill the spread.
- The resulting effect is a struggle between two or more algorithms to gain supremacy on the “touch” with very little trading.

The beginning of the trading day is usually prone to a lot of HFT’s induced noise.

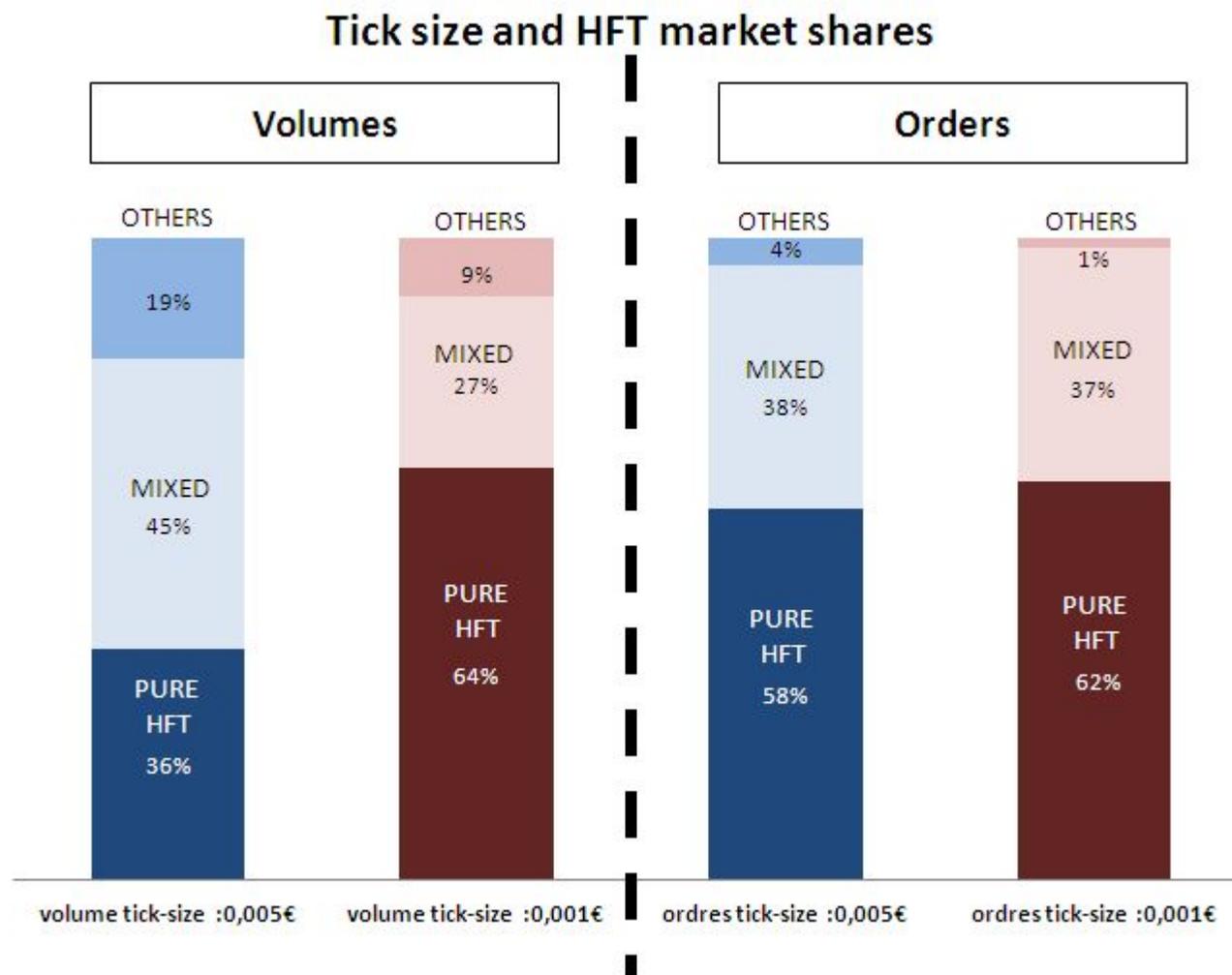
Consequences of a smaller tick-size (4/6)

- Zooming on the first percentiles enables us to pinpoint what could be considered as manipulative behaviour.
- The median time to send an order to Nyse Euronext and to receive the acknowledgement is 300 μ s.
 - Before 9:15, when the spread is wider, 1% of the orders are modified or cancelled before the acknowledgement message may have been received.
 - After 9:15, this figure drops to 0.6%.
- If you consider that an average market participant, to be able to physically interact with an order arriving in the order book, needs 600 μ s (these 300 μ s plus his own 300 μ s) to trade, that means that this is nearly impossible for:
 - 4% of the orders before 9:15
 - Only 1.5% of the orders after 9:15.
 - As there is no real intention to trade, the behaviour is observed independently of the tick size.



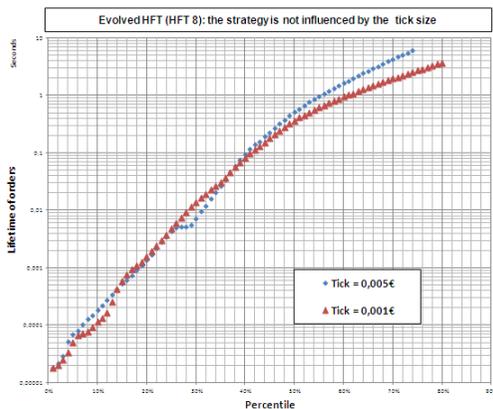
Consequences of a smaller tick-size (5/6)

- The smaller tick size significantly changes the proportion of the volumes traded by pure HFT and mixed market participants, from 81% to 91%.
- The smaller tick size dramatically changes the proportion of the orders sent by pure HFT and mixed market participants, from 96% to 99%.

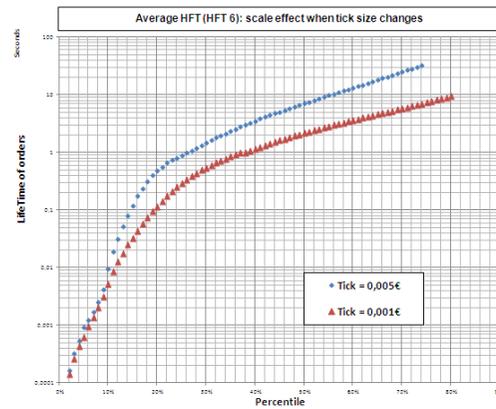


Consequences of a smaller tick-size (6/6)

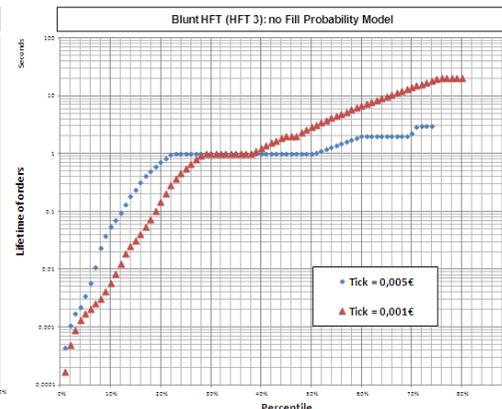
- **The probability of orders being executed at the best limit decreases when the tick size decreases:**
 - The execution rate at the “touch” is 33% less for the 0.001€ tick size than for the 0.005€ tick size.
 - Market participants need to have a “Fill Probability Model” to take this into account or to more frequently update their orders.



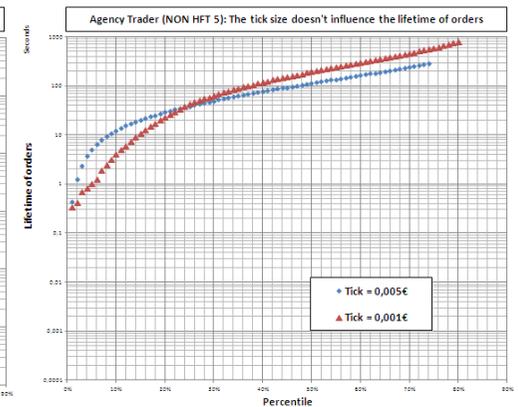
Evolved HFT: the strategy is not influenced by the tick size and the cancel/replace rate is fairly homogeneous.



Average HFT: a scale effect is seen as the cancel/replace rate increases when the tick size decreases.



Blunt HFT: no Fill Probability Model, most orders are probably sent “Fire and Forget” with validity at +1s.



Agency trader: the tick size hardly influences the lifetime of the orders (also note the distribution start).

- **A small tick size may discourage investors from posting orders at the best bid and offer:**
 - The number of orders placed at the best bid or offer is 25 % less for the 0.001€ tick size than for the 0.005€ tick size.

Consequences of a larger tick size (1/2)

- **Increased queuing:**

- The waiting time necessary for an order to be executed at the “touch” nearly doubles when the tick size increases from 0.001€ to 0.005€, forcing the HFT market participants to adjust their risk envelop accordingly.
- The proportion of orders executed at the “touch” before being modified or cancelled increases when the tick size increases:
 - The trade-off between the capture of the spread and the implementation risk is changed.
 - The average traded size is 25% larger with the wider tick size.
- Unbalanced order books encourage traders to fire aggressive orders.
- Tariffs from a venue offering significant rebates to one category only of market participants will change the trade-off for that category and increase the proportion of orders from that category in the order book. If that proportion becomes too important, it will force the market participants (who do not benefit from this particular rebate) to fire more aggressive orders and to lose the spread more often.
 - Increased vigilance is required on that topic.

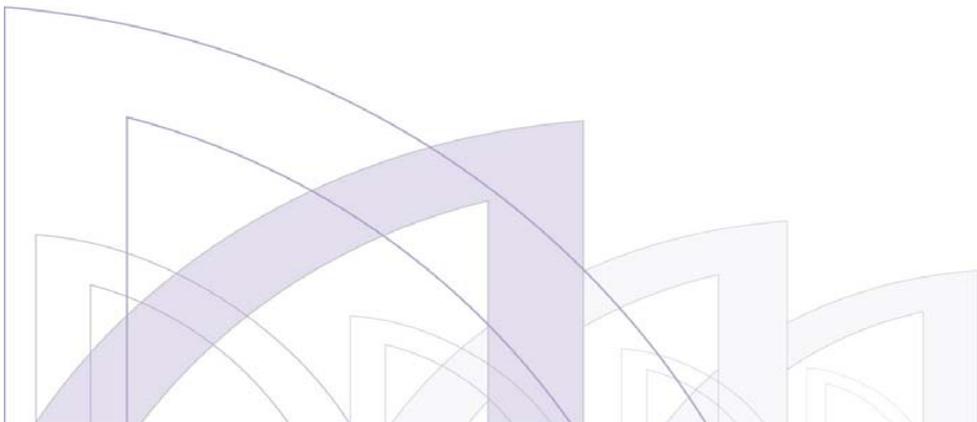
Consequences of a larger tick size (2/2)

- **Increased viscosity:**

- If the tick size constraints the spread too much, the viscosity added to the order book will favour OTC trading and reduce liquidity in the Lit order books. Losing or gaining the spread would then represent an important part of the transaction costs and trading at mid-spread in the Dark would be incentivised.
- The optimal tick size should be established so as to be large enough to constraint the spread and at the same time small enough to keep the transaction costs unaffected. The analysis of the data shows a good balance between constraints and transaction costs when the spread is between 1.4 and 2 ticks. The optimal tick size should therefore be established as a proportion of 1.4 to 2 average spread.
- The new tick size regime is based on that principle: the tick must be built from the average spread.



III. The new tick size regime



The optimal tick size (1/3)

- The optimal tick size should be a function of the average spread.
- It must maintain a balance between constraints and transaction costs.
- Constraints increase significantly when the average spread is under 1.4 ticks.
- A strong divergence between the transaction costs of HFT and other market participants is seen when the average spread is over 2 ticks.
- For each cluster the new tick size is defined as such that the average spread represents between 1.4 and 2 ticks.
- To be able to maintain a smooth transition between ticks and reduce cliff-edge effects, every cluster is calibrated as to maximise to 2.5 times the difference between the smallest tick and the biggest tick in a cluster.

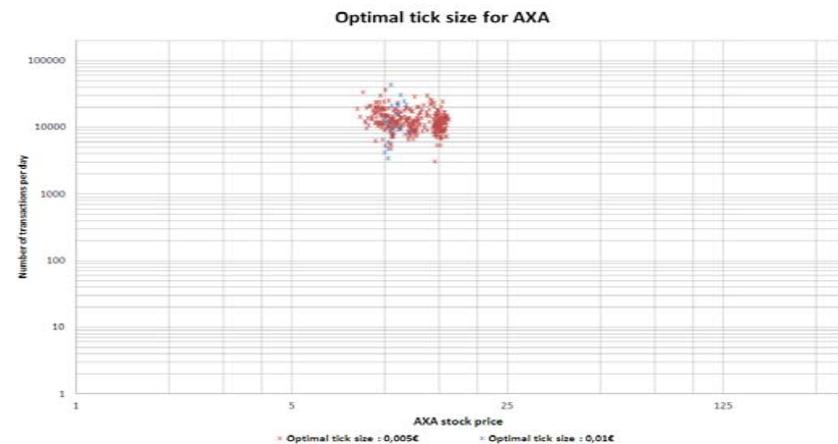
The optimal tick size (2/3)

- **Smoother tick increments:**
 - 0.0001, 0.0002, 0.0005, 0.001, 0.002, 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5,...
- **For smoother price levels:**
 - 0.10, 0.20, 0.50, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000...
- **Four bands:**
 - Very liquid: more than 5 000 trades/day
 - Fairly liquid: 2 001 to 5 000 trades/day
 - Liquid: 501 to 2 000 trades/day
 - Poorly liquid: up to 500 trades/day
- **Triggered at different points.**

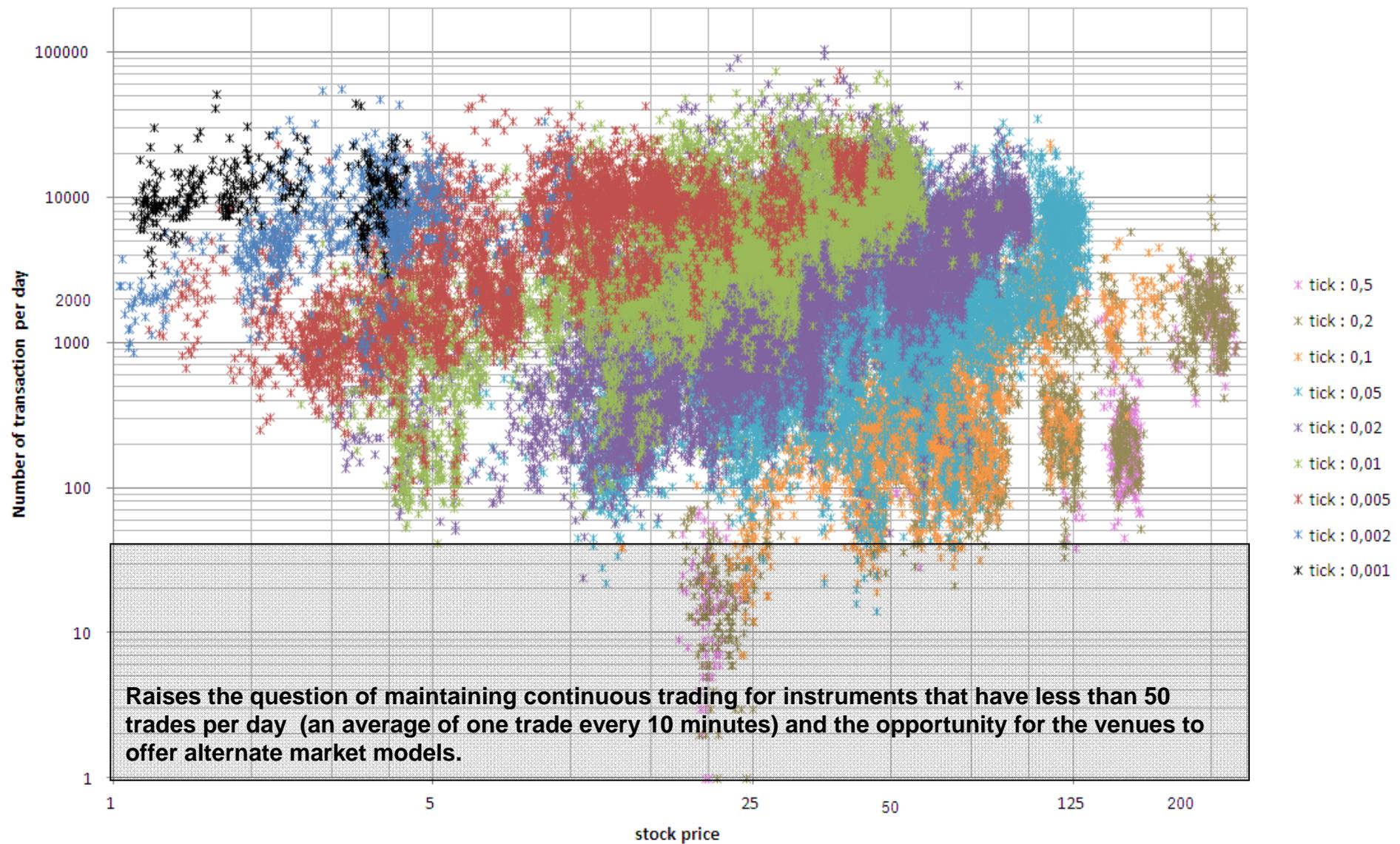
The optimal tick size (3/3)

- The new tables cluster the stocks by number of transactions on the primary venue per day and price so that the average spread is homogeneous for each cluster.
- Data :
 - The AMF clustered market data for the top 123 stocks on Nyse Euronext over 339 trading days between 01/02/2011 and 31/5/2012.
 - This corresponded to 41 700 triplets : (Number of transactions, Price, Average Spread).
 - The optimal tick size tables are based on this data.

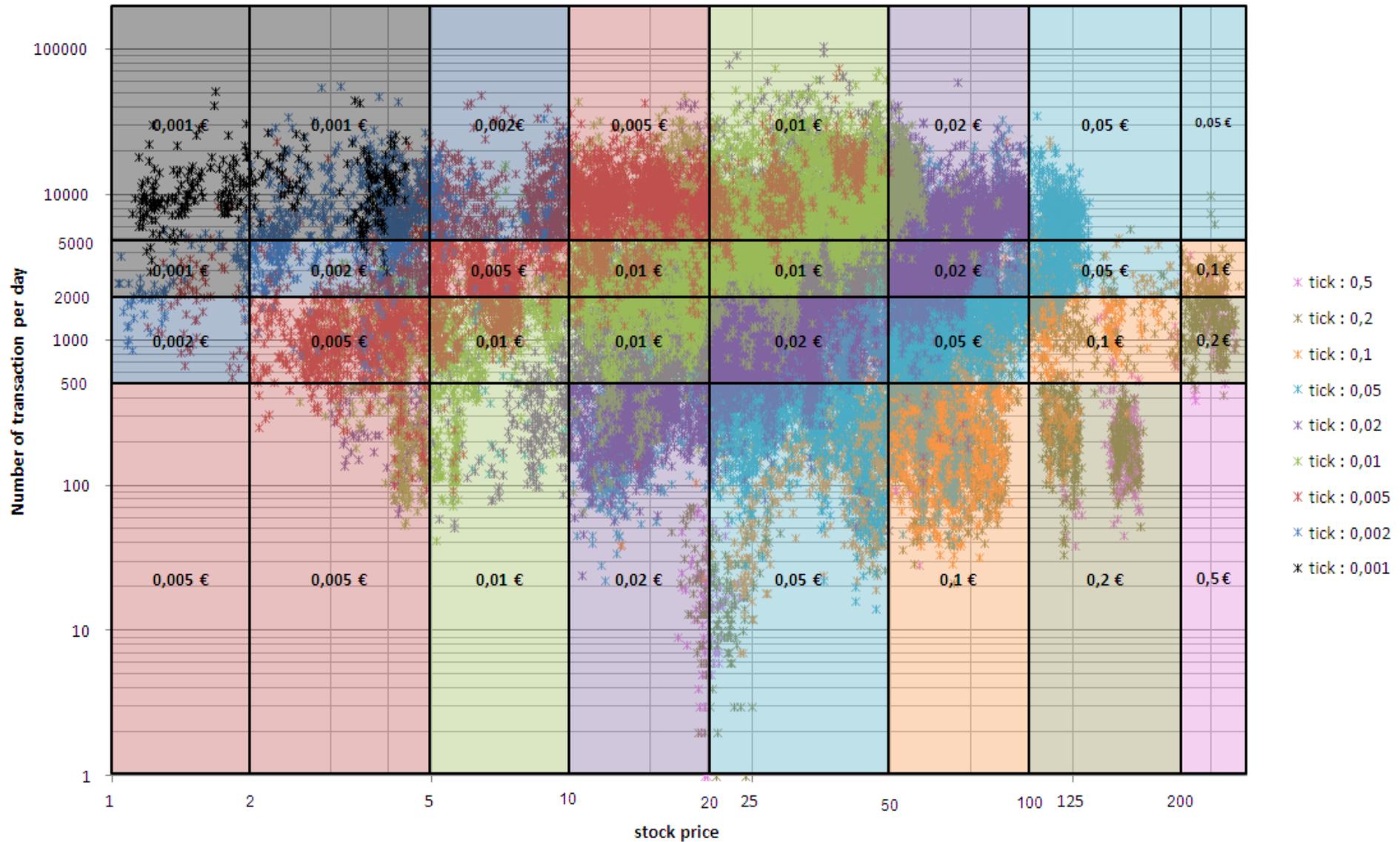
Example: Axa has had on average 13 324 transactions/day (max.43 545, min 3 123) between 8.16€ and 16.11€, with an average spread of 0.0739%. The 339 points are in the following graphs, with different colors for different optimal tick sizes calculated from the daily average spreads:



Optimal tick size for a given price and daily transactions



Optimal tick size for a given price and daily transactions



The new tick size tables

A translation from the previous graph gives the tick size tables.

An extrapolation of that translation gives the new tick size tables.

		1 - <2	2 - <5	5 - <10	10 - <20	20 - <50	50 - <100	100 - <200
<i>FESE table 4</i>		0.001		0.005		0.01	0.05	
Number of transactions per day	>5000	0.001	0.001	0.002	0.005	0.01	0.02	0.05
	2001 - 5000	0.001	0.002	0.005	0.01	0.01	0.02	0.05
	501 - 2000	0.002	0.005	0.01	0.01	0.02	0.05	0.1
	0 - 500	0.005	0.005	0.01	0.02	0.05	0.1	0.2

		<0.5	0.5 - <1	1 - <2	2 - <5	5 - <10	10 - <20	20 - <50	50 - <100	100 - <200	200 - <500	500 - <1000	1000 - <2000	2000 - <5000	5000 - <10000	10000 - <20000	20000 - <50000	>50000
<i>FESE table 4</i>		0.001			0.005		0.01	0.05										
Number of transactions per day	>5000	0.0001	0.0002	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20
	2001 - 5000	0.0002	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50
	501 - 2000	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	100
	0 - 500	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	100	200

Consequences on European stocks

Using the Stoxx600 universe, we see that these new tick size tables have their harmonising effect at around the first third of the current distribution.

	Current situation				Using the new tick size table		
	NB	MEDIAN	1st QUINTILE	1st DECILE	MEDIAN	1st QUINTILE	1st DECILE
ATHENS STOCK EXCHANGE	3	1,79	1,40	1,28	5,21	3,14	2,45
AUSTRIAN STOCK MARKET	10	10,47	8,57	6,86	2,08	1,41	1,13
BRUSSELS STOCK MARKET	17	5,22	4,30	2,95	1,70	1,25	1,08
DANISH STOCK MARKET	16	1,78	1,36	1,23	2,34	1,51	1,41
FINNISH STOCK MARKET	20	1,87	1,31	1,23	1,74	1,31	1,20
FRENCH STOCK MARKET	86	3,43	2,39	1,73	1,70	1,34	1,18
GERMAN STOCK MARKET	64	5,03	3,06	2,42	1,60	1,25	1,00
IRISH STOCK MARKET	8	8,20	3,59	2,67	2,06	1,57	1,50
ITALIAN STOCK MARKET	32	1,67	1,33	1,26	2,15	1,38	1,30
LONDON STOCK MARKET	177	1,92	1,42	1,25	1,17	1,00	1,00
NETHERLANDS STOCK EXCHANGE	30	3,46	2,36	1,62	1,65	1,20	1,00
NORWEGIAN STOCK MARKET	15	1,67	1,23	1,12	2,63	2,09	1,85
PORTUGUESE STOCK MARKET	5	2,83	2,23	2,09	1,41	1,11	1,04
SPANISH STOCK EXCHANGE	30	3,35	2,18	2,01	1,63	1,20	1,09
SWEDISH STOCK MARKET	40	1,30	1,16	1,14	2,36	1,87	1,45
SWISS STOCK MARKET	17	1,94	1,53	1,31	2,10	1,55	1,45
VIRTX STOCK MARKET	29	1,53	1,14	1,08	1,65	1,35	1,22
TOTAL	599	2,31	1,44	1,25	1,57	1,29	1,16
STD DEV		1,76			0,49		

Conclusion

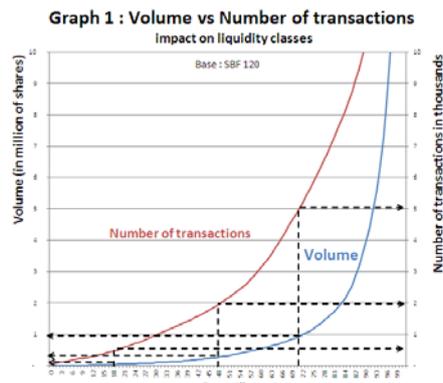
- **Easy to implement:**
 - All stocks already belong to a liquidity band.
- **Easy to adjust:**
 - All venues and market participants adjust tick size on a regular basis.
- **Automatic process for band changes:**
 - When a stock stays twenty consecutive trading days in a liquidity band, then that new band is used.
- **Adjustments no longer need to be done through the price:**
 - Set-up a process for a yearly revision of the liquidity bands.
 - Not enough constraining? Move the bands up.
 - Too constraining? Move the bands down.
- **Control sample:**
 - No other method to adjust market microstructure would systematically allow keeping a control sample of unaffected stocks to be able to compare objectively the changes made to market microstructure.

New tick size regime proposal:

the average number of transactions per day is the best proxy for liquidity

1. A two dimensional approach calibrated on both price and liquidity

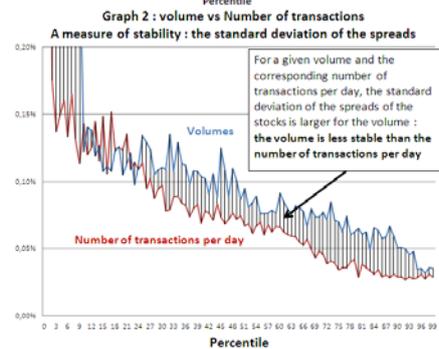
For measuring liquidity, it is considered that the most relevant option is to rely on the **average number of transactions per day** on the ground that this indicator is **easy to assess**, very **stable** therefore easy to integrate in the new tick size model. Other possible liquidity indicators, such as the turnover (which contains redundant information as the price is already included in the calculation of this indicator and would therefore appear on both axis in the new tick size table) or the daily volume (as illustrated in the following graphs) are not as efficient.



Graph 1 shows that **the different liquidity classes are easier to differentiate when using the average number of transactions** as a measure of liquidity. The following table on the liquidity classes confirms this:

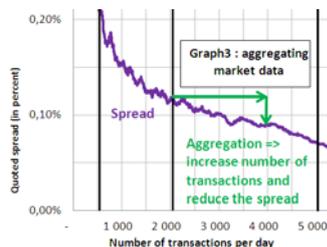
	Volume	Number of transactions
Poorly liquid (PL)	0 < 50k	0 < 500
Liquid (L)	50k < 300k	500 < 2k
Very liquid (VL)	300k < 1M	2k < 5k
Highly liquid (HL)	< 1M	< 5k
95 th percentile value	8.2M	14.3k

Moreover for each percentile of the distribution of the volume or of the number of transactions, the standard deviation of the observed spreads is larger when using the volume as a liquidity indicator. This could result in a less accurate clustering algorithm for the new tick size regime. Hence, the **daily volume is not stable enough** so that its use will obviously lead to **erroneous liquidity measurements** (graph 2).



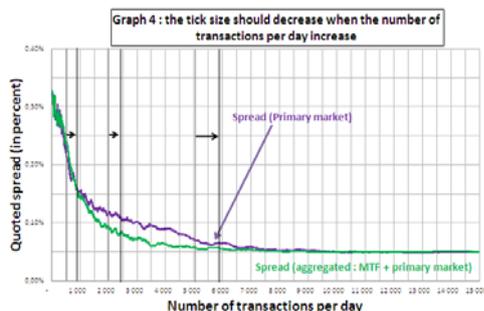
Finally, the new tick size regime may have an endogenous effect on the Average Traded Size (ATS). Reducing viscosity may slightly decrease the ATS and increase the number of transactions per day while increasing viscosity could increase the ATS and decrease the number of transactions. Considering that the new tick size regime is designed to allow easy calibration, using the most stable proxy, the number of transactions, is more appropriate. It particularly allows assessing the impact of tick size changes. This would be especially useful when monitoring the impact of the new regime on stocks whose tick size is modified, in comparison with the **control sample**.

2. Use of aggregated market data:



To develop the new tick size table, the parameters of the clustering algorithm have been set using primary market data. On this basis, **four liquidity classes (each with an homogeneous spread)** have been identified. These four classes are a **proxy** so that the parameters of the new tick size table could be determined on a larger data set (e.g. European data instead of French data).

Aggregating the MTFs' data and the primary market's data would considerably increase complexity for no gain in definition. Even more, aggregation would combine **more transactions** to a **smaller average spread** (graph 3). The overall spread/liquidity illustrated on graph 4 shows that deterioration.



Considering aggregated data might only bring slight modifications, liquidity classes could easily be modified to keep the same number of stocks into each class. But **each class would then be more difficult to differentiate**. In this example the new distribution would be:

	Primary market data		Aggregated data	
	Transactions	Average Spread (bps)	Transactions	Average Spread (bps)
Poorly liquid (PL)	[0 < 500]	[0,20 ; 0,40]	[0 < 900]	[0,15 ; 0,40]
Liquid (L)	[500 < 2000]	[0,12 ; 0,20]	[900 < 2400]	[0,09 ; 0,15]
Very liquid (VL)	[2000 < 5000]	[0,07 ; 0,12]	[2400 < 5800]	[0,06 ; 0,09]
Highly liquid (HL)	[≥5000 [[≤0,07]	[≥ 5800[[≤ 0,06]