Box 3

Financial stability implications of structural changes in market microstructures – algorithmic and high-frequency trading

The use of algorithms to execute trades in financial markets has grown considerably in the last decades, amid technological advancements in computing power and the speed of processing information. Among the wide range of algorithmic trading strategies, high-frequency trading (HFT) has received perhaps the most attention given its potential for major market disruptions such as the "flash crashes" that have occurred in recent years. Gauging the financial stability implications of HFT strategies is complex given that different strategies may create very heterogeneous externalities (both positive and negative) for other market participants unable to process such high-frequency information. Such externalities give rise to financial stability risks encompassing liquidity, procyclicality, confidence in the face of prospective opacity, and market resilience.

HFT activity has tended to migrate towards electronic trading platforms and standardised products, the structured nature of which is a precondition for high-frequency algorithmic trading. The characteristics of the global foreign exchange market, the US Treasury market as well as certain equity and commodity futures markets meet these requirements, which has resulted in a high presence of HFT in those markets. In 2010 the TABB Group estimated that HFT represents 56% of trading volumes in US equity markets, 38% in European equity markets and in the range of 10-30% in Asia-Pacific equity markets. For FX markets, according to the BIS (2011), HFT amounted to 24-30% of spot market turnover. The BIS (2016) estimates that more than 50% of trading volume in benchmark US Treasury bonds can be associated with HFT. European bond

markets are, however, believed to be less exposed to HFT because the use of request-for-quote protocols that query for executable prices quoted to multiple counterparties simultaneously (rather than the use of central limit order books that match bid and ask orders in real time), manual processes, and a low degree of standardisation, as seen in euro area corporate and government bond markets, limit HFT trading strategies. In the euro area bond futures markets, which are more important for price discovery in the cash bond market than in the United States or Japan, HFT is however increasing in volume.

Four key issues from a financial stability perspective should be highlighted. A first risk relates to the implications for market liquidity and the presence of liquidity providers during stressed market conditions in particular. The impact of HFT on market liquidity and volatility is subject to controversy. Some studies cite benefits associated with HFT in terms of lowering transaction costs, helping price discovery, improving secondary market liquidity, and providing more diversity of market participants. Others argue that gains from HFT are only reaped by HFT participants themselves with limited societal benefits, and that HFT may exacerbate volatility in stressed market conditions.[9] While the presence of HFT on top of central limit order books may improve liquidity for small transaction sizes, it can create the illusion of ample liquidity that disappears when transaction sizes become larger.

A second implication for financial stability is that a large presence of non-human trading may increase the "self-reflexivity of markets", i.e. price changes are increasingly driven by prices themselves. To date, it is unclear what the implications of strategic behaviours among fast-adapting machines are, as in most cases these are agnostic to underlying fundamentals. A key question in this respect relates to the availability and effectiveness of, for example, circuit breakers in the event that the machine-led price discovery runs off track very quickly.

Third, the crowding-out of traditional committed market-makers is a concern from a financial stability perspective as their presence is needed in particular during adverse market conditions. Trust and confidence in the integrity of financial markets are key to ensure that markets can perform their fundamental role of matching suppliers and users of capital, hence efficiently allocating capital. Events such as "flash crashes", the risk of fraudulent behaviour, adverse selection stemming from the competitive advantage of extremely low response times, concerns over the depth of central limit order books and the enforceability of observed prices may undermine that trust. More precisely, the perception of an uneven playing field may crowd out traditional market-makers and incentivise them to migrate their activities from "lit" markets to "dark" trading venues that function at a lower frequency.

A final implication for both financial stability and the prudential supervision of markets concerns the ability of infrastructures to cope with the surging speed of messaging and trading. Significant, albeit short-lived, price moves even on very liquid markets[10] have highlighted the need for circuit breakers. The challenge for prudential supervision of markets relates to the large portion of orders being cancelled quickly and illegal market practices occurring too quickly for supervisors to detect them. While many of the perceived negative implications of HFT are already

[9] See Chung, K. and Lee, A. (forthcoming) for a review of the literature on the impact of HFT and regulatory initiatives around the world.

[10] Examples are the US equity markets (e.g. the August 2015 1,000 point drop in S&P futures) and the US Treasury markets (e.g. the October 2014 "flash crash"). See Bouveret, S. and Lemaître, M., "Characterizing conflicts in fair division of indivisible goods using a scale of criteria", *Autonomous Agents and Multi-Agent Systems*, Vol. 30(2), 2015, pp. 259-290.

addressed by existing regulation, notably rules against market manipulation, some HFT trading strategies are however designed specifically to obscure their actual trading intent.

Amid this rapidly changing landscape, regulatory discussions around the world have focused on four main approaches to address the risks described above, which are already partially covered by the upcoming MiFID (Markets in Financial Instruments Directive) II rules.[11] First, minimum transparency requirements for all market-makers and trading risk controls, which will also involve a pre-trading test phase for algorithms, primarily intend to reinforce market integrity. Second, taxation and trading fee regimes intend to limit procyclicality, shore up market liquidity and enhance market integrity. Third, technical limitations on trading platforms, such as harmonised tick-size regimes, aim to strengthen market resilience. Finally, requirements to register on trading platforms and the imposition of market-making obligations and other trading commitments based on traders' activity levels will require large traders to maintain liquidity even under stressed market conditions and therefore help dampen market cyclicality. In addition, "soft regulation", such as establishing codes of conduct, is also considered by both the industry and policymakers to improve market integrity (see for instance the development by the BIS Foreign Exchange Working Group of a single code of conduct for the foreign exchange market). While single measures may not suffice to contain specific risks arising from (high-frequency) algorithmic trading given its complex nature, the collective set of measures taken together should enhance monitoring and oversight of high-frequency algorithmic trading – to the benefit of financial stability.

[11] See the 2015 ESMA draft Regulatory Technical Standard on MiFID II/MiFIR. See also Directive 2014/65/EU, Article 4(1)(39) and (40) and Articles 17(1) to 19(4).