

Fragmentation in Canadian Equity Markets

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- Changes in technology and regulation have resulted in an increase in the number of venues for equity trading in Canada. This market fragmentation has both costs and benefits: it has the potential to make trading more difficult by segmenting liquidity, but it can also increase efficiency through innovation and intensified competition.
- Overall, we find that market fragmentation has reduced trading fees and created an environment that facilitates innovation. It has had no clear effect—positive or negative—on market quality, as measured by liquidity and price efficiency.
- Fragmentation has, however, required market participants to invest in technology to manage trading at multiple venues. The cost advantages from reduced trading fees do not necessarily offset the large, fixed costs of this investment, especially for smaller dealers. Fragmentation has also created new complexities in the market that may increase operational risks. These effects could be controlled through a carefully adapted regulatory response.

As recently as 2001, there was only one senior equity marketplace in Canada, the Toronto Stock Exchange (TSX). Today, 10 trading platforms compete for market share, and more are on the way. Canadian equity trading has undergone a decade of market fragmentation—the creation of new and separate venues for trade. Financial participants can now exchange Canadian equities at many venues, each with different trading rules and fee structures.

This market fragmentation has created both costs and benefits. One of the benefits is intensified competition among new trading venues, which can reduce trading fees, encourage efficiency-enhancing product innovation and promote market resilience. However, fragmentation can also introduce new problems. It can significantly increase system- and technology-related costs by requiring market participants to connect with and monitor multiple trading venues. It can also complicate markets and segment trading by isolating groups of trading participants. If buyers cannot easily find sellers and vice versa, trading becomes difficult. This segmentation of trading can result in poor market liquidity and the presence of stale prices.

While segmented trading has been a primary concern in Canada historically, it is much less of a problem in modern markets. New technologies, trading practices and regulations have knit together separate venues. Market participants have the technology to integrate their view of markets on a single computer terminal, and financial intermediaries match orders across markets at speeds measured in fractions of a second. Although segmentation is of less concern than before, the “bricks and mortar” costs of market fragmentation have grown in importance. The technologies, practices and regulations that have driven markets to fragment have also made expensive technological investment necessary for participants to continue to connect with and monitor multiple exchanges. Moreover, participants now communicate with one another through a variety of complicated protocols, which may create operational risks. It is necessary to consider whether these costs are offset by the benefits that accrue from the increased competition that market fragmentation fosters.

The structure of equity markets is important for the Bank of Canada, not only because of the importance of these markets to the Canadian economy, but also because equity markets act as a leading indicator of likely developments in other markets. Equity markets are often early adopters of technology because of the wide participation in equity trading. Developments in equity trading could help shed light on upcoming developments in fixed-income trading, which has seen some movement to organized electronic trading platforms, and could also inform potential rule changes in over-the-counter derivatives markets, where standardized contracts will be increasingly traded electronically.

This article updates a previous *Bank of Canada Review* article on competition in Canadian equity markets (Boisvert and Gaa 2001), addressing the substantial changes to the regulation and structure of these markets in recent years.¹ It describes the factors that have driven market fragmentation over the past decade and discusses the impact of this fragmentation on different aspects of the Canadian equity markets. It concludes by suggesting areas for further study.

Factors Driving Market Fragmentation

Historically, a stock exchange featuring national listings has been the dominant equity trading venue in virtually all jurisdictions, unchallenged except by regional exchanges that served the specific needs of local markets. Central stock exchanges were dominant for so long because they benefited from two gains by concentrating trade:

- (i) **Economies of scale.** Most of the costs of operating a trading venue do not vary with its level of activity. Increasing trading activity at a single venue is therefore much cheaper than opening a second venue.
- (ii) **The liquidity externality** (Pagano 1989). Simply put, liquidity attracts liquidity. The more buyers in a market, the more attractive the market is to sellers, and vice versa. Conversely, isolating buyers and sellers can cause liquidity to dry up.

¹ Research for this article included interviews with financial industry participants and regulators: Stephen Bain (Royal Bank of Canada), Tal Cohen (Chi-X), Kevan Cowan (TMX Group), Darryl Mackenzie (Canada Pension Plan Investment Board), David Panko (TD Canada Trust), Randee Pavalow (Aequitas Innovations Inc.), Cindy Petlock, John Reilly (Royal Bank of Canada), Doug Steiner (Perimeter Financial Corp.), Tracey Stern (Ontario Securities Commission), Nick Thadane (ITG Canada) and the Ontario Teachers' Pension Plan. While these interviews inform the analysis, the opinions expressed are those of the authors, and any errors should be attributed to them.

A stock exchange derived enough advantage from these gains to be considered a good example of a natural monopoly (Pirrong 2000). But, since the 1980s, advances in technology and new regulatory environments have fundamentally changed this situation. Today, it is far less costly for entrants to deploy a new trading venue.

Advances in technology have long influenced market structure. Communications technologies from the telegraph to the fibre optic cable have enabled participants to bypass a local trading floor in favour of a more desirable stock exchange located elsewhere. More recently, cheap computer hardware and open-source software slashed the cost of deploying a new trading venue to a level that invites competition from new entrants. Operational economies of scale are no longer a barrier to entry. In addition, technology has made it easier to use multiple venues. A single computer terminal can generate a consolidated view of multiple markets, and smart-order routers automatically scan all marketplaces and dispense orders to the venue offering the best prices. Although liquidity is physically dispersed across markets, the market is consolidated virtually. Technology has eroded the natural monopoly advantage of a single exchange.

Competition has been encouraged not only by advances in technology, but also by regulatory liberalization. In the 1990s, Canadian regulators were monitoring increasing competition in U.S. equity markets and received requests to enter the Canadian market from potential new trading platforms such as Instinet and Versus. In 2001, a regulatory framework for trading on an alternative trading system (ATS) was established. This framework included requirements for registration, reporting, transparency and record keeping, and it obliged brokers to achieve a good price (“best execution”) for their clients. With a clear set of rules in place for the entry and operation of ATSs, the Canadian marketplace was ready for competition among trading venues.

◀ *Technology has eroded the natural monopoly advantage of a single exchange, and...*

◀ *...competition has been encouraged by regulatory liberalization*

Fragmentation in Canadian Equity Markets over the Past Decade

Competition among equity venues in Canada lagged the United States by more than 15 years, and Canadian participants did not have public discussions on liberalizing the entry of ATSs until the 1990s.² This delay can be explained in part by the technological leadership of the TSX, which reduced the incentive for other technology innovators to compete. The TSX was an early adopter of electronic trading: in 1977, it was the first primary national exchange to enable a fully electronic matching system, a technology it sold worldwide. But the technological leadership of the TSX began to erode in the 1990s. Some participants began to express concerns that the monopoly status and mutualized ownership structure of the TSX reduced its incentive to keep pace with the evolution of technology.

After ATS regulations were put in place in the early 2000s, new trading platforms opened in Canada: the Canadian National Stock Exchange (CNSX) in July 2003, Perimeter Financial Corp.’s BlockBook in 2004 and the Shorcan ATS in 2006. While these venues were pioneers as the first competitors, they failed to capture more than a 5 per cent share of the market. They suffered from a lack of liquidity and did not receive much support from financial intermediaries, probably because no Canadian intermediaries were

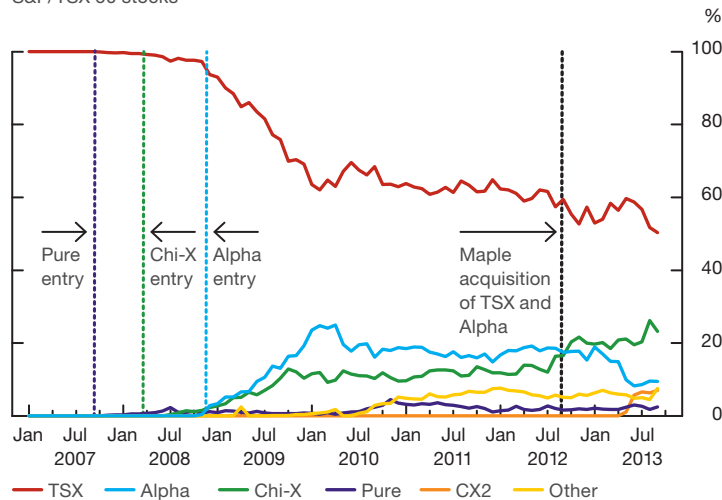
² Competition from electronic trading systems (known then as electronic communications networks), such as Instinet and Posit, began in the United States in the 1980s and intensified in the late 1990s.

stakeholders. Trading venues typically encourage major financial intermediaries to supply liquidity by giving them an ownership stake. Ownership may be preferred to the alternative of contracting for liquidity supply—for example, by hiring market-makers such as New York Stock Exchange specialists or TSX-registered traders to maintain market quality—because it is difficult to define a good such as liquidity and give terms for its provision in a contract (Shleifer 1998). Moreover, a share of the dividends and a certain amount of control over strategy are often necessary to get intermediaries to participate in an operation that might threaten established business lines. It is particularly necessary for venues to secure participation from liquidity suppliers in Canada’s concentrated financial markets.

In contrast to these early ATS entrants, Alpha ATS, which entered in December 2008, was developed and owned by major industry participants. Its company motto was “By the industry, for the industry.” The Canadian broker-dealers contributed to Alpha’s eventual 20 per cent market share (Chart 1) by directing traders to give preference to Alpha over the TSX when possible under best-execution rules. Alpha later merged with the TSX when it was acquired by Maple (now TMX Group Limited) on 1 August 2012. Another later entrant, Instinet’s Chi-X in March 2008, distinguished itself by offering a free equity stake to Canadian broker-dealers. Although no Canadian participants accepted, Chi-X had already obtained investments from financial intermediaries in the United States, and its liquidity support would help it to capture 10 to 15 per cent of equity trading volumes by the end of 2009.

Chart 1: Volume shares of the largest trading venues in Canada, 2007–13

S&P/TSX 60 stocks



Source: Bloomberg

Last observation: 30 September 2013

The Impact of Market Fragmentation

Trading volumes in Canada have fragmented among 10 trading venues now competing for market share. Has the change been good for markets overall? We assess its impact on different aspects of Canadian equity markets: fees and innovations, market quality, and complexity.

Trading fees and product innovations

Competition among trading venues has been associated with an overall reduction in trading fees in Canada. The amount that the TSX charges per transaction has fallen substantially—by nearly 80 per cent from 2006 to 2010—specifically in response to increased competition (TMX Group 2010). Venues have also adopted new ways to charge fees such as maker-taker pricing, which gives a rebate to participants when their limit orders are filled. Such a pricing scheme can encourage the supply of liquidity (Malinova and Park 2011). The TSX introduced maker-taker pricing for all securities in 2006 and, in 2008, it introduced price breaks for electronic liquidity providers aimed at competing for flows from U.S.-based high-frequency traders (TMX Group 2008).

Increased competition has also led to a number of product innovations and performance improvements in Canada. To compete for trades, Canadian venues began to offer tools aimed at enhancing execution for end-users (CSA/IIROC 2009). The tools include new order types, which enable participants to accomplish with a single command an operation that once required continual monitoring of the market. A specific example is the introduction of “dark” orders, i.e., orders that can be submitted without pre-trade disclosure to other market participants. A participant will use a dark order if it intends to take action only when certain conditions are right. These orders appeal in particular to participants who wish to transact a large quantity without revealing their interest, which would affect prices. Arguably, dark orders provide incentive for informed market participants to price their orders more competitively (Boulatov and George 2013). Data show that, so far, dark trading in Canada has been associated with better liquidity and price efficiency (Foley and Putniņš 2013), although there is a concern that too much dark liquidity could make it difficult for participants to agree on a fair price.

Many in the industry also credit market fragmentation with contributing to the improved performance of both trading venues and market participants. The most dramatic improvement has been in areas such as latency, which is the time it takes for an order or trade to reach its intended recipient. For example, in response to competition, the TMX phased in a faster trading engine, TMX Quantum, in 2013.

Market quality

A key question concerning market fragmentation is whether it improves the quality of markets—their ability to facilitate trades quickly and at fair prices. Several measures of market quality are available, including measures of market liquidity, such as the bid-ask spread and the depth of available volume on the order book, and measures of price efficiency, such as volatility.³

Economic theory suggests that an increase in the number of venues should intensify competition among intermediaries to have the best bid or ask price, because fragmentation breaks the strict time priority of orders in an order queue (Foucault and Menkveld 2008). In a fragmented market, different participants can be first in an order queue at different venues. Participants would prefer to be the first market-wide, and they can do so only by improving on price.

◀ *Competition among trading venues has been associated with an overall reduction in trading fees...*

◀ *...as well as a number of product innovations and performance improvements in Canada*

³ Trading volume has also been used to measure market quality, but volume tends to increase with market fragmentation because of cross-market trading strategies, not necessarily because of a rise in liquidity.

Case studies suggest that the relationship between fragmentation and measures of liquidity is unclear. For example, Foucault and Menkveld (2008) study competition between two limit-order markets in Europe and find that increased competition improves market depth (the number of shares available at the best prices). A number of other studies similarly find that increased fragmentation improves various measures of market quality (Davies and Kim 2009; Battalio 1997; O'Hara and Ye 2011). In contrast, some comparisons of stock exchanges with more-fragmented dealer markets (such as NASDAQ) find that consolidated exchanges provide better liquidity (Bennett and Wei 2006; Gajewski and Gresse 2007). Other studies also find that greater consolidation increases market quality (Amihud, Lauterbach and Mendelson 2003). Results are similarly mixed on market fragmentation involving dark orders or completely dark venues (Weaver 2011; Degryse, De Jong and Van Kervel 2013; Foley and Putniņš 2013).

These mixed results suggest that a range of elements determine whether fragmentation improves market quality. Outcomes have been sensitive to the prevailing institutions, technologies, trading rules and regulations in a jurisdiction. In Canada, the rules, technologies and practices are designed to unify trading across different venues, making it less likely that market fragmentation would result in segmented liquidity. Market participants have access to smart-order routers that can automatically find the best execution across multiple venues. High-frequency traders quickly remove any price differences between markets through arbitrage. And regulation prevents segmentation through the order-protection rule, which requires market-makers to have procedures to ensure that trades are executed at the best price offered on any market, thus ensuring that traders cannot neglect good prices wherever they are posted. Given these factors, the multiple equity markets in Canada act far more like a unified market than they do a series of segmented venues, which is consistent with evidence in other jurisdictions, such as the United States (O'Hara and Ye 2011).

The intuition that technology has knit together markets is supported by the history of certain measures of market quality in Canada. Market-quality measures of the S&P/TSX 60 stocks trading on the TSX were not obviously affected after Chi-X entered in March 2008. Similar measures around the entry of Alpha in December 2008 are unfortunately obscured by the financial crisis, but they do not show negative effects.

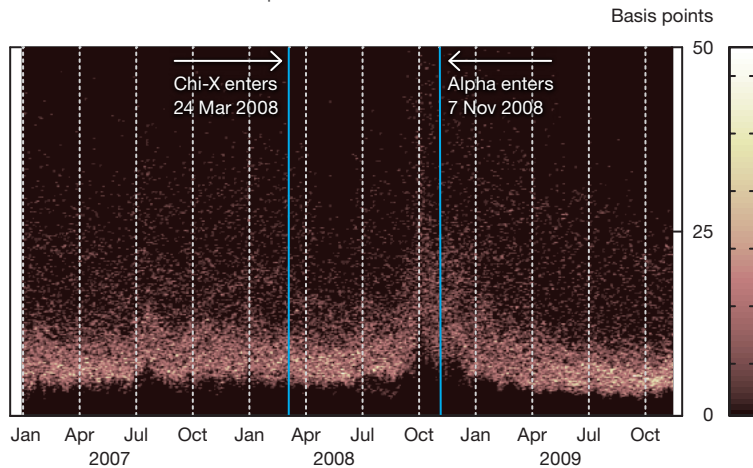
Chart 2 shows that S&P/TSX 60 relative spreads—bid-ask spreads divided by prices—dropped to a lower equilibrium after Alpha's entry in late 2008, but it is difficult to know how much of this drop is attributable to Alpha, how much to coincidental changes in market structure and how much to the recovery from the financial turmoil of 2008. The 2008 financial crisis is the most obvious aspect of the chart, making it difficult to analyze the impact of Alpha's entry. Nevertheless, market fragmentation was not at any time associated with worsening spreads. Furthermore, the more recent spreads are slightly narrower than they were before the crisis, and trading fees were declining throughout the 2007–09 period.

Chart 3a and Chart 3b provide a closer examination of three averaged measures of market quality at the time of the entry of Chi-X and Alpha. Market depth improves dramatically after Alpha's entry, although some of this is because of duplication of offers across venues (Van Kervel 2012). Bid-ask spreads and volatility (as seen in the standard deviation of prices) either stay the same or perhaps improve slightly with market fragmentation, although (again) Alpha's entry is obscured by the recovery of the market after the financial crisis.

◀ *In Canada, the rules, technologies and practices are designed to unify trading across different venues, making it less likely that market fragmentation would result in segmented liquidity*

Chart 2: Relative spreads of the stocks of the S&P/TSX 60, 2007–09

S&P/TSX 60 relative bid-ask spreads



Note: The relative spread is the bid-ask spread divided by the mid-quote price. A lighter dot indicates that a greater number of stocks have the same relative spread near a certain date.

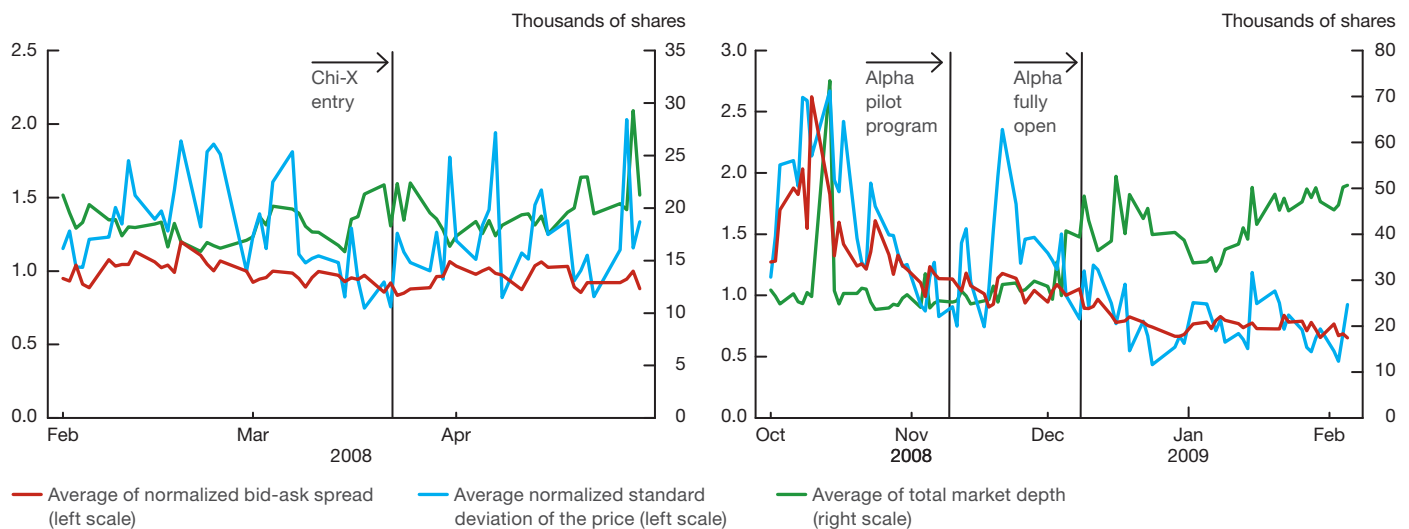
Source: Thomson Reuters

Last observation: 6 November 2009

Chart 3: Market quality measures surrounding the entry of alternative trading systems

a. Chi-X (24 March 2008)

b. Alpha (7 November 2008 and 5 December 2008)



Source: Thomson Reuters

Last observation: 23 May 2008

Last observation: 5 February 2009

Market complexity, costs and risk

Fragmented trading has placed new demands on market participants. They must install costly systems that handle multiple venues, new types of orders, new pricing regimes and new trading strategies. As well, regulation requires market intermediaries to make similar costly investments to achieve compliance. In addition to increasing costs, market fragmentation has made markets more complicated, which raises operational risks.

A particular concern of Canadian market intermediaries is the order-protection rule. Dealers feel that the rule requires them to monitor all prices available on all trading platforms in case any have a better price.⁴ To monitor all venues,

⁴ The order-protection rule does not explicitly protect every single price, but participants try to avoid any possibility of violating the regulation by interpreting it strictly.

participants must pay connection and data fees to each venue regardless of its importance, subsidizing new venues and increasing costs. The additional costs have made it difficult for smaller brokers—who lack the funds to make repeated investments in technology—to remain in the Canadian market, although some have adapted by buying services from larger intermediaries.

As markets grow more fragmented, the concerns about complexity multiply. The entry of every new trading venue raises the number of prices and the amount of activity that participants have to monitor. The amount of activity increases substantially because participants in each market react to changes observed in the others. When there are multiple venues, high-frequency trading strategies, already active by design, are particularly prone to increased activity, which can generate a deluge of information. For example, the enormous amount of data generated during the flash crash of 6 May 2010 made isolating the cause more difficult (Kirilenko et al. 2011). Complexity also creates opportunities for traders and infrastructure providers to profit at the expense of other market participants. For example, electronic traders may be able to exploit timing differences between venues to gain an information advantage (a practice known as “latency arbitrage”).⁵

Complexity can in turn create new operational risks. Each trading platform uses different and often proprietary technology and communications protocols. The need to write trading software that is compatible with multiple trading platforms raises the likelihood of glitches, which are increasingly common. In the United States, a coding problem was responsible for an August 2012 disruption in markets that cost Knight Capital more than US\$400 million. More recently, in August and September 2013, operational failures were responsible for two outages at NASDAQ, an options market halt at the Chicago Board Options Exchange, an outage at Eurex, a sequence of options trading errors by Goldman Sachs and a national U.S. options market outage. So far, operational failures have been relatively short and contained, and have not caused wider financial problems. But the risk remains that a glitch could precipitate or accelerate a systemic shock.

Market fragmentation can nevertheless be both a cause of software glitches and a cure, given the right regulations and trading practices. Operational failures triggered by problems with exchanges, participants or the connections between them are inevitable. Work should therefore focus as much on making the system resilient to such failures as on avoiding them. For example, the presence of multiple trading venues can improve financial stability by reducing the systemic importance of each individual venue. Participants should be able to continue trading despite the failure of even the largest venue by routing trading activity to other venues. But this works only if single points of failure are minimized, and market participants are prepared and permitted to bypass failing infrastructure to reach markets.

There is a broad appetite among market participants for regulators to introduce some thoughtful improvements to the market structure. Regulators are currently examining issues related to fees for market data, the order-protection rule and high-frequency trading.⁶ These initiatives may lead to some limits on innovation and competition in the Canadian marketplace

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◀ *...complexity can create new operational risks*

◀ *Market fragmentation can be both a cause of software glitches and a cure, given the right regulations and trading practices*

⁵ Differences in access to markets are, of course, far from new. For example, before the advent of electronic trading, floor traders had a huge latency advantage over other market participants.

⁶ See Ontario Securities Commission, “CSA Staff Consultation Paper 21-401 Real-Time Market Data Fees,” 12 November 2012, available at http://osc.gov.on.ca/en/SecuritiesLaw_csa_20121108_21-401_real-time-data-fees.htm; and Investment Industry Regulatory Organization of Canada, “The HOT Study: Phases I and II of IIROC’s Study of High Frequency Trading Activity on Canadian Equity Marketplaces,” 2001, available at http://www.iiroc.ca/Documents/2012/c03dbb44-9032-4c6b-946e-6f2bd6cf4e23_en.pdf.

in exchange for reduced cost and complexity for market participants. In deciding what regulatory changes to make, careful consideration of the potential effects on market quality will be essential.

Conclusion

The fragmentation of equity trading in Canada has brought competition, both on price and on product. Our simple analysis of measures of market quality finds that the long-term trend of improving market quality has continued alongside increasing market fragmentation. Nonetheless, more rigorous econometric techniques are necessary to disentangle the many factors at play, and more-sophisticated measures of market quality should be employed.⁷ Much work is still to be done to fully assess the impact of fragmentation and other changes to the structure of the equity markets in Canada, including recent events such as the Maple Group's acquisition of Alpha and the potential future entry of the Aequitas trading venue. A full assessment of the impact of these events on market quality would provide regulators and market participants with a foundation for analyzing additional instances of fragmentation that will likely occur in the future.

We have described a number of costs and complexities associated with market fragmentation that deserve to be studied independently of the classical trade-off between concentration and competition, which we view to be less relevant given modern trading technology. In particular, the increased expenditures on technology and expertise are not trivial, and increased market complexity can bring greater operational risks. These are concerns that regulators must carefully manage.

⁷ For example, Bain and Mudassir (2013) show a recent increase in intraday volatility.

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