

**What glory price?
Institutional form and the changing nature of equity trading**

by

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Abstract

The last decade has increasingly witnessed marked change in the manner by which equity securities are traded, especially in the United States. Trades are no longer consummated only on a formal stock exchange but also on a continuum of functionally equivalent trading venues with radically different organization forms. This paper discusses how equity markets are evolving and the underlying economic reasons for these changes. I argue that two factors, technological progress and the process of regulatory arbitrage, have enabled newer more efficient organization forms for stock trading. However, the proliferation of trading venues has brought its attendant problems. Markets have fragmented as new entrants unbundle the standard package of services offered by traditional exchanges and compete on only the most profitable portions of the business. This has posed challenges for federal regulators such as the Securities and Exchange Commission, which would like to foster competition and encourage innovation. It has also altered the competitive positions of brokers that are customers of the exchanges. I argue that such a landscape may challenge simple economic maxims such as “the law of one price.” The policy implications of this are legion when considered against the backdrop of securities regulations that have devolved from a framework adopted in the 1930s.

*Thou shouldst rather ask if it were possible any
villany should be so rich; for when rich villains
have need of poor ones, poor ones may make what
price they will.*

William Shakespeare
Much Ado about Nothing (Act 3, Scene 3)

1. Introduction

I was recently at an industry conference with a colleague. During a break in the program our conversation turned to matters other than finance. She remarked that she had recently become interested in acquiring an antique clock made a century ago by a now-defunct company that used to be located in her town. She had spoken to some clock dealers about buying such a clock and learned that dealers will use eBay, the online auction, to buy and sell merchandise for subsequent resale. She was amazed that such unique and idiosyncratic items as antique clocks could find a successful marketplace in an anonymous internet auction. When she logged into eBay, not only did she find clocks of the type she wished to buy, but she was able to peruse the market's offerings and get a better feel for how much she should be paying for a working clock. In the end she made her purchase not on eBay but from a clock dealer near her town.

What is both striking and relevant for my purpose is that eBay provided a useful and free service to this buyer merely as a by-product of its core auction business. It allowed my colleague to know the price she should expect to pay for her clock. She no longer needed to rely on the good offices of her local clock dealer, which presumably meant she was able to pay a lower price than she otherwise would have paid in the absence of the eBay information.

The formation of a valuable price as a by-product of trade is not limited to clock auctions. There is a story that circulates around academic circles that attributes to William Batten, at one time the Chairman of the New York Stock Exchange (NYSE), the statement that “we produce the price.” I could not reliably verify the quotation and I am not certain that it matters for the purposes of this paper. One cannot debate that a central feature of most exchanges is that a price that arises as an outcome of trade, and that in most cases investors other than the trade counterparties would be eager to know the trade price.

Robert Merton developed a functional perspective to analyze financial systems. He states that any financial system performs six basic and immutable functions. He argues that although institutional forms may change over time or may be divergent across countries, these six functions must be performed by any well functioning financial system. One of the six functions concerns the price. Merton’s formulation states that “a financial system provides price information that helps coordinate centralized decision making in various sectors of the economy.”¹

The importance of creating and disseminating prices lies at the heart of this paper. I will focus on the evolving structure of equity markets, paying particular attention to the environment and treating of the pricing function along the way. Decisive change is occurring in the equity marketplace. Trading volume is expanding rapidly, both for institutions and for individual investors. New venues for trade are springing up, known variously as ECNs (Electronic Communication Networks) and ATSs (Alternative Trading Systems.) For the first time since 1973 a new securities exchange, the International Securities Exchange, has been opened in the United States. That this time is unique should not be in doubt. Seen over the long run, the 20th

¹ See Merton and Bodie (1995) as well as Merton (1993). The other five functions include clearing and settling payments, pooling resources and subdividing shares, managing risk, transferring resources across space and time, and dealing with incentive problems.

century was generally an environment in which the number of trading venues in the United States declined. Angel (1998) reports 41 exchanges that were shuttered or merged during the 1900s. Even in the past 3 years there have been at least two failed mergers among the extant exchanges. Thus the sudden burst of new trading venues is truly unique when seen against the backdrop of the last century. Not only are there more places to trade, but several new business models (wholesaling brokers, e-brokers, internalization of order flow, etc.) have taken hold.

It is reasonable to ask why this change is occurring now. I believe it is because of the confluence of two distinct factors. The first is the rise of new communication technology, including the internet. This technology lowers the cost of gathering order flow from remote points and allows the introducing broker to transport the orders to a venue of choice.² In particular, it has become much more profitable for brokers to handle the small orders of retail investors orders. In the past, the fixed cost of handling the small orders rendered them a much less attractive prospect. Thus it is the trading of retail rather than institutional order flow that has been the genesis for the restructuring of much of the equity markets. Also, the cost of creating a new trading platform is quite small. Computerized markets have none of the bricks-and-mortar cost associated with traditional floor-based exchanges. These markets case use the internet for connectivity, obviating the need for dedicated networks. Open limit order book systems, modeled after Toronto's CATS system, have been provided to emerging market countries as their nascent exchanges at low cost.

The second reason that rapid change in this market is occurring at the present relates to regulatory arbitrage between traditional exchanges and broker-dealers. New entrants into the

² An introducing broker is the agent that interacts with the customer and takes his or her order. This may be distinct from the executing or clearing broker who actually handles the details of order completion.

trading platform business, ECNs and ATSS, are offering quasi-exchanges that are organized for regulatory purposes not as exchanges but as broker-dealers. The reason for this is an issue of cost. Not only do traditional exchanges bear the costs associated with brick-and-mortar, but such exchanges are subject to more stringent Securities and Exchange Commission (SEC) regulation and must perform a host of regulatory functions required of any self-regulatory organization (SRO.) These tasks include oversight of SRO members, governance procedures, market surveillance, and the filing of rules with the SEC. The new ECNs are organized as broker-dealers and are required to join an SRO, which must in turn perform a set of regulatory functions (for a fee) upon the ECN. Because the ECN is a broker-dealer and not an exchange, issues such as surveillance, rule filings, and governance are not applicable. Thus, by organizing as a broker-dealer, the new entrants can escape the regulatory tax associated with being an exchange/SRO.

This brings us to the crux of the issue plaguing markets and the central regulator at the moment, which is that *trading venues that perform substantially identical economic functions are subject to different regulatory obligations and costs.* Both the exchanges and the ECNs transact shares, but it is no coincidence that all of the new equity marketplaces have chosen to organize as broker-dealers. To be sure, the SEC has attempted to ameliorate the discrepancy but the cost differential remains.³ Up until recently the possibility of such an arbitrage was not germane because there was no technology to allow a broker-dealer to perform exchange functions. This is no longer the case.

This difference has left policy makers in a difficult position. Like my colleague in search of a clock, the externalities such as prices associated with an exchange are important to commerce. And unlike my colleague, who dealt in a private-value auction for a single good,

share prices are determined in a common-value auction with multiple units for sale. The manifest purpose of share markets is to allow for efficient channeling of capital from investor to productive firms. A well-crafted policy is one that will serve to enhance this capital flow, thereby lowering the cost of capital for firms. One can imagine a policy that simply forces all trade to a single point, whether physical or electronic, and applies a uniform regulatory policy to all who participate. The basic problem with this approach is that the benefits that have accrued to investors over the last half of the decade have come from innovations brought by the new entrants. They have been the adept users of technology, new services, e-brokerage, and so forth. Many of the traditional players in the market, whether brokers or exchanges, have only innovated because they heard competitive footsteps of the new entrants. Policy makers are therefore caught on the horns of a dilemma: whether to allow competition and new entry to continue, thereby conferring benefits on investors, or whether to rationalize the regulatory environment and, to use a popular but misleading phrase, “level the playing field” for the economically equivalent entities. The situation is also cast as one of market fragmentation, where investor orders are scattered among various competitors, depriving market participants of the benefits that arise from a traditional centralized auction.

This paper will analyze this issue in some detail, paying particular attention to the role and quality of price discovery in this process. It is an issue of critical importance within our financial system. This was recognized by Richard Grasso, Chairman of the NYSE, when he wrote to the Chairman of the SEC, Arthur Levitt, expressing his concern over the problems that after-hours trading was causing in reported prices. In speaking of the effect that small trades in after-hours trading can have on reported closing prices for issuers, Grasso stated that “the

³ Specific regulatory issues will be discussed in more detail in Section 2. It should be noted that two ECNs, Island

cumulative effect of many of these kinds of events, and there are several every evening, week in and week out, is to convince people that the tape cannot be trusted. Our best tool for insuring transparency in our markets is being destroyed.”⁴

2. Exchanges, broker-dealers, and the law

Regulation and law is an important factor in governing market developments. For example one could ask if, like the antique clock, shares might not be traded on eBay. The answer is that as a technical matter the shares could be traded there but that doing so would be in violation of the securities laws because eBay is not a registered securities exchange. It does not provide the protections to investors that the law demands, nor does it perform the necessary complement of functions required of an exchange. As will be seen below, there is a certain amount of arbitrariness to exchange regulation. Because of this, it is the case that both incumbents and new entrants use regulation to their own advantage. Incumbents generally point to the law, intone sacred phrases such as “investor protection” and assert that entrants are bypassing the spirit if not the letter of the law in creating new exchange forms. New competitors, in turn, have skirted the edges of what much of the law intended in an effort to gain a relative advantage, often putting institutional form over substance. This is made all the more complex in light of the fact that the framework under which all this occurs was drafted in 1934, long before automated trading was even imagined.

and Archipelago, have filed with the SEC to convert from broker-dealer to exchange status.

⁴ Letter from NYSE Chairman and CEO Richard A. Grasso to SEC Chairman Arthur Levitt re: Extended-Hours Trading, dated April 6, 2000.

A brief history of recent exchange regulation

The beginning of the change that has swept our equity markets began with the SEC's 21(a) report that faulted the National Association of Securities Dealers (NASD) for failing to adequately supervise the Nasdaq market.⁵ In the wake of that report, a policy window opened in which the SEC could effect major changes in market structure. The result was the Order Execution Obligations, more commonly known as the Order Handling Rules.⁶ These consist of two rules that increase the transparency of the marketplace. The Limit Order Display Rule requires exchange specialists and Nasdaq market makers to immediately display in their bid or offer both the price and the full size of each customer limit order that would improve their quoted price in a particular security. It rectifies the problem of market makers holding better-priced customer orders without showing them to the entire market place for interaction. The second rule, the Quote Rule, requires market makers to reflect, in their own bid and offers, any superior priced quote that they enter into an ECN. An exception to this requirement occurred when the ECN disseminated its quotes to the public at large and stood ready to trade with the public at its posted prices. This rule was meant to solve the problem of certain ECNs being used as an inside market in which dealers traded at advantageous prices among themselves, while trading at inferior prices with their public customers. Because the public could not see the ECN prices, many did not know that dealers were failing to give them the best price available in the market. The Order Handling Rules are widely held to be successful in improving the quality of the Nasdaq market.

⁵ Report Pursuant to Section 21(a) of the Securities Exchange Act of 1934 Regarding the NASD and the NASDAQ Market, Securities Exch. Act. Rel. No. 37542 (Aug. 8, 1996).

⁶ Order Execution Obligations (Rules 11Ac1-4 and 11Ac1-1), September 6, 1996, SEC Release No. 34-37619A, File No. S7-30-95.

Within a year after these rules, the SEC issued a concept release asking, among other things, how Alternative Trading Systems (ATSs) should be regulated.⁷ Because of the broad way in which the SEC defined an ATS (it includes all ECNs at a minimum) the concept release expanded the scope of trading venues for which the SEC was considering new regulation. In late 1998, the SEC issued its new exchange regulation, spelling out the conditions under which an ATS would be regulated going forward.⁸ The rule basically gave ATSs a choice of registering as a full blown national securities exchange or registering as a broker-dealer and complying with a new Regulation ATS. The spirit of the rule is to require ATSs to increase the amount of transparency, connectivity, access, and price dissemination based on the amount of volume the ATS trades. In particular, the ATS must link into the national market system through an exchange or the Nasdaq. Because the ITS was not usable by ATSs for all practical purposes, ECNs were required to hook into the Nasdaq and thus would fall under NASD regulation.

It is worth noting that the SEC was forced to draw a line in the sand about what is and what is not an exchange. In Regulation ATS, the SEC set two primary criteria for determining what was an exchange. It is defined as any organization, association, or group of persons that: (1) brings together the orders of multiple buyers and sellers; and (2) uses established, non-discretionary methods (whether by providing a trading facility or by setting rules) under which such orders interact with each other, and the buyers and sellers entering such orders agree to the terms of a trade.⁹

The sentence is as important for what it omits from the definition of an exchange as it is for what it captures. The key phrase here is the use of “non-discretionary methods.” For

⁷ Regulation of Exchanges, Release No. 34-38672; File No. S7-16-97, May 23, 1997

⁸ Regulation of Exchanges and Alternative Trading Systems. December 8, 1998, Release No. 34-40760; File No. S7-12-98.

example, the rule does not cover entities such as an upstairs or block trading desk. A block desk searches for counterparties to large institutional trades, negotiates the terms of that trade, including the setting of a price, and then consummates the trade. Most economists would argue that these are just the functions carried out by a traditional exchange.

Explicitly exempted from this definition are several types of entities. First, the definition excludes systems operated by a single market maker to display and execute against its own bids and offers and the limit orders of its customers. It also excludes systems that allow persons to enter orders for execution against the bids and offers of a single dealer. Taken together, the Commission exempted systems that internalize order flow within a broker-dealer and prevent those orders from interacting with the public order flow at large. Finally, the definition excludes crossing networks such as ITG's POSIT and Reuters' Crossing Network, which passively price and trade shares based on prevailing quotes in the central market.

3. The functions of an exchange

Most observers tend to view exchanges from an institutional view. That is, exchanges are defined by the edifice they occupy, the floor space on which members trade, or perhaps the computer system that supports trading. There is another way to view an exchange, however, which is from the viewpoint of the functions that the exchange provides. I argue that exchanges can meaningfully be deconstructed into six basic functions, which are listed and explained below.¹⁰ Not all exchanges have each of these functions within them; some may only have two or three. By thinking in terms of the functions the exchange provides, we are better able to

⁹ Rule 3b-16(a), 17 CFR 240.3b-16(a).

understand the competition that is going on in the transactions services industry. This, in turn, leads to a functional consideration of the regulatory burden applied to entities that call themselves exchanges. In particular, two entities may both call themselves exchanges, but provide different functions from the exchange menu. In such a case, the two exchanges should have regulatory obligations that match their different functional descriptions.

A functional perspective has the additional benefit that it is not altered by institutional form. The institutions in which the functions of an exchange take place have changed and will continue to change over time, but the functions that exchange provides are constant. Advocacy of a functional framework analyzing financial systems has received considerable attention from Robert Merton.¹¹

1. Exchanges facilitate the search for a counterparty, or the opposite side to a trade.

People come to an exchange to trade and at a minimum you need a counterparty for a trade. Counterparties can be searched for in various ways. On an exchange floor, physical presence, brightly colored clothing, and open outcry can signal a desire to trade. Most exchanges have some mechanism for advertising the fact that there is a desire to trade. However, this is not always the case. Certain exchanges have as a *raison d'être* the absence of this function. For example, Optimark is a truly anonymous trading system organized as a crossing network that is a facility of the Pacific Exchange. Shares are crossed at pre-specified times, but no information leaks out of the “box” about trading demand. Counterparties are found by temporal aggregation but little is done in the way

¹⁰ See also Sirri (2000).

¹¹ See for example, Merton (1992), Merton (1993), and Merton and Bodie (1995).

of aggressive search. Contrast this to the upstairs block market where skillful search is everything.

2. *Exchanges disseminate market intelligence before trade occurs, either as formal quotations or as other soft but valuable information.* In its most common form, pre-trade information takes the form of a quote, either binding or not. SEC and exchange rules generally cause formal exchange quotations to be binding.¹² To the extent that market participants are able to advertise their desire to trade, exchanges will informally disseminate that information to some or all of their members. On the floor of the NYSE, the specialist often keeps order information for his customers, disseminating soft indications of interest to other traders and eliciting their demands as well. For example, if a buyer tells him he is looking to accumulate a substantial position of stock, the specialist will keep tally of who is selling shares and create an information flow between the parties. This is critical on a floor because not all traders are present at any one time.

3. *Exchanges consummate trade, determining the price and quantity that clears the market.* This is the classic function of an exchange, determining the quantity and price at which cash and securities are to change hands. In those markets that have price formation, this function is paramount. It is one of the most valuable traits of the NYSE--most players in the market regard the price determined on the Big Board to be the price in the market. Indications systems, such as Aut-Ex, of course do not engage in trade and hence have no

¹² Major securities firms that wish to advertise quotations to customer but do not want to be deemed an ECN do so by placing indication screens in their trading firms that allow customers to advertise block trading interest to the

price. Intermediate between Aut-Ex and the NYSE is the crossing networks such as POSIT and Crossing Network. These systems look up the price of trade on the NYSE or Nasdaq and then cross matching buy and sell interest at the NBBO prices, free-riding in effect on the price formation in the central market.

4. *Exchanges disseminate post-trade information, such as the price and quantity of the trade.* At the moment of trade, only the counterparties know the price of the transaction. U.S. securities law requires that no later than 90 seconds after trade occurs, exchanges must report the price and quantity of the trade to the central reporting system. For systems like the NYSE, this price is valuable and the exchange is able to charge for it. Data fees are a primary sources of revenue for the NYSE. No useful price information comes out of a crossing network of course, though the quantity information may be of some marginal interest.

5. *Exchanges clear and settle the trade.* Clearing is the process of comparing and matching the various parties to a trade so that everyone agrees on the cash and shares to change hands. Full blown exchanges usually have clearing operations. Even smaller operations such as the Philadelphia Exchange, the Boston Stock Exchange, and the Chicago Stock Exchange, either have operated their own clearing operation or have only recently ceased doing so. Conversely, POSIT outsources clearing to a large broker-dealer better able to process the paperwork and assume the risk in the trades. Interestingly, Instinet chooses to

firm, and kind of non-firm quote. Even though the indication may be broadly disseminated, because the quotation is not firm it avoids the ECN designation and hence regulation.

self-clear, meaning that they do all the comparison and matching work themselves. This choice may in part be due to anonymity considerations of their clients.

6. *Exchanges certify, both implicitly and explicitly, the quality of the issuers whose shares trade on the exchange and the quality of the trading counterparties who transact on the exchange.* This guarantee, along with price formation, is at the heart of the functions of a traditional exchange. Listing requirements, self-regulation, market-watch, and surveillance functions are all things that full blown exchanges take upon themselves. Notably they are totally absent from the new entrants to the marketplace, the ECNs. ECNs may evaluate traders to ensure that they are not likely to default on their trades. However, the clearing agent is probably better able to do this than the ECN. Also, ECNs simply trade those shares that are listed on another exchange, free-riding not on the price formation as a crossing network does, but on the certification aspect of the exchange. In fact, for an electronic trading system like an ECN, there is not apparent reason why either listing firms or traders should be guaranteed or certified by the exchange. The fact is that the ECN would have no comparative advantage in doing so. There is no economic reason why the administrator of a computer network with a good order and transactions audit trail would be better at a surveillance or certification function than a special purpose entity. For physical exchanges, such as the NYSE, the bundling of on-floor surveillance and operation of the floor is sensible, in that proximity to the process may lead to more informed monitoring. The skills required to monitor trading or issuer behavior in an electronic system may be best executed by an accomplished auditor who is facile at dealing with large amounts of objective data. Finally, the certification function is one of

the most expensive, in terms of manpower and contingent liabilities. It is not surprising that all of the new entrants have chosen to join the NASD and outsource this function.

Exhibit 1 analyzes a representative group of trading venues using this functional perspective and evaluates the importance of each of the six functions to the exchange's core operations. There is considerable variation in how important each function is to an exchange. Only for the NYSE and the Nasdaq are all six functions central to the exchange.

The six functions listed above may display considerable variation as to their form when reflected in actual exchanges. For example, a web based aluminum exchange, www.aluminium.com, provides a venue for buyers and sellers of various types of aluminum to meet and trade. On this exchange, prices are not made public after the trade; they are only known to the counterparties of the transaction. The exchange takes no part in facilitating completion of the trade in terms of the clearing or settlement function. However, the exchange does bundle a financing option with trade (using a financing subsidiary) enabling either the buyer to receive funding or the seller to get their sale proceeds more quickly.¹³ Though not strictly a settlement function in the sense of traditional financial exchanges, the financial arm of the exchange serves a similar function. It diminishes the likelihood of a failed transaction by interposing a financial intermediary to bear counterparty performance risk on either one or both sides of the transaction. In essence, members can elect to opt in and pay for a the third party guarantee provided by the financing arm as they see fit.

Of course, the fact that various equity exchanges contain different combinations of these functions is a reflection of their underlying business strategies. In a recent speech, Richard

¹³ The securities laws in the United States prevent an exchange from financing the transactions of buyers or sellers.

Grasso said that he saw the role of his exchange as one of a “liquidity aggregator,” an expression that does not directly map into these six functions.¹⁴ By this, Grasso means that he hopes to offer a menu of functionality to an array of investors and issuers and let them decide how to best accomplish their goals. This is in contrast to the functionality offered by an exchange such as the Chicago Stock Exchange. It is a venue that has specialized in the execution of small to medium sized orders of shares whose primary listing is on another exchange. The NYSE lists 3,100 firms. In contrast, the CHX has only 17 uniquely listed firms yet trades 2,872 NYSE issues and 450 Nasdaq issues.¹⁵ Clearly the CHX is not attempting to compete by functioning as a guarantor of quality, which generally requires a listing process.

4. Economics of orders

It is a given in the equity markets that not all orders are equally profitable to trade against. Professionals have a strong preference to interact with order flow emanating from retail customers. The reason for this is that retail order flow is regarded as being uniformed; that is, it has little information about future prices. For example, if I as a broker receive an order from a retail investor who wants to buy 5000 shares of Motorola, I may consider selling the investor shares out of my proprietary account or shorting the stock in the market. To do so, however, I will be accepting a risk that prices do not rise following my sale of stock. The likelihood that this happens when a retail investor buys stock is small because by and large retail investors do

¹⁴ See speech by Richard Grasso at Investment Technology Group conference at <http://www.itginc.com/eyeofthestorm/home.html>.

¹⁵ Annual Report of the Chicago Stock Exchange, 1999.

not know anything unique or material about the firm. Such investors are said to be “uninformed.”

This is in contrast to an institutional investor or corporate officer who wants to buy shares in a firm. Such investors only do so if they have reason to believe share prices will rise. Accordingly, I as a broker am less willing to trade with such entities, or if I do trade, I will only sell them shares at a higher price. Often times, I am unwilling to trade at all with such “informed” investors. The reason can be seen from considering the extreme case of a trader who knows with certainty what the price of a share will be tomorrow. If that trader is willing to trade with me at the price I quote, it must be that I am quoting the ‘wrong’ price and will lose money because fully informed traders will never enter into losing transactions.

The formalism behind such a model of trading has been developed by Glosten and Milgrom (1983), Kyle (1985), Easley and O’Hara (1986), and Admati and Pfleiderer (1988). They cast the problem as a model of adverse selection in a setting of asymmetric information. For our purposes, the important consequences of such models are that in competitive markets that can distinguish buyer informativeness, uninformed traders should buy shares at lower prices and sell shares at higher prices than are available for informed traders. However, in a central market there is only one price at which everyone trades. This means that profits can be made by trading with uninformed traders at this price, whereas losses will be suffered when a trader meets the occasional informed trader at that same price. Said another way, an investor would rather buy 10,000 shares that came from 10 individual orders to sell 1000 shares each than trade with a single sell order of 10,000 shares generated by a professional active portfolio manager.

The key to profitable trading in a market is therefore to find a way to separate the informed from the uninformed traders. Much of the innovation in market structure has been

about finding an acceptable method to accomplish this separation within the framework of the securities law.

5. Transactions business and institutional form

Any entity that chooses to enter the market for transaction services must decide what institutional form to take so as to maximize their trading profits. At a minimum, this involves the decision of whether to operate as a broker-dealer or as an exchange. A complete analysis of the question is beyond the scope of this paper but we can list some of the advantages of each form. If the entity chooses to organize as an exchange, they can set their own rules of trade on the exchange. In addition, the exchange generates tape revenue and data fees by producing and selling quotations and the price/quantity information that results from trade. Finally, organizing as an exchange prevents a potential SRO competitor from acting in a self-interested manner when overseeing the exchange's operations.¹⁶ On the other hand, for the reasons discussed above organizing as an exchange is costly from a regulatory perspective. It also takes more than a year to get regulatory approval to start a new exchange. For these reasons, entrants have chosen to organize as broker-dealers.

As discussed above, the onset of communication technology has unlocked the profitability of retail orders for introducing brokers. In the past, the uniformed retail orders were simply routed to the central market, generally the NYSE or the Nasdaq, where the market maker kept the rents from the trade. Today, these orders can be packaged and routed among various venues, allowing the introducing broker to enjoy some or all of the information-driven profits. It

¹⁶ This is one of the most often heard complaints of ECNs and ATNs that organize as broker-dealer and are in turn regulated by NASD. The NASD operates the Nasdaq as a for-profit facility, causing some ECNs to complain about rules that serve the interest of Nasdaq over the member firm competitors.

remains, however, for the broker-dealer to select an appropriate form to capture the rents bound up in the retail order flow they direct.

There are at least four mechanisms to capture these rents. The simplest model is to trade all retail orders as principal against the broker-dealer's own account. In such a model, the introducing broker is the executing broker as well and serves as counterparty to all trades. Of course, such a model requires technology, skill, and scale and is not feasible for most brokers. The largest users of this model are Schwab (Mayer and Schweitzer), Salomon, and Merrill Lynch. A second model is to vertically integrate and buy a specialist or market making operation. Fidelity is a good example of this model. They are the largest specialist operation on the Boston Stock Exchange, trading not only their own customer's order flow but that of other parties as well. Third, a small broker may engage in the practice of payment for order flow and receive a side payment from a particular dealer for directing all order flow to them. Though this may at first seem a suspect practice, it is allowed under the securities law provided that the executing broker treats the introducing broker's customers fairly. From the perspective of the introducing broker, this is an instance of selecting the "buy" over the "make" in the make-or-buy decision. Pershing Securities and Madoff Securities are examples of entities that engage in payment for order flow to introducing brokers. Finally, there is the possibility that a group of brokers may mutualize and take a financial interest in an entity that engages in trade among its investors. Broker members agree to send their orders to this mutual organization and in turn receive a share of the firm's profits. Knight Securities and Herzog, Heine & Geduld, Inc. are the two largest examples of such a form of organization. These firms are known as wholesale market makers and may also pay non-members for their order flow.

These four mechanisms affect more than just the price discovery process. Because the institutional forms are predicated on a lack of strict price-time priority in the market, they can leave other investors who lack access to captive order flow without a counterparty to trade. This has created a backlash among some industry participants. A common complaint among institutional investors is that internalizing and preferencing dealers steal order flow away from the central market. When these institutions attempt to bid for orders by raising their prices, the internalizing broker-dealers simply match the new price and continue to capture the orders. This theme can be seen in Exhibit 2, which shows an advertisement for the new PCX/Archipelago exchange, playing on the theme of fair treatment of members. Though this is an important aspect of market fragmentation and may have serious consequences, it is outside of the scope of this paper, which focuses on price discovery.

The combination of an execution with an order entry facility can be a powerful and profitable combination. Technology is such that some broker-dealers have invested in systems that let them monitor the profitability of trading as principal against their retail customers on a name by name basis. Other firms are said to have provide order entry brokers with screens that inform them which stocks to promote based on the market quotations and current real-time inventory of the firm, providing higher commissions for supplying order flow to the dealer when it is most needed.

To appreciate how important this change in market structure has been, consider the case of the NYSE. Though the NYSE has a market share of approximately 90% of all orders among the six U.S. equity exchanges, their share of small retail orders is under 50%. Further, Peterson and Sirri (2000) report that orders of 500 shares or less make up about 54% of the NYSE's order composition, where has they make up approximately 80% of the order flow on the regional

markets. These statistics reflect the migration of the most profitable type of orders, uninformed retail trades, to regional exchanges that have specialized in facilitating the capture of rents via one of the mechanisms described above.

The result of these institutional arrangements is that the economic forces that drive broker-dealers to profit have also driven them to segment the order flow to their own advantage. In both the listed and the Nasdaq markets, orders flow not to one central linked exchange or facility but to regional exchanges and specialized broker-dealers that trade as principal against the incoming order flow and then share the subsequent rents of this trade with the order entry firms. The result is that the markets are fragmented and near simultaneous trades take place at many points without order interaction.

6. The fight over the price

We have now set the stage to consider the core issue of this paper, which is the effect of the various changes in market structure on the discovery and dissemination of price. Recall from section 3 that the discovery of price is one of the basic functions of any financial system. Prices are important positive externalities generated as a consequence of trade. They are basic signals to investors and are instrumental in allocating resources. This section of the paper will discuss four different ramifications of market structure changes on the discovery and dissemination of prices.

Retail investors and best execution

The discussion of institutional form in section 5 above illustrated how several business models can be used to extract rents from retail investors. There is however a limit to how much rent a broker-dealer can extract from a customer. A broker-dealer who takes a customer order to trade, whether as agent or principal, has a duty of *best execution* toward that order. As defined by the SEC, the duty of best execution "...requires a broker-dealer to seek the most favorable terms reasonably available under the circumstances for a customer's transaction."¹⁷ A broker who is charged with overseeing the execution of a customer's order has a fiduciary responsibility to see that the customer receives favorable terms of trade.

In the recent past this duty has been interpreted by some brokers as being satisfied if they provide their customer with an execution at the National Best Bid and Offer (NBBO) price, defined as the highest bid or the lowest offer in the market. However, it is possible for orders to receive prices better than the NBBO, that is, to receive "price improvement." Price improvement arises when a market-maker or specialist elects to pay more than the quoted bid, or receive less than his quoted ask, for a trade. This might happen if the market-maker's quote were set by a customer limit order and the market-maker wanted to participate in the trade as principal. To do so he would be forced to offer a better price to step ahead of the customer, providing price improvement to the market order. In addition, the SEC also requires that "a broker-dealer must regularly and rigorously examine execution quality likely to be obtained from the different markets or market makers trading a security,"¹⁸ so that periodic assessment of trading alternatives is also required.

¹⁷ Order Execution Obligations, September 6, 1996, SEC Release No. 34-37619A, pg. 171.

¹⁸ *Ibid.*, pg. 174.

Best execution is at the heart of how the SEC determines whether a broker receives a passing grade for the economics of their customer order routing and execution. Firms that execute customer orders pay a great deal of attention to the standards whereby best execution is evaluated.¹⁹ Adjudication of these standards is problematic however. The reason lies in the nature of the bundle of services an investor receives from his or her broker. Though best execution has a strong connotation of best price, the SEC has been explicit that “a broker-dealer must consider several other factors affecting the quality of execution, including, for example, the opportunity for price improvement, the likelihood of execution (which is particularly important for customer limit orders), the speed of execution, the trading characteristics of the security, and any guaranteed minimum size of execution.”²⁰

Thus, two investors might prefer two different convex combinations of the traits that constitute best execution, based on their own preferences for trade. In particular, some investors may be willing to trade off unbiasedness of price discovery in favor of other traits such as speed of execution. In other words, two investors with the same order might have two different views of what constitutes a good execution. This is not must a hypothetical example. Regional exchanges such as the PCX has specialized in providing rapid executions to brokerage firms that, a part of their business model, demand very rapid turn around times for their customers’ orders. These investors are willing to sacrifice some amount of price to obtain a rapid execution. A consequence of allowing broker-dealers to provide investors the package of execution services they desire is the prices coming out of such bargains are biased indicators of firm value.

The combination of regulatory focus and increasing public attention on issues of best execution has caused trading venues to begin to market themselves to customer in new ways.

¹⁹ For a more complete discussion of best execution and the law see Macey and O’Hara (1997).

Exhibit 3 is a best execution report taken from public NYSE information that documents the quality of executions provide by the Exchange as a function of order size. Production of such information is consistent with the SEC's goal of requiring market centers to produce more objective information to aid in broker's routing decisions.²¹ Another example of market positioning by an exchange is shown in Exhibit 4, which shows a print advertisement by the Chicago Stock Exchange. The ad promotes not only "a new spirit of equity for investors everywhere" but highlights the fact that the CHX is an appropriate trading venue for both retail, online, and institutional orders. The factors mentioned in the ad (number of stocks traded, hours of operation, market structure) are valid considerations for a broker making a prospective best execution determination.

Uniqueness of the price

The discussion of adverse selection above implies that the equilibrium price for trade is a function of how smart or informed the trader is. A rational seller would demand more for a share offered to an informed trader than to an uninformed. When all orders are funneled to one point this may be of limited importance in that over time gains and losses to market makers balance out. However, once different types of traders can be segmented in the market, it stands to reason that the competitive price for trade in each of these venues will not be unique. That is, when traders are segmented into different exchanges based on their characteristics, shares may be transacting a different prices at the same time even if the market is functioning well. A given stock therefore has more than once correct price at the same time, an apparent violation of the "law of one price." For example, index funds and passive/quantitative portfolio managers may

²⁰ Disclosure of Order Routing and Execution Practices, Release No. 34-43084; File No. S7-16-00, p. 39.

choose to trade shares among themselves at prices near the midpoint of a bid-ask spread while at the same time active managers are trading similar size blocks of stock at large price concessions.

Whether or not this effect is important is an empirical matter. It will in part depend on the uses investors have for price information.

The validity of the price

The above example documents an instance where the price may not be unique. I would now like to consider cases where the price may be *incorrect*. An example of where this occurs is in the notoriously thin trading after the close of the central market. For example, on February 24, 2000 Wal-Mart (WMT) closed on the NYSE at \$44 3/8, having traded over 19 million shares.²² At 6:10 p.m. 100 shares traded at \$46, up \$1 3/8 from the last trade. A little later, WMT traded up another \$1 on 200 shares to \$47, and the last trade, for 100 shares, was at \$47 7/8, up 3½ from the NYSE close. The next day WMT opened on the New York Stock Exchange at \$44 5/16, down only 1/16 from the previous NYSE close, but down \$3 9/16 from the last reported trade carried on the tape the day before. The overnight market capitalization of Wal-Mart was inflated by over \$15 billion by these trades. As Richard Grasso said of such trades, “if there is anyone who is still naïve enough to make a contract or price a transaction based on the consolidated close, they would also be materially affected by these anomalous trades.”²³ In an effort to ameliorate this problem, the Consolidated Tape Association (CTA, which produces the trade price and quantity data for public dissemination) has agreed to issue a daily 4:15 p.m. Market Summary of stock prices based on the close of the regular trading session. In addition, the CTA

²¹ Ibid.

²² This example is taken from the letter from NYSE Chairman and CEO Richard A. Grasso to SEC Chairman Arthur Levitt re: Extended-Hours Trading, dated April 6, 2000.

will append a “T” qualifier onto all trades that occur after-hours so that investors will not be duped by the large price movements that may accompany small after-hours trades.

A second example of invalid prices can be found in our domestic market quotations of international securities.²⁴ U.S. open end mutual funds generally price their shares for sale or redemption at the close trading, 4 p.m. EST. However, a problem has recently come to light when the funds contain substantial amounts of foreign equities. The problem arises because foreign markets such as Japan are closed for most of U.S. trading day. For a U.S. fund that holds Japanese stocks, these shares last traded around 1 a.m. EST when Japan closed. However, U.S. investors can buy the mutual fund at a net asset value that reflects these stale prices until 4 p.m. EST. If the U.S. market takes a sudden jump up or down during the day, it is reasonably likely that the Japanese market will react in a similar direction when it opens around 8 p.m. EST. Thus U.S. investors have an option to invest in fund at stale prices. The papers that have studied this have found that it is possible to earn returns of more than 40% above the base return in the fund by playing on the stale prices.

This problem is not due to the structure of United States markets, per se, but it is suggestive of what is in store as shares begin to trade more continuously around the globe. Prices evolve continuously, albeit at different rates depending on the time zone of the home country. Financial products such as mutual funds that rely on underlying asset prices will no longer be able to price at times other than when underlying securities trade. As U.S. investor trade more foreign securities in general, prices will need to be derived from home country markets. If these markets are not open, issues such as best execution will become increasingly

²³ Ibid.

problematic as broker will have not basis to determine what constitutes a fair price for an incremental amount of a security.

The price of the price

As a final example of the interaction between market structure and price discovery, we consider the case of the fees associated with the sale and delivery of market data. The data in question here are the quotations and the trade reports (prices and quantity) for transactions on securities exchanges and Nasdaq. Data fees have always been an important source of revenue for exchanges. Users of such data have generally paid nothing for data that was 15 minutes old but were charged a fee based on the number of users for real-time data. With the advent of internet brokerage, such pricing models became very costly to e-brokers who had millions of customers using real-time data to make trading decisions. Because the marginal cost of distributing the same information to an additional investor was virtually zero, the explosion of retail investor was meant a sharp increase in fees for SROs who generate this data. These SRO revenue are in turn costs of their member brokers.

The rise of e-brokerage has in fact made market data more valuable than it once was. This raises the immediate question of who should get the new surplus. The exchanges, which have recently scaled back the fees they charge for market data, maintain that they should be allowed to charge a reasonable price for this information, and implicitly wish to garner some of the surplus. The broker-dealer community, and especially the e-brokers, feel that market data fees should be regulated and priced on a cost recovery basis. They argue that exchanges are in

²⁴ For a discussion of these issues see Goetzmann, W. et al., "Day Trading International Funds: Evidence and Policy Solutions" and Chalmers, J., et al., "Predictable Changes in NAV: The Wildcard Option in Transacting Mutual-Fund Shares."

fact public utilities whose data products should be regulated on a public utility model, that is, for the public good and not for a profit.²⁵ For example, Schwab states that the various costs imposed by the four data networks, including a \$60 per user access fee, are too high because the majority of their customer trade only six to either times per year and pay only \$29.95 per trade.

The NYSE counters this by stating that the argument over retail investors' access to data is not the issue.²⁶ They feel the core issue is the ability of internalizing broker-dealers to access price data to allow them to trade captive order flow at reasonable prices. There are substantial recriminations back and forth and a great deal of disagreement over the actual costs. The SEC has convened as special committee of industry and public member for advice on this matter, the Seligman committee. Until the facts become clearer, all that can be said is that the property rights associated with one of the core functions of an exchange, the production of market data, remain clouded. The salient point is that the pricing and availability of such data will have a great deal to say about subsequent market structures. As a monopolist, the NYSE will charge a price high enough to stifle competition and to under-produce liquidity services. On the other hand, to the extent that William Batten, the past NYSE Chairman was right when he said that the main mission of the Exchange was to produce the price, it might not be appropriate to force the exchanges to give away their core product at cost.

²⁵ As an example, see Comment Letter by David Pottruck of Charles Schwab & Co., March 14, 2000, on Regulation of Market Information Fees and Revenues, Exch. Act Rel. No. 42208 (Dec. 9, 1999), 64 Fed. Reg. 70613 (Dec. 17, 1999).

²⁶ See Comment letter of James Buck of the New York Stock Exchange, April 10, 2000, on Regulation of Market Information Fees and Revenues, Exch. Act Rel. No. 42208 (Dec. 9, 1999), 64 Fed. Reg. 70613 (Dec. 17, 1999).

7. The larger debate

*I am glad 'tis night, you do not look on me,
For I am much ashamed of my exchange:
But love is blind and lovers cannot see
The pretty follies that themselves commit.*

William Shakespeare
Merchant of Venice (Act 2, Scene 6)

Well crafted securities regulation lowers the cost of capital to firms. Firms' equity trades on exchange markets and a proper market structure with low trading costs is essential if a firm is to get the highest possible price for its shares.²⁷ Policy toward price discovery is therefore only one aspect of the larger question of what to do with the structure of markets and exchanges. To be sure, price discovery and dissemination is an important function of exchanges, perhaps *the* most important function. As we have discussed above, the importance of the price extends beyond the shares that were traded in the transaction.

Our discussion of price discovery is in some sense a proxy for a discussion of the policy that should be adopted toward guiding the evolution of the exchange marketplace. There are two polar points in this debate. At one extreme, policy makers can sit on the sidelines and watch the various contestants, new and old, battle for market share. The new entrants bring technology and innovative products to the fray, while incumbent exchanges have the benefit of controlling the connectivity and technology standards, and because of their large market share, the discovery of the price. Perhaps this is one of the reasons that despite the looming competitive threats, the current price of a set on the NYSE, \$2 million, is still 70% above what it was two years ago.

²⁷ See Amihud and Mendelson (1986) and Madhavan (2000).

Also, because the entrants compete against their supervising SROs, the potential for conflict is large. As one internalizing market maker put it, “particularly disconcerting would be their SRO-competitor’s authority to examine their operations and impose disciplinary sanctions, especially in connection with members’ order routing obligations.”

At the other extreme, policy makers can step in and attempt to guide the evolution of the marketplace. Of course, the problem is that the SEC has no particular skill at selecting the best market structure. Policy makers could try to keep to a middle ground, only intervening to insure fair competition and transparency. The difficulty is that policy choices inevitably arise that are not clear cut, e.g., the pricing of market data, the standards for connectivity between exchanges and brokers, the ability of ECNs to charge fees for accessing their orders, etc. Adjudicating these questions inevitably causes the policy maker to favor a particular institutional form for an exchange over another.

Left to their own devices, it seems that the competitive forces that are fragmenting the market are providing concomitant benefits to investors. Much of our fragmentation is in fact a specialization and segmentation of the market. It is interesting to note that we are in a different portion of the life cycle of the exchange industry than is Europe. Much of the focus overseas has been aimed at consolidation of markets for reasons of back-office costs. In the United States, we are largely segmenting and fragmenting our markets based on providing more specialized services.

In doing so, we are changing the industrial organization of the industry to the point that the scope of a securities firm has become enlarged. The world is no longer described by a securities firms accessing the functions of an exchange in an arms length transaction. Many of the functions, if not the form, of the exchange have been taken within the securities firm.

Implicit examples of this are the internalization practices of many broker-dealers. More explicit examples include the recent purchase of Speer Leeds by Goldman Sachs and the reported desired of many large Wall Street brokers to develop a captive uninformed order flow against which they can trade.

The difficulty with price discovery is that it is hard to capture all of the benefits of associated with producing a good price. The SEC seems unwilling to let exchanges charge a market price for their data. This restriction may explain part of the evolution toward greater scope of securities firms. If exchanges are unable to realize market prices for their data, their next best alternative may be to use that data themselves, and changing the institutional form of the brokerage and exchange industry is one way for that to come about.

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Exhibit 1

A Functional Analysis of Different Trading Venues. The table reports the importance of each of the six functions described in the paper to the core operations of the various trading venues.

Exchange	Exchange Functions					
	Search	Pre-Trade Information	Trade Consummation	Post-Trade Information	Clearing and Settlement	Certification
NYSE	High	High	High	High	High	High
Aut-Ex or Indications	High	Medium	None	None	None	None
POSIT (X-ing Net.)	Low	None	Medium	Medium	None	Limited
Optimark	Low	None	High	Medium	None	Limited
Instinet	Medium	Medium	High	High	High	Limited
Archipelago	High	Medium	High	High	High	Limited
Upstairs Block Market	High	High	High	High	None	Limited
Nasdaq Wholesaler	Low	None	High	High	High	None
Nasdaq	High	High	High	High	High	High

Exhibit 2

Example of a recent print advertisement for Archipelago, which is seeking to join its ECN to the Pacific Exchange to form a new electronic exchange

**LIKE OTHER FINANCIAL INSTITUTIONS,
OUR EXCHANGE WILL BE VERY EXCLUSIVE**

Basically, if you have opposable thumbs, you're in.

Time was, unless you're part of the Old-Boys network, you were not privy to a lot of financial information. We think this excludes too many of you. (Old-Boy Networks tend to be somewhat exclusive and, subsequently, rather small.)

At Archipelago, we think everyone should have access to the same information. Because a system that treats a differently based on who they are, who you know, or where you work is completely

ARCHIPELAGO SCREENING PROCESS:

Fill entire box with No. 2 pencil

- 1) Did a female give birth to you? YES NO
- 2) Do you need oxygen to live? YES NO
- 3) Do you live on a planet that has one sun? YES NO
- 4) Are you visible to the naked eye? YES NO
- 5) Do you have a head? YES NO
(If you answered "no" to question 5, skip to question 7.)
- 6) Is there a face on your head? YES NO
- 7) Are you a cat? YES NO
- 8) Do you have internal organs? YES NO
- 9) Do you keep getting older? YES NO

CHECK YOUR RESULTS

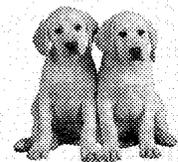
If you answered "yes" to number 7, then you're a cat. **STOP HERE.** If you answered "yes" to the rest of the above questions, congratulations, you're a human being. And you should have access to all market information.

DO NOT MARK IN THIS AREA 5610023

Fair is Good.

So how do we make everything is fair? Here are three examples: We have an electronic automated order matching, we have an order limit order book, and we have match orders in our system using price-time priority.

They sure are cute, don't get us wrong. Unfortunately, they can't be part of our exchange.



Only when investors have equal treatment, equal opportunity, and an unbiased representation

Exhibit 3

Best Execution report posted by the NYSE for all SuperDOT Market Orders

August 2000		Executions Inside the Prevailing NBBO Quote(4)			Executions Outside the Prevailing NBBO Quote(4)	
Order Size	Total Execution Reports(2)	Eligible Execution Reports(3)	Reports receiving executions inside the quote	Percentage receiving execution inside the quote	Reports receiving executions outside the quote	Percentage receiving execution outside the quote
100 Shares	897,713	804,602	308,037	38%	50,667	6%
101 - 499 Shares	2,280,979	2,046,603	722,890	35%	97,477	5%
500 - 2,099 Shares	2,229,205	1,520,715	468,165	31%	96,481	6%
2,100 - 4,999 Shares	390,481	157,533	42,262	27%	7,396	5%
5,000 - 9,999 Shares	209,181	63,684	17,082	27%	3,566	6%
10,000 Shares	178,323	18,289	4,603	25%	1,078	6%
All Sizes	6,185,882	4,611,426	1,563,039	34%	256,665	6%

(1) All NYSE-listed issues except: (a) stocks priced above \$1000, (b) stocks trading in variations of less than 1/16th, and (c) stocks trading in round lots of less than 100 shares and (d) the seven issues included in the decimal trading pilot.

(2) Execution reports for SuperDOT market orders, excluding odd lots and orders for which no valid NYSE quote existed at Display Book arrival time.

(3) Execution reports for non-tick-sensitive, non-opening, non-MOC SuperDOT market orders the size of which is less than or equal to the size of the relevant NBBO quote (odd lots excluded). E.g., if the NBBO represents 1,000 shares offered, an 800 share market buy order would be eligible, but a 2,000 share order would not.

(4) Buys (sells) receiving prices lower (higher) than the NBBO-offer(bid) price at the Display Book arrival time (the "prevailing NBBO quote".) E.g., if the NBBO is 2/16-4/16, an execution at 3/16 would be considered inside the quote. For minimum variation markets, execution of buy orders at the bid and sell orders at the ask are considered inside the quote. The NBBO is the highest bid and lowest offer posted by the NYSE, NASDAQ and the Regionals.

(5) Buys (sells) receiving prices higher (lower) than the NBBO-offer (bid) price at the Display Book arrival time (the "prevailing NBBO quote".) E.g., if the NBBO is 1/8-1/4 a buy at 5/16 or a sell at 1/16 would be outside the quote. Executions outside the quote may occur when, for example, multiple buy orders hit the quote almost simultaneously; the first order takes out the offer and the subsequent orders execute at a higher price than the offer quoted on arrival. Executions outside the quote may also occur when the NBBO consists, for example, of an off-NYSE offer of 100 at 20 1/16 with the NYSE offer being 10,000 at 20 1/8; a 1000-share market buy order arrives at the NYSE, the specialist executes at the NYSE offer of 20 1/8 since he is not expected to match or send an ITS commitment to the 100-share off-NYSE offer because of Regional Exchanges auto-quoting; even though this execution is not outside the NYSE quote, we count it as, "execution outside the quote" because it is outside the "pure" NBBO.

Source: NYSE web page at <http://www.nyse.com/marketinfo/marketinfo.html>.

Exhibit 4

Example of a recent print advertisement for the Chicago Stock Exchange

Introducing:

**THE
NEW
EQUITY**

No, the Chicago Stock Exchange isn't going public. But it is helping to create a new spirit of equity for investors everywhere. With access to more stocks — over 4,500 — including NYSE, Amex and Nasdaq issues. More stocks than any floor-based exchange in the U.S. And more hours to trade them than the primary markets. Plus the perfect blend of technology and a specialist system. The CHX. Serving all segments of the market. Retail. Institutional. And online.

CHX

The Chicago Stock Exchange
There is a Difference. We're Making it.

| www.chicagostockex.com |