



Why do traders choose dark markets?

Ryan Garvey^{a,*}, Tao Huang^{b,c,1}, Fei Wu^{c,2}

^a Duquesne University, 600 Forbes Avenue, Pittsburgh, PA 15282, United States

^b International Business School Suzhou, Xi'an Jiaotong-Liverpool University, Suzhou, China

^c Shanghai Advanced Institute of Finance, Shanghai Jiao Tong University, Shanghai, China



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ABSTRACT

We examine U.S. equity trader use of dark and lit markets. Marketable orders executed in the dark have lower information content and smaller fill rates. Dark orders take longer to execute, but they execute at more favorable prices. Traders are more likely to go dark when the bid-ask spread is wider and those with higher dark participation are more sophisticated. Although market regulators have expressed concern over the rise in dark trading, our results indicate that dark markets provide important benefits to traders that lit markets do not.

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1. Introduction

An increasingly large portion of U.S. equity trading volume is moving away from traditional stock exchanges. For example, in 2013, approximately 37% of stock trading occurred away from U.S. exchanges, an increase above the average of 29% in 2008.³ Traders are bypassing public (i.e., lit) markets at an increasing rate in favor of private (i.e., dark) markets. In lit markets, buyers' and sellers' orders are displayed to the rest of the marketplace. In dark markets, the trading interests of market participants are not displayed prior to execution. The declining market share of U.S. stock exchanges is causing many in the securities industry, including market regulators, to question the value of dark markets openly. While recent studies on dark trading have attempted to address the issue of whether the existence of dark venues operating alongside lit venues improves overall market quality, in our study, we take a different approach and examine dark trading from the perspective of an individual trader. We seek to provide some insight for answering a fundamental question related to dark trading: *Why do traders choose dark markets?* Answering this question is important for understanding not only the issues involved in dark trading, but also

the (dis)advantages that continually confront traders when choosing dark versus lit order execution in U.S. equities.

To conduct the study, we obtained proprietary data from a U.S. direct market access (DMA) broker. DMA data are advantageous because their brokers allow clients to choose where and how orders are executed. The brokerage-level data enable us to analyze trading from the order submission decision and measure various dimensions of execution quality that are not observable in transaction-level data, including time to execution and percentage of an order filled. We are also able to analyze characteristics of traders who use dark markets more often. These factors are not examined in recent studies on dark trading that use data sources at the market center-level (e.g., Degryse et al., 2014; Comerton-Forde and Putnins, 2015). We study more than two and one-half million dark/lit marketable order execution decisions, and more than six million trading decisions overall. The results are based on more than three thousand equity traders who are geographically dispersed throughout the U.S.

Why might traders choose dark over lit markets? First, content regarding trader information is likely an important factor. For example, Zhu (2014) argues that informed traders have low execution probabilities in dark venues because they all tend to trade in the same direction at the same time. In contrast, uninformed traders are equally likely to buy or sell and this increases the probability of finding a match in the dark. Consequently, dark (lit) markets will be more attractive on average to uninformed (informed) traders. We find that significant differences exist in the information content behind dark and lit marketable order executions. Lit trades are

* Corresponding author. Tel.: +1 (412) 396 4003; fax: +1 (412) 396 4764.

E-mail addresses: Garvey@duq.edu (R. Garvey), thu@saif.sjtu.edu.cn (T. Huang), fwu@saif.sjtu.edu.cn (F. Wu).

¹ Tel./fax: +86 216 293 4063.

² Tel.: +86 791 381 6750; fax: +86 791 381 6792.

³ "SEC Chairman Targets Dark Pools, High-Speed Trading" by Scott Patterson, *Wall Street Journal*, June 6, 2014, C1.

informative about future price direction while dark trades are not. Furthermore, we find that the average fill rate for a dark marketable order execution is lower than that of a lit marketable order execution. This is also in line with [Zhu's \(2014\)](#) prediction that finding a match in the dark is more difficult for the informed.

Traders may also choose dark venues because they offer better prices. For example, in our setting, the dark venue is operated by a large wholesale market maker. The firm seeks to profit by matching incoming retail/institutional order flow in the dark either at or within the lit market spread. Price improvement may occur on trades because market makers are particularly good at “cream-skimming” uninformed order flow and pay for it by offering slightly better prices (see, for example, [Easley et al., 1996](#); [Barclay et al., 2003](#)). We find that dark marketable order executions have significantly lower effective spreads than lit orders and that price improvement occurs on more than 80% of the dark orders executed, thus saving traders more than \$6.3 million (on average, \$18.66 per order). This cost-saving estimate assumes traders could have obtained the NBBO quote displayed in the lit markets at the time of their order submission to the dark market.

If, on average, dark orders execute at better prices, then presumably the cost-saving benefit must be traded off with slower execution. The financial literature has long noted the price-time tradeoff with trader decision to use a market order versus a limit order (see [Cohen et al., 1981](#)). For example, market orders execute quickly but pay the bid-ask spread. Limit orders are slower to execute (and may not execute), but they avoid the bid-ask spread.⁴ Overall, we find that the average time-to-execution for a dark order execution is much longer than for a lit order execution, and the average effective spread for a dark order execution is much smaller than for a lit order execution. The price-time tradeoff a trader faces with the use of a dark venue versus a lit venue is similar to the one they face with the use of a market order versus a limit order. Our results suggest dark trades result from patient traders who are motivated to trade for liquidity reasons and are willing to trade waiting costs for better prices.

Order size may also influence a trader's decision to go dark. In general, dark markets are good for locating large counterparties. Trading in the dark enables a trader to hide his or her interest, which prevents front running practices. A trader does not want to display a large limit order in a lit market because it offers free options to other market participants. Executing a large marketable order in a lit market results in a cost as well, because market makers need to be compensated for inventory risk and the risk of adverse selection. Academic researchers have studied differences in trading between “upstairs” and “downstairs” markets. An upstairs market is one where brokers work privately to negotiate terms and find counterparties for large block transactions. In such non-anonymous settings, [Seppe \(1990\)](#) and [Madhavan and Cheng \(1997\)](#) argue that reputation mechanisms exist that enable uninformed traders to credibly signal their block trades are motivated by liquidity and, in return, execute with smaller price impact. The wholesale market-making firm that operates the dark venue in our setting is not able to identify individual market participants, but is able to identify where order flow originates and the information content that is typically behind it. We find that orders sent to the dark market are significantly larger in size. The average submitted size of a dark order execution is more than twice the size of the average trade size in the overall marketplace. In addition, dark block orders (10,000+ shares) have a shorter time-to-execution and smaller price impact than lit orders.

Finally, market conditions and trader characteristics likely influence trader decision to execute in the dark. For example,

consistent with [Zhu \(2014\)](#) and others, we find that a wider bid-ask spread in the lit market (and other factors) increases the likelihood of a dark order execution. Trader characteristics are also correlated with dark trading. Overall, we find that the more experienced and skillful one is at trading, the higher their dark market participation. For example, traders who more often execute in the dark execute significantly more orders overall. They are more patient with executing orders, use more trading venues and order types, trade over a longer period of time, and pay a lower overall cost to trade. It is important to note that traders who execute in the dark more often also appear to be better at forecasting future price direction. For example, when traders with higher (lower) dark market participation buy, market prices are more likely to rise (fall); and, when they sell, market prices are more likely to fall (rise). Ex-post performance is measured by using three time intervals (e.g., five minutes, one hour, and to the end of the trading day).

Most of the recent empirical and theoretical studies on dark trading have attempted to address the issue of whether the existence of dark venues operating alongside lit venues improves overall market quality. The findings are mixed.⁵ For example, one way to proxy for dark trading activity in the overall market is by means of data from a trade reporting facility (TRF).⁶ Trades reported to a TRF often originate from dark venues (dark pools and broker-dealer internalization), although they can also originate from lit venues such as electronic communication networks (ECNs). [O'Hara and Ye \(2011\)](#) find that stocks with higher TRF reporting exhibit better market quality. [Weaver \(2014\)](#) examines a more recent sample period when TRF reporting is driven by broker-dealer internalization and finds a negative relationship between market quality and higher TRF reporting. Both [Buti et al. \(2011\)](#), as well as [Nimalendran and Ray \(2012\)](#), study trading data that are provided by dark pool operators. In particular, [Buti et al. \(2011\)](#) find that increased dark pool activity improves market quality measures such as spreads, depth, and daily (intradaily) volatility, whereas [Nimalendran and Ray \(2012\)](#) find that, in less liquid stocks, trading in the dark market leads to increased spreads and higher price impacts in the lit market. Theoretical studies on the impact of dark trading also seem to indicate varying results. For example, [Zhu \(2014\)](#) conjectures that the existence of dark trading alongside lit trading improves market quality; yet, [Ye \(2012\)](#) predicts an opposite result.

The impact of dark trading on market quality is not well understood. In addition, whether or not the proliferation of dark venues operating alongside lit venues in the fragmented U.S. equity market is beneficial remains a highly controversial topic.⁷ In our study, we examine dark trading from a different perspective, namely that of an individual trader. Unlike the aforementioned prior studies, we use U.S. brokerage-level data and examine trading over a different sample period that spans eight calendar years ending in May 2006. Our motivation is to provide some insight into why traders choose dark markets. Answering this question is important for understanding not only the issues involved in dark trading but, also, the (dis)advantages with which traders are continually confronted when choosing

⁵ Researchers have examined the relationship between dark trading and market quality in settings outside the U.S. As in the case of U.S. equities, the results appear mixed. For example, [Comerton-Forde and Putnins \(2015\)](#) find that increases in dark trading adversely impact market quality in Australia, whereas [Degryse et al. \(2014\)](#) find that increases in dark trading lessen market quality in Dutch stocks. [Brugler \(2015\)](#) finds that increases in dark trading improve market quality in the U.K., whereas both [Brandes and Domowitz \(2011\)](#) as well as [Buchanan et al. \(2011\)](#) find that increases in dark trading improve market quality in Europe.

⁶ Public exchanges (also) allow traders to post orders that are hidden from the rest of the market. These trade executions are not identified as such when exchanges report their trades to the consolidated tape. [Hautsch and Huang \(2012\)](#) study hidden order placement strategies on the NASDAQ (lit) stock market.

⁷ Market regulators have recently requested information from dark pool operators in an attempt to gain a better understanding of trading in their markets. “Dark Pools Face Scrutiny” by Scott Patterson, *Wall Street Journal*, June 5, 2013, C1.

⁴ [Boehmer \(2005\)](#) and [Hodrick and Moulton \(2009\)](#) also emphasize a trade-off between the various dimensions of order execution quality such as price and time (e.g., [Boehmer, 2005](#)) and price, time and size (e.g., [Hodrick and Moulton, 2009](#)).

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