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Is market fragmentation harming market quality? ☆

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ABSTRACT

We examine how fragmentation is affecting market quality in US equity markets. We use newly available trade reporting facilities (TRFs) data to measure fragmentation, and we use a variety of empirical approaches to compare execution quality and efficiency of stocks with more and less fragmented trading. We find that fragmentation affects all stocks; more fragmented stocks have lower transactions costs and faster execution speeds; and fragmentation is associated with higher short-term volatility but greater market efficiency, in that prices are closer to being a random walk. Our results that fragmentation does not appear to harm market quality are consistent with US markets being a single virtual market with multiple points of entry.

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1. Introduction

One of the more striking changes in US equity markets is the proliferation of trading venues. While the traditional exchanges continue to execute orders, they now face a host of competitors ranging from electronic platforms, such as electronic communication networks (ECNs) and alternative trading systems (ATs), to the trading desks of broker–dealer firms, and even to a variety of new entrants such as futures and options markets. The addition of these new trading venues has created a marketplace in which equity trading can take place in ways and places unimagined but a few years ago. And these changes

are not just confined to US markets. European equity trading has seen dramatic growth of electronic platforms such as Chi-X and BATS, and even Canada, where the Toronto Stock Exchange enjoyed a virtual monopoly on trading, has experienced fragmentation with the addition of electronic venues Alpha, Pure, and MATCH Now.¹

What is less clear is how this fragmentation of trading is affecting the quality of trading. Certainly, the addition of new trading venues has increased competition, forcing traditional exchanges to lower trading charges and other fees.² The proliferation of venues has also provided a wealth of trading options to the trading community, fostering innovations such as reductions in latency and

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¹ From its launch in 2007, Chi-X captured 19% of European trading volume market share, and in June 2010 it was the second largest trading venue in terms of volume. Alternative trading venues have grown rapidly in Canada following the launch of the consortia-owned Alpha trading system on November 7, 2008. As of March 2010, ATs have captured 33% of the trading volume in Canada.

² See, for example, *Wall Street Journal* (2009) which discusses the NYSE's strategy of trading fee rebates to attract more high frequency traders.

more sophisticated crossing networks. However, a deeper concern exists that fragmentation of trading could also be harming the quality of markets by reducing the liquidity available not only in individual markets but in the aggregate market as well. Such a degradation of market quality could occur, for example, if fragmentation reduced the enforcement of time priority across markets, thereby dis-incentivizing traders from posting limit orders. A related concern is that, because many of the new trading platforms are proprietary systems, not all traders can access all trading venues. This raises the specter that markets might not be fragmenting so much as they are fracturing into many disparate pieces.

In this research, we investigate how fragmentation is affecting equity market quality. This question has long interested researchers but empirical investigations have been limited by the difficulty of measuring both the extent of fragmentation and the quality of executions in diverse venues. Our analysis draws on new data sources to provide better metrics for addressing these issues. We measure fragmentation in individual stocks by using volumes reported by the newly established trade reporting facilities (TRFs). Whereas before off-exchange volume was simply aggregated with exchange-executed volume for reporting purposes, now exchanges must report only their on-exchange volumes, with off-exchange volumes handled by TRFs.³ Because all trades must be reported to the consolidated tape, TRF data provide an accurate measure of the trades being executed in non-exchange venues.⁴

To address market quality issues, we use Securities and Exchange Commission (SEC) Rule 605 data, which are execution metrics reported monthly on a per stock basis by all execution venues.⁵ These data were generously provided to us by TAG/Audit, and they allow us to compare execution quality as measured by effective spreads, realized spreads and execution speeds across stocks. We also use more standard TAQ microstructure data to investigate quality issues related to price

efficiency. Our analysis here examines short-term return volatility and variance ratio tests.

Determining the effects of fragmentation on execution quality is complicated by endogeneity issues. As previously demonstrated (see Securities and Exchange Commission, 2001; Boehmer, 2005), different stocks could have different costs of trading for reasons unrelated to fragmentation. For example, small stocks generally have higher trading costs. If small stock trading is also more likely to fragment, then finding higher trading costs for fragmented stocks could be spurious due to the failure to control for firm size. In addition, market-related issues (see Bessembinder, 2003b; Boehmer, Jennings, and Wei, 2007) could lead to fragmentation for reasons unrelated to the trading costs of stocks. If particular venues trade only specific stocks, a finding of lower trading costs for fragmented stocks could be spurious due to a failure to control for this selection bias.

Previous research addressed these concerns in a variety of ways, including matched samples, regression analysis, and the Heckman correction. We use each of these approaches in our research. We use the Heckman correction to test for selection bias in how stocks fragment across markets, and we use a matched sample approach to compare the execution quality of stocks with more fragmented trading and that of stocks with more consolidated trading. We also use regression analysis to investigate more fully how spreads are affected by fragmentation and other economic variables.

Our analysis yields a number of results. We provide compelling new evidence on the extent and nature of fragmentation in US equity markets. We find that off-exchange venues are executing almost 30% of all equity volume. While fragmentation levels vary widely across stocks, all firms now exhibit fragmented trading, and major markets and TRFs now trade virtually all stocks. These results are in stark contrast with earlier findings that only subsets of stocks fragmented and that markets were selective regarding the stocks they chose to trade. Results from the Heckman correction confirm that selection bias is not a factor in explaining the relation of fragmentation and market quality.

Turning to our main focus, we find fragmented stocks generally have lower transaction costs and faster execution speed. The specific effects of this fragmentation differ across firm sizes, and it differs as well for NYSE-listed and Nasdaq-listed firms. For large firms, fragmentation is associated with faster execution time. For small firms, effective spreads are lower, but there are no significant effects on speed. For NYSE-listed stocks, large, liquid stocks appear to gain the most from fragmentation, and for Nasdaq-listed stocks, small, illiquid stocks benefit from fragmentation. Fragmented stocks (particularly on the NYSE) do have higher short-term return volatility, but prices appear to be more efficient in that they are closer to being a random walk. These efficiency effects also exhibit differences with respect to firm size and listing venues. Regression analysis provides confirming evidence that market quality, as measured by effective spreads, is not harmed by market fragmentation. Our results support the conclusion that while US equity markets are spatially

³ TRFs were mandated by the Securities and Exchange Commission (SEC) as a condition for approval of Nasdaq's application for exchange status. The SEC required that as of March 5, 2007 all non-exchanges must report to a trade reporting facility, which in turn would report trades to the consolidated tape.

⁴ TRF data do not disaggregate trades into specific execution venues so we cannot determine the specific volume of trading in each of the many non-exchange venues. We can determine the aggregate off-exchange volume per stock, however, giving us comparable, and much improved, metrics for fragmentation. An alternative fragmentation metric is the volume of trade executed away from the listing exchange. Results using the two fragmentation metrics are similar, but for brevity we report only the TRF results.

⁵ Rule 605 data arise from an SEC requirement that all market centers publicly disclose on a monthly basis execution quality statistics. Not all trade executions must be included, but data must be provided for orders meeting the following criteria: Orders must be held; limit price must be less than ten cents from the quote; order must be straight market or limit order; and the order must be for ten thousand shares or lower. Bennett and Wei (2006) also use what was then known as SEC 11Ac1-5 data to address market quality in their study of firms moving from the Nasdaq to the NYSE, as do Goldstein, Shkillo, Van Ness, and Van Ness (2008) in their interesting study of competition for Nasdaq securities.

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