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Effects of lit and dark market fragmentation on liquidity

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ABSTRACT

Based on data from eight stock exchanges and a trade reporting facility for London Stock Exchange- and Euronext-listed equities, I investigate how lit and dark market fragmentation affects liquidity. Neither dark trading nor fragmentation between lit order books is found to harm liquidity. Lit fragmentation improves spreads and depth across markets and locally on the primary exchange, or at worst does not affect them. Benefits are greater for large stocks and stocks with less electronic trading. Lit fragmentation however harms the depth of small stocks. The adverse effects on the depth of large stocks result from algorithmic trading, not fragmentation.

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1. Introduction

With the development of sophisticated trading technologies and the enforcement of pro-competition market regulations, fragmentation of trading volumes between competing trading venues has undeniably increased in all large western stock markets. There are more than 15 trading venues in the United States, with more than 45% of volume in S&P 500 stocks and around 55% of volume in NASDAQ 100 stocks traded off primary exchanges in 2016 according to Fidessa.¹ In Europe, more than ten trading venues have now become fairly active in liquid European stocks. Levels of fragmentation in stock markets however strongly differ across countries and exhibit time series variations. On average, the level of fragmentation in U.S. stock markets is twice that observed in the main European and Canadian markets, while stock trading is relatively concentrated in the primary exchange in Japan. It is thus important to understand how those differences impact trading costs, and thereby investment performance, for domestic and international investors.

A market is fragmented when trading takes place simultaneously at different locations. The trade flow in a security may fragment in essentially two ways: (1) several open and transparent order books compete for the order flow; (2) a portion of the order flow is internalized off-exchange by dealers or crossing engines, either under regulation or in the over-the-counter (OTC) market. Case (1) will be referred to as lit fragmentation while case (2) will be referred to as dark fragmentation or dark trading.

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¹ Fidessa is a private company that provides trading systems, market data, and connectivity solutions.

While there is concern among regulators, issuers, and asset managers as to how the different forms of fragmentation and their level may impact the quality of order execution and market liquidity, the empirical evidence on this issue is relatively scarce, probably because obtaining exhaustive data from all active markets on large stock samples is a difficult hurdle to overcome. In this paper, I examine how the consolidated liquidity of competing trading systems, here called global liquidity, as well as the local liquidity of the primary exchange, relate to lit and dark fragmentation, on a large sample of equities listed on the London Stock Exchange (LSE) and Euronext. To my knowledge, it is the first paper to address the issue with both a long time series and a large sample. An original aspect of the study lies in that it is conducted with two distinct approaches: a first approach which treats the shift from consolidated to fragmented markets legally supported by the implementation of the Markets in Financial Instruments Directive (MiFID)² in November 2007 as a natural experiment, and a second approach that investigates the time series of spreads, depth, and fragmentation measures in fragmented markets. Both approaches provide novel insights by disentangling the effects of algorithmic trading (AT) and fragmentation. They also provide new evidence on differentiated impacts of fragmentation according to market size and to the initial level of automation and/or centralization of the order flow.

The results show that (1) spreads and depth improve with, or at worst are not affected by, lit fragmentation after controlling for endogeneity and AT; (2) when both AT and lit fragmentation contribute to improving spreads, the effect of fragmentation is economically more significant; (3) stocks with less electronic trading before MiFID benefit more from multiple-venue trading; (4) dark trading does not harm liquidity but may, on the contrary, improve some of its dimensions; (5) lit fragmentation reduces the depth of smaller stocks but adverse effects on the depth of large stocks result from AT and not from fragmentation.

The remainder of the paper is organized as follows. In [Section 2](#), I review the related literature and present the research objectives. In [Section 3](#), I provide details about the regulatory framework and the organization of the marketplace. In [Section 4](#), I describe the sample and the data. The fragmentation and liquidity measures used in the empirics are presented in [Section 5](#). In [Sections 6](#) and [7](#), I compare the liquidity of the pre-MiFID quasi-consolidated marketplace with that of post-MiFID fragmented markets. In [Section 8](#), I conduct panel analyses of the relation between fragmentation and liquidity in the post-MiFID fragmented markets. I conclude in [Section 9](#).

2. Literature review and research objectives

Lit fragmentation, which is fragmentation between transparent trading platforms, is generally considered as producing positive competition effects ([Hamilton, 1979](#); [Stoll, 2003](#)). Bid-ask spreads have been observed to narrow in the incumbent market for diverse financial instruments when a new market starts operating ([Battalio, 1997](#); [Huang, 2002](#); [Mayhew, 2002](#); [Boehmer and Boehmer, 2003](#); [Fontnouvelle et al., 2003](#); [Nguyen et al., 2007](#)). [Foucault and Menkveld \(2008\)](#) also show that, due to the absence of price priority across markets, consolidated depth is larger after the entry of a new order book. Nevertheless, market fragmentation may have adverse effects. First, the dispersion of trading may “prevent full realization of any economies of centralized trading on the exchange” ([Hamilton, 1979](#), p.186). Second, fragmentation may harm liquidity by increasing information asymmetry costs. [Chowdry and Nanda \(1991\)](#) demonstrate that adverse selection costs increase with the number of markets listing an asset. [Easley et al. \(1996\)](#) and [Bessembinder and Herbert \(1997\)](#) also suggest that when a new market opens for a stock, it may skim the least informed and consequently most profitable orders, and then harm the liquidity of the primary market. [Bennett and Wei \(2006\)](#) provide empirical evidence that stocks switching from a fragmented market of dealers, as the old NASDAQ structure, to a more consolidated structure such as the electronic order book of the NYSE, experience an improvement in spreads.

While most of this literature provides evidence on the benefits of competition between markets, none of these authors analyze the direct interaction between fragmentation and liquidity when an asset trades on several venues. The first empirical study to address this issue is that of [O’Hara and Ye \(2011\)](#), who exploited Securities and Exchange Commission (SEC) Rule 605 monthly data for 262 U.S. stocks over six months in 2008. They find that highly fragmented stocks have lower transaction costs and faster execution speed than lower fragmented stocks, but their approach is essentially a cross-sectional analysis and cannot distinguish cross-market consolidated liquidity from local liquidity in a given market due to the nature of the data exploited. [Degryse et al. \(2015\)](#) are able to make this distinction with detailed order book data for 52 Dutch stocks. They find that lit fragmentation improves the depth of the consolidated marketplace but reduces that of the primary exchange. While their work makes a valuable contribution due to a long time series analysis and a sound methodology, their sample only covers one country whose stock market is not among the largest in Europe, which raises the question of whether their results can be generalized.

As a result, to date, no work has investigated the link between lit fragmentation and liquidity with high-frequency data covering all trading venues for a large sample of equities listed on leading exchanges. My main research objective is to fill this gap by exploiting a large sample of European stocks listed on the LSE and Euronext and by measuring liquidity for global

² This European Union law provides a comprehensive and harmonized regulatory regime for investment services and activities across the 31 member states of the European Economic Area (EEA), i.e., the 28 member states of the European Union (EU) plus Norway, Iceland, and Liechtenstein.

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