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COMPETING MODELS FOR MARKET DATA DISSEMINATION: A COMPARISON OF STOCK AND FUTURES MARKETS

by

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Executive Summary

While transaction and price information are vitally important to both the efficiency and functioning of financial markets, the regulatory treatment of that data in the securities and futures markets are markedly different. Securities regulation treats stock quotations and transaction prices as a common-pool resource, controlled jointly by the self-regulatory organizations (SROs) that govern stock trading, and requires dissemination and pricing to be centrally controlled. Futures regulation, on the other hand, treats market data as a proprietary asset owned by the trading venue that produces the information. These different regulatory approaches define different competitive models for information provision, and suggest divergent theories regarding the role and the value of information to financial market operation. More importantly, these different competitive models appear to affect the distribution and pricing of market data, which in turn affects market quality and innovation.

This paper finds that the different infrastructures for market data have led to divergent outcomes with respect to prices and fee structures. Specifically, we find that:

- Prices for comparable market data streams are found to be significantly lower for futures than equities overall;
- Market data emanating from the futures markets are found to provide transparency well exceeding the regulatory minimum, with a broad range of real-time data available on diverse platforms at prices comparable to those in the equities markets.
- Both futures and equities are heavily dependant upon market data revenue, with the primary difference being the cost and revenue allocation models;
- The equities model leads to incentive compatibility problems that create inefficiencies in cost allocation and increases the costs of implementing change within the governance structure for consolidated information provision. These problems give rise to observable differences in innovation and contracting in the production and dissemination of market data.
- The futures market-based approach does not yield evidence of anti-competitive or discriminatory pricing behavior.
- The equities central consolidator model appears to discourage markets and intermediaries from providing differentiated data products to the public at lower cost, and impedes innovation at the market level and at the vendor level.
- From a policy perspective, the more activist assertion of regulatory authority in market data dissemination does not yield an environment characterized by greater transparency or lower prices for market data.

This paper examines the futures' market-based framework as a counterpoint to the securities regulatory framework, and provides a context for future regulatory decisions regarding market data reporting. It begins by tracing the development of the treatment of trade and quote information generated in the futures and equities markets historically, and reviews the propagation of current regulation and rules governing the dissemination of market data. It then examines the effect of different regulatory structures on the quality of the information available, as well as the costs and revenues associated with different market microstructures. The analysis focuses on the U.S. markets, specifically U.S. futures exchanges and U.S. stock markets. In the historical review, the analysis focuses exclusively on the New York Stock Exchange as the earliest stock exchange and exemplary of the securities markets, and the Chicago Board of Trade, the earliest example of a U.S. futures exchange.[1]

I. The Development of Different Approaches to Transaction Information: Historical Context

While there are differences in the market structure and purposes for securities and futures markets, there is no apparent economic reason why the regulatory treatment of price information in these markets should be different. In fact, in their early history, both futures and securities exchanges asserted a proprietary interest in the transactions data emanating from their markets, with the implication that there could and would be restrictions on the dissemination of such information.

A. Early History: Transaction Information Treated as Proprietary

In 1815, prices of stocks became a common feature of daily and weekly newspapers, with the first complete list of stocks traded on the early New York Stock Exchange appearing in the New York *Commercial Advertiser*.[2] A couple years later, in 1817, the New York Stock Exchange enacted limitations on members, barring them from publishing prices. The authority for determining what could be disseminated, when, and how, rested with the NYSE Board. Specifically, the Board:

> *"Resolved,* That the Secretary be authorized to furnish the prices of stock but once a week, to one price current only, at his discretion, and that no other quotation be made for publication."[3]

These actions constitute an assertion by the fledgling exchange of its property rights to the prices and quotations negotiated and arrived upon between members.

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[1] While options markets retain some specialized features and are of additional interest, they are not treated explicitly here. Options on individual stocks operate within the centralized network system required of the securities markets; while options on futures, commodities, and other assets operate using the futures model for market data dissemination.

[2] Robert Irving Warshow, *The Story of Wall Street*, Greenberg Publisher, Inc. (1929), 59.

[3] Edmond Clarence Stedman, ed., *The New York Stock Exchange*, (1905), 66.

The *Chicago Daily Journal* began publishing daily prices for grain trade from the earliest meetings of the Chicago Board of Trade (CBOT) beginning in 1848, "unless more important matter crowded it out."[4] No evidence was uncovered that the Chicago Board of Trade attempted to charge for the daily information or sought to limit publication of daily prices. The following year, 1849, market reports of prices were swapped via telegraph among Chicago and the "eastern markets."[5]

It was not until the invention of the ticker, in 1867, that contemporaneous ("real time") price dissemination became possible. In a series of court cases outlined in their paper, Mulherin, Netter, and Overdahl (1991) document that the exchanges' rights of ownership and control with respect to quotations and prices were subject to numerous challenges from would be competitors.[6] As is the case in current controversies regarding the pricing and distribution of data, advances in technology induced the challenges, as the use of the telegraph for transmitting continuous stock price information across multiple locations began.

The operational and legal framework for transaction price dissemination began to take on aspects of its current character in the early years of the ticker. Both securities and futures exchanges charged the original ticker companies a monthly fee for access to the quotations, and the data were initially collected by employees of the ticker companies. These companies would then provide tickers to their customers (which included exchange members) for a monthly fee. When it became clear to the exchanges that the quotation information was being used in ways that did not enhance the business purposes of their members, the exchanges sought to control who had access to the ticker information.

While in most of these cases, the courts affirmed the exchanges' property rights to the quotations and their right to control the methods for collecting, disseminating and pricing the information, the courts in the earliest cases ruled against exchanges' attempts to control access granted by the telegraph companies.[7] It was this factor that propelled the exchanges toward vertical integration: rather that allowing telegraph companies to post reporters in the exchange and then attempting to control who their clients were, the exchanges began to collect and distribute the market data to vendors themselves.[8]

The Chicago Board of Trade began to collect and disseminate its own ticker data in 1883, seeking to trump a ruling by the Illinois Supreme Court that found that since the quotes were initially collected by Western Union, they were of the character of news, and therefore vested with the public interest. In 1892, the New York Stock Exchange followed suit and purchased a

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[4] Charles. H. Taylor, *History of the Board of Trade of the City of Chicago*, Chicago: Robert O. Law Company (1917), 139.
[5] *Id.* at 157.
[6] J. Harold Mulherin, Jeffrey M. Netter, and James A. Overdahl, "Prices Are Property: The Organization of Financial Exchanges from a Transaction Cost Perspective," *Journal of Law and Economics,* Vol. XXXIV. (October, 1991), 591-644.
[7] *Commercial Telegraph Company v. Smith* (1888), *Wilson v. Telegram Company* (1888), and *O'Keefe v. New York Quotation Company* (1890), *New York Grain and Stock Exchange v. Board of Trade of the City of Chicago,* as detailed at *Id.*, 606-620.
[8] *Id*. at 618-619.

majority interest in the New York Quotation Company and then used that infrastructure to transmit quotations to the telegraph companies, specifically Western Union.[9]

Numerous parties who faced off against the Chicago Board of Trade and the New York Stock Exchange in their early and contemporary history have argued that quotations like those generated through trade are a public good and therefore should be surrendered freely or at cost for the greater benefit of the public. Bronfman and Overdahl (1997) document this sentiment in early case law, quoting from Munn vs. Illinois, 1877, that "Property does become clothed with a public interest when used in a manner to make it of public consequence, and affect the community at large."[10] And more recently, the largest online brokerage in public securities stated: "Schwab believes that, in order to make the markets as transparent and fair as possible consistent with Securities Exchange Act § 11A, market data should be treated as a public good and all investors should have access to the same quality and quantity of market data at the lowest possible cost."[11]

The federal courts were decisive in their rejection of the proposition that market information is a public good. On the futures side, in *Metropolitan Grain and Stock Exchange v. Chicago Board of Trade,* the court recognized that exchanges and their members invest significantly in collecting information and reports in order to properly arrive upon a futures price.[12] That the exchanges had property rights to the market data that should be afforded the protection of law was affirmed in 1905 by the U.S. Supreme Court in *Board of Trade of the City of Chicago v. Christie Grain and Stock Company*. This case laid the legal footing for the assertion of those rights by exchanges to limit, control, and price market data in both futures and securities markets.

B. The Economics of Exchange Actions

Since the prices and quotations generated by the exchanges convey information about the value of the assets being traded, exchange actions to control and price can be seen as a means to capture the rewards associated with investment in price discovery. A primary motivation of exchanges to limit the distribution of market data has been that, if given access, competing markets could free-ride on the information production that occurs in the exchanges, without ascribing to the costs and requirements of membership. Those markets that attempted to speculate on the prices from the exchanges without dues of membership nor effecting delivery of securities or commodities were referred to as bucket shops.

Predictably, early securities exchanges sought to control free-riding on their price information by limiting access to members and member firms, and proscribing members' ability to transact off the exchange. In the securities market, prohibitions on members from trading stocks listed on the exchange afforded exchanges exclusive rights to deal in their listed stocks, with agreed upon

[9] *Id.* at 615-616.
[10] Corinne Bronfman and James A. Overdahl, "Would the Invisible Hand Produce Transparent Markets?, Working Paper, 1997, at 2.
[11] Comments from letter received from David S. Pottruck, Charles Schwab & Co., March 14, 2000.
[12] Mulherin, Netter, and Overdahl, at 621.

commission and fee structures for transactions required of exchange membership.[13] Similarly, members of the commodity futures markets were prohibited from "operating or dealing with bucket shops; and charging commissions lower than the rates established by the exchange."[14]

Movement by the securities exchanges toward consolidation of market data occurred prior to regulatory action, driven both by economic efficiencies made possible by scale processing and demand by information vendors and broker-dealers. In 1972, the NYSE and the American Stock Exchange (AMEX) entered a joint venture to create the Securities Industry Automation Corporation (SIAC). SIAC's business proposition was to capitalize on innovations in data processing to implement and develop information and communication lines for the securities industry. Combining the established infrastructures of AMEX and the NYSE, the SIAC sought to market data processing and dissemination technology to the regional exchanges and over-the-counter markets.

C. Equities Markets: The SEC Intervenes

As the exchanges moved forward with their own model, the process was pre-empted by the Securities Exchange Commission (SEC) and its intention to initiate rules that would require a consolidated transaction reporting system. The SEC's actions seemed directed toward creating a market for securities in which investor protection was interpreted to mean that all investors should receive the best available price in the market, regardless of other non-price advantages offered across alternative markets. The consolidated data model was an important step leading down the path of creating the National Market System since it resulted in the unified single source publication of price and quotation data. The creation of the "securities information processors," or SIPs, that SIAC would become, effectively concentrated the operation and control of information into single entities, increasing concerns in Congress that the government-created institutions might behave monopolistically. The concern about anti-competitive or discriminatory practices that may arise from the centralized model motivated Congress in crafting the Securities Act Amendments of 1975, as it directed the SEC to ensure that securities information be such that access is granted on "reasonable and non-discriminatory terms."[15]

Perhaps the most basic justification for the SEC's cost-based regulation of information dissemination was the general concern that the major equities exchanges prior to 1975 retained practices that were considered monopolistic, such as limitations on the trading of listed securities on competing exchanges and fixed brokerage commissions. The implementation of the 1975 Amendments was the first of many actions in which SEC began to preclude exchanges from passing rules and asserting their property rights in order to temper an exchange's ability to engage in practices that could be considered anticompetitive. The fixing of brokerage commissions was such a practice and was eliminated in 1975. Although the information dissemination practices at the time did not appear to be and were not identified as monopolistic,

[13] Rule 390 of the NYSE provides one such example, which prohibited over-the-counter transactions and internalization of orders for NYSE-listed stocks by members.

[14] Julius Baer and Olin Glenn Saxon, *Commodity Exchanges and Futures Trading: Principles and Operating Methods*, Harper and Brothers, 1949.

[15] Senate Committee on Banking Housing, & Urban Affairs, *Report to Accompany S. 249: Securities Act Amendments of 1975,* S. Rep. No. 94-75, 94th Congress, 1st Session, 1975, at 104.

the SEC rules requiring information consolidation mandating the central networks took away individual exchange authority and redistributed it to the SIPs.

D. Futures Markets: The CFTC Stays Out

As in the securities markets during the 1970s, the futures industry was managing the benefits and challenges of increased trading volume, broader market participation, and technological innovation. Without coaxing or intervention by the Commodity Futures Trading Commission (CFTC) or Congress, members of the futures industry started down a path toward consolidation and dissemination of market data emanating from competing exchanges.[16] In July 1977, the Commodity Exchange (COMEX), the Coffee, Sugar, and Cocoa Exchange, the New York Cotton Exchange, and the New York Mercantile Exchange (NYMEX) entered into a joint venture to form the Commodity Exchange Center (CEC). The CEC developed a joint ticker plant, and they agreed to split the proceeds from the sale of the ticker data evenly, with 25% going to each of the exchanges.

In the ensuing years of the CEC, COMEX proposed that, because their products, especially gold, were more valuable, they should receive a greater share of the market data revenues. Reluctantly, the other exchanges agreed. In the early 90's NYMEX wanted a bigger share, to which the other exchanges did not agree, so CEC changed their software to segregate the NYMEX ticker, using a different exchange code in each market data record. While all four exchanges continued to use the same physical ticker plant, eventually COMEX and the Coffee, Sugar, Cocoa Exchange and the New York Cotton Exchange (later merged into New York Board of Trade) chose to segregate their data. This logical segregation of the data stream allowed the exchanges to minimize the costs of data processing, and provided uniformity and flexibility to the market data product. More importantly, it allowed individual exchanges to price and market their individual component of the data stream according to its economic value. Market data vendors and others who purchased the data could then bundle any combination of data from the different exchanges, paying on an a la carte basis.

The CEC case illustrates that the competitive market model for the provision of market data did not preclude mutually beneficial cooperation that would lead to a level of market transparency demanded by information consumers and that would benefit the industry as a whole. Even as the NYMEX has parted from the CEC infrastructure, the cooperation among competing exchanges, brokers and dealers, information venders, and others in the futures industry has continued today. This cooperation has intensified as market participants have sought to contend with the increased competition from a global market place, and challenges posed by advances in technology (particularly the internet).

[16] Bronfman and Overdahl, supra 10, at 5.

II. Regulatory Structure for Data Dissemination in the Securities and Futures Markets

A. CFTC Regulations

While the treatment of market data with respect to its dissemination and pricing was the territory of the futures and securities exchanges through the better part of the 19th and 20th century, a key point of departure occurred in the 1970s. In the futures markets, the Commodity Futures Trading Commission Act of 1974 established the Commodity Futures Trading Commission (CFTC) as the independent agency for enforcing the Commodity Exchange Act of 1936 (CEA). The CFTC Act left unchanged Section 5 of the CEA, previously administered by the Department of Agriculture, which requires that all futures exchanges publish price and statistical information for each contract on a daily basis.[17] The CFTC Rules specifically require the following information:

1. Rule 16.01(a)1-5: The Trading Volume and Open Contracts Rule requires the exchange to collect and publish for each contract the total volume of trading, the total quantity of futures for cash transactions, the total open contracts for which no notices for delivery have been made, and, in the case of options on futures, the option delta.

2. Rule 16.01(b)1-2: The Prices Rule requires the exchange, for each contract market, to collect and publish the settlement (or closing) price, the high and low prices for the day, the total daily volume, and the open interest for the day.[18]

CFTC Rule 16.01 further states that:

> "This information shall be made readily available to the news media and the general public in printed form and without charge at the office and trading floor of the contract market no later than the business day following the day for which publication is made."[19]

In practice, the price, trading volume, and open contracts information has been disseminated to the public shortly after closing. Continuous real-time information continued to be available to exchange members and to the public via information vendors over the ticker, telephone, and teletype at terms and prices determined by the individual futures exchanges.

B. SEC Regulations

The SEC adopted an activist approach to securities market data, advocating direct market linkages and a centralized system that would unify reporting of stock price information. In the Securities Exchange Act Amendments of 1975, the U.S. Congress endorsed the concept of a National Market System that would be enabled by information and communication linkages between the exchanges and the over-the-counter market for unlisted securities.[20] The SEC

[17] *Commodity Exchange Act*, Section 5.
[18] CFTC Rules, Part 16 – Reports by Contract Markets, Rule 16.01(a)-(b).
[19] *Id.*
[20] Pub.L.No. 94-29, 89 Stat.97 (1975).

directed the exchanges and the National Association of Securities Dealers (NASD), in their capacity as Self Regulatory Organizations (SROs), to jointly develop and operate a system that consolidated transaction and quotation data from the various markets. In 1978, the SEC promulgated three rules under Section 11A of the Securities Exchange Act that laid out the new regulatory infrastructure in information:

1. Rule 11Aa3-1: The Transaction Reporting Rule requires the participants of the SROs (exchanges and NASD) to transmit transactions reports, including the last sale price for each stock, where the transaction occurred, and the volume at that price.

2. Rule 11Ac1-1: The Quote Rule requires the SROs to collect and transmit quotations, in particular the best available (highest) bids and (lowest) asks and the associated order sizes at those quotes, of its members to information vendors.

3. Rule 11Ac1-2: The Display Rule requires information vendors and broker-dealers to display a consolidated array of information for each stock including the single best quotation available in the reporting markets or a montage of all market's best quotations, and the last sale data including price, place, and volume.

The 1975 Amendments also set forth that the SEC use its authority to ensure that the market information be made available on terms that are "fair and reasonable" and "not unreasonably discriminatory." Thus, while the Securities Exchange Act does not explicitly require any information be provided for free to the press or the public at large, the rule-making authority it extends to the SEC to regulate and oversee the price of market information is substantially broader and more nebulous than that proscribed in the Commodities Exchange Act for the futures markets.

In order to comply with the SEC mandates, the SROs submitted and developed national market system plans that resulted in the centralized data consolidation model still in use today. The SEC saw it necessary to require the pooling of data from competing markets and intermediaries, and as a consequence, the costs, revenues, and control of market data would have to be shared as well. From a property rights perspective, this meant that the consolidated stream would be owned jointly by the SROs.

The disposition of the resulting streams of data and how the networks creating the data would be governed was determined by the position of the equities exchanges in 1978. The costs of producing the data streams by the networks, the fee structures, and the associated revenues and the amounts distributed are governed by the original participants to the system. Even as the securities markets have evolved and new players have gained market share, the central consolidator model mandated in the securities regulation is operationally unchanged.

III. Differing Approaches To the Regulation of Market Data: Institutional Explanations

A. Market Fragmentation As a Rationale for Regulation of Securities Information

The fragmented nature of stock trading has frequently been raised as an argument for requiring a consolidated stream of market data, one that provides the best quoted bids and offers, and real time transaction prices. Securities trade in multiple venues and this creates the potential for multiple prices in different markets for the same stock. Since identical products (shares of Walmart) are being traded in different places, consolidation of market data ensures that investors are informed as to the most recent and best available price. The SEC has suggested that this information is necessary because it provides small investors with a metric for measuring execution quality, helping them to compare the prices of their own executions relative to the market, and indirectly, allows them to monitor the performance of their broker. Theoretically, if the information is utilized, orders are directed to the market with the best prices, fragmentation is minimized, price discovery is enhanced, and investor protection, broadly construed to mean obtaining the best price available, is obtained.

But the potential benefits to investors of real-time information are not at issue. Certainly investors, in their trading decisions and in their choice of brokers, would demand and be willing to pay for a level of information that gives them the confidence in their decision making. In fact, comment letters received by the SEC from brokers bemoan the high cost of providing continuous real-time consolidated market data to their customers, and note that this high cost is inevitably passed on to those investors. The mandate for real-time consolidated data, however, denies investors and brokers the ability to choose and pay for something less than the regulated minimum. As discussed below, in the case of long-term investors or passive contributors to retirement funds, something less than real-time continuous data with the associated NBBO may be sufficient to help them make their decisions.

Is consolidation necessary in competitive markets? Economics suggests that competition among trading venues and arbitrage will lead to similar prices for the assets traded in multiple locations. The actions of arbitragers will tend to ameliorate transitory price discrepancies, making data streams from competing venues good substitutes. Rather than purchasing a consolidated stream of data, investors could purchase data from one market, which has the potential to lower the cost of data thereby increasing investor access to market data.

B. Competition in Futures Markets

Like stocks, futures contracts can trade in multiple markets, with competitive challenges mostly manifested in the over-the-counter derivatives markets and from international competitors. U.S. futures exchanges face few regulatory barriers to listing competing contracts, and indeed, similar contracts are listed on the same underlying assets. Historically, however, positive network externalities have led to single contract markets dominating in the trading of particular assets or risks. However, the futures markets illustrate that sufficient competition for market share, contestability of markets, and economic incentives exist to constrain exchanges from behaving as monopolists in data provision or transaction services.

In any market, perfectly concentrated trading is consolidated data, in that it represents all the trading interest with respect to a given financial product of commodity. As a result, some futures contracts, like the CME contract on pork bellies, tend to be the single best source of market information. Other contracts, like the CME S&P stock index futures contract or the CBOT Treasury bond contract, are but one source of information for which there are many related sources emanating from the cash, over-the-counter, and international market sectors.

Like the stock markets where regulatory protections such as Rule 390 have been removed to allow off-board trading of NYSE listed stocks, the Commodity Futures Modernization Act of 2000 creates new points of entry for competitors to the primary futures exchanges. In addition, futures exchanges are seeking to create markets and engage electronic systems in OTC assets and risks. Lacking regulatory protections that erect barriers to entry, futures exchanges are aware that market dominance is illusory, particularly as electronic markets face lower up-front costs associated with establishing a marketplace For example, the market dominance enjoyed in 10 year German treasury bonds by the London International Financial Futures and Options Exchange (LIFFE), was completely supplanted by the Deutsche Terminboerse (now Eurex) when it introduced a screen-based trading for the same asset.

C. Challenging the Exchanges' Market Data Systems: Intermediaries

The rapid rise of intermediaries that have developed their own trading system interfaces challenge the primary exchange-centered trading environments of both futures and equities markets. Third market dealers, automatic trading systems such as electronic communication networks (ECNs), and large brokerage houses who internalize order flow are all examples of a more decentralized execution model where orders are executed away from the primary market. While the business models of these organizations differ, their primary appeal is based on lower transactions costs.

1. ECNs' Challenge to Securities Exchanges

In the equities markets, ECNs are electronic order matching trading systems that have become an increasingly important factor in executing Nasdaq orders, and have made recent inroads into the listed market as well. Some ECNs maintain open limit order books, providing information and participation via subscription to Nasdaq market makers and brokers on the bids and asks residing on their book. By providing a means for principal to principal matching, ECNs are able to eliminate the spread associated with intermediation by a dealer.

As a price matching mechanism where quotes are entered and trades are executed automatically, ECNs raise the question of the relationship between price discovery and the property rights to the data generated in transactions. Even as these member competitors effect more transactions away from the primary markets, they are still required to report their transactions to a SIP via a primary market. The emerging member competitors have no claim of ownership to transaction data and have not, heretofore been able to govern the disposition of and fees associated with it or have any clear claim to the revenues. Rather, the SRO that reports an ECN's transaction data is entitled to the revenue derived from the sale for these data. In effect, the development of

significant off exchange member competitors for trading securities challenges the central consolidator model, both operationally and with respect to its costs and revenues.

The first challenge came from Instinet, an ECN catering to large institutions, in 1984. In 1982, the SEC mandated that Nasdaq provide quotation information on Nasdaq stocks to information vendors, and in 1984 the SEC ruled that fees for the quotation information should be cost-based. Bronfman and Overdahl (1997) suggest that the ruling requiring the Nasdaq to sell information for a price based on arbitrary cost considerations was yet another step in the regulatory assault on the markets' property rights to market data. In this case, the NASD, as developer, self-regulatory authority, and owner of the Nasdaq system for trading National Market System securities, defined the line of battle for the question of who owns the quotes. On the one hand, Nasdaq is the sole source provider of the NMS quotes and as such, had claim to the revenue for market data sales. On the other, Nasdaq as an order execution facility was able to vend data to its subscribers without facing explicit costs, but simultaneously sought to charge Instinet fees for data it provided to its subscribers. These factors lead the SEC to conclude that Nasdaq might be inclined to charge member competitors fees that exceed what is reasonable, and ruled that Nasdaq should price the data based on the cost to process and disseminate it.[21]

The second most recent challenge to Nasdaq by their member competitors came from another ECN, Island ECN. Again, the issue centers on Nasdaq as a competitor with ECNs in the provision of execution services, but also as beneficiary of a source of revenue from market data sales to which ECNs are not entitled. Under the Network system established in 1978, only reporting SROs are eligible to receive market data revenue. ECNs are not SROs, but rather are broker-dealers who have registered as Automated Trading Systems (ATS). As ECN transaction volume increased (Island reports a rate of 1 in 4 executions in NMS stocks), they have challenged the model which requires them to buy the consolidated data from Nasdaq, while simultaneously requiring them to surrender quotation and transactions data generated within their trading platforms without the benefit of revenue from the data sales.

Both Cincinnati and Nasdaq report trades to the SIPs; Nasdaq for unlisted securities, and SIAC for listed securities. Both markets pay expenses to and receive revenues from each SIP according to the regulated metric under each Plan. Given these metrics, competition amongst SROs exists to report trades thereby earning revenues. ECNs are an increasingly significant source of trades, a source with no proprietary claim to the data these trades create. In terms of revenues for a trading venue, trading volume provides at least two possible revenue streams. First a trading venue may charge its' members transaction fees. Secondly, as one venues' percentage of order flow rises, the value of its market data rises as well. ECNs have built a business model absent of, and with no rational legal expectation of revenue from the sale of market data. Having proven their ability to compete in transaction services by capturing significant order flow, Island is in a position to bargain for a percentage of SRO revenues created by Island data.

Recently, Island began to report its trades in NMS securities to Cincinnati Stock Exchange, a participating SRO. In return, Cincinnati has agreed to share their revenue with Island. In order to keep Island's reporting revenue, Nasdaq has revised its system for assessing members' fees for

[21] Federal Register, Vol. 49, No. 80, April 24, 1984.

order execution. It has proposed a two-tiered system which increases costs for Nasdaq members who report less than 95% of trade activity thru Nasdaq SRO to Nasdaq SIP. In effect, Nasdaq is seeking to raise transactions costs for Island if they report their trades through Cincinnati. This demonstrates the significance of market data revenue, or the loss of it, to the Nasdaq organization. Also, this exemplifies how the current consolidation system has handicapped new, and potentially new non-SRO trading venues.

2. OTC Market's Challenge to Futures Exchanges

The over-the-counter markets (OTC) also pose a competitive threat to futures exchanges. While off-exchange futures contracts are prohibited by law, products that contain similar risk and return profiles, like forwards and swaps, are readily available on a number of underlying assets in the OTC markets. A long futures position can be synthesized in a number of ways, for example, by selling a put and buying a call. This competitive influence has important implications for market data. First, futures exchanges are aware that volume is inversely related to transactions costs, including those associated with market data.[22] Second, while price transparency is an important attribute of a successful market, a one size fits all approach that either provides unnecessary and costly information or too little information may discourage some market participants from using a the market.

Thus, although trading concentration tends to be high in many futures contracts, the potential for monopolistic behavior in the dissemination and pricing of data appears to be constrained by the exchange's quest for order flow and the threat of competition. In the equities markets, the common-pool resource model of information dissemination built around single consolidator eliminates the possibility of an information monopoly at the exchange level, but it also creates the potential for one at the network level. Nasdaq's efforts to raise fees for firms like Island who report trades to different SROs illustrates to some extent the their willingness to use the Network power they have and shows how important market data revenue is to these markets. This raises the issue of whether there is an economic basis at the micro-theory level for requiring the consolidation and common pool treatment of market data.

IV. Economic Guidance for the Disposition of Market Data

Economic scholarship suggests that financial market data are information goods, and as such, exhibit unique properties on both the supply and demand side. Technological advances have vastly expanded investor participation in these markets and increased demand for market data, while simultaneously lowering the direct costs of processing trade and quote data. Shifts in the demand and supply schedules generally create some uncertainty as the market searches out a new equilibrium, in this case, a price for market data. This uncertainty is compounded by regulatory intervention or the threat thereof.

[22] One futures exchange official recalled anecdotally that in a year where market data fees were raised to a comparatively high level, volume declined.

A. Supply and Demand Considerations

An analysis of the supply side is complicated by the recognition that production of market data involves many sometimes competing entities, who each contribute their own information, judgment, and skill to the transaction process. As a result, there are direct and indirect costs associated with information production. A direct cost includes the actual recording and dissemination costs associated with the data. An indirect cost includes the establishment, maintenance, and operation of a trading system wherein those prices are generated. To focus entirely on the direct costs would be a naïve specification of the production function, since without investment in trading technology or a trading microstructure that attracts sufficient volume, there would be no data to distribute.

In part due to the traditionally high front-end costs associated with establishing a market, financial market data are characterized by high fixed costs and decreasing marginal costs. As technology has improved, many have noted that the marginal cost of reproducing information is approaching zero. For example, in a concept release, the SEC used a similar economic argument as a basis for arguing for imposing cost-based pricing of data since the exchange fees for information are not aligned with the enterprise level costs of producing the information.[23]

To understand why the market level costs of data production do not adequately characterize the function, one can view the creation of market data as a process in which information becomes impounded into the prices that eventually become quotations and transactions prices. Market participants devote resources to accumulate useful, potentially valuable, information on which to base their trading decisions. The unlicensed individual or institution communicates their information to a broker in the form of an order. Since this trade order may be the result of some investment in information gathering and analysis, the individual or institution making the order adds value to the data, which at this stage is the order information. Securities brokerage houses or Futures Commission Merchants (FCMs) as futures brokers, by processing and executing orders submitted to them, form a perspective of market conditions. These intermediaries, like the individual, may also invest time and research to form an in-house store of information. Taken together, intermediaries may perform trades in the market place on behalf of its clientele (as brokers) and itself (as dealers).

Brokers in both futures and securities have a fiduciary responsibility to their clients. In the equities markets, this means that brokers have an obligation to obtain best execution of the customers order. In both markets, the broker acts as a conduit for trades, never legally retaining ownership over customer trade information (including for example, the order type of buy or sell, or the order size). Rather, the intent to trade belongs to each investor, the ability to trade with the broker. This ability is not a right, but rather a privilege, and in some cases a costly one. Market centers including exchanges charge brokerage houses and FCMs a range of fees, including membership fees and transaction fees. The market center or trading venue provides, among other things, a trading system or infrastructure through which trades can occur, and performs some self-regulatory functions to insure that the trading practices of participants are not fraudulent or non-competitive, and do not expose the market to undue risks.

[23] SEC Concept Release: Regulation of Market Information Fees and Revenues, Release No. 34-42208; File No. S7-28-99, 1999, p 26.

B. Role of Exchanges in Producing Market Data

Once the trade occurs, the financial center assumes a proprietary interest in the transaction price. In their law and economics analysis of the role of financial exchanges in the production of market data, Bronfman and Overdahl (1997) suggest that exchanges' proprietary interest derives from their contribution to the price discovery process. By developing protocols and technologies for order entry and trade execution, establishing trading rules, standardizing terms of contracts and enforcing contractual obligations, the exchanges help intermediaries and their clients economize on costs associated with transacting.[24] In order to accomplish a trade, principals incur search, bargaining, contracting, execution, and settlement costs, among others, and principals and their agents choose to transact in a market or exchange in order to minimize those costs. In the Bronfman and Overdahl model, market transparency is endogenous to the process of profit maximization, so the exchange chooses the quantity and price of market data that maximizes trading volume.[25]

When financial information is viewed as a product of a market that provides for transaction execution and price discovery, the cost to provide and operate the market itself is a cost. Similarly, providing a market structure that insulates constituents from default, fraud, and manipulation also adds value to the price data. Without an efficient, safe, and reliable market for transactions and price discovery, the market data will be of little value. As a result, markets optimally allocate revenue over such costs as those necessary to provide transaction and execution services, those self-regulatory functions that build confidence in the markets, in addition to the costs it incurs collecting and disseminating information generated in the market.

1. Differing Abilities to Allocate Costs

The most continuously successful financial markets expend substantial resources innovating and increasing their offerings and updating their technologies. The provision of transaction services that result in both trades and trade information become welded together in the same production function.

In the futures market, exchanges are able to optimally allocate costs for the purpose of apportioning them across constituent functions. For example, an exchange may use revenue garnered from its constituent functions of transaction services, market data provision, and clearing services to support the costs of developing and introducing new contracts. This is a dynamic optimization strategy wherein the exchange allocates current revenue to promote innovation that they hope will lead to future revenue. In the securities market, the pooled resource model in which an exchange cannot directly adjust market data dissemination or prices limits a market's ability to allocate costs optimally over transaction services, regulatory functions, and market data production. As a result of regulatory pressure (threat of a rate-making approach) and competitive pressure from regional and ECNs, Nasdaq recently formalized an

[24] Bronfman and Overdahl, p. 1.
[25] *Id.*, p.13.

approach that unbundles these functions, raising fees for regulatory functions so it can increase revenue it shares with member-competitors who report their trades through their SIP.[26]

Additional inefficiencies result from an allocation scheme for costs and revenues when market data are treated as a common-pool resource. In the single consolidator model, SROs allocate costs and revenues associated with data collection and dissemination using a formula approach based on trades executed, but not on total costs associated with quotation and price production. For example, as discussed in more detail below, in the securities markets' revenue sharing formulas, revenues associated with market data are distributed to the SROs according to each market's proportion of trade, severing the value of data from both supply side (what traders invest in information collection, what markets invest in their trading systems and reputations) and demand side (how buyers value data) considerations.

Perhaps one reason that the indirect costs of producing information are often overlooked or discounted as contributory to the value and price of information is because they are less easy to identify and quantify. For example, the primary exchanges in securities markets have suggested that transactions price data that emanate from markets that employ price matching mechanisms such as payment for order flow or internalization are of less value since those markets do not contribute to price discovery.

The concept of price discovery, when information of buyers and sellers becomes reflected in the transaction prices and quotations, is variously and imperfectly measured by statistical techniques. Constructing a data pricing mechanism that seeks to allocate revenue from market data based on price discovery would be analytically challenging and difficult to implement. However, if individual markets were in a position to sell their own data, then demand for data would encompass the markets' judgment as to the value of the data. Specifically, when purchasers of data believe that the information content of the data is highest, they would be willing to pay a higher price for that data. In this way, the provision of price discovery is rewarded according to its value to those who demand market data, not according to a formula based on the number of transactions reported to that market.

2. Efficiency Implications of the Ability to Allocate Cost

Given that different market participants place different values on market data, a discriminatory pricing method can be efficient. For this to be the case, suppliers must identify multiple markets for information in which each market places a different value on information. If a lower price can be charged to consumers that value the information less, then they would consume more information and would experience higher utility than they would if the information were only available at a single higher price. This may explain the practice of segregating the professional and non-professional investors and charging them different prices, as is common in the equity markets. Rather than charging all consumers the same price, price is set according to the suppliers' estimate of value that each consumer group places on information. Under this pricing scheme, professional investors would be thought to place a high value on information and they would be charged accordingly. Non-professionals are thought to value information less, and

[26] Form 19b-4 Proposed Rule Change by National Association of Securities Dealers, submitted to Katherine England of the Securities Exchange Commission, May 3, 2002.

therefore would be charged less. Since more information is produced and consumed than would be without market segmentation (as opposed to less information production that is predicted in the standard monopoly case), price discrimination could potentially increase market efficiency while increasing total revenue.

Differentiation of market data to cater to different types of consumers may also increase revenue and market efficiency. Information producers can tailor their products for different consumers with different information demands, and this can increase the value of the information provided.[27] Further, for some consumers, less may be more – having too much information can raise the cost without increasing the utility a consumer derives from market data.[28] In this respect, if the real-time consolidated data required to be disseminated to the public in the equities markets (as required by the display rule) exceeds investors' needs or demands, then revenues may be higher for equities markets, but the efficient allocation of information is impeded.

C. The Value of Market Data Over Time

Market data's value diminishes over time. Shapiro and Varian summarize it this way: "Information is like an oyster: it has its greatest value when fresh."[29] Substantial literature in finance and economics examine how information becomes impounded into prices, and how efficiently those prices reflect information. If markets are efficient, in that all relevant information is reflected in prices, information about current conditions is more likely to be observed and extracted from real-time prices than those that are delayed.

Fundamental and technical traders invest in acquiring and analyzing information in an effort to uncover information that is not fully reflected in the price. They seek to uncover price inefficiencies and then strategically trade in advance of the price adjustment in order to profit. Traders who wish to trade based on such price inefficiencies can best assess the value of the information they have collected by observing current prices. If they are looking at prices from 20 minutes ago, their choices about whether and how much to trade would be based on stale prices. As a result, the ability to free-ride on market data that are delayed is reduced.

This is not to say, as some have suggested, that delayed data are of zero value and should be surrendered for free.[30] On the supply side, there are advantages to offering delayed data for a nominal price. First, the price itself has the effect of signaling the value of the data. Too high a price would discourage its consumption, but providing the data for free might diminish the perception of its value. At the same time, ensuring that data is easily accessible has the effect of advertising and enhancing a market's reputation. It serves to enhance an outsider's view that the market is operating, accessible, safe, and transparent. Providing delayed market data at a nominal price may be part of a pricing strategy that signals to the markets that there are varying qualities of data available, with the real-time data premium priced, and the delayed data available

[27] Carl Shapiro and Hal R. Varian, *Information Rules*, Harvard Business School Press (1999), p. 54.
[28] *Ibid*, p. 70.
[29] *Ibid*., p. 56.
[30] As documented later, many market centers do make available substantial delayed data for free. This may be a consequence of regulatory pressure to disseminate data below its market value, helping to deflect criticism of the pricing of real-time data and reassure regulators that markets are transparent (due to the availability of free data).

at a discount price. This is part of a larger strategy used in information goods that enables information producers to differentiate the data to maximize their value (referred to as "versioning," but also akin to the economic concept of product differentiation).[31]

On the demand side, from the perspective of market participants who are not active traders, and who do not seek to uncover price inefficiencies for the purposes of earning short-term profits, delayed data are of obvious interest and have value to them as they monitor and revise their positions under changing market conditions. This would be true for a farmer who is interested in the futures price for wheat or an investor who is contemplating rebalancing her portfolio. The hedger and the investor have longer time horizons over which they are managing their assets, so transitory price changes evident in real-time data are of minimal consequence to their overall strategies.

D. Summary of the Differences in Regulatory Approaches

Differences in regulatory approaches affect the nature of property rights to market data, and even affect what constitutes market data and how they are valued. As described above, the sale of market data occurs towards the tail end of a multi-stage process of information accumulation. By the time information becomes market data, it is a valuable, yet short-lived product, the sale of which is an important source of revenue for financial markets.

Futures exchanges clearly, and extensively, define their property rights in contractual agreements entered into with intermediaries and data vendors. Market centers in the equity markets also claim a proprietary interest in trade data, but are unable to act unilaterally when it comes to the collection and sale of market data. To the extent that property rights derive their inherent value from the property owners' ability to do with the property what they wish, the value of equity markets proprietary claim has been altered.

In order to sell market data, the information must be collected, processed/packaged and transmitted. The manner in which this set of activities is carried out differs markedly in the futures markets from that of the equity markets. Equity markets perform these functions jointly, based on a shared governance model that dictates the collection, dissemination and profit sharing. In contrast, futures exchanges alone govern the disposition of market data that arise from trading.

V. Effect of Different Regulatory Approaches on Information Quantity and Quality

A. Market Structures and Instruments Traded

The pooled treatment of market data in equities markets imposes particular structures on governance and influences the operational aspects of data dissemination. However, differences in the content of information disseminated in real-time by the securities and futures markets and the associated transparency of the markets are driven primarily by differences in market structure and instrument traded.

[31] *Supra.* at 28, p. 68.

1. Futures Markets

Futures contracts are obligations that give counterparties the ability to buy or sell specified assets at a future date at a price determined today. Futures are similar to forward contracts, wherein counterparties agree to future transactions as well, but what sets futures apart conceptually is that the contracts themselves are traded in the market. Thus, a farmer who wishes to lock in a price for his wheat crop may enter into a futures contract calling for him to deliver 5000 bushels of wheat in September. Suppose the following day prices begin to rise and he decides to get out of his futures position. He can do so simply by selling a futures contract on wheat and paying the price difference, thus canceling his obligation to deliver wheat on the contract. The standardized features of futures contracts, performance margining of both short and long positions, and daily marking to market of open positions are among the features that contribute to the liquidity and importance of futures as a price discovery and risk management tool.

Since futures prices are referenced by many sectors of the economy, price discovery is a vital function of futures markets. Futures are part of a class of financial instruments known as derivatives, whose value depends upon the price of an underlying asset. The assets underlying a futures contract include commodities (such as pork bellies or crude oil), securities (such as stocks or bonds), currencies (such as Japanese yen or British pounds), rates (such as interest rates, inflation rates) or indexes whose values depend on the performance of a basket of assets (such as the Standard and Poor's Index of 500 stocks). The liquidity and low cost associated with assuming futures transactions make them the center of price discovery for many of the underlying assets. As such, the price and quotation data generated on the futures exchanges are important indicators of both the present and future value of the underlying assets.

With respect to quotations data in the traditional futures markets such as commodities, the market structure of a continuous auction where brokers and dealers strike transactions in an open outcry setting means that there is no explicit agent responsible for posting a bid and ask quotation. The quotes of floor-traders are not "posted" ex ante, but are revealed as the participants on the floor yell or signal their bids and offers with hand motions. As the quotes are voiced, they are posted: the price reporter enters them immediately into a reporting device, and they appear contemporaneously on the screens in the trading pits and are transmitted to the market data vendors. In addition to the price associated with transactions, price reporters report the most recent highest bid and lowest offer that have been communicated in the pit. In a traditional futures pit, the existence of a spread between bids and offers is indicative of an illiquid period of market activity, since transactions are characterized by a meeting of the best bid and best ask in a trade execution.

In the futures markets, all orders, including market, limit, and other orders, submitted by customers reside with the Futures Commission Merchants and brokers that are responsible for executing the order when the price is touched. Thus, price contingent orders, to the extent they comprise an array of quotation data descriptive of market supply and demand, do not become the property of the exchange nor the public at large. In fact, futures practitioners are quick to note that limit orders, like all orders submitted and held by brokers, are *not* quotation data, but are order data. The order data are de facto the property of the customer and his agent on the floor.

Quotes by definition are only those prices that are verbalized in the ring for all to hear. In the futures market, the broker-dealer has a statutory duty not to trade ahead or against his customer orders in such a way that he profits at his customer's expense. He also has a fiduciary responsibility to get his customer the best available price in the market. Thus, the agent is careful not to reveal the order until he verbalizes it, nor the order size until the entire order is executed.

Two factors that have increased the frequency and depth of reporting of market data in the futures markets are the integration of automated trading and the proliferation of financial futures. The underlying value of financial futures is not directly dependent on physical supply, but rather on a typically more complex and varied set of factors (such as interest rates, credit risk, currency rates, inflation, etc.). Back months (contracts whose maturity date is more distant than the front month, which will mature first) in financial futures are typically deeper than that of commodities, and can have maturities ranging up to ten years. As a result of these factors, even some liquid contracts in financial futures will have continuously updated quotations that contain the highest bid and lowest ask in the contract. In these cases, the best bids and asks become part of the ticker data disseminated by the exchanges. Appendix A contains a description of the data fields that are eligible for reporting, along with a description of the technological interface used by the futures exchanges.

2. Equities Markets

Real-time data in the equities market include the price of the last completed transaction (sometimes referred to as the last sale), the number of shares transacted at that price, and the SRO furnishing the price (in effect an indicator of where the transaction took place). In addition to information describing the last trade, securities markets require SROs to collect quotation information from all trading a particular stock and disseminate the best bid and ask to broker-dealers and information vendors. As a result of the Display Rule described earlier, broker-dealers and information vendors, in turn, cannot provide a display of any information unless it also includes this "National Best Bid and Offer" or the NBBO. In the listed markets, the NBBO is referred to as the Consolidated Quotation or CQ data, while in the over-the-counter market of Nasdaq, the NBBO is referred to as Level 1 data.

The publication of price contingent orders, including market maker quotations and limit orders, has been a source of considerable controversy in the equities markets. In the agency markets' microstructure, such as the specialist based system of the NYSE, the limit order book has been controlled by the specialist and not available for dissemination to the public.[32] Floor traders—in effect, broker dealers operating on the exchange floor—also possess orders (not-held orders), many of which are price contingent. They are not required to divulge information regarding the prices or the size of the orders to the public.

Recognizing that limit and not-held orders contain implicit information regarding the value and trading interest for a particular stock, many have lobbied the SROs and the SEC to require the limit order book and not-held orders be made public in some fashion. The argument is that these

[32] The NYSE has recently begun marketing a proprietary product, NYSE OpenBook, that provides access to limited information on the top bids and offers in the limit order book, to market professionals.

orders contain substantial information regarding market depth, specifically the direction of trading interest (whether there are more bids than offers, for example, or vice versa) and the size of trading interest (how many shares are being bid and offered for each outstanding order). It is argued that the specialists and floor traders are at a competitive advantage and, therefore, they will use this information to profit at the expense of principals (investors, fund managers) and their agents who do not have a floor presence and therefore do not possess the information.

While the advantages and disadvantages of the specialist or agency microstructure is well beyond the scope of this report, the futures market model for information dissemination contains some precedence and logic that can usefully be applied to the equities markets, particularly with respect to order data such as that contained in the limit order book or that held by floor traders. As with brokers in the futures pits, floor personnel including specialists and floor traders have a fiduciary duty to the public to execute orders at the best price(s) that can be attained for that order. In this respect, orders are the property of the submitting principal (including investors, fund managers, dealers, etc.) and floor personnel recognize that displaying those orders could compromise their ability to get the best execution in the agency auction setting.

3. OTC Markets

Treatment of order data as proprietary and therefore, subject to limitations on its dissemination, is a somewhat different issue in the over-the-counter equities markets. In the OTC setting, the market microstructure is that of a dealer market, where traders communicate their trading interest through electronic means, and such order information forms the raw material for all transactions. Nasdaq is the umbrella electronic market disseminating quote information for trading OTC equities, and was formed by the National Association of Securities Dealers, or the NASD. In order to take orders from customers, Nasdaq dealers (or market makers) are required to post both a bid and an ask for stocks in which they deal (referred to as making a two-sided market), and these quotes form the basis for transactions. Nasdaq displays an array of the best bids and offers, the number of shares for each bid and offer, and the dealer that has posted that quotation. This is done for each stock listed as a National Market System security on Nasdaq for the market makers that participate in the Nasdaq system. The best bid or offer is eligible for inclusion in the NBBO, if in fact it is the best price quoted for the stock in question.

4. Quality and Quantity of Data

In both futures and equities exchanges, the competitive auction models employed necessitated the use of price reporters to capture the data for transmission out to vendors and the public. In both stock and futures markets, as electronic trading platforms have been introduced and interfaced with the trading floors, price reporting depth and frequencies have markedly increased. In addition, higher volumes of trade registered in the equities markets result in significantly greater volume in terms of the frequency and depth of data reported, depending upon the stock in question.[33]

An often cited measure of market quality is the level of market transparency. A market is considered most transparent if contemporaneous price and quote data are easily accessible and

[33] Thinly traded and illiquid stocks see infrequent revisions to the last sale and NBBO data.

available without discrimination to both agents and their principals. While the futures markets regulatory baseline for data reporting is lower, a continuous stream of real time data is available in a variety of formats and through varied means, suggesting that futures markets are highly transparent. Similarly, US equities markets are considered highly transparent, although it is hard to say whether the source of that transparency is market driven or the result of a higher regulatory baseline. In either case, the ease with which market data can be obtained on stock and futures prices suggests comparable levels of transparency, with some observable differences we will proceed to document.

In both futures and equities markets, principals have access to data either by subscriptions provided in great variety by vendors or directly through their brokers. On the futures side, FCMs and introducing brokers enter into licensing agreements either with data vendors or directly with exchanges that enable the futures intermediaries to provide real-time transactions data to their customers. Vendors are the same across futures and securities markets. Vendors compete on both price and quality, and seek to differentiate the data in the way that they are bundled, in presentation, and in add-on analysis tools in order to appeal to different segments of consumer demand.

B. Technological Change

As noted, securities and futures exchanges had made progress toward technological innovation in the early 1970s. As a result of unprecedented increases in stock trading volume and increased participation of institutional investors, a severe and persistent paper backlog on clearance and settlement plagued the securities exchanges in the late 1960s. Without the automation of back office functions, stock exchanges were occasionally forced to stop trading in order to move the paperwork through, even though stock transactions were not settled for 5 days (T+5 settlement).[34] In both stock and futures markets, the necessary automation in the back office drove automation in the front office. As a result, markets went from delivery of market data via telegraph to main frame computer technology and delivery of high speed tape over phone lines.

The coordination of back office functions and market data dissemination continues in the futures markets.[35] The futures exchanges established the Inter-exchange Technical Committee, a cooperative organization composed of the futures exchanges and market data vendors, which implemented the T+1 settlement model in use today more than a decade ago. This back office automation is vital to futures markets, since daily and sometimes intraday marking to market is an important feature of their settlement process. These detailed transactions data (CTR data) have been consolidated and available to exchange self-regulatory arms and the CFTC as federal regulator to monitor and manage risk at the client, broker-dealer, clearing-house and exchange levels, to ensure compliance, and to aid in surveillance and rule enforcement.

Futures exchanges' have also acted cooperatively to set technical standards for the data industry so as to insure that high quality real-time consolidated data are available. Interest in establishing high speed quotation lines is another area pursued by the ITC. The ITC is an "informal

[34] Sidney Robbins et al, "Paper crisis in the securities industry", Lybrand, Ross, Montgomery, NY, 1969

[35] In the area of clearing and settlement, securities markets are behind the futures markets and the rest of the world in equities markets, utilizing a T+3 settlement window.

committee of technical representatives of commodity exchanges which meets on an as-needed basis", which offers a single source of specifications for the transmission of price and quotation information between exchanges and to vendors.[36] The interfaces, formats and conventions established by the ITC emphasize data integrity and error recovery capability. Following ITC specifications, vendors and subscribers usually develop their own systems to read exchange lines and reformat the data in a suitable manner for end users.

In the equities markets, the central consolidator model resulted in networks in which a single repository and processor of information was designated, SIAC for listed securities, and Nasdaq for the unlisted securities. From a technical standpoint, the regulated solution hastened the movement toward scale processing of market data and uniformity in technical specifications and data output. It has been suggested that this system has been slow to innovate its own internal processes. As will discussed later, the review process associated with technological changes and display features proposed by vendors and broker-dealers is also wrought with complex reporting features and delay, leading many to suggest that external innovation is also discouraged.

C. Information Dissemination by Futures and Securities Exchanges

Both futures and equity markets are required by CFTC or SEC regulations to disseminate certain portions of market information. Using this required level of disclosure as a baseline, markets choose to disseminate additional market data. In the equity markets, the regulatory minimum calls for the consolidation and dissemination of continuous intraday market information. As such, a contractual interpretation of the regulatory minimum is imbedded in the data vendor contracts. Futures vendor contracts are less imposing in many respects, in part because futures markets are not required by law to disseminate intraday data, giving the exchanges and the vendors more flexibility in contracting.

With futures markets, the definition of market data found in vendor contracts is descriptive of information dissemination beyond the scope of regulation. In the market for market data, conflicting regulatory approaches have led to the growth of divergent business models. Where futures markets are able unilaterally to determine the form, substance and price of their market information, equity markets are constrained by regulation and the shared governance model it entails.

Typical of futures markets, the CBOT defines the content of its market data as follows:

> "…CBOT Market Data includes, but is not limited to, bids asks, and market prices of commodity futures or options, opening and closing range prices, high-low prices, settlement prices, estimated and actual contract volume, and information regarding market activity including exchange for physical transactions."[37]

Common across all definitions of market data is a list of specific datum, and a clause allowing for the addition of datum. Visiting the CBOT web site provides a visual display of the above description. For example, following the Quotes & Data link, financial futures, 30-year U.S.

[36] ITC Specification 2.1 Documentation http://www.mgit.com/pubopen/freedown.htm
[37] Chicago Board of Trade Market Data Vendor/Subvendor Agreement, 2001, p. 1.

Treasury Bonds, produces a table covering the open-outcry market activity for bonds of different maturities. Each row lists a bond of different maturity, and each column corresponds to an item of the above definition. The data here are delayed by 10 minutes.

In addition to the table, market information on futures contracts may be viewed in chart format. For example, following the Market Information link, chart link, a list appears. Choosing financial products, 30-year U.S. Treasury Bond with a maturity of September '02 results in a chart. The top section of the chart is equipped with both a 9- and 18-day moving average weaved around lines that represent daily range and closing prices. The bottom section focuses on volume and open interest, but can be displayed stochastically or by way of a relative strength measure. Above the chart are several links, one of which produces a 10-minute delay chart.

The NYSE definition of market information rests upon the threshold established by regulation. The division between regulatory minimums and market self-determination is exemplified in the NYSE Professional Subscriber Agreement. It reads as follows:

> "Market Data" means (i) CTA Network A last sale information, (ii) CQ Network A quotation information, (iii) NYSE bond last sale information, (iv) NYSE bond quotation information, (v) NYSE index information and (vi) each other category of market information make available by NYSE as NYSE may designate from time to time.[38]

Clauses three through six are referred to separately as "NYSE Securities Information". Nearly identical language and separate definitions exist in the AMEX Professional Subscriber Agreement. This split is rooted in the CTA definition of what constitutes an "eligible security". All non-eligible securities (such as bonds) fall under the auspices of NYSE or AMEX security information.

Like the CBOT, a link on the NYSE website offers delayed market data in a number of forms. A scrolling ticker provides data that are 20 minutes delayed, with the delayed transaction price along with the change in price from the previous transaction. The ticker can display a portfolio of up to 20 stocks. Unlike the typical ticker seen on financial news programs, this ticker does not display any order size. In addition to the ticker, by inputting the purchase price and number of shares of each stock, an investor can view a list that summarizes changes in the value. Stock by stock charting is also available, with price and volume for various time frames: daily, weekly, quarterly or yearly.

In the futures markets, the absence of regulations that explicitly require the dissemination of specific intraday market information allows exchanges more flexibility in their ability to differentiate the data and enhance their value. As a result, futures exchanges provide an extensive variety of data that can be obtained through a number of means. However, due to regulation requiring consolidation and display, equities exchanges are not the direct source for market information and their ability to version their data for public consumption is limited. For example, in the case of NYSE eligible securities, Network A is the mandated source of market data, which includes data from all trading locations that trade in NYSE eligible securities. The designation of Network A as a supplier of NYSE data limits the value of unconsolidated NYSE

[38] Agreement for Receipt of Consolidated Network A Data and NYSE Market Data, Form 2-207, Rev. 12/91.

data. This leaves the NYSE with less reason to invest in innovations in the collection and provision of market information to the public, where regulation prescribes that returns to innovation be shared with participants in Network A.[39]

As required by regulation, all equity markets maintain a level of cooperation with respect to the collection and dissemination of consolidated market information. Within the Network model, the individual exchanges do not have flexibility to package and sell information on eligible securities. As a result, the NYSE, or any equity market, will limit the number of innovations it will undertake. With potentially fewer options and limited upside potential on the options that do exist, the regulatory environment in the equity markets slows the pace of innovation in the delivery of market information to the public.[40]

D. Conclusion: Comparable Quality and Quantity of Information in Futures and Securities Exchanges

In the preceding sections, consideration of market data across futures and equities markets, while complicated by differences in market microstructure, yields some guidelines for comparison. In both the futures and equities, intermediaries that cater to market data consumers such as market data vendors and broker-dealers employ essentially the same business model. Since market data are the raw materials of their business, facilitating customer access to high quality, useful market information is a primary objective. While noting institutional differences, market data vendors and broker-dealers with whom we spoke that consume both equities and futures data suggest that the real-time data streams emanating from the equities consolidators and from the futures exchanges are comparable with respect to quality and quantity. Therefore, in the analyses that follow, prices are compared across equities and futures markets for data feeds, for which prices are based on the number of devices.

VI. Comparison of Cost of Data in the Two Market Settings

As noted in the previous section, real-time data streams include the most recent transaction data (including the exchange, the price, and the share volume transacted, and for some contracts, estimated volume in the case of futures), the change from the last transaction, the daily price range (high and low) for the stock or futures contract, the best standing bid and ask for the stock or future (if appropriate), and the size of the trading interest at the bid and the ask in the case of equities. In addition to basic data, like those provided via a data feed, additional information can be gotten in both stock and futures markets, including intraday statistical data and analysis tools

[39] The NYSE has instead focused investment and innovation in a proprietary network of market data products, including the NYSE OpenBook and Market Data Express (MDX), which provide real-time data direct from the NYSE to members, sponsored nonmembers (e.g. institutions, broker/dealers, and individual investors), and data vendors, at a premium price (see www.NYSEdata.com). Since these are not Network A products, they are not subject to the constraints of regulation in either content or conduct, so revenues accrue to the NYSE, and are not parsed across Network plan participants.

[40] Where there is less regulatory scrutiny or fewer formal statutory constraints, such as the proprietary data market which caters largely to professionals, we see a variety of data offerings delivered via multiple platforms. See, e.g. www.NYSEdata.com.

and output, but differences between the data delivery mechanisms and packaging make a head-to-head comparison more difficult.

In both equities and futures, a data feed allows information consumers to receive a basic data stream. Consideration of these prices allows for a uniform comparison of real-time data across equities and futures markets which, although they are not identical, are of comparable quality and quantity. In this section the explicit fee structures for market data in the equities and futures markets are detailed. Explicit fees include access fees and usage fees, which are considered first separately and then combined at the end of the analysis.

A. Access and Administrative Fees

1. Equity Markets

In accordance with the National Market System, security markets consolidate and distribute market data from a central location. Separate systems, or Plans, provide the framework for this cooperative arrangement. Under these Plans, there are two methods used to divvy up shared expenses and revenues. Each Plan, however, has its' own fee structures for the sale of consolidated market data. These fee structures create the revenue stream shared by the Plan participants, and it is these fees that we detail. The mechanics of data consolidation require review first since this consolidation process is the primary functional difference between the market types.

Unconsolidated market data are generated, collected and transmitted by market centers and dealer-markets. A SIP receives trade and quote data from multiple trading venues and consolidates the information according to regulation. So, for instance, all trade and quote data related to shares of XYZ Inc. generated by numerous market centers, ECNs and/or broker-dealers are transmitted to the Plan SIP. The SIP consolidates, or generates one data stream, out of the multiple streams of data. Once consolidated, the data are made available for purchase. Certain expenses incurred by the SIP are shared, resulting in a pool of revenue net of costs to be shared among Plan participants.

Consolidated market data are generated by three entities in the equity markets; Network A, Network B and Nasdaq/UTP.[41] The securities reported under each Plan are determined by listing location. Network A reports all NYSE-listed long-term warrants, common and preferred stock, while Network B reports all AMEX-listed long-term warrants, common and preferred stock. Quotes and last trades for listed securities are reported on these two Networks in compliance with the Consolidated Quote (CQ) and Consolidated Tape Association (CTA) Plans. Meanwhile, Nasdaq National Market Securities and OTC market information is reported under the Nasdaq/UTP Plan. In Nasdaq, last trade data are termed NTDS while quotation data are Level 1 data. These three entities provide consolidated equity market data, be they CTA/CQ or NTDS/Level 1, through their SIP to the data recipients.

[41] The plan for unlisted securities will be referred to as Nasdaq/UTP. The SIP for unlisted securities, i.e. those traded via Nasdaq, which was founded by and is majority owned by the NASD, is referred to as Nasdaq.

Network A and Network B use the same SIP, the Securities Industry Automation Corporation (SIAC), which is a subsidiary of the NYSE and the AMEX. Like SIAC, Nasdaq is the processor for market data reported under the Nasdaq/UTP Plan. Thus, for consolidated equity market data, there are two sources: SIAC and Nasdaq.

Access fees for Networks A and B are bundled together. Vendors must establish direct data links to SIAC, and pay direct access fees. Sub-vendors and clients who take a data feed from a vendor have indirect access to CTA/CQ data via direct vendors and must pay indirect access fees. Direct and indirect access fees are detailed in Table 1.

Table 1
Monthly Direct Access Fees

Monthly Access Fees for Networks A and B	**Consolidated Last Sale (CTA)**	**Consolidated Bid-Asked (CQ)**	**Combined CTA/CQ Data**
Direct Access	$750.00	$700.00	$1,450
Indirect Access	$375.00	$350.00	$725

Source: NYSE Schedule of Monthly Charges

A data vendor wanting to receive and retransmit market data from both Network A and B must pay for each stream of data. Combined, CTA/CQ market data costs $725 per month for indirect access and $1,450 per month for direct access.

To receive comparable Nasdaq data via a data feed, a vendor pays a similar fee, which is referred to by Nasdaq as an Annual Administrative Fee. Nasdaq, as the Plan administrator, charges vendors an annual fee for the distribution of real-time market data according to the number of interrogation devices they service. Nasdaq upfront fees are assessed per firm per year, and increase discreetly as the number of terminals increase. Fees are listed in Table 2.

Table 2
Nasdaq Annual Administrative Fee

Number of Devices	**Annual Fee**	**Monthly Equivalent**
0-999 real-time terminals	$500	$41.67
1,000-4,999 real-time terminals	$1,250	$104.17
5,000-9,999 real-time terminals	$2,250	$187.50
10,000 + real-time terminals	$3,750	$312.50

2. Comparison of Access Fees Across Futures and Equities Markets

To form a comparison across market types, we abstract slightly from the term access fees. In general, access fees are interpreted to mean any up-front, unavoidable charges incurred prior to the receipt of market data. Since both access and administrative fees can be viewed as up-front

costs, they will be included in this comparison. In Table 3, futures market access and administrative fees are listed along with the equity market fees. The right-hand column shows monthly vendor cost across all markets for a twelve-month period.

Table 3
Access and Administrative Fees

	Average Monthly Access Fees	Annual Equivalent
Network A/B	$1,450	$17,400
Nasdaq/UTP	$41.67 – $312.50	$500 – $3,750
CBOT	$1,000	$12,000
CME	$625	$7,500
KCBT	$600 - $700	$7,200 - $8,400
NYBOT	$500	$6,000
NYMEX	$750	$9,000

Source: Vendor contracts from network plans and exchanges.

The CBOT recently increased its access fee from $625 to $1000. Such changes are made at the discretion of the market and require written notice to the vendor. Fees charged by Networks A/B and Nasdaq/UTP have been stationary since 1998, possibly due to the governance structure of the Plans. Based on the figures in the table, we see that access fees for futures market data range from $600 to $1,000 per month. Access to market data from equity markets ranges from $41.67 to $1,450, depending on the number of devices serviced by each data feed.

B. Usage Fees

1. Usage Fees in Equity Markets

Usage fees for vendors of trade and quote data accumulate based on who, what, when and how they transmit market data. Who receives what data, how much and when? Are they real-time or delayed? How are the data received (data feed or stand-alone terminal)? Are they being retransmitted? If so, then return to the first question and repeat. Emerging from this basic formula are many classes of data recipients and different fee structures for the various classifications. Classifying consumers of market data allows the purveyors of that data to differentiate consumers so that they may be charged different prices, from the data provider's point of view, the highest they are willing to pay.

Following a hub and spokes pattern, vendors who receive and retransmit market data are the major hubs. If the party receiving market information from the vendor is approved to retransmit data, then they become minor hubs, or sub-vendors. A subscriber is a data recipient who does

not retransmit data, but who can relay market information in a permitted business setting. As end-users, subscribers are classified as professional or non-professional.[42] Vendors, broker-dealers, and sub-vendors retransmit data both internally and externally.

Equity markets rely heavily on user distinctions in their invoicing process. Data vendors and broker-dealers receiving data feeds are billed for all internal distribution plus any external distribution to non-professional subscribers. Professional subscribers are invoiced directly by the Plan administrator, e.g. NYSE for Network A, Amex for Network B, and Nasdaq for Nasdaq/UTP. In the case of Network A and B, broker-dealers may cap their monthly fees on an enterprise level and with respect to their non-professional clients. Nasdaq similarly allows a cap to be applied on a per client basis. With respect to both markets, the consumer of data must make the selection *ex ante.* For uniformity of comparison, the costs of real-time market data are compared across equity markets as they relate to professional subscribers on a per-device basis.

Across all equity markets, professionals must specify in advance whether they wish to be charged usage fees by either a device rate or by a quote packet rate.[43] Table 4 lists the device fee schedule for Network A.

As evident in Table 4, the variable cost of devices measure ranges from $127.25 for the first device, to $18.75 for each device when 10,000+ are in use from one data feed. The marginal cost of devices then decreases, in a highly non-linear fashion, as devices in use increases. For example, between devices 1 and 5, total marginal price changes erratically. For 2 devices, the cost of the first device is $127.25, but the marginal cost of the second device is $31.75. Similarly, the marginal cost of the third device is $15.75. In percentage terms, these marginal cost shifts are -74.75% and -50.39%. Following, the total marginal costs of the 4th and 5th devices are $37.25 and $26.75, changes of +136.51% and –28.19%. This pricing structure rewards institutions who can optimize on the number of devices in use, and that optimization is complicated by severe jumps in the marginal cost structure.

[42] The *NYSE and AMEX - Application and Agreement* defines "nonprofessional subscriber:"
"Subscriber certifies that he/she is a natural person who is neither
(a) registered or qualified with the Securities and Exchange Commission, ("SEC"), the Commodities Futures Trading Commission, any state securities agency, any securities exchange or association, or any commodities or futures contract market or association,
(b) engaged as an "investment advisor"…
(c) employed by a bank or other organization exempt from registration under Federal and/or state securities laws to perform functions that would require him/her to be so registered or qualified if he/she were to perform such functions for an organization not so exempt."

[43] "…includes any data elements or all data elements in respect of a single issue."-*Market Data Schedule of Monthly Charges*

Table 4
Network A Fee Schedule

Number of Devices	Monthly Rates per Device
1	$127.25
2	79.50
3	58.25
4	53.00
5	47.75
6-9	39.75
10-19	31.75
20-29	30.25
30-99	27.50
100-249	26.50
250-749	23.75
750-4,999	20.75
5,000-9,999	19.75
10,000+	18.75

Source: NYSE Schedule of Monthly Charges

Marginal cost reduction as a percentage of total cost is highest with the addition of the 750th device, which leads to a drop in total device cost of $2,226.25 or 12.51% of the cost of 749 devices. Dividing this cost savings by the marginal cost per device suggests that the lowered marginal price per device in the higher bracket lowers total cost enough to add up to 107 devices without exceeding the total cost of 749 devices. This equates to a 7% increase in devices without raising total costs. In fact, 856 devices cost $26.75 less than 749 devices. This pattern repeats itself as you increase devices. While the pricing structure of Network A provides cost advantages to data recipients with large numbers of devices in one location, these jumps skew incentives and create inefficiencies in device usage.

Complicating the device-based pricing problem in equities markets is the need to determine the method of cost accounting *ex ante*. Given the number of devices a professional subscriber uses, the number of quote packets that may be used in a given month must be estimated for the professional to determine a cost minimizing strategy. They then must choose to be charged by the device fee schedule or by the quote packet. Table 5 summarizes the per-quote prices for Network A and B.

Table 5
Network A and B Quote Packet Prices

$0.0075 for each quote packet up to 20 million quotes
$0.0050 for each quote packet between 20,000,001 and 40 million
$0.0025 for each quote packet above 40,000,001

Consider a professional subscriber with five devices, with a total monthly usage cost of $238.75. For each basket of quote packet charges, this figure has a cost equivalent expressed as a quantity of quotes. For instance, when quotes cost $0.0075, $238.75 would buy 31,833 quotes. So a cost minimizing professional subscriber with five devices and expecting to receive under 20 million quotes in a month, would choose the cost accounting method by estimating the number of quote packets they expect to receive in a given month. Any estimate lower than 31,833.33 would lead a cost minimizing professional to prefer the quote packet rate of $0.0075 for a total cost less than the five-device fee of $238.75. This analysis ignores reporting costs that include quote counting mechanisms, making it expensive for small broker-dealers and making vendors less likely to offer it to smaller organizations.

From the point of view of a broker-dealer who acts as a data vendor, the internal professional transmission of market data plus these non-professional fees and the assorted fees detailed later can be capped at $525,000 per month. By either increasing the number of internal professional and/or external non-professionals, to the point of exceeding the monthly cost cap, very large broker-dealers can benefit from the Network A pricing structure. Industry experts suggest that very few organizations can take advantage of these caps.

Table 6
Class C Fees

Computer Program Application Fees (Networks A and B)	**Network A**		**Network B**	
	CTA	**CQ**	**CTA**	**CQ**
Professional Service-Member Firms Use of real-time data for professional subscribers representing a member firm.	$18.75 – $127.25*		$13.60	$13.65
Professional Service-Non-member Use of real-time data for professional subscribers representing a non-member firm.			$14.60	$15.60
Compilation of Stock Tables- Use of market data in the compilation of stock tables and summary statistics for press associations or printing.	$500	$500	$200	$200
Operations Control Program- Use of market data in program used to monitor various market activities.	$500	$500	$200	$200
Analysis Program- Use of market data in program that leads to trading decision.	$500	$500	$200	$200
Market Making Program- Use of market data in programs that generate quotes used to trade in a proprietary fashion.	$3,000	$3,000	$1,000	$1,000
Real Time Market Check- Use of Network B market data to provide post-trade market conditions related to traded issue. Waived if included in a system subject to interrogation fees.	N/A	N/A	$100	$100

*Sources: www.amextrader.com and NYSE Schedule of Monthly Charges

Like Network A, Network B has the same three quote packet baskets with the same fee assigned for each. The Network B device structure, however, is a flat rate in terms of ticker display. Per

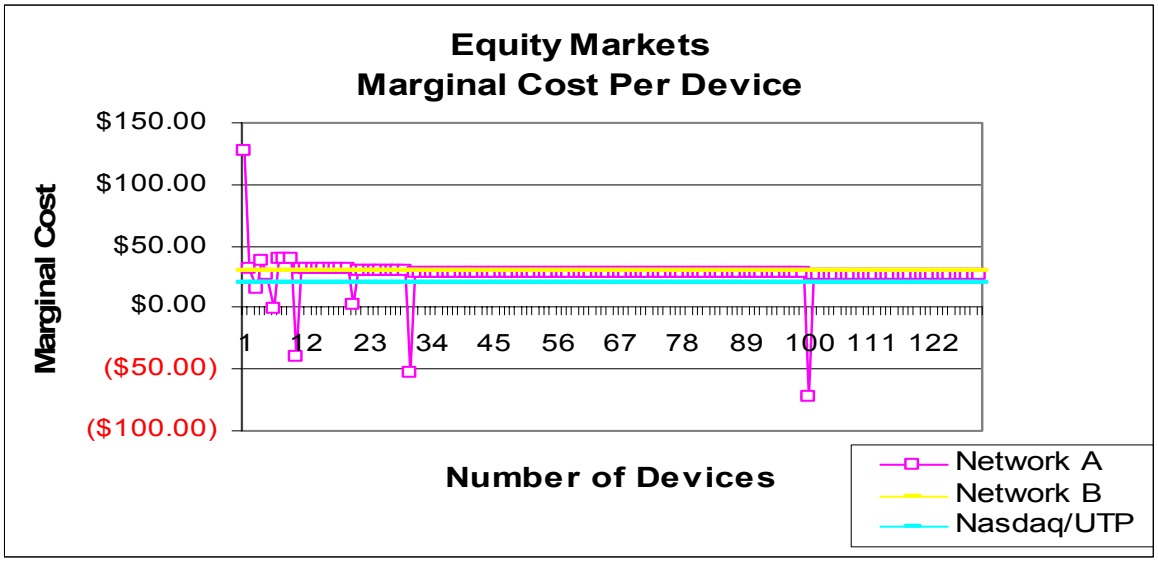
device, the fee for a professional who is an exchange member, Network B ticker display is $13.60 for last sale data and 13.65 for best quote data. Non-members face a combined cost of $30.20 per month. Network B also offers a broker-dealer cap of $500,000 a month, but again few organizations are said to qualify for the cap.

Perhaps the fees that most distinguish the equities and futures pricing structures are those that apply to the manner that market data are used. The Class C fees are assessed for both Network A and B, and they are additive to the fees charged for data feeds. Network A charges a fee to televise a ticker.[44] Additional fees are charged when the data is used for the compilation of stock tables and or in analysis programs. Table 6 summarizes these fees, referred to in the industry as Class C charges. As noted, Network A bundles CTA and CQ data and does not distinguish between member and non-member, but rather price based on number of devices. The explicit use of CTA data results in one fee, while CQ data elicits an additional fee.

Last sale data, using Nasdaq/UTP terminology, are Level 1 data, while quotation data are referred to as NTDS. In addition to the administrative fees outlined in Table 2, the professional NTDS/Level 1 costs the data recipient $20.00. The January 2002 *Nasdaq Market Data Policies* report states the monthly professional cap to be $20 or 2000 quotes and the non-professional cap as $1 or 200 quotes. The per quote packet rate of $0.005 per query is available for both professionals and non-professionals.

Figure 1 shows the marginal price of professional devices in the equity markets.

Figure 1
Marginal Usage Fees in Equities Markets

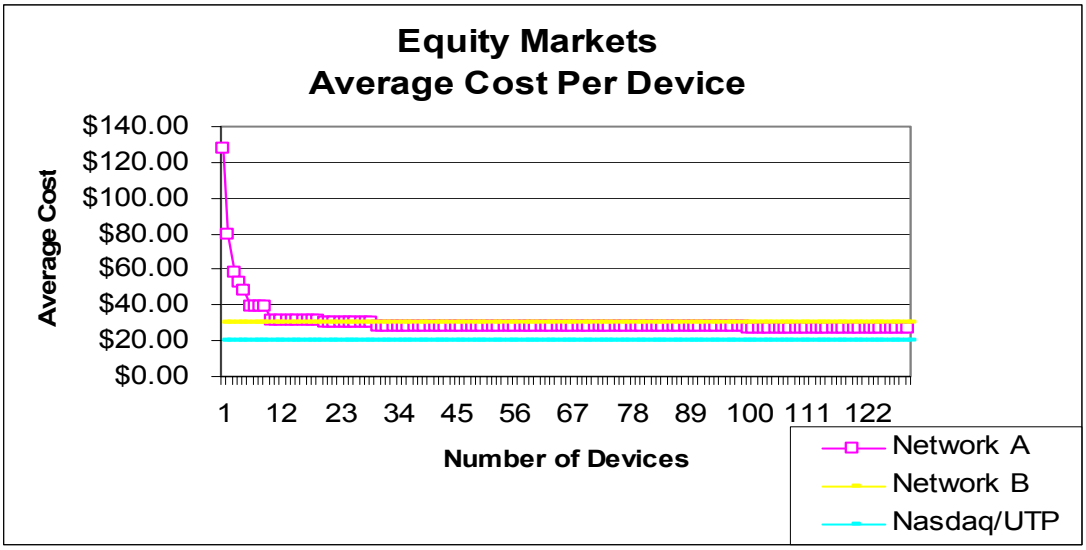


In the Network A pricing structure, beginning with the seventh device, there are sharp dips in the marginal cost. For example, device 100 lowers the total marginal cost by $72.50, which translates into a negative marginal price for the 100th device. If the analysis were extended to

[44] $2.00 per thousand households reached—Minimum vendor payment of $2,000 per month.

5,000 devices, Network A's marginal price would fall below the Nasdaq/UTP marginal price of $20.00. Network B has a constant marginal price of $30.20. The Nasdaq/UTP usage fee is also flat at $20. Figure 2 shows us the average cost of equity market data per professional device.

Figure 2
Average Usage Fees in Equity Markets



Network A has a steadily falling average price, which levels out within each basket of devices. As with the marginal price comparison, the average cost of Network A devices drops below the cost of Nasdaq/UTP devices starting with the 5,000th device. This cost structure has different implications for the two types of professionals; the broker-dealer and the subscriber.

While the professional subscriber faces relatively high average costs over the first 10 devices, the professional broker-dealer can take a longer view of Network A and B average costs. From the broker-dealer perspective, two advantages exist; their likely use of a larger number of devices and their ability to cap their overall monthly costs. Utilizing more devices allows broker-dealers to benefit from a lower average cost. Holding all other broker-dealer costs at zero, the Network A broker-dealer cost cap would be reached by the use of 28,000 Network A devices. Any further device use would necessarily lower the average cost per device for the professional broker-dealer. The same is true for professional broker-dealers utilizing 18,349 Network B devices. So where the professional subscriber faces high average costs with the use of a few devices, the professional broker-dealer would pay a lower average cost by using a larger quantity of devices, and by capping their monthly costs.

With respect to delayed data (defined by Nasdaq as data that are 15 minutes old), vendors of delayed Nasdaq/UTP market data pay one of two annual fees; $250 per year if they receive and retransmit delayed data, $500 per year if they receive real-time data and redistribute delayed data, plus access fees as outlined earlier.[45] Similarly, real-time last sale data purchased and paid for in Network A and B may then be delayed by 20 minutes and redistributed at an additional

[45] NASDAQ Vendor Agreement for External Distribution of Delayed Market Data- Attachment A Item #1c

cost of $500 per year. Network A and B explicitly prohibit the dissemination of delayed quotation data, and contractually define the life-span of last trade information to be 20-minutes post transmission from the trade originating SRO.

2. Usage Fees in Futures Markets

Future markets depend on the classifications of data recipients in their billing process to a lesser degree. Only the Chicago Mercantile Exchange (CME) differentiates between professionals and non-professionals. The CBOT provides a monthly rebate of usage fees to members. Further, futures exchanges do not have separate additive fees that are based on how the data are used (as detailed in Table 6). In general, futures markets differentiate the consumers of market data markedly less. Fewer classifications of data recipients results in lower implicit costs related to reported data usage. Before considering this implication, we construct a measure of cost comparison between the futures markets, and combine this with our intra-equity market cost comparison, to arrive at a cross-market cost comparison of real-time market data.

Most futures exchanges employ a tiered pricing structure with respect to devices. Per location, each data recipient is charged one price for the initial unit, or device, and another price for each additional device. The tiered pricing, termed first unit/add unit, is shown in Table 7 along with the cost of delayed data.

Table 7
Futures Device and Delayed Data Fees

	First unit	Add unit	Delayed Data
CBOT	30	30	see text
CME	60	12	--
NYMEX	60	12	--
NYBOT	83	11	500
KCBT	12	4	100

A concern across all exchanges is to protect the value of information. The Kansas City Board of Trade (KCBT) differentiates between controlled devices ($3.00/month) and open device ($4.00/month).[46] The KCBT also offers real-time quotations and real-time snapshots.[47] For vendors of KCBT real-time data, there is no additional cost for distribution of delayed quotations, defined here as 10-minutes old, or end-of-day data transmitted to subscribers. Vendors who specialize in delayed data are charged $100 per month for each sub-vendor they provide with delayed data.

The KCBT and the CME have incorporated an internet pricing policy. In both cases, the cost structure is similar to the first unit/add unit structure in Table 7. Other futures markets have

[46] A controlled device is equipped with quote reporting technology, in other words, entitlement control software is used to ensure users are authorized or "permissioned". Open devices lack such controls.
[47] Real-time data provided no more often than 10-minute intervals; $2.00 per month per device.

begun to explore the internet approach, partnering with data vendors to provide click-on access to market data at tailored internet prices. Futures exchanges are contractually adapting to technological changes in the provision of information.

The cost structure of CBOT real-time market data differs from other futures markets in that the marginal price does not fluctuate as locations are increased. Continuous real-time market data costs $30.00 per display device regardless of the number of locations receiving data. In addition, the CBOT offers its members a rebate of $10 per display device. Data are piped into a "dedicated terminal," from which they can be accessed by an "authorized display device." The primary difference between a terminal and display device is the extent to which the data supplier controls and accounts for access to market data. A dedicated terminal allows the data provider more oversight capabilities. Discrete market data updates, termed real-time snapshots[48] cost $15/month per display device.

The CBOT miscellaneous fees include two trademarked items and a wallboard fee[49]. The CBOT Market Profile and the CBOT Liquidity Data Bank (LDB) are trademarked data sets, and cost $7 and $10 per month, respectively. The Market Profile "provides a time and sales Market Data ticker and a current graphic reflecting price/time relationships", while the LDB is described as "an analysis of volume and price for every CBOT contract, including information relating to volume at each price level, percentage of volume at each price related to total volume…" These items provide examples of the innovation in market data products of the futures markets we see at the exchange level.

The CBOT has the most extensive pricing of delayed data amongst all markets. Vendors of continuous CBOT delayed data are charged a monthly fee based on the number of devices they service. The initial cost is $250/month for each device from 1 to 1,500, and $500 for each display devices from 1,501 to 7,500 devices.

The marginal price graph in Figure 3 illustrates the basic nature of the futures' markets device fee structure, where the first device is substantially higher at each location. Only the CBOT employs a flat rate. All the others have a relatively high marginal price for the first device, followed by a relatively low and consistent marginal price for each device thereafter. The largest marginal change occurs in the NYBOT fees, which drop from $83 to $11.

[48] Market data less than 10 minutes old, not refreshed more than once every 60 seconds.
[49] Vendor cost of $60/month for the display of real-time market info on wall display device.

Figure 3
Marginal Usage Fees in Futures Markets

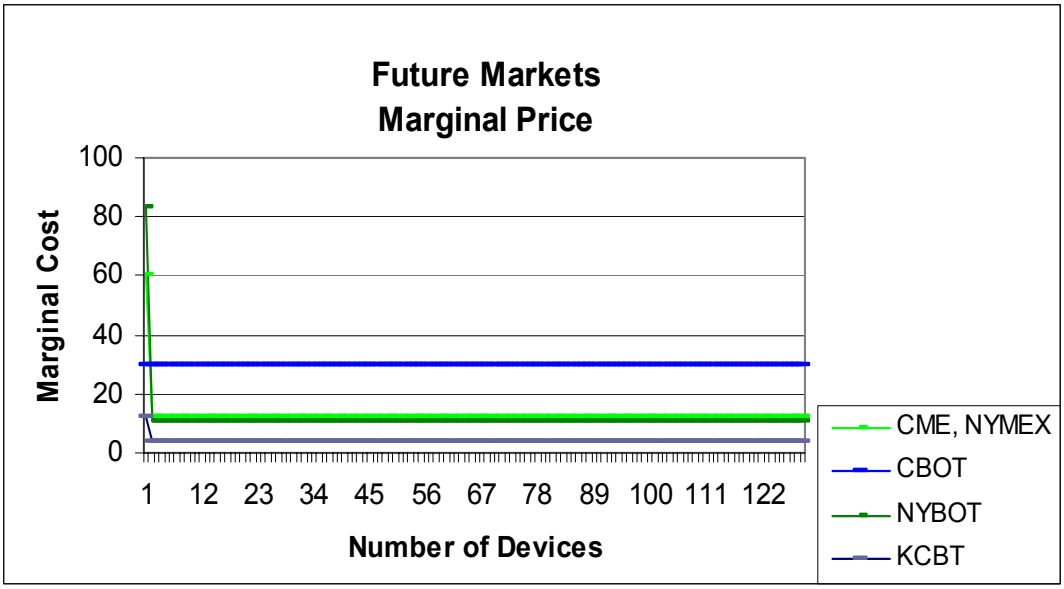
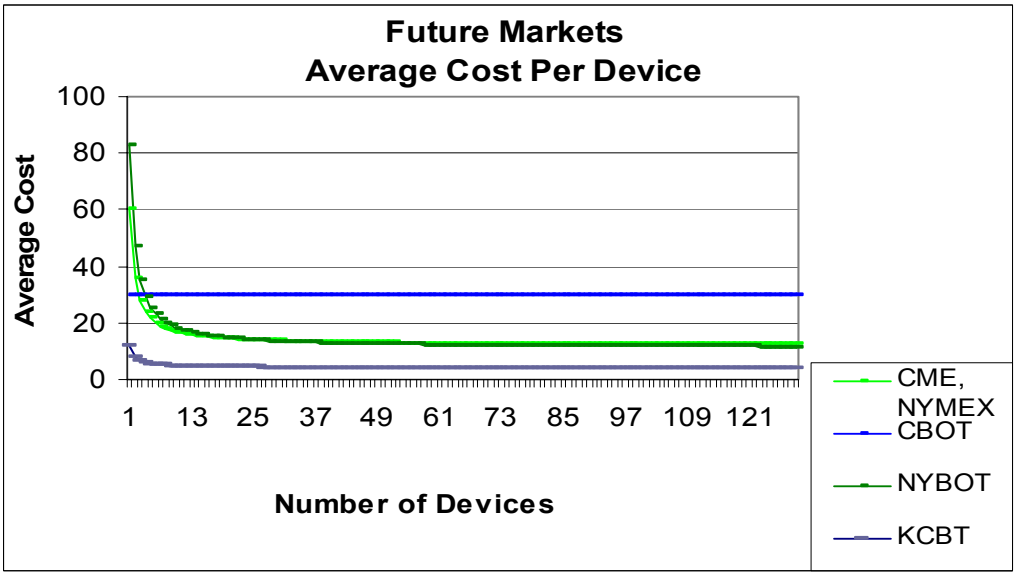


Figure 4 illustrates that the CME average costs drop below the CBOT flat line with the addition of a 3rd device at a single location. NYBOT follows suit with the 4th device. At the 24th device, the average cost per CME and NYBOT device is equal at $14. After which, NYBOT costs continue at a lower average cost approaching $11, while CME average cost approaches $12.

Figure 4
Average Usage Fees in Futures Markets

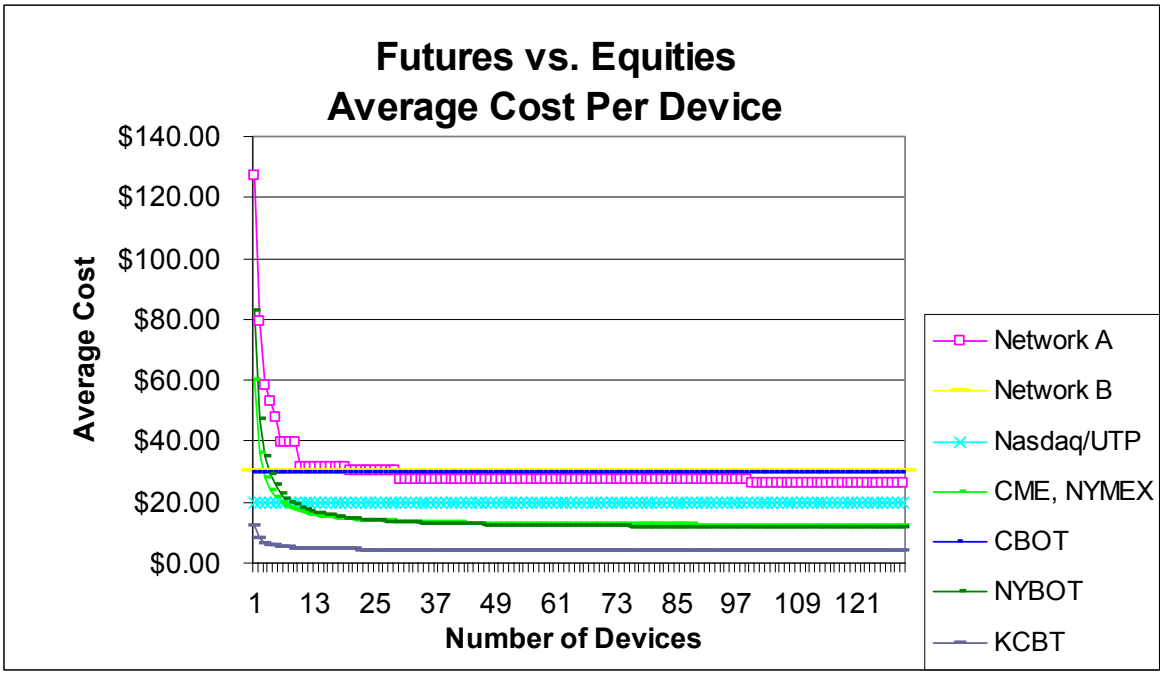


The typical staggered pricing structure of futures markets leads to a rapidly decreasing average cost per device at any one location. Due to its flat rate pricing on a per-device basis, the CBOT market data represent the least cost for professionals of smaller size. Since the CBOT does not use the "first unit, add unit" pricing structure, it is also beneficial to market data recipients who require data at multiple locations.

C. Comparison of Fees Across Equities and Futures Markets

Since per device usage fees are used in both futures and equities markets, they provide one method of comparing the respective cost faced by market data consumers using a common metric. Figure 5 provides a cross-market comparison of professional device fees, using the average cost in order to provide a representation of costs over a range of devices.

Figure 5



Over the range providing for the lower number of devices, the impact of tiered pricing structures and the effect that has on the less device-intensive data recipient is evident. On a per device basis, without factoring in multiple locations and additive fees common in the equities markets, Figure 5 illustrates that the cost of real-time continuous data for professionals drops off faster and more significantly with respect to futures data. Where the average device cost of all futures exchanges with tiered pricing drops below the Nasdaq/UTP flat rate by the 9th device, the NYSE tiered pricing does so with device number 5,000.

Table 8 builds on the Figure 5 average device-cost comparison. Here, access fees are factored in, the effect of increasing locations is added, and total cost is shown over a range of devices.

Table 8
Combined Monthly Access and Device Fees for 10 Locations

	Range of Devices				
	10	50	100	200	500
Network A	1,768	2,825	4,100	6,750	13,325
Network B	1,752	2,960	4,470	7,490	16,550
Nasdaq/UTP	242	1,042	2,042	4,042	10,042
CBOT	1,300	2,500	4,000	7,000	16,000
Nymex	1,350	1,830	2,430	3,630	7,230
CME	1,225	1,705	2,305	3,505	7,105
Nybot	1,330	1,770	2,320	3,420	6,720
KCBT	770	930	1,130	1,530	2,730

Table 8 illustrates the impact of the location-to-device ratio and the influence of flat rate fees on total cost as the number of devices increases. At the 10 device level, the location-to-device ratio is one-to-one. This ratio produces the highest per-device cost within the first unit-add unit pricing structure common in most futures exchanges. At the 10 device level, the tightest grouping of prices is evident. Despite the resulting increase in the per-device cost of futures information, the futures exchanges still exhibit a lower combined cost when compared to Network A or B.[50]

As the number of devices increases, the cost of futures information generally rises at a much slower pace, in part due to the falling average cost per device. Table 8 shows how the tiered pricing of Network A and to a lesser extent, the location-based pricing of futures exchanges, increase the average costs most for small firms with fewer devices. On the other hand, the flat rate fee schedules of Nasdaq/UTP, Network B, and CBOT are most advantageous to data consumers with fewer devices and locations, but become relatively more expensive as devices are increased.

Table 9 combines access and usage fees and ranks the average cost figures over a 10,000 device range. Also, an ordering of average cost, from the least to the most costly, is shown. Table 9 focuses on the one location, range of devices format. Note that of the 20 highest ranked prices, equities exchanges (Network A, B, and Nasdaq/UTP) have 14 entries while futures exchanges (CBOT, CME, NYMEX, Nybot, and KCBT) represent half that number at 7. Of the 20 lowest ranked prices, equities offer only 1 with Nasdaq/UTP being the lowest price for 1 device, while

[50] We sought to normalize these prices using volume of trade, dollar volume, and other variables. We found that on a per unit basis, where units were shares in the case of equities and contracts, in the case of futures, equities prices appeared extremely lower since the number of shares traded are significantly higher than the number of contracts. However, when incorporating dollar volume, we find the average share on NYSE was worth $42, while the average futures contract on the CME had an underlying dollar value of $794. After adjusting for dollar value, the results flipped, with futures exchanges extremely lower than equities on a dollar value basis. Since the normalizing variables tended to drive the results to extremes, the raw price data for comparable data streams are used in this analysis.

futures exchanges have 19 of the lowest prices for receiving market data over a range of different numbers of devices.

Table 9
Combined Average Usage and Access Fees

RANGE OF DEVICES					
	1	100	200	6,000	10,000
Network A	1,577.25	4,100.00	6,750.00	119,950.00	188,950.00
Network B	1,480.20	4,470.00	7,490.00	182,650.00	303,450.00
Nasdaq/UTP	61.67	2,041.67	4,041.67	120,187.50	200,312.50
CBOT	1,030.00	4,000.00	7,000.00	181,000.00	301,000.00
Nymex	810.00	1,998.00	3,198.00	72,798.00	120,798.00
CME	685.00	1,873.00	3,073.00	72,673.00	120,673.00
Nybot	583.00	1,672.00	2,772.00	66,572.00	110,572.00
KCBT	662.00	1,058.00	1,458.00	24,658.00	40,658.00
RELATIVE COST					
	1	100	200	6,000	10,000
High Cost	Network A	Network B	Network B	Network B	Network B
	Network B	Network A	CBOT	CBOT	CBOT
	CBOT	CBOT	Network A	Nasdaq/UTP	Nasdaq/UTP
	Nymex	Nasdaq/UTP	Nasdaq/UTP	Network A	Network A
	CME	Nymex	Nymex	Nymex	Nymex
	KCBT	CME	CME	CME	CME
	Nybot	Nybot	Nybot	Nybot	Nybot
Low Cost	Nasdaq/UTP	KCBT	KCBT	KCBT	KCBT

Given one location, the combined access and usage fees for Network A do not drop below any future exchange except the flat-rate CBOT at the 100 and 200 device level. By the one-hundredth device, the tiered futures exchanges occupy the four low-cost positions. No change is seen from this point through device ten-thousand.

Table 10 presents the statistical analysis of the price comparisons. The population of data includes prices for market data for the 4 largest futures exchanges, CBOT, CME, NYMEX, and NYBOT, and the three data networks, Network A, Network B, and Nasdaq. The futures exchange KCBT was excluded from this broad market comparison since it is a much smaller exchange, offering fewer contracts, lower trading volumes, and market data prices that are significantly lower than both equities and futures exchanges. In addition to the flat per-device analysis, results were tabulated also for when one market data feed is received at multiple locations.

Table 10
Mean Price of Market Data Per Device Per Month

Range of Devices	Equities	Futures	
		1 location	10 locations
1 to 10	180.91***	239.07	N/A
11 to 30	53.49**	56.80	76.95
31 to 99	34.42	29.28*	35.76
100 to 249	28.61	20.91*	23.22*
250 to 999	25.24	17.65*	18.35*
1000 to 10000	23.60	16.44*	16.54*
Total	24.08	16.99*	17.03*

*99% Confidence Level
**95% Confidence Level
***90% Confidence Level
11 to 30, 31 – 90 devices: equities are lower than 10 locations at 99%.[51]

Table 10 results indicate that for 1 to 30 devices, the monthly cost of market data in the equities markets is lower than that of the futures markets for a basic data feed. While Network A is still the most expensive data by itself, the equities markets overall perform well over fewer device range as a result of the combined access fees of SIAC for Network A and B data, and the flat pricing of Nasdaq and Network B, which benefits the smaller professional subscriber. Further, these prices do not include any additive fees that would accrue to equities market subscribers based on the analysis and control program interfaces (see table 6). As devices increase, futures market data prices are significantly lower than those of the equities markets.[51] Over the entire sample of market data prices in this analysis, futures markets are priced lower than equities markets for market data feeds on a per device and total cost basis.

D. Non-professional Access and Innovation

In the equities markets, the infrastructure is built around regulating the flow of information with the SIP as the sole source of market data. This makes unlikely the possibility of a non-professional accessing market data from the source. Fees alone make it unlikely that a non-professional would seek a direct access data feed, since they would be required to pay access fees and usage fees based on the number of devices or quotes they choose. Compare this to the $60 monthly fee to receive real-time streaming quotes from the CME. Or the $10 version, tailored for non-professionals, providing real-time quotes at 1-minute intervals. In addition to the basic market information, futures exchanges offer a broader array of market data products that are accessible to the individual.

As exemplary of greater product differentiation, the CME offers their market data directly to non-professionals in several different packages. The most basic is continuous real-time data. Five levels of service exist, ranging from $10 per month to $155 per month. Based on the

[51] Additional tests suggest that increasing locations affected the results only at the margin where location to device ratios are very high.

consumers' preferences, the CME market data are available to the public in a number of formats with numerous features.[52]

The futures market model of direct access is in contrast with the equity markets where large broker-dealers have become the primary source as vendors of information to the individual, and where the cost of accessing that data is priced either based on the number of users or the number of quotes accessed. Thus, to get real-time data at its lowest cost, investors must maintain a brokerage account. While not transparent to the data consumer, broker-dealers must pay for the data, the costs of which are inevitably passed along to investors through commissions or other transaction costs.

Vendor costs generated by servicing non-professional subscribers can be summarized also for comparison. The non-professional costs are: Network A $1.00[53], Network B $1.00[54] and the Nasdaq/UTP range of $42.67 to $1.0313 per device, from the first device to the 10,000th device, approaching $1.00 each as more non-professionals are added. In Network A and B, broker-dealers and vendors face a monthly fee for non-professionals capped at a $1.00 each for the first of 250,000 users, and $.50 for additional users beyond $250,000.

Usage-based pricing is the most cost efficient structure for non-professionals or those whose data consumption levels are low, but it requires an intermediary such as a broker-dealer or vendor to implement and realize the cost efficiencies. Since all usage-based pricing involves securing access that can be prohibitively costly, individuals do not generally pay these prices explicitly, but instead intermediaries bundle the data and charge a monthly rate (in the case of vendors) or expense the cost via other means (e.g. through commissions). Vendors and broker-dealers may elect to be assessed a usage-based fee which depends on the number of quotes. The prices for equities are the same as the quote packet prices for professionals outlined in Table 5. For Nasdaq/UTP, a per quote packet rate of $0.005 per query applies to both professionals and non-professionals, and since administrative fees are comparably low, non-professionals may practically become subscribers via a data provider. On the futures side, the CME, NYMEX, and the CBOT also have usage-based pricing of $0.01 per quote.

An important difference between futures and equity markets is the advent of internet pricing by the futures exchanges. Both the KCBT and CME have instituted fees for internet access, and allow "click-on" agreements that enable data users to obtain real-time data immediately. The CME advertises this internet connection as a way for non-professionals to receive market information directly from the source. Non-professionals in the equities markets must go through a vendor or a brokerage to obtain internet access to market data, and the access, usage, and various implicit costs often are borne (directly by the subscriber or indirectly by the intermediary) to obtain internet data. Critics and intermediaries have suggested that the pooled-resource model, with its shared governance model and central "bottleneck" consolidation

[52] See http://www.cme.com/prices/index.cfm
[53] Assumes no more than 250,000 non-professional subscribers per vendor.
[54] Network A/B figures do not account for diminished costs past the broker-dealer monthly cap.

function, have kept the equities networks from innovating market data delivery in the world of e-commerce.[55]

The primary difference between the explicit fee structures of the two market types is that there are more numerous pricing distinctions for different customers in the equities markets than in the futures markets. The exceptions are the CME, which is the only futures market to distinguish between professional and non-professional, and the CBOT, which provides a rebate to CBOT member recipients of market data. In contrast, different pricing structures exist for most classifications in the equity markets. All equity markets make a professional distinction, and each offers a quote counting option for certain types of customers. Even though market data vendors report and track usage through similar processes, the increased number of classifications and additional fees based on how the data is used leads to higher implicit costs of receiving equity market data.

E. Implicit Costs and Systemic Knowledge

Futures markets, by and large, charge vendors and data consumers a straightforward fee based on the number of devices and locations. In equity markets, vendors are faced with a labyrinthine fee structure. As a result, purveyors of market data incur substantial administrative and implicit costs in order to navigate the system in place.

In Greek mythology, Theseus affixed a string to the labyrinth entrance, hunted and defeated the Minotaur and then used the string as a roadmap out of the maze. Purveyors of market data, including vendors and broker-dealers, must follow Theseus' example. To hunt their Minotaur, vendors and broker-dealers must demonstrate that they properly control data access, report how it is used, and pay in the event that data are accessed. With respect to market data, the string is the vendors' or broker-dealers' communication system, while the complexity of the maze is determined by the intricacies of the assurance and the billing process. Where the maze created by futures markets is straightforward, the labyrinth borne out of the equity market assurance and billing structure would make Daedalus proud.

1. Administrative and Other Costs of Securities Market Data

The structure of the equity market labyrinth is laid out in a document termed Exhibit A for Networks A and B, and Attachment A for Nasdaq. There are two Exhibit A's; one for internal redistribution of data, and one for external redistribution. The former, officially entitled Exhibit A/Data Feed Questionnaire Short Form, is a ten-page document. The external form is fourteen pages. These documents are designed to provide assurance that the data are not available to users who are not "permissioned."

The equity portion of the Short Form begins its' search by first determining how many vendor locations, or branch offices, will receive market information. Then, a system diagram is required, described as,

[55] For example, see Reuter's letter to the SEC Re: Securities and Exchange Commission File No. S7-28-99, April 5, 2000, p. 3.

> "…a high level overview of each network utilizing market data. Each site location should be included, noting where data are received as well as the entitlement control location."[56]

This 'high level overview' has several implications, the importance of which cannot be overstated. As such, this quote is found both in this Short Form and the Exhibit A version dedicated solely to potential vendors of Networks A and B market data. The formal purpose of this requirement is to ensure that the value of information is protected through control and assurance. This is accomplished through diagramming the data feed network, and all connected sub-networks. For the purposes of complete billing, this exercise also should illustrate how the data are used since equities markets also have additive fees tied to different uses of market data. Therefore, significant systemic knowledge of the vendors' network is required in order to fully capture the value of the data, and to ensure the fees are assessed on the data consumption and usage.

In obtaining this knowledge of their customers' network systems, NYSE and AMEX focus in on the 'entitlement control location'. These locations are merely checkpoints on the information highway. Because equity markets have multiple categories of data recipients, and fee schedules, properly categorizing and tracking who is permitted access to market information is of accomplished via the 'entitlement control' function. Just as 18-wheelers pay different tolls than motorcycles, equity markets have built a multi-laned toll system with differentiated fees. As the information intermediaries, vendors and other data feed recipients must navigate the toll structure, ensuring that data consumers do not enter the wrong lane.

The Short Form queries a data feed recipients' ability to explicitly control each devices access, or entitlement, to market information. Answering 'no' implies an open network; a 'yes' signifies the data feed recipient uses a controlled system, a value-preservative for the information good. The issue of 'open network' versus 'controlled network' is common across all markets.

Network A and B do not explicitly charge data feed recipients who display delayed data. On the other hand, delayed CBOT streaming data are a source of revenue for the CBOT. The fact that futures exchanges are able to charge for delayed data and that it is a respectable source of revenue for them suggests that the assurances to protect the value of the market data are by and large successful. While protection of supply lines is not the whole story, it provides weak evidence that value has been preserved.

In addition to demonstrating and documenting the functionality of technical controls, recipients of equities data must relay information on administrative control over their networks. First, vendors are asked if documented administrative controls exist with respect to identifying authorized access, and prohibiting unauthorized access to market information. While these questions go to the issue of preservation of value, the next two questions focus on collection of value. In other words, can the vendors' internal systems comply with the billing requirements of the different markets? Considering the importance of these questions, the yes/no format, and the introductory nature of this form, one wonders what a no answer would get. Data feed recipients

[56] Exhibit A/Datafeed Control Questionnaire, p. 3.

report substantial delay in the granting of access and denial of access if adequate documentation is not provided to the networks' satisfaction.

The next section of the Short Form addresses the following issues: data types received, how data types are used, and accountability. Data types are segregated by data provider (AMEX, NYSE, Nasdaq, etc.). Under each data provider, the data are listed as last sale or quotation data, and are either real-time or delayed. In addition to checking off all category data types that apply, data recipients must acknowledge if access is direct or indirect. If indirect, then the name of the intermediate vendor is required. Also required in this instance is the name of the service provided by the intermediate vendor (or name of the data feed product in the case of Nasdaq/MCI). Since different fees apply for direct and indirect access, obtaining this information goes to proper invoicing.

How the data types are used by the vendor relates largely to the billing structure of Networks A and B. The basic fee structure of these Networks is built around the dissemination of data on real-time tickers or interrogation devices. When used in this manner, fees are assessed either by device or quote. If data are used in any other manner, additional fees apply. Examples of additional uses include, software development, analysis programs, portfolio valuation services, etc. These Class C fees, detailed in the previous section of data fees in Table 6, are additive to the device or quote fees.

The Short Form covers internal distribution. For vendors who wish to redistribute data externally, there is the longer Exhibit A. This form links vendor communication systems with Networks A and B pricing structure. After billing and contact information, the meat of this Exhibit A version begins with the data types to be received by the vendor and the data types that will be retransmitted. The recipients of this data retransmission are subscribers. Listed under the section on subscribers and pricing, there are seven possible combinations of subscriber and pricing method. So each vendor keeps track of up to seven billing categories. Each month, someone will be invoiced by the NYSE or AMEX for each and every subscriber in each of the seven categories. This complex billing structure requires vendors carry a hefty supply of string as they wind their way through the equity market maze.

The vendor tracks the access of all subscribers, but does not invoice all subscribers. In the case of professional subscribers, they access NYSE market information through a vendors' communication system but are invoiced directly by NYSE. The vendor incurs costs on behalf of the professional, but the NYSE invoices the professional. Vendors pay directly to distribute market data. Vendors' establish and maintain a communication network that protects the value of market data. In addition, the network tracks subscriber access to market data. Vendors' are required to report access on a monthly basis.

The vendor must file paperwork on each subscriber they service. In the case of all non-professionals and those professionals who are charged on a per-quote basis, this paperwork can be done electronically. But the point here is not the preservation of natural resources. Instead the focus is on the information-intensive nature of the paperwork. The electronic version of the 'paperwork' filed by vendors on behalf of their non-professional clients includes a section on personal and employment data. It reads as follows:

> As a prerequisite to qualifying as a "Nonprofessional Subscriber", Subscriber shall provide the following information,
> Subscriber's name and address:
> Subscriber's occupation (include all occupations – including homemaker, student, retiree, etc.):
> Name(s) and address(es) of Subscriber's employee(s):
> Subscriber's title(s) and position(s):
> Subscriber's employment functions (description):

The vendor must also collect similar information on all professional clients. The need for intensive amount of information on subscribers is in part due to the cost structure of equity market data, since the pricing structure depends on segregating subscribers.

The external version of Exhibit A requires more detail with respect to possible uses of market data. Covering Network A/NYSE and Network B/AMEX, there are 46 boxes, each relating to a specific use of market data. The vendor checks off each box that applies, and is then instructed to, "Provide a brief explanation for all boxes checked above." Thus, no more than 46 brief explanations are needed.

2. Administrative Costs of Futures Market Data

In contrast, futures exchanges rely on vendors and subvendors to provide assurance that the value of market information is protected. Just as with equities markets, vendors must report data usage each month. Electronic reporting is done through TCB Data Systems, Inc. (TCBD)[57] or the Vendor Automated Reporting System (VARS).

This level of information on subscribers is in direct contrast to the futures markets, where electronic access to market data is simpler and less time consuming. For example, while click-on agreements for data on controlled devices are enabled by most futures exchanges (including the CME, NYBOT, and KCBT), their use is limited for non-professionals in the equities markets, and non-existent for professional subscribers in the equities markets.

The CBOT differentiates between Internet distribution and the more traditional distributions. Internet distribution pushes the open network envelope. Vendors who want to distribute CBOT data over the Internet must meet certain requirements. Most notably, before being granted authority to distribute Market Data over the Internet, the vendor or subvendor must be able to demonstrate that the distribution system has sufficient controls to prevent unauthorized receipt and redistribution of CBOT market data. The threat of open networks to the value of information reaches a zenith in the form of the Internet. In response to this threat, the CBOT requires knowledge of the "system architecture, functionality and security features."

The CBOT requires vendors to collect contracts from all the subscribers they serve. The information collection portion of the CBOT *Subscriber Agreement* centers on the equipment that will be used to transmit CBOT data to the subscriber. This demonstrates how the CBOT

[57] TCBD used by AMEX, NASD, NYSE, CBOT, CME, NYMEX, NYBOT

manages the interchange of its information between vendor and subscriber. When applicable, technical controls and device counting abilities must be displayed. The simplicity of their fee structure allows them to collect less user-intensive data, however, since futures exchanges do not finely differentiate data consumers based on how the data are used.

3. Vendors' Proprietary Information and Conflict with Data Providers: Securities v. Futures Markets

The above descriptions of Exhibit A, both the Short Form and the longer version, provide a general overview of what is required of vendors. The information required in these forms is only a starting point. Upon return of these forms, the ability to distribute market data is in no way guaranteed. Vendors report substantial delay and denial of permission, sometimes without explanation. Unlike the futures agreements, where data can begin flowing as soon as the form is filed (or sooner, when click-on agreements are allowed), data vendors in the equities markets must attain approval by the Network administrator before data may be accessed.

It is a foregone conclusion that compiling and properly reporting the information required on the Exhibit As is costly to the data vendors. In addition, the systemic disclosure, the detail regarding intent and business purpose of the market data, and the proposed method for display of data, and even the names, addresses, and employment data of the vendors' clients is required. While the information is required under the mantel of assurance and billing, it also provides the networks and their administrators' substantial additional information that gets to the business proposition of the data vendors themselves. Akin to trade secrets, this information would become invaluable if exchanges who are also network administrators (specifically the NYSE and Nasdaq) enter into the data delivery business.

Recent proposals to introduce competition into the equities market include such models. For example, the NYSE has proposed to the SEC to withdraw from the CTA and market their data through SIAC. If networks are enabled through regulation to sell exchange data and consolidated data directly to the public, they will be at a significant competitive advantage over market data vendors. While introducing competition is laudable, the level of disclosure required to participate in the network system has forced vendors to surrender information regarding the clients that they have recruited, and this would put vendors at a competitive disadvantage should the SIPs be allowed to enter into the data vendor business.

In contrast, even as the futures exchanges have begun to sell data directly to the public, data intermediaries such as the vendors and broker-dealers have expressed less concern. For one, futures exchanges do not have a copy of Bloomberg's specifications, a list of Bloomberg's clients with names and addresses, and a schedule of exactly what data those clients access, a detailed blueprint of how the data are used, their item by item price schedule, and complete knowledge of their payment records. For another, vendors and broker-dealers in futures have been able to perform the consolidation function, without a mandate from the CFTC that that function be performed by exchanges or any alliance of exchanges.

In a competitive market, price discrimination is difficult to implement. First, suppliers are often unable to infer the demand curve. Doing so may be possible, but it usually entails some cost.

Second, and more importantly, the ability of suppliers to charge individual prices to different consumers according to their willingness to pay is limited since competitors can always step in and offer the good for marginal cost. But in the current regulated environment for equities market data, the two conditions that would deter price discrimination are not satisfied.

By extensive use of Exhibit As and data usage tracking, along with a pricing scheme that differentiates users without differentiating data, equities market data networks have an extensive store of information that enables them to infer market demand for data. Second, since broker-dealers, vendors, member competitors, and exchanges themselves are all obligated to operate within the pooled resource model where decisions are made jointly by the SROs, there is significant control of the pricing process. This model ensures that there are no opportunities for a defector competitor to offer data and price outside of the central networks. As a result, the pooled resource model mandated in the securities markets creates an opportunity for price discrimination while erecting impenetrable barriers to competition.

VII. Comparison of Revenues from Market Data

As outlined in Section IV, economic theory suggests that if the producers of market data are able to price discriminate, it would lead to higher revenues for that market relative to a market model that did not engage in price discrimination. Further, the pooled resource model increases the opportunity for price discrimination since competitors who would be able to undercut high prices for the same data could be co-opted through shared governance and favorable revenue sharing arrangements. While we cannot determine whether revenue differences are driven by greater data sales or price discrimination, we can examine how differences in the revenue distribution models have lead to different outcomes for the participating actors.

Table 11 presents the revenue figures from the three Network plans and futures exchanges that provided data.

Table 11

Year 2000
Revenues from Sale of Market Data
(in thousands)

Network A	181,624
Network B	125,471
Nasdaq/UTP	234,500
CBOT	61,060
NYBOT	19,514
CME	36,285

Sources: Seligman Report, Appendix C
Futures Markets Annual Reports

The revenue differences across futures and equities markets are in large part due to the broader general interest of equities market data that generates greater sales of market data. Market data revenues for the equities market networks in the year 2000 are significantly greater than that of

the futures markets. In fact, each network has revenue that exceeds the market data revenue from the two largest futures exchanges of CME and the CBOT, and NYBOT combined.[58]

Table 12 presents total revenue figures from year 2000 Annual Reports and revenue distribution figures for each of the equities exchanges. Revenues from the sale of market data as a percentage of total revenues range from 4.40% to 50.74%, with an average of 24%. For most financial centers for which information was available, this one revenue stream accounts for more than one fifth of total revenue.

Table 12
Year 2000 Comparison of Revenues

Equity Market Centers	Revenues from sale of data	Transaction Services (trading fees)	Total Revenues	Transaction Revenue as a % of Total	Data Revenue as a % of Total
NYSE	135,646	142,152	815,289	17.44%	16.64%
NASD*	353,885	519,045	1,481,684	33.39%	23.88%
Nasdaq**	258,251	395,123	832,711	47.45%	31.01%
AMEX	74,399	N/A	262,078*	N/A	28.39%
NASD	21,235***	N/A	396,689*	N/A	5.35%
Philadelphia	2,326	26,115	52,899	49.37%	4.40%
Chicago	35,872	N/A	70,699	N/A	50.74%
Cincinnati	5,805	N/A	N/A	N/A	N/A
Pacific	6,141	58,993	94,048	62.73%	6.53%
Boston	8,673	11,393	23,323	48.85%	37.19%
Futures Exchanges					
CBOT	61,060	101,981	212,919	47.90%	28.68%
NYBOT	19,514	27,985	7,909	48.33%	33.70%
CME	36,285	156,649	226,552	69.14%	16.02%

As a percentage of total revenues, market data revenue for the futures and equities exchanges are not significantly different, with equities at 23% and futures at 26%. In absolute terms, the equities markets earn a much larger amount of revenue from all sources, reflecting the size and scope of their business. [59] Both equities and futures exchanges are heavily dependent on market data. Notably, the NYSE is less dependent on revenues from transactions and those resulting from the sale of data related to those transactions. However, the NYSE collects 34% of its total revenue from companies in the form of listing fees. Thus, 68% of total revenue is derived from intermediating between companies and investors, with information playing a key role.

[58] Revenue figures for Cincinnati Stock Exchange, the Kansas City Board of Trade, and the New York Mercantile Exchange (NYMEX) were not made available.

[59] Security market revenues from the sale of market data, as listed in the Seligman Committees Report were not revenues, but were revenues minus costs. The equity figures were adjusted by allocating common-pool costs to each exchange. Cost allocation followed was determined according to the proportions of income allocation. For instance, the NYSE received 74.68% of distributable revenues, so their revenue figure in Table 8 is 74.68% of the common pool, pre-cost cash flow.

The CTA Plan, governing Network A and B, splits revenues according to the number of trades reported by each exchange relative to the total number of trades reported.[60] The Nasdaq/UTP Plan differs slightly, but significantly, in that it also factors the number of shares reported. The Nasdaq/UTP method is more sensitive to a trades worth, in terms of acting as a signal to market participants. Under Network A and B, this is not the case. The incentive is to report as many trades as possible irrespective of size. The CTA revenue distribution scheme rewards trade turnover. Venues that report large trade orders are not rewarded under this system.

Market centers can reduce costs related to the collection and transmission of their market data to the SIP, but have no direct control over costs incurred by the SIP. In addition, changes to the fee structure are not made at the market center level. Therefore, the ability of SROs to profit must be found in raising other revenues and reducing other costs. This suggests an added upward pressure on other revenue streams, to account for either low or uncertain revenue from the sale of market data.

Market centers traditionally compete against each other on several fronts, to include order flow. With respect to the consolidation and sale of market information, the regulated model in the equities markets requires natural competitors to cooperate. In the case of Network A and Network B, the centralized data disseminator is SIAC, a subsidiary of the NYSE and the AMEX. Nasdaq provides SIP services for the Nasdaq/UTP Plan. AMEX, NASDAQ and the NYSE each fulfill administrative functions under these Plans, thereby increasing the perception, if not the likelihood, of a conflict of interest. Independently, each competitor incurs costs and generates revenues. The sale of market data is only one revenue source, and the existing model has begun to break apart.[61]

The revenue sharing under CTA/CQ Plans (Network A and B) differs from that of the Nasdaq/UTP Plan. Currently, Nasdaq/UTP revenue distribution is determined by averaging each participant's transaction and share volume. At the SRO level, the Chicago Stock Exchange is the only recipient other than NASD to share revenues generated under the Nasdaq/UTP Plan.[62] The CTA/CQ Plans use transaction volume alone to determine the percentage of revenue going to the SROs. In both cases, the pool of revenue available for sharing is the revenue left over after the common costs are paid.

Costs and revenues are not all that is shared under these Plans. Implicit in the creation of consolidated data, is the need for individual markets to surrender exclusive proprietary rights over trade and quote data generated by their members. Rather than each trading venue exhibiting complete control over market data generated by its' members, all venues simply maintain a "proprietary interest in Market Data that originates on or derives from its markets or in its index information".[63] The muddling of property rights thus reinforces the potential for conflict of interest and incompatibility of incentives.

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[60] Report of the Advisory Committee On Market Information: A Blueprint For Responsible Change, Footnote 152.
[61] See Nasdaq Proposed Rule Change, Form 19b-4, outlining its proposal to increase consolidated tape revenue sharing while also instituting a direct fee for regulatory services, May 3, 2002.
[62] Seligman Report-Appendix C, Table 4
[63] Uniform Vendor Agreement.

The common-pool resource model creates the potential for either inflated costs or a reduced incentive to minimize costs. In the case of security markets, the costs of SIPs are covered prior to sharing revenues. As the costs rise, the revenue left over for the SROs to share shrinks. SIAC is the SIP for both Networks A and B and is a subsidiary of the NYSE and AMEX. SIAC incurs costs to consolidate information, and receives payment from Plan participants in excess of shared expenses.[64] So, an NYSE subsidiary stands to gain revenue from costs shared by the NYSE and their natural competitors, while the NYSE realizes a revenue stream from common-pool revenues remaining after SIAC costs are covered.

The practice of revenue sharing amongst competitors for trade services, when processing costs are controlled by the SIPs creates an incentive compatibility problem. For example, based on total transmissions processed and processor costs, the per transaction cost of processing Network A and B market data was $0.0070 in 2000, while Nasdaq processing costs for the same period was $0.0169[65]. This significant disparity in reported processing costs raises concerns, particularly for the SROs within the Nasdaq/UTP system who see processing costs eating up a significant proportion of the revenue pie.

Not only are processing costs hard to monitor, but the individual financial markets have no independent ability to offset these costs by raising the sale price of market information. While an audit may be requested by Plan participants regarding processing costs, there is little recourse for SROs, broker-dealers, or individual member competitors under the revenue sharing arrangement Absent is the ability of individual market centers to control the cost function related to processing, consolidating and disseminating market data.

In the securities markets, the muddled property rights mute the ability of SROs to control the cost of data consolidation, while the governance structures of the Plans inhibit the ability of individual markets to set the fees charged to data vendors. Implementing change within the governance structure of the joint ownership model requires agreement from all the SROs, which fosters delay and inaction.[66] In contrast, futures markets are able to control all costs and fees associated with the collection and dissemination of market information.

Significantly, the CFTC regulations do not group together the proprietary interests of multiple exchanges, thereby do not restrict the ability of financial markets to collect, process, and disseminate data as they see fit. This difference is exemplified by a short amendment to the CME contract, in which it states,

> "Exchange reserves the right, at its sole option, to change the administrative charge or exchange fees..."

In contrast, similar changes by equities markets would require, in effect, a unanimous decision from Plan participants.

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[64] Seligman Report- Footnote 85 states SIAC costs are covered for Network A and B plus a 7.7% charge for General and Administrative.
[65] Processor costs: Appendix C, Tables 1-3. Transaction and Quotation Figures: Appendix D.
[66] Seligman Report, Section III C and footnote 63.

Futures markets have more flexibility in setting and changing the cost of information. This increases the ability with which the markets can maximize revenues as demand conditions change. Given a certain price structure, as the aggregate value that consumers place on information ebbs and flows, so too will demand. The more flexible the price structure for information, the more likely it can be adjusted to meet changing market conditions. Thus, the better able a market is to maximize this revenue stream and optimize consumers' marginal utility.

VIII. Concluding Comments and Recommendations

Both equities and futures markets have a long history of providing real-time data via ticker, telephone, and teletype to the public. Futures markets do so without regulation requiring dissemination of real-time information on transactions and quotations. Given the precedence of over 100 years, it is clear that even without such regulation, securities information would also be readily available, although perhaps it would not be presented or consolidated in precisely the same manner it is today. SEC actions in the early 1970s dictated the scope and the form for market data dissemination in the securities markets. As a result, both the content and technical infrastructure for data dissemination became subject to inflexibility and gerrymandering with respect to innovation and control.

A. Findings of this Study

In this study, we find:

- There is nothing in the historical, institutional, legal and economic analysis to suggest that market data in the equities markets should be managed as a common pool resource. On the contrary, the analysis indicates that the equities model mandated by regulation resulted in the creation of a network system that institutionalizes monopolistic practices in supply and pricing, and there is significantly less evidence of these practices in the analysis of the futures markets.

- The revenue analysis shows that the futures and the equities markets are heavily dependant on market data as a source of revenue. Further, this revenue stream is inextricably wed to other revenue streams, and decisions that may affect market data revenue, such as the quantity and price of information, can affect a market's income cross-sectionally and over time. In effect, the price-quantity decisions that determine market data revenue endogenously and dynamically affect other revenue streams including those garnered from transaction and listing fees. Since transparency inherent in the provision of market data affects a market participant's willingness to use a market or a company's willingness to list on that market, markets are constrained from offering too little transparency or charging too high a price for data.

- Competition from competitors in market data and transaction services impose additional constraints. Some competitive challengers, like ECNs in the equities markets, thrive on a high level of transparency and provide the full depth of their order

book on the web free of charge. Other competitive challengers, particularly those in the OTC and international markets, are the beneficiary of order flows (particularly from institutions) that are seeking to avoid the liquidity costs associated with one-size-fits-all transparency requirements. By requiring real-time consolidated data, equities market regulators effectively take market transparency off the table – hurting the competitiveness of US markets when they must compete with markets that have the ability to choose the optimal level of transparency that can attract additional or specialized order flow.

- In the equities markets, consolidated market data must be included with all data sold or purchased, limiting the use of product differentiation for market data suppliers and demanders. In addition, equities markets have more classes of data consumers subject to a myriad array of additive costs as compared with futures markets. Market participants indicate that the equities market cost structure is complicated, and many firms including vendors, broker-dealers, and their clients require consultants to review billing and to ensure they have not paid more than once for the same data. Innovation is also hindered, as market centers have less incentives to enhance the quality of their data since the shared revenue model inhibits their ability to profit fully from their investment. Firms and vendors of equity market data are also deterred from innovation, since the process of attaining approval from the central administrators is tightly controlled, lacking transparency, and subject to delay. These outcomes result from the shared governance and revenue sharing model required of the pooled resource model.

B. Recent SEC Actions

It is perhaps in recognition of these shortcomings that the SEC, the regulatory agency that instituted the centralized model, proposed a utility-style rate-making process to regulate prices of market data in a concept release issued in 1999.[67] This proposal elicited criticism from the industry and from economists, many of whom noted that cost-of-service regulation has proven problematic in other industries and economic inefficiencies would result. Brown-Hruska and Ellig (2000) suggested that while the SEC's regulated approach did lay the groundwork for monopolistic practices, the reductions in fees over the course of time suggested that networks' ability to exercise market power in pricing was moderated by competition among trading venues and market contestability. They argued that layering cost-based limits on network pricing would likely produce worse results than the current system. With the rate-making approach under heavy fire, the SEC appointed a committee composed of industry representatives and legal scholars headed by Joel Seligman to consider it further and tender alternative recommendations.

The Seligman Committee Report (2001) proposes a method to introduce competition into the equities market model by recommending a system of "competing consolidators" in which market centers would be able to sell their data to processors other than the central administrators. The important question that emerges when reviewing their proposal is whether monopolistic practices institutionalized in the current model are addressed by this approach.[68] This question is

[67] SEC Concept Release: Regulation of Market Information Fees and Revenues, 12/14/1999.
[68] Report of the Advisory Committee on Market Information: A Blueprint for Responsible Change, September 14, 2001.

especially made relevant since the source of monopoly power in data dissemination lies with the consolidators, or SIPs, who are owned as subsidiaries by the primary markets, the NYSE, AMEX, and Nasdaq, as network administrators.

C. Looking Ahead

Proposals to abandon the model of a single data consolidator[69] or to introduce a model in which the data consolidation function would be open to competition[70] do not address the fundamental inefficiencies created by the regulatory approach. By advocating the continuation of a consolidated data stream that has been heretofore solely produced by the SIPs, and prolonging a mandate that the consolidated information be purchased and displayed, the proposals underestimate other market forces, such as price competition, non-price competition, and arbitrage that exist in the market for equities. Changing the system to one that encourages competition while nurturing natural efficiencies in data production, but does not retain the vestiges of the pooled-resource model presents the greatest challenge to attaining a more competitive environment.

The question of how to encourage competition in an environment where the incumbent producer inherits significant assets, both physical and implicit, as a result of regulatory and institutional protections has plagued numerous industries and their regulators, including the telecom and utilities industries. In those instances and others, regulators have sought to dilute the market power of the incumbent so that real competition can occur by redistributing those assets, limiting the use of those assets, or opening those assets up to others. Primary market SROs, as incumbent owners of the SIPs, are in line to inherit an advantage if competing consolidators are adopted and the requirement for consolidated data maintained.

The following issues should be considered,

- Dismantling the pooled resource model and enabling a competitive model for market data relies upon on introducing competition in data products, and that competition would be facilitated by encouraging exchanges to compete in providing exchange level data; and SIPs, vendors, and other intermediaries (like broker-dealers) to compete in providing various forms of consolidated data. As in the futures markets, product differentiation could be encouraged by allowing individual exchanges to price and market their data to vendors, broker-dealers, subscribers, and individuals in a variety of formats.

- Allowing equities exchanges to recover a direct proprietary interest in the data they produce will help to restore natural incentives to innovate and sell their own data product in order to compete with other entities that produce similar data products. As noted, competition in equities and futures markets is brisk, with electronic exchanges, financial institutions and dealers, and OTC market participants setting up competing trading systems. Some of the challengers are setting up proprietary systems that offer lower levels

[69] In their comments on the SEC Concept Release on Regulation of Market Information Fees and Revenues, NYSE proposes to dissolve the joint ventures "within the framework of mandatory dissemination and mandatory consolidated display of the data." April 10, 1999 letter from James E. Buck, p. 19.
[70] Seligman Committee Report, 2001.

of transparency for sophisticated users. Others are automated trading systems such as ECNs, that cater to public investors and offer high levels of transparency. As suggested by Bronfman and Overdahl (1997), transparency is but one plane on which markets compete.

- While concerns are raised that network externalities prevail in futures and equities markets and this may lead markets to act as monopolists in information, a broad-ranging analysis suggests that competition can constrain the assertion of market power in market data. Both futures and equities markets are contestable, illustrated by the existence of markets for similar assets and products and the changing market share of new entrants and incumbents.[71] Further, a competitor may not have to cater to a whole network of clients to substantially challenge the primary markets, since it may differentiate its service and products to appeal to a particular sector of the market.

- The costs of the provision of transaction services have declined with technology, encouraging new entry and the profitable operation of competing systems without scale economies.[72] In addition, order routing technologies of brokerages allow clients and intermediaries the ability to direct order flow to any number of markets, reducing frictions that once limited market users from information about and access to competing pools of liquidity. In the equities markets, as in the futures markets, competition among market data providers, the vital nature of information in attracting users to a market, and competition in market data products will ensure that information is abundant, diverse, and competitively priced.

[71] Eurex, an all electronic exchange, for example, has recently surpassed the two previously largest futures exchanges of the CME and the CBOT, increasing pressure on those exchanges to move toward more automated trading platforms. In the equities markets, ECNs have gained significant market share.

[72] Ruben Lee, "What is an exchange? The Automation, Management, and Regulation of Financial Markets," Oxford University Press, (January 15, 2000), p.10.

Appendix A: Market Data Characteristics and Reportable Items by Exchange

Exchange	Communications Lines	Hardware	Software	
Chicago Board of Trade	4 wire, private line, full duplex, conditioning required for aggregate speeds beyond 56 KBPS	19,200 BPS	A	Bid/Ask/Trade – No Volume
Exchange ID: B		Asynchronous	B	Bid and Ask
		Even Parity	C	Control (Type K, T, N, O)
		NO Horizontal Parity	G	Request for Quote
		1 Start Bit	H	High-Low-Last
		1 Stop Bit	I	Volume and Open Interest
		7 data bits plus 1 parity bit	J	Summary
			Q	Settlement
			R	Refresh
			T	Bid/Ask/ Trade
			U	Range Quotations
			X	Text
			Y	Cash Prices
			Z	Contract Specifications (Type D,O,S)
New York Board of Trade	The network is Frame Relay based with a 56K Digital Circuit at each vendor location.	Asynchronous	B	Bid and Ask
Exchange ID: C	ISDN Back Up is provided at each location.	Odd Parity	C	Control (Type K, T, N, O)
	NYBOT supplies all circuits and equipment for each vendor site.	9600 BPS	E	Exceptional Quotation
		7 Data bits, 1 Stop bit plus 1 Parity bit	F	Market Condition
		Vendor cable (DTE)	H	High-Low-Last
		DTR on Pin 20	I	Volume and Open Interest
			J	Summary
			Q	Settlement
			R	Refresh
			T	Bid/Ask/Trade
			U	Range Quotations
			V	Cumulative Volume
			X	Text
			Y	Cash Prices

Source: ITC Specification 2.1, Appendix 2

Exchange	Communications Lines	Hardware	Software	
Chicago Mercantile Exchange / GLOBEX® Exchange ID: H	4 Wire (2 CME, 2 AT&T or MCI diagnostic), multi-drop, private line, broadcast 19,200 BPS All lines should be ordered through the CME at 312-930-8193	19,200 BPS Asynchronous Even Parity, LRC Character NO Horizontal Parity 1 Start Bit 1 Stop Bit 7 data bits plus 1 parity bit	B E G H J T U V X Y	Bid/Ask - E.T.H. only Exceptional Quotation Request-For-Quote High-Low-Last Summary message Bid/Ask/Trade - E.T.H. only Range Quotations Cumulative Volume Text Cash Prices Index prices and Inter-bank Spot Bid prices
Chicago Mercantile Exchange Exchange ID: M	4 Wire (2 CME, 2 AT&T or MCI diagnostic), multi-drop, private line, broadcast 19,200 BPS All lines should be ordered through the CME at 312-930-8193	19,200 BPS Asynchronous Even Parity, LRC Character NO Horizontal Parity 1 Start Bit 1 Stop Bit 7 data bits plus 1 parity bit	A C E F H I J N Q U X Y Z	Bid/Ask/Trade - Future - No Volume (Type A, B, C, D, G, I, J, K, N, O, R, S, T) Exceptional Quotation Fast Market (and Late Market) High-Low-Last Volume and Open Interest Summary message Bid/Ask Market; Bid/Ask Trade All option quotes Settlement and Limits Range Quotations Text Cash Prices Index prices and Inter-bank Spot Bid prices Contract Specifications

Source: ITC Specification 2.1, Appendix 2

Exchange	Communications Lines	Hardware	Software
A/C/E – Alliance/CBOT/Eurex Exchange ID: U	4 wire, point-to-point, private line Full duplex, conditioning required for aggregate speeds beyond 56 KBPS	19,200 BPS Asynchronous Even Parity NO Horizontal Parity 1 Start Bit 1 Stop Bit 7 data bits plus 1 parity bit	H High-Low-Last I Volume and Open Interest J Summary M Market Bid/Ask, Last Trade Q Settlement U Range Quotations V Cumulative Volume
MidAmerica Commodity Exchange Exchange ID: X	4 wire, point-to-point, private line Full duplex, conditioning required for aggregate speeds beyond 56 KBPS	4800 BPS Asynchronous Even Parity NO Horizontal Parity 1 Start Bit 1 Stop Bit 7 data bits plus 1 parity bit	A Bid/Ask/Trade - No Volume B Bid and Ask C Control (Type K, T, N, O) H High-Low-Last I Volume and Open Interest J Summary Q Settlement R Refresh T Bid/Ask/Trade U Range Quotations X Text Y Cash Prices Z Contract Specifications (Type D,O,S)
Kansas City Board of Trade Exchange ID: K	4 wire, point-to-point, private line, Full duplex	1200 BPS Asynchronous Even Parity NO Horizontal Parity 1 Start Bit 1 Stop Bit 7 data bits plus 1 parity bit	A Bid/Ask/Trade - No Volume C Control (Type T) F Fast Market I Volume and Open Interest Q Settlement U Range Quotations X Text

Source: ITC Specification 2.1, Appendix 2