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Crossing network versus dealer market: Unique equilibrium in the allocation of order flow ☆

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ABSTRACT

The allocation of order flow to alternative trading systems can be understood as a game with strategic substitutes between buyers on the same side of the market, as well as one of positive network externalities. We consider the allocation of order flow between a crossing network and a dealer market. We show that small differences in traders' preferences generate a unique switching equilibrium in which patient traders use the crossing network while impatient traders submit orders directly to the dealer market. Our model explains why assets with large turnovers and low price volatility are likely to be traded on crossing networks, while less liquid assets are traded on dealer markets.

1. Introduction

Traders who do not require immediate execution of orders can reduce trading costs by searching for counterparties on alternative trading systems (ATS), instead of going to traditional dealer markets. New communication technologies and deregulation—e.g. the EU's MiFID directive—have fuelled the development of such systems (see overviews by Degryse, 2009 or Stoll, 2006). Some are sidelines of broker-dealers, and some are "dark pools" that aim to reveal as little information about trades as possible. Examples of opaque trading systems are crossing networks, which allow traders to enter orders that are crossed at a specific time at a price derived from another market.[1] Offering lower commission after-hours trading and

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[1] For instance, the New York Stock Exchange operates several different crossing sessions after its trading floor closes. In crossing session I, single share block orders are crossed at the closing price established on the exchange. ITG's POSIT offers several crossing solutions to its customers, including a crossing session operating daily at 9:45 am EST that crosses orders against the midpoint of the current national best bid and offer ("NBBO", a benchmark index for

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anonymity, these systems direct order flow away from traditional exchanges, reducing transparency and potentially fragmenting liquidity. The development is of interest to economists, regulators, investors, and others who closely follow the emergence of new market structures.

A major question is how liquidity will be allocated and under which circumstances and for which sorts of assets these alternative markets can emerge, co-exist with dealer markets or even replace them. It is not immediately obvious whether traders would keep on using traditional markets if there are cheaper alternatives. However, one barrier for adoption is that new venues must attract sufficient order flow to ensure a sufficiently high probability of order execution. When traders choose venues, strategic complements arise due to the liquidity externality of a deep market. As in other settings with strategic complements, this may lead to the existence of multiple equilibria. Previous theoretical research that has explored the issue of competition between trading venues has suffered from an indeterminacy due to the multiple equilibria, impeding policy implications. In some equilibria, alternative markets almost completely replace dealer markets, while in others they fail to attract sufficient liquidity to be viable.

In this paper, we investigate the allocation of order flow between a traditional dealer market (DM) and a crossing network (CN). We contribute to the literature on the allocation of order flow by removing the multiplicity of equilibria that has plagued previous models. In our model, trading on a DM guarantees immediate order execution at bid and ask prices quoted by market makers. Trading on the electronic market is less expensive, as traders do not have to pay for an intermediary's services but only a small commission. However, the execution of an order submitted is uncertain because the number of buyers and sellers that are active in the market is *ex ante* unknown. The allocation of order flow can be understood as a game with strategic substitutes as well as strategic complements. Strategic substitutes exist because traders on the same side of a venue compete for orders. But if sufficiently many buyers and sellers coordinate to trade on a new venue, the probability of order execution is high and expected payoff from trading on this market may exceed the payoff from trading on a DM. We show that the positive network externalities arising from overall market size dominate the strategic substitutes induced by competition of orders on the same side, so that one can apply the global game approach of Carlsson and van Damme (1993) and Morris and Shin (2003) to derive a monotonic switching equilibrium.

Heterogeneity is the driving force in our model. Since the two venues differ in features, they attract different kinds of traders. In our model's equilibrium, traders with a strong preference for immediate order execution trade at traditional DMs, while patient traders prefer submitting orders to a CN, other things equal. Markets coexist when the CN is sufficiently liquid and there is sufficiently large heterogeneity of traders, so that some agents are patient and some are not. Traders whose liquidity preference is below a certain threshold then go to the CN. A unique such threshold exists, and it is increasing in the liquidity of the market, measured by the expected number of traders. This allows us to answer the question under which conditions a CN can coexist with a DM and conduct comparative statics.

These features of our model explain why assets with large turnovers and low price volatility are likely to be traded on CNs, while less liquid assets are traded on DMs, as empirical evidence also shows. Using a propriety data set on trading, Conrad et al. (2003) find that CNs attract mostly stocks with large market capitalisation and high trading volume. Gresse (2006) finds that less risky and more actively traded stocks are more likely to trade on a CN, based on LSE and Irish stock market data. Mao Ye (2010) studies NSYE and NASDAQ stocks and finds that the market share of CNs is higher for lower volatility stocks and higher volume. More generally, Theissen (2002) reports evidence that the market share of competing electronic trading venues increases with the trading volume of a stock and is negatively related to return volatility.

Market liquidity is a crucial parameter in our model. When liquidity is low, there is a substantial risk of mis-coordination by buyers and sellers. The CN becomes a viable trading venue only if it attracts sufficient liquidity to reduce the coordination risk. It is something that alternative trading systems have to deal with in reality. For CNs, this coordination risk is strengthened by their opaque character and potentially low order execution probabilities. Gresse (2006) describes how in the 1980s, a first attempt at establishing a European CN, ARIEL, failed to attract sufficient liquidity. She also documents probabilities of order execution on CNs as low as 2–4%. Theissen (2002) reports that XETRA, after expanding the set of traded stocks beyond an initial set, reduced its number of auctions due to lack of liquidity.

Several other papers study competition for order flow between a DM and an alternative market. These papers have one thing in common: there are multiple equilibria due to the presence of liquidity externalities. This holds in particular for the seminal paper by Hendershott and Mendelson (2000), who study the impact of introducing a passive CN on competitive DMs and trading behaviour. The most plausible equilibria share the property that patient traders use the CN exclusively, traders with medium liquidity preferences use DMs when their order could not be matched at the CN, and traders with a strong liquidity preference go to the DM directly. Glosten (1994) examines an idealised electronic limit order book and shows that it does not invite competition from other markets while other markets do. Parlour and Seppi (2003) present a model of competition for order flow between different pairings of pure limit order markets and hybrid specialist/limit order markets. Viswanathan and Wang (2002) model a traders' choice between a limit-order book, a DM, and a hybrid market structure of the two when traders differ in size and risk aversion. Chowdhry and Nanda (1991) analyse how the ability of traders to choose the trading venue affects functioning and liquidity of markets in the presence of informational

(*footnote continued*)
current trading prices). Other examples of crossing networks are Instinet, E-Crossnet and XETRA XXL. Degryse et al. (2008) provide an overview of recent market developments.