

Should Securities Markets Be Transparent?*

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Financial markets have traditionally been viewed as providing a function of price discovery, i.e., finding prices that equilibrate supply and demand. Another objective of markets is to assist in the process of capital formation. Secondary markets allow initial purchasers of claims to exchange these claims at fair prices should their investment objectives change.

While efficient price discovery is crucial, there is another equally important attribute of markets that merits consideration, namely liquidity. Efficient prices, after all, are unimportant if one can transact only a 100-share lot at these prices. Liquidity was historically provided by dealers who buy or sell securities on demand. In the past, where communication links were poor and buyers and sellers had little information about current market prices, it made sense to rely on dealers who stood ready to buy or sell on demand by posting bid and offer quotes. In the modern world, advances in communications technology allow buyers and sellers to interact with one another at current prices in an electronic auction without the need for a physical exchange floor or for dealer intermediaries.

The electronic or automated auction is widely used to trade equities, derivatives, bonds, and foreign exchange. In this model, liquidity is supplied by public investors rather than by dealers. But how to attract liquidity? Investors will move to a venue that provides what they want. For institutions, these requirements include:

- direct access, electronically;
- automation;

* For complete paper, see conference draft version.

- low cost;
- priority rules to give limit orders a chance to meet market orders;
- hidden orders;
- significant tick size that protects limit orders;
- anonymity, pre- and post-trade;
- an optimal level of transparency.

Of these, the last attribute is especially significant. Market transparency refers to the ability of participants to observe information about the trading process. An especially important aspect of transparency concerns the effect of widely publicizing information about investors' latent demands present in the limit-order book. This topic lies at the heart of controversial debates (regulatory, academic, and practitioner) about floor versus automated trading systems, the informational advantages of market-makers, and inter-market competition between trading systems with different levels of transparency.

Some regulatory responses to transparency questions have been predicated on the belief that greater transparency will increase the efficiency and fairness of securities markets. For example, both the U.S. Securities and Exchange Commission and the U.K. Office of Fair Trading have called for increases in transparency in their respective securities markets as a way of improving market quality. However, this salubrious view of transparency is not universal. The U.K. Securities Investment Board, for example, opposes increases in transparency; it contends that transparency increases will reduce liquidity, since market-maker positions must be publicly disclosed. Harris (1996, 1997) develops a similar argument where changes in transparency alter a trader's ability to strategically expose orders, which results in increased transactions costs or reduced liquidity when trades are withdrawn to avoid revealing orders to parasitic traders. Given the controversial positions and the significant theoretical research in the area, it is unusual that O'Hara (1999) points to the lack of empirical evidence that transparency "matters" in the sense that it affects liquidity, transactions costs, and hence asset values.

Experimental (laboratory) studies offer considerable promise for understanding the more subtle aspects of transparency. In an experimental study, human subjects trade in artificial markets, allowing researchers to study the effects of changes in information in a controlled setting. The ability to frame controlled experiments also allows researchers to gather data on traders' estimates of value over time, their beliefs regarding the dispersion of "true" prices, and the trading profits of various classes of traders. Recent

experimental studies confirm that transparency matters and often in very complex ways.

Experimental studies do not duplicate natural environments, but the importance of experimental research is heightened by the lack of natural experiments where markets have made exogenous changes in transparency. The few natural studies of transparency have generally focused on post-trade transparency, such as the issue of delayed trade reporting where natural data exist. Yet pre-trade transparency is as critical—if not more so—to the provision of liquidity and hence to intermarket competition. Pre-trade transparency issues permeate debates on the willingness of investors to supply liquidity through limit orders, the growth of upstairs (off-exchange) trading, the desirability of pre-announcements of intentions to trade (sunshine trading), the nature and extent of disclosure of order imbalances at openings or trading halts, and most recently, the choice of floor-based or automated trading systems.

In an ideal environment, pre-trade transparency would be studied during *changes* in transparency regimes, using natural experiments to examine prevailing theory. Although experimental studies are appropriate when natural experiments are not available, a natural experiment occurred on 12 April 1990, when the Toronto Stock Exchange (TSE) instituted a computerized system to disseminate real-time detailed information on the limit-order book to the public. This rule change applied to both the stocks traded on the TSE's floor (the more actively traded issues), as well as to the less actively traded stocks traded on the TSE's computer-aided trading system (CATS), and the rule change allows us to study the impact of a dramatic increase in pre-trade transparency on *the same stocks in the same market structure*.

Beyond the rarity of such a change in transparency regime, the TSE's protocol change is of special interest for several reasons. First, the TSE's CATS, instituted in 1977, is the blueprint for most automated trading systems in existence, most importantly the Paris Bourse. Thus, the experience of the TSE has implications for many existing markets worldwide.

Second, the wide cross-section of stocks in our sample allows us to make inferences regarding the effects of changes in liquidity and transactions costs on asset prices, a topic of considerable research interest.

Third, the protocol change allows us to isolate the effects of changes in disclosure across two systems *that already differ in the amount of transparency they offer*. In particular, the TSE's floor resembles the NYSE (New York Stock Exchange) in that *only* the registered trader—the TSE's

equivalent of the NYSE specialist—observed the limit-order book. By contrast, CATS already offered a high degree of transparency to all members, but not to the general public. Of course, these two systems are in no way intended to be controls in our study.

Fourth, some Canadian securities are traded in U.S. markets, which allows us to study the effects of changes in disclosure on cross-border order flows without complications arising from time-zone effects. Such an investigation sheds light on the effects of global competition for order flow among markets with different disclosure regimes.

Finally, the TSE's transaction data allow a detailed analysis of the effects of changes in transparency across "internal" dimensions.

Regulatory interest in pre-trade transparency stems from the differences in transparency that exist both nationally and internationally. Automated limit-order-book markets (e.g., Paris Bourse and Toronto CATS) disseminate not only current quotes but information on limit orders away from the best quotes. Consequently, these markets offer higher degrees of transparency than U.S. markets, which generally display only the best bid or offer. U.S. markets are either fragmented, screen-based markets (Nasdaq) or floor-based markets—NYSE, AMEX (American Stock Exchange), CBOE (Chicago Board Options Exchange), CBOT (Chicago Board of Trade). In floor-based markets, customer limit orders are held either by a specialist in a central book, which is not publicly revealed (NYSE, AMEX, and regional exchanges), or by individual brokers and not revealed to the market (CBOT). The exception is the CBOE, where the "book" of customer limit orders can be viewed by traders on the floor. Hence, the CBOE has the highest level of pre-trade transparency among U.S. exchanges. These differences in transparency pose a dilemma for regulators and policy-makers, because they complicate the task of integrating financial markets, both within the United States and internationally.

Academic interest in transparency is reflected in a rapidly growing theoretical, experimental, and empirical literature on the relationship between information and security prices. Previous theoretical research finds that transparency (i.e., providing information about traders' identities and motivations for trade) affects various dimensions of market quality, including liquidity, trading costs, and the speed of price discovery. Models by Pagano and Röell (1996), Chowdhry and Nanda (1991), and Madhavan (1995, 1996), among others, reach mixed conclusions regarding the effects of transparency. The lack of consensus arises because transparency admits many definitions as well as the difficulty in modelling behaviour (designing experiments) when traders' strategies are endogenous to trading protocols and information. None of these papers, however, explicitly addresses the

type of pre-trade transparency (i.e., public display of limit-order books) examined here.

Our analysis begins with a simple framework within which we explore the issues raised by the public display of limit-order books. Theory suggests that greater transparency of this form will result in more efficient order placement by market-order traders. Since trading is a zero-sum game, this gain in expected profits is associated with larger losses to liquidity providers if the limit-order book remains as deep as before. It follows that liquidity providers will be less willing to provide free options to the market in the form of limit orders and, hence, that spreads will widen.

Our empirical results strongly support the view that transparency matters in the sense that it has an economic effect on trading costs and liquidity. We find that higher transparency does *not* improve market quality. In particular, our analysis shows that transactions costs increase after the introduction of the rule change, even when controlling for other factors that may affect trading costs, such as volume, volatility, and price. This finding is consistent with a decrease in liquidity under transparency because limit-order traders are reluctant to offer free options to other traders. Cross-sectional evidence shows that the reduction in liquidity and increase in transactions costs are associated with reductions in asset values, consistent with the predictions of Amihud and Mendelson (1986) and Brennan and Subrahmanyam (1996). There is no evidence, however, that spreads of cross-listed stocks widen in other markets, nor is there any significant order-flow migration from one exchange to another. We discuss the implications of these results for public policy, including issues relating to intermarket competition between trading systems with different levels of transparency, public display of limit-order books, and the design of automated trading mechanisms.

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