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Trading mechanisms and market quality: Limit-order books versus dealership markets☆

Xiaochuan Xing [a], Yi Xue [b,*]

[a] Department of Economics, Yale University, United States
[b] School of International Trade and Economics, University of International Business and Economics, Huixin Dongjie 10, Chaoyang, Beijing, 100029, China

HIGHLIGHTS

- We compare the market quality of the dealer market and limit order book market.
- We highlight the key is that the different pricing rules in the two markets.
- The market quality of each market depends on the size of orders.
- The market quality of a hybrid competitive dominates the two pure markets.

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ABSTRACT

We compare the market quality of the dealer market and limit order book (LOB) market in a unified framework. We find that, in terms of liquidity and gains from trade, dealer market performs better when the order size is small, while LOB market performs better when the order size is large. A competitive hybrid market where the dealer marker and the LOB market compete with each other dominates the two pure markets.

1. Introduction

As a central aspect in financial market design, trading mechanisms have received much attention from both academia and practitioners. There are two main trading protocols in practice: a dealer market, in which all orders are submitted to the dealers (market makers), who post bid and ask quotes to the traders, and a LOB market, in which traders submit limit or market orders that are executed directly without any intermediaries. NASDAQ and London SEAQ are traditionally considered dealer markets, whereas NYSE, Toronto Stock Exchange, Tokyo Stock Exchange, Paris Bourse and Shanghai Stock Exchange, among others, are governed by the LOB system.

In the past two decades, the trading mechanisms in financial markets around the world have become less fragmented and more hybrid. On the one hand, dealer markets have been transformed into LOB markets or hybrid markets. In 1997, for instance, limit order trading was introduced in the NASDAQ to compete with the dealer market to avoid tacit collusion between market makers (Christie and Schultz, 1994; Christie and Huang, 1994) and to narrow the bid–ask spread. Similarly, the markets for FTSE100 and FTSE250 stocks in the London SEAQ (dealer market) were respectively replaced by SETS (limit order market) in 1997 and SETSmm (hybrid market, where "mm" indicates "market maker") in 2003. On the other hand, dealer markets have also been introduced in limit order markets. For example, market makers were introduced in the electronic continuous auction market in Paris Bourse NSC (Nouveau Système de Cotation) and Frankfurt XETRA (Exchange Electronic Trading). Although the hybrid architecture has become more widespread in the financial markets around the world, there remain several important differences in how trading activities are regulated between the two mechanisms. Therefore, it appears far from conclusive which market architecture in practice offers distinct advantages in terms of market quality, such as liquidity, informational efficiency and welfare distribution.

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* Corresponding author.
E-mail addresses: xiaochuan.xing@yale.edu (X. Xing), yxue@uibe.edu.cn (Y. Xue).

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In literature, there are abundant papers that focus understanding the nature of a certain trading mechanisms,[1] but few focus on comparing the performances of different trading mechanisms under a unified framework. In different models, the assumptions, economic environments and parameter values are different, so the features of the two mechanisms discovered by isolated papers cannot be compared directly. The issue of which market architecture is more desirable in terms of market quality is still far from consensus, both in practice and in literature (Giouvris (2013)).

One important discrepancy between the two markets highlighted in literature comes from their pricing rules. In the dealer market, all units of the order are executed at the market clearing price, which indicates that the trading protocol in the dealer market is well approximated by a uniform-price auction, as modeled by Glosten (1989) and Madhavan (1992) etc. In LOB market, the order is executed against the LOB at different prices, starting from the highest bid or the lowest ask to the market clearing price, i.e. a discriminatory-price auction is adopted in the LOB market,[2] as modeled by Glosten (1994), Biais et al. (2000) and Back and Baruch (2013) etc. Following these two groups of papers, we compare the two markets by modeling the two types of pricing rules in this paper. Thus, our dealer market captures the main features of the former cited papers and our LOB market captures the main features of the latter ones.

Our model reveals that the discriminatory pricing rule in the LOB market generates a bid shading caused by the "winner's curse" effect for the liquidity providers, so the quoted prices, conditional on the trader's type, are less aggressive than the conditional expectation of the asset value, which leads to a "no trade" regime or equivalently a zero-quantity bid–ask spread. However the bid shading converges to zero because the "winner's curse" effect tapers as the order size increases. The quote schedule in the dealer market is steeper than that in the LOB market, because the dealers, who have to set the market clearing price equal to the conditional expectation of the asset value, can only protect themselves from the adverse selection by bidding less aggressively on the quantity. The more severe the degree of adverse selection, the steeper the quote schedule, the less liquid the market is. When the degree of the adverse selection problem is sufficiently severe, the dealer market closes down, the liquidity of the market disappears.

Given that both markets are open, the trade-off of bid shading and zero-quantity bid ask spread implies that, in terms of liquidity and gains from trade, dealer market performs better when the order size is small, while LOB market performs better when the order size is large. We also consider a hybrid market where dealer market and LOB market compete with each other, the quote schedules in each market is the same with that of the pure market. However, the trader opt to trade in the dealer marker if her desired trading volume is moderate, while chooses the LOB market otherwise. The two markets are mutually complementary in the hybrid market, in specific, the "no trade" regime is supplanted by the dealer market that is open when the degree of adverse selection is not too severe, and the steep quote schedule of the dealer marker is supplanted by the flatter quote schedule of the LOB market when the order size is relatively large. The above findings suggests that the hybrid market certainly dominates the two pure markets both in terms of liquidity and gains from trade. In particular, it can inject liquidity into the market if dealer marker is introduced into the LOB market, This potentially explains that why we need a hybrid market where market makers are asked to provide liquidity when the zero-quantity bid ask spread in the LOB market is too wide. On the other hand, it can improve the gains from trade if LOB market is introduced into the dealer market. All the findings suggest that the hybrid market is a good market design and rationalizes the recent trend that hybrid market is becoming more and more prevailing all over the world.

This paper relates to and differs from few studies that compare different market architectures explicitly. Biais et al. (1998) compare floor, dealer and LOB market where the order size is known before the liquidity providers submit the quote schedules. In contrast, our paper and Viswanathan and Wang (2002) consider the markets where liquidity providers post the quote schedules before observing the order size from the trader. However, in Viswanathan and Wang (2002), the trader is non-strategic in the sense that her order size is randomly determined, whereas in our model, the trader behaves strategically by maximizing the gains from trade so that the order size is not only ex-ante unobservable for the liquidity providers, but also endogenously determined. Furthermore, Viswanathan and Wang (2002) belongs to the literature of "inventory" model where there is no information asymmetry in the value of the asset, thus the main costs of making market for the liquidity providers arise from the "inventory" effect. On the contrary, our paper belongs to the literature of "information" model where some traders have superior information about the intrinsic value of the asset, hence the liquidity provider's main cost of making the market arise from the loses due to the adverse selection or "information" effect. Therefore our model is essentially a screening game in which the liquidity providers, as the principal, moves first by offering a fully committed[3] continuum of price-quantity menus (the quote schedule) that screen the trader's private information, while the trader, as the agent, chooses the optimal menu by submitting the order size in the second stage subject to her incentive constraint. Our "information" approach also reveals some features that are "observationally equivalent" to those discovered by the "inventory" approach of Viswanathan and Wang (2002), i.e. the trade off between the bid-shading and the zero-quantity bid ask spread in the LOB market. Because of such factors, we find that the dealer market is more liquid and generates higher gains from trade when the trader's order size is small while LOB performs better in terms of these two criteria when order size is large.

This paper also relates to the common value divisible goods auction literature such as Wang and Zender (2002), which compared the single-price auction and discriminatory-price auction in a general framework. This model differs from Wang and Zender (2002) by endogenizing the trader's order size in a screening game where the bidders (liquidity providers), as the principal, are competitive. Furthermore, the cause of the bid-shading in our LOB market is similar to the well-known "winner's curse" depicted in the common value auction theory. Since the liquidity providers bid schedules (a functional form) for multiple number of asset rather than a single price for a unit number of indivisible good, this paper also relates to the schedule competition and the nonlinear pricing literature that has been studied in the theory of industrial organization, such as Klemperer and Meyer (1989). We differ from Klemperer and Meyer (1989) by analyzing not only the uniform price Walrasian auction, but also the discriminatory price rule given that schedule supplies are competitive.

[1] For pure studies on the dealer market, see Bagehot (1971), Copeland and Galai (1983), Glosten and Milgrom (1985), Kyle (1985), Glosten (1989), Wahal (1997) and Corwin (1999) etc. For studies on the pure LOB market, see Glosten (1994), Parlour (1998), Goettler et al. (2005), Baruch (2005), and Roşu (2009) etc.

[2] For example, there is a limit order for a security in which 2 units will be sold at \$99 and 4 units will be sold at \$100. There is also a market order to buy 6 units of the security. The first 2 units are executed at \$99, and the 4 remaining units are executed at \$100. This mechanism is called a discriminatory-price auction because a market order is paired off with the limit order at different prices. However, in the dealer market, the market maker chooses a market-clearing price of \$100, and all the orders are executed at this single price, so it is called a single-price auction.

[3] Because the liquidity provider must execute the orders at the pre-claimed bid or ask prices without any renegotiation with the trader.