

Securities Markets in a Competitive Age

An Empirical Analysis of Regulation NMS

by

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Abstract

The United States securities markets have served as the subject of a continuing debate regarding the structure most beneficial to local market participants. A consolidated market structure reduces transactions cost by increasing liquidity in the shares of a security. Conversely, fragmentation creates a system wherein competition flourishes and innovation is fostered. Balancing these opposing viewpoints, the United States Securities and Exchange Commission, under mandate from Congress, has attempted to create a segmented market structure void of monopolistic inefficiencies, but consolidated in information sharing. The resulting National Market System began with the Securities Acts Amendments of 1975 and culminated in the passing of Regulation NMS in 2005. In this paper, I assess the degree to which the goals of a National Market System – reduced transaction costs and increased liquidity – are met with the passing of Regulation NMS. I first chronicle the debate surrounding NMS and the regulatory steps leading to Regulation NMS. I then use empirical analysis on the changes in key measures of execution costs and liquidity following the full implementation of Regulation NMS on August 31, 2006. Through this analysis I find that market quality has indeed increased as a result of Regulation NMS.

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I. Introduction

On June 4, 1975 the United States Securities and Exchange Commission (SEC) promulgated a wide reaching fundamental shift in the US securities regulatory framework. Congress passed the Securities Acts Amendments of 1975 with the explicit intention to improve the efficiency and attractiveness of the US securities markets. Among the items passed by Congress within the Securities Acts Amendments was the mandate that the SEC facilitate the institution of a National Market System (NMS) for securities trading, along with a consolidated clearing and settlement system for securities transactions within the US. Following more than thirty years of ancillary regulatory steps, the SEC completed the final phase in the implementation of its Congressional mandate by passing Regulation NMS in 2005. With the introduction of Regulation NMS, the SEC hoped to significantly improve the market structure for securities by providing market participants with full access to the best possible price for a security.

Advocates of the National Market System believed that through the establishment of a communication system linking all national exchanges, there would be a consolidation of order flow and sufficient competition amongst brokers, dealers, and securities markets.¹ The anticipated result of this system would be a reduction in trading and execution costs for local market participants, an increase in market depth and liquidity, and an increase in the overall efficiency of the securities markets.² Moreover, it is expected that general investor confidence could also be improved as a result of this system.³

¹ Kalman J. Cohen and Robert M. Conroy, "An Empirical Study of Rule 19c-3," *Journal of Law and Economics* April 1990: 277-305

² Paul S. Atkins, "Enhancement and Modernization of the National Market System" Speech, Washington, D.C., April 2005, 1 January 2009 <<http://www.sec.gov/news/speech/spch040605psa.htm>>

³ Atkins 1.

While proponents of the National Market System foresaw a consolidation of the national securities markets as fundamentally beneficial to investors, others believed the system would lead to quite the opposite intended effects. Murphy (2002) notes that “markets could alternatively result in the development of monopolistic inefficiencies that would limit options available for the system’s participants and reduce incentives for the system to improve its efficiency and effectiveness.”⁴ The net result would be a stifling of innovation in securities as a result of the dominance of certain exchanges for various securities. Opponents of the National Market System express a concern that the consolidation of order flow may lead to a reduction in the volumes on specific exchanges and, as a result, the liquidity in certain securities.⁵ This could also lead to an increase in the trading costs for these securities. Proponents have refuted these assertions by suggesting that there would remain sufficient competition amongst markets in securities and the unintended effects of lower order flows among markets would be minimal.

At the heart of the debate regarding the implementation of a National Market System within the United States is a greater discussion of the choice between fragmentation and consolidation of a securities market. To some, a National Market System represents an embracing of the consolidation viewpoint over that of fragmentation. Taking this into account, the SEC has aimed to achieve a compromise system that sufficiently consolidates order flow while maintaining the benefits of competition. The promulgation of Regulation NMS provides an opportunity to gauge the extent to which the goals of the SEC have been met. Moreover, we are also offered an opportunity to expand the fragmentation versus consolidation debate by looking

⁴ Albert J. Murphy, *Financial Market Consolidation Versus Fragmentation: A Comparative Analysis*, Diss, The City University of New York, 2002, Proquest Digital Dissertations, Proquest, Bobst Library, NY, NY, 10 Oct. 2008 <<http://www.proquest.com/>>.

⁵ Murphy 3.

at regulation aimed at satisfying the needs of both sides. These considerations shall serve as the goal of this paper.

Outline

This thesis will analyze the impact the implementation of Regulation NMS has had on local market participants specifically as it relates to two aspects of market quality: transaction costs and liquidity. I hypothesize that a National Market System is beneficial to investors and successfully overcomes the costs of consolidation while incorporating the benefits of fragmentation. To organize this discussion, I shall first analyze both the fragmentation and consolidation market structures for a formal securities market. In doing so, I hope to explore the conceptual impact on trading costs and liquidity as a result of choosing between the two alternatives. Next, I shall provide an in depth overview of the US regulatory framework and the milestones that have brought forth Regulation NMS. I then provide an overview of the regulation's rules and its intended goals. Empirical tests are then developed and executed to understand the impact on the US securities markets in the periods leading up to and immediately following the formal implementation of Regulation NMS.

II. Fragmentation versus Consolidation Debate

Securities markets have been subject to an ongoing debate regarding the market structure that best satisfies the dynamic needs of the various market participants. One side of this debate extols the virtues of a consolidated market framework wherein orders flow freely between an interconnected network of market centers to achieve the best price. On the other hand, there are those that believe a fragmented market best serves market participants through a system that

breeds competition amongst brokers and dealers. Both market structures yield positive and negative results for market participants which we will now explore in detail.

A. Consolidation

Albert Murphy explores the impact of market consolidation on the Toronto Stock Exchange in a 2002 study of the consolidation versus fragmentation debate. Murphy (2002) defines consolidation as occurring “when orders flow to a single location for execution, and all buying and selling interest is shown.”⁶ In this context, a consolidated market yields depth in a particular security by the presence of many buyers and sellers of that security and the ability of these counterparties to execute a trade. The result of this is reduced transaction costs to market participants and increased liquidity. Transaction costs are reduced as a result of the greater probability of the trader discovering a better price. Liquidity is improved through the competition amongst participants for order flow, therefore reducing the difficulty of executing trades in a timely manner. Moreover, the overall efficiency of the market increases due to a better price discovery process resulting from a greater convergence of prices to their true economic value.⁷

A consolidated market, such as the one defined above, thrives on the assumption that all market participants share a homogenous set of needs. However, this is usually not the case. Investors may in fact value certain aspects of a system to varying degrees, including immediacy of execution, size of order, or the volatility within a security.⁸ These divergent needs result in a system in which some participants are made better off while others are made worse off by consolidation. In such a situation, fragmentation may develop as participants develop or seek out

⁶ Murphy 7.

⁷ Murphy 9.

⁸ Marchall E. Blume, “Competition and Fragmentation in the Equity Markets: The Effects of Regulation NMS,” The Rodney L. White Center for Financial Research February 2007: 6, 1 April 2009 <<http://ssrn.com/abstract=959429>>

alternative markets in order to satisfy their individual needs. This departure leads to a disruption to the orderly, consolidated marketplace. Even further, a consolidated market may also lead to the suppression of innovation due to the monopolistic tendencies of a single market. Therefore, it becomes imperative that in a consolidated market care is taken to ensure the preservation of an orderly marketplace and that the needs of participants have been weighed.

Prior to considering the alternative to a consolidated system, a distinction in definition must be made. Market fragmentation, which may be viewed as the antithesis to consolidation, “exists when the market mechanism consists of mutually exclusive, disjoint sub-mechanisms where orders are matched separately within each mechanism.”⁹ A segmented market, on the other hand, “consists of an amalgam of submarkets trading a stock, with each market catering to a particular trader type, and where information flows freely across market segments.”¹⁰ The principal difference existing between both frameworks is the provision of information to participants in the system, with the segmented market serving as a compromise system. I shall now explain each system in turn.

B. Fragmentation

Fragmented markets are characterized by an execution of order flow on independent submarkets wherein orders are filled according to the price quoted in this submarket. Murphy notes that fragmentation of a trading system may develop as a result of three principal factors:

- *Orders are dispersed among different organized market centers*
- *Orders are dispersed among separate order matching systems*

⁹ Murphy 10.

¹⁰ Murphy 13.

- *Significant timing differences in the decisions of different investors to participate in the market for any given stock exist*¹¹

The fragmentation of market systems leads to various effects, both positive and negative, on participants. First, fragmentation characterized by limited communication across market centers may result in inefficiencies in price discovery for a particular security. Order matching on different centers may result in securities being quoted and executed simultaneously at different prices in the same system. Secondly, the overall liquidity of the system may be reduced as a result of the greater time necessary to seek out and match orders across market centers. Each market center may exhibit varying degrees of depth for a particular security, further impacting the timing and prices at which trades are executed.

Fragmentation may also lead to positive results for market participants. Principally, a fragmented market encourages competition amongst market centers for order flow. Whereas consolidation yields a competition between investors seeking to find the best price for a trade, fragmentation creates competition amongst brokers and dealers for order flow. The result can be a net reduction in execution costs charged by brokers and an overall increase in the liquidity of the system as a result of increased trading activity. Without a monopolistic system, innovation is also fostered as market centers continually develop as a means of attracting order flow and appeasing the unique needs of investors.

C. Segmentation

A segmented market provides a compromise between consolidation and fragmentation.

¹¹ Murphy 10.

Whereas a consolidated market is characterized by standardized communication flow and the elimination of disjointed order execution, a segmented market provides a singular flow of communication between independent, segmented market centers. According to Murphy, “a segmented market simultaneously accommodates a heterogeneous trading community while avoiding information flow problems associated with a fragmented market.”¹² This compromise is able to exist due to the elimination of profit opportunities resulting from price discrepancies that may exist between market centers. Arbitrageurs play a vital role in the elimination of these price differences.

Despite the apparent virtues of segmentation, it should be noted that such a system requires significant regulatory presence in order to preserve secondary price precedence on the relatively autonomous markets. Secondary price precedence is the established protocol defining the priority a trade may receive in the event that it is presented at the same price to a counterparty.¹³ For example, the most common form of secondary price precedence is time. In the event two identical quotes are received bearing the same price, the quote submitted first is granted precedence. In a consolidated system, this rule is established and enforced across the entire market. A fragmented system exhibits disjointed protocols on secondary price priority with each market center providing its own distinct rule. However, given the diffusion of orders to various market centers in a segmented system, it is necessary for secondary price priority to be maintained albeit across autonomous markets. Herein rests an issue that must be solved through regulatory enforcement of the rules governing price priority.

The consolidation versus fragmentation debate has been waged over the past decades as a means of influencing public policy and market participants. The United States, with the 1975

¹² Murphy 13.

¹³ Murphy 13.

Securities Acts Amendments has embraced a system closer to consolidation in its decision to implement a National Market System for securities trading. It began with the Intermarket Trading System, which can be defined as a segmented market, and has since supplanted ITS with Regulation NMS. The goal of Regulation NMS is to enhance the US securities framework by providing a more efficient means of price discovery and ensure the maintenance of competition amongst US market centers. This initiative embraces the benefits of a consolidated market system as a means of assisting investors.

III. Road to a National Market System

The evolution of the regulatory framework within the United States has been a gradual shift of successive milestones culminating in the release of Regulation NMS and its component Rules 610 and 611. The SEC has maintained as its goal the introduction of a framework that adequately meets the needs of market participants through the development of a system that successfully incorporates the benefits of a consolidated market system while simultaneously fostering competition amongst market centers. To achieve this goal, the SEC has established and executed upon various targets that include both regulatory and market changes. Coupled with this have been several industry shifts that have significantly impacted the ability of the SEC to implement a National Market System.

A. Before 1975

Founded in 1792, the New York Stock Exchange (NYSE) is the oldest securities exchange in the United States, commanding a dominant share of the market for securities trades

for most of its history. When it was founded the exchange adopted a fixed commission scheme that effectively established its member brokers as a cartel in the trading of securities. Fixed commissions, strict limitations on and exclusivity of membership, and other rules protecting the dominance of NYSE remained in effect until the 1975 Amendments to the 1934 Securities Act.¹⁴ Other exchanges within the securities system also maintained anticompetitive rules including similar policy of fixed commissions and hindrances on the trading of listed securities in other markets. The result of such a mechanism was a highly fragmented securities market within the US with excessively high trading costs. In fact, Hans Stoll notes that the “dollar commission to buy 1,000 shares of a \$40 stock was \$500” in 1970.¹⁵ This commission has since been reduced to about \$40 today.

B. The 1970s, 1980s and the Introduction of Competition

In 1975 the SEC released the Amendments to the Securities Acts of 1934 (Securities Acts Amendments) that abolished fixed commissions charged by brokers on exchanges, thereby introducing a new element of competition within the market system. Furthermore, the Securities Acts Amendments also “required the US SEC to abolish anticompetitive exchange rules that were not necessary for a legitimate regulatory objective, and they called for a national market system with transparency, linked markets, and the ability to execute orders in the “best” market.”¹⁶ This marked the first major step by regulators in the direction of a consolidated marketplace.

¹⁴ Hans R. Stoll, “Future of Securities Markets: Competition or Consolidation?” *Financial Analysts Journal* November/December 2008: 16

¹⁵ Stoll 16.

¹⁶ Stoll 16.

In 1976, the first anticompetitive rule was abolished on the NYSE: Rule 394. Enacted in 1957, Rule 394 strictly forbade the transacting in an NYSE-listed security by a member organization off the exchange floor without the prior permission of the exchange. This rule severely hindered the ability of member brokers to execute off-board trades within securities given the process of requesting approval to perform such a transaction. However, in 1976, under pressure from the SEC, Rule 394 was replaced with a weaker Rule 390. Rather than forcing exchange members to seek prior approval in the trading of a security, Rule 390 required members seeking to execute a trade to first query exchange floor specialists before moving to an off-board market. Limit orders, on the other hand, were allowed to move to off-board markets without direct prior approval. While Rule 390 enabled brokers to execute off-board trades, there remained a strong incentive for to trade directly with the NYSE specialist. As a result, Rule 390 did not create the fundamental shift sought by the SEC. Rule 390 nevertheless served as a step in a new direction by permitting agents to engage in transactions in markets other than the exchange floor.

The SEC followed the implementation of Rule 390 by instituting Rule 19c-3 in 1980. Rule 19c-3 “permitted brokers” to make a market for securities listed on the New York Stock Exchange (NYSE) by “allowing them to match buy and sell orders in-house without sending each order directly to the floor of the exchange.”¹⁷ Rule 19c-3 was made effective for all newly listed securities after April 26, 1979. By allowing brokers to make off-board markets for securities the SEC hoped to create direct competition with the NYSE Specialists for securities issued on or after April 26, 1979. This increased competition would force market makers to reduce bid-ask spreads “to attract order flow” and encourage markets to further distribute quotes

¹⁷ Cohen and Conroy 278.

to over-the-counter (OTC) markets, thereby increasing the liquidity and depth in the market for 19c-3 securities.¹⁸

The 1970s also heralded the introduction of the Intermarket Trading System (ITS). In 1978, the SEC released a preliminary statement calling for the “prompt development of comprehensive market linkage and order routing systems to permit the efficient transmission of orders among the various markets for qualified securities, whether on an exchange or over-the-counter.”¹⁹ Pursuant to this request several exchanges, including the NYSE and American Stock Exchange, submitted the “Plan for the Purpose of Creating and Operating an Intermarket Communications Linkage,” known simply as the ITS Plan.²⁰ Following a series of modifications the proposal was finalized and permanently approved in 1983 to include both the original ITS exchanges and the NASDAQ stock market in an automated interface that linked the communication and dispersal of information between the markets. Moreover, the ITS Plan also contained provisions to protect price discovery in the system by proposing rules to limit trade-throughs and establishing a national best bid and offer price for securities within the system. Trade-throughs refer to the practice of a broker executing an order against his inventory as opposed to routing the order to other potentially better markets. This practice hinders the ability of an investor to achieve the best price in a trade and reduces competition between brokers for order flow. While initially restricted to Rule 19c-3 securities, ITS gradually expanded to include all securities in 2001.

¹⁸ Cohen and Conroy 278.

¹⁹ Securities and Exchange Commission, Final Rule: Adoption of Amendments to the Intermarket Trading System Plan To Expand the ITS/Computer Assisted Execution System Linkage to all Listed Securities (Washington, D.C.: 2000) 1 April 2009 <<http://www.sec.gov/rules/final/34-42212.htm>>.

²⁰ Securities and Exchange Commission (2000).

C. The 1990s and the NASDAQ Stock Market

The 1990s also heralded a series of changes and industry shifts to further propagate the SEC's goal of a National Market System. Most notably, the SEC introduced new rules targeted at the NASDAQ known collectively as the Order Handling Rules (OHR). Prior to OHR, the NASDAQ Stock Market did not routinely display limit orders and did not allow these limit orders to directly compete with dealer quotes.²¹ Limit orders are not routed through a broker, and therefore are an alternative source through which to execute trades. As a result, they serve as a source of competition to brokers. A second complication on the NASDAQ involved several dealers engaging in a practice of selectively choosing the counterparty with whom to provide order flow. This practice, known as preferencing, severely hindered competition between dealers and subsequently drove up bid-ask spreads and trading costs within the market.

OHR sought to fundamentally alter the process of displaying and executing against limit orders on the NASDAQ through two primary provisions. First, the Limit Order Display Rule, "requires that market makers display investors' limit orders that are priced better than the market maker's quote."²² This rule provides investors with the ability to find potentially better prices for their trades thereby improving the price discovery process. It also adds a new element of competition as market makers must now compete directly with limit orders for order flow.

The second major provision, the Quote Rule, "requires market makers to publicly display their most competitive quotes."²³ Given that NASDAQ market makers routinely deal privately with electronic communication networks (ECN), an element of transparency was lost as investors were not privy to these private quotes. The Quote Rule required the market maker to

²¹ Stoll 17.

²² Thomas H. McInish, "The Effect of the SEC's Order-handling Rules on NASDAQ," *Journal of Financial Research* 22 September 1998: 1

²³ McInish 2.

display publicly the quotes provided by the counterparties with whom they deal, including ECNs. Therefore, the investor gains access to quotes provided by specialists in other markets namely ECNs. As a result, the transparency of quotes within the market system is improved and, subsequently, the competition amongst the purveyors of these quotes. Overall, as demonstrated in Figure 1, OHR was successful in reducing the spreads associated with NASDAQ traded securities through the introduction of competition to the market.

D. The 2000s and Final Preparations

In the 2000s, the final major set of milestones necessary for or aiding in the establishment of the National Market System framework were achieved. The first such milestone was the rescission of NYSE Rule 390 in 2000. As previously discussed, Rule 390 represents a less stringent version of the since rescinded Rule 394. Rule 390 restricts NYSE member organizations and affiliates from transacting in NYSE-listed securities on markets other than a national securities exchange. Thus, members may not transact with certain electronic communications networks or alternative trading systems regardless of the ability to attain a more favorable price. While the rule allows members to perform off-board transactions, it nevertheless represents a means of inhibiting competition with the NYSE by placing undue restrictions on the transacting ability of market participants. The rule was viewed as a means of preventing non-exchange organizations from adequately competing with exchanges in the execution of trades for NYSE-listed securities. As a result of these and other concerns raised by the SEC and market participants, the NYSE requested the revision of Rule 390.

The second major development in the early 2000s is the decimalization of tick sizes on all major US exchanges in 2001. Prior to decimalization tick sizes in stocks were quoted in

fractions of one-sixteenth of a dollar, or 6.25 cents, on the NYSE and at similar levels on other exchanges. As a result, dollar bid-ask spreads had a minimum of 6.25 cents. Following decimalization, minimum tick sizes have been reduced to one penny. This enabled bid-ask spreads to reduce further to this lower bound. It also simplified the trading process and brought US markets in parity with international markets. Figure 1 also demonstrates the impact decimalization has had on the NASDAQ market by highlighting the significant declines in Microsoft's average daily quoted and effective half-spread following the introduction of this rule.

E. Conclusion

In summary, the passing of Regulation NMS within the United States has been a three decades long process. It began in the 1970s with the implementation of the Amendments to the Securities Acts of 1934 which formally mandated the creation of a uniform system for the execution of trades within the US securities markets. The 1980s brought about the introduction of the Intermarket Trading System as the first established central communications network for securities trading. This was followed by the inclusion of the NASDAQ and, eventually, electronic communication networks and alternative trading systems into the ITS framework. The 1990s brought about that Order Handling Rules which further exacerbated the degree of competition existing within the NMS. The final set of milestones was achieved in the early 2000s with the rescission of Rule 390 and decimalization of minimum tick sizes. The culmination of these efforts has been the passing of Regulation NMS in 2005.

IV. Regulation NMS

According to the SEC, Regulation NMS provides “four substantive proposals that are designed to enhance and modernize the regulatory structure of the U.S. equity markets.”²⁴ These rules provide for:

- 1. A substantial reduction in trade-throughs,*
- 2. Modernization of the terms of access to quotations and the execution of orders in the NMS,*
- 3. Restrictions on market participants from quoting prices less than a penny for securities not trading below \$1.00, and*
- 4. Increasing the efficiency of communicating information to the public.*²⁵

The SEC consented that the rules were a necessary next step in upgrading the regulatory framework to best preserve the “growth, efficiency, innovation, and competition” of the National Market System.²⁶ In order to achieve this objective, the SEC has outlined two primary goals of Regulation NMS.

A. Stated Objectives of Regulation NMS

The first objective of Regulation NMS addresses the notion of competition within a consolidated framework. The SEC does not intend to fully consolidate the securities market as this would pose the adverse effects related to any monopolistic market such as hindered competition and innovation. Rather, a compromise is desired, similar to the earlier discussed

²⁴ Securities and Exchange Commission, Regulation NMS [Release No. 34-49325] (Washington, D.C.: 2004) 1 April 2009 <<http://www.sec.gov/rules/proposed/34-49325.htm#I>>

²⁵ Securities and Exchange Commission (2004).

²⁶ Securities and Exchange Commission (2004).

segmented system, wherein competition is allowed to thrive. Competition within the NMS resides in two discrete forms: amongst market centers and amongst individual orders. By mandating linkages between individual market centers, order flow is diverted to the best available price. In this way, market centers must compete for order flow through reduced spreads and increased efficiency. Moreover, the diffusion of data throughout the system and between different participants enables a more vigorous competition amongst individual orders for the best price. The expected result is a more efficient market for securities.

The second objective of Regulation NMS is sufficiently appeasing the needs of long-term investors and listed companies through the reduction in the trading costs related to a security and, in turn, the inherent cost of capital attributed to the company. In establishing this objective the SEC made a clear choice of supporting less volatile, but liquid markets. This decision places an emphasis on long-term investors seeking minimum undue price movements, rather than short-term traders that profit from volatility in price and the ability to quickly enter and exit a trade. While the needs of both investors are normally achieved with regulatory policy, this discrepancy in needs nevertheless represents a moment of divergence. Overall, Regulation NMS aims to achieve depth in securities markets void of undue price swings that may invariably raise transaction costs for long-term investors. These costs are not only commissions and fees, but also search costs, which the SEC estimates to be about \$30 billion annually for institutional investors such as mutual funds.²⁷

²⁷ Securities and Exchange Commission, Regulation NMS: Final Rules and Amendments to Joint Industry Plans (Washington, D.C.: 2005) 1 April 2009 <<http://www.sec.gov/rules/final/34-51808.pdf>>

B. Order Protection Rule

The four principal rules and initiatives of Regulation NMS are aimed at achieving the aforementioned objectives. Rule 611, known as the Order Protection Rule, addresses access to public markets by focusing principally on the reduction of trade-throughs. Trade-throughs represent the execution of trades “at a price that is inferior to the price of a protected quotation, often representing an investor limit order, displayed by another trading center.”²⁸ Occurring at a rate as high as 1 in 11 actively traded NASDAQ stocks, this process hinders price discovery by precluding investors from accessing more favorable quotes, namely counterparty limit orders.²⁹ The result is a market inefficiency that deters participants from issuing limit orders and yields inferior trades for investors. Rule 611 therefore aims to protect all automated national best bid or offer quotes by requiring “trading centers to establish, maintain, and enforce written policies and procedures reasonably designed to prevent trade-throughs.”³⁰ Further, these standards must be incorporated within the trading systems of the center.

In order to qualify for protection under Rule 611, a trading center must be capable of displaying and executing trades in under two seconds. This rule therefore requires a trading center to automate its systems in order to ensure the speed requirement is met. Arguably, automation as a result of Rule 611 severely hampered the role of the specialist on the NYSE and other traditional exchanges. Given the timely manual decision making of the specialist, Rule 611 protection would not apply were the specialist system to remain in place. Following the implementation of Regulation NMS and the further automation of securities exchanges, there has been a continued decline in the role of the specialist in market making and securities trading.

²⁸ Securities and Exchange Commission 26 (2005).

²⁹ Securities and Exchange Commission 26 (2005).

³⁰ Securities and Exchange Commission 26 (2005).

C. Access Rule

Rule 610 of Regulation NMS is known as the Access Rule and oversees the fair and efficient access to quotes by market participants. To accomplish this, Rule 610 departs from the mandated linkages set forth by ITS and allows trading centers to utilize private linkages to attain better access to quotes. Rule 610 imposes a limit of \$0.003 per share on the fees charged for access to protected quotations. This cap on fees precludes trading centers from charging unnatural fees for protected securities and standardizes the fee structure of the NMS. Moreover, this fee structure is necessary for the propagation of protected quotes, as stipulated by Rule 611, to all market participants. It does so by eliminating the ability of market centers with an abundance of actively traded and quoted securities to charge excessive fees to investors seeking to further execute orders in these securities.

D. Sub-Penny Rule

Rule 612, the Sub-Penny Rule, prohibits “market participants from displaying, ranking, or accepting quotations in NMS stocks that are priced in an increment of less than \$0.01, unless the price of the quotation is less than \$1.00.”³¹ This rule is intended to prevent participants from attempting to win an order by presenting a quote slightly better than that which is displayed. Given that this practice most often occurred when participants attempted to beat limit orders, Rule 612 intends to further protect limit orders and increase transparency.

³¹ Securities and Exchange Commission 29 (2005).

E. Market Data Rules

The final set of initiatives set forth by Regulation NMS is known collectively as the Market Data Rules. These rules, 601 and 603, provide for the efficient dissemination of market data to the investing public. They ensure that revenues from market data fees are allocated to trading centers on a rational basis. More specifically, the rules attempt to make certain that market data revenues are allocated based on the quality of the data provided and not simply the amount. Further, the rules enable trading centers to distribute independent data to investors in a modernized fashion as to provide for greater access by retail investors.

F. Conclusion

In sum, Regulation NMS represents the culmination of a long history of developments within the US securities market. Made effective on August 29, 2005, Regulation NMS provides new and amended rules to abridge the inefficiencies of prior securities acts including the ITS Plan. Regulation NMS contains provisions aimed at creating and enhancing competition on and between market centers for order flow as well as protecting the interests of long-term investors. These provisions include the Access Rule, Sub-Penny Rule, and Market Data Rules.

V. Empirical Analysis

A. Methodological Overview and Data

Among the primary goals of Regulation NMS are further reductions in trading costs to market participants and an overall increase in the liquidity of the system. Having outlined the regulatory framework that has culminated in the adoption of Regulation NMS as well as the

specific components of the act itself, it is now important to verify the degree to which the aforementioned goals appear to have been achieved. In order to accomplish this, several hypotheses are developed and tested to assess the overall impact Regulation NMS has had on the US Securities Market.

Regulation NMS was rolled out to the market in two sequential phases. Beginning June 26, 2006, Phase 1 of the regulation required each market center to begin trading a representative sample of 100 NMS stocks and to ensure that these securities were in full compliance with the law. Phase 2, which began August 31, 2006, expanded the coverage of Regulation NMS to all traded securities within the system. In order to assess changes within market quality subsequent to the full implementation of Regulation NMS, each hypothesis is tested using intraday quote and volume information for a sample of fifty securities. The tests are conducted on each security to establish whether a statistically significant change occurred between the period prior to the full implementation of Regulation NMS and the period immediately following it. The event date is therefore defined as August 31, 2006. The pre- and post-event periods are defined as the fifty trading days preceding and immediately following the event date. The period surrounding the event date may yield biases in the analysis as traders attempt to prepare their systems for the change in regulation or to make profits from the change. As a result, five trading days prior to and following the event date have been omitted from the sample.

Using the New York Stock Exchange's Trade and Quote Database as well as the database of the Center for Research in Securities Prices, quote and volume information for a sample of fifty securities were obtained. The sample of companies is chosen at random based on their industry and size. Ten broad industries have been identified to represent the overall market. Five companies are then chosen randomly from each industry to yield a total of 50 companies within

the sample that are traded on the NYSE-Amex or the NASDAQ securities market. To restrict the sample, each security maintains an average daily volume between 100,000 and 1,000,000 shares traded. Each security also has a market capitalization between \$100 million and \$5 billion. These restrictions have been placed as a means of focusing on the securities most likely to recognize a change in market quality. Securities with sufficiently high trading volume have greater market depth for each share and, therefore, lower trading costs. Moreover, larger companies tend to also trade more efficiently and thus maintain low trading costs. Smaller companies, on the other hand, have been omitted as a means of circumventing the excessive volatility that these companies maintain.

Quote data has been constrained to quotes present within the system at 10:30AM on each trading day in the pre- and post-event periods. The data has been sifted to eliminate various inconsistencies within the data set. Most notably, negative quotes are eliminated from the sample. These quotes may have resulted from the presence of a bid or ask price within the system, but lacking a matching ask or bid at the moment the quote was posted. To compensate for this, the database may have placed an arbitrary bid or ask price of zero or a sufficiently high price thus resulting in unnaturally high or low bid-ask spreads within the data.

B. Situational Overview

Trade execution costs within a market system are impacted by several distinct factors. One factor of particular importance is the liquidity present within the system. Murphy defines liquidity as “the ability of traders to trade an asset without undue price impact.”³² Further, this liquidity is “characterized by the number of shares offered or sought in the current market by

³² Murphy 74.

limit orders.”³³ This attribute is referred to as market depth. Greater liquidity within the system leads to the execution of limit orders against market orders more frequently. This creates price competition within the market system between limit order traders and market makers as well as between trading centers, thereby reducing the overall quoted spreads for a particular security. As Murphy further points out, limit order investors, market makers, and other suppliers of liquidity are compensated for the higher competition within the system through the ability of traders to accept higher ask and lower bid prices due to their immediacy needs.

A liquid market is also self-perpetuating. Greater liquidity within a market attracts more market participants to that market given the anticipated ease of transacting within a security, greater overall efficiency of execution and price discovery, and lower expected trading costs. Regulation NMS hoped to capitalize on this phenomena by instituting rules aimed at deterring market makers from engaging in activities that hinder price discover and liquidity. The Order Protection Rule and Market Access Rule each attempt to ensure that investors have adequate access to the best available price in a segmented market system. By preventing brokers from trading through securities the degree to which limit orders are executed against market orders increases by allowing these orders to be triggered more readily. By ensuring sufficient access to a range of markets, investors are best able to engage in the price discovery process. The result is a system with greater liquidity given the prevalence of limit orders and the attraction of more market participants. Quoted bid and ask spreads will also decline as more competition ensues in the system from limit order traders and between market centers vying for order flow.

³³ Murphy 74.

C. Execution Costs – Bid-Ask Spread Hypothesis

To test the degree to which the US Securities market has experienced a reduction in trade execution costs and increases in liquidity following the full implementation of Regulation NMS, several hypotheses will now be developed. The first test will be conducted on the trading costs. The null hypothesis holds that:

Hypothesis 1: *The implementation of Regulation NMS created no statistically significant change in the execution costs experienced by market participants.*

In order to test for changes in execution costs, the quoted bid-ask spread for a particular security shall be used as a measure of trading costs. The quoted bid-ask spread is defined as:

$$\text{Dollar Spread}_x = \text{Ask Price}_x - \text{Bid Price}_x$$

where Ask_x and Bid_x are the dollar quoted ask and bid price for firm x at a particular moment in time. Using this measure, the arithmetic average dollar spread within the system at 10:30AM on each trading day for each security is computed and compared between the pre- and post-event periods using a two-tailed t-test.

While the dollar spread provides an assessment of the trading costs for investors, the percentage spread, provides a similar measure on a relative basis. The percentage spread is defined as:

$$\text{Percentage Spread} = (\text{Ask}_x - \text{Bid}_x) / (\text{Ask}_x + \text{Bid}_x)/2$$

The percentage spread provides a measure of trading costs taking into consideration the spreads relative to the underlying stock prices. For example, a \$3 spread would suggest a higher trading cost if the underlying stock price was \$10 versus \$30. As a result, the percentage spread enables one to measure changes in spread between the pre- and post-event periods on a relative basis.

To provide a more comprehensive discussion of execution costs, it is important to also consider ancillary factors that may also impact the changes in trading costs over the course of the sample period. Hamilton (1979) and Stoll (1989) describe two factors that may also impact the costs faced by traders. First, as explained by Murphy, as a stock's trading volume increases as does the expected liquidity. This relationship holds given that greater volume within a security increases the frequency of trades per period of time within the security and, therefore, reduces the risk to the market maker associated with holding the security. As such, the trading costs should also be lower in a higher volume security as "more orders, per period of time, compete on price."³⁴

A second ancillary factor impacting the trading costs within a security is the cost of capital to a market maker associated with holding a relatively high priced stock. A stock that trades at a sufficiently high price will compel a market maker to require additional capital from traders to deal in that stock. As a result, the cost of capital to participants will increase given the higher reserves necessary to execute a trade. Therefore, a higher priced stock would result in an increase in the overall costs.

Taken together, the aforementioned factors can be combined into a more comprehensive test of trading costs in the market system. To model this relationship, three additional variables, in addition to dollar spread and percentage spread, shall be introduced for each firm:

³⁴ Murphy 78.

- 1) The logarithm of average daily trading volume.
- 2) The arithmetic average daily closing prices.
- 3) A dummy variable to represent the pre- and post-event periods. The post-event period has been assigned a value of 1, while the pre-event period has a value of 0.

These variables yield a full regression model as follows:

$$Spread_z = \beta_0 + \beta_1 LogVolume_x + \beta_2 Price_x + \beta_3 Dummy_Rule_Change_x + \varepsilon_x,$$

with each variable representing a particular firm and ε_x representing an error term for the distribution.

Execution Costs Results

A univariate test was first performed on the quoted dollar spreads and the percentage spreads for the sample during the pre- and post-event periods. As seen in Table 4, both the dollar and percentage spreads declined in the post-event period as compared to the pre-event period. Moreover, a two-tailed t-test reveals a statistically significant decline in the quoted dollar and percentage spreads for the sample of firms following the implementation of Regulation NMS. The introduction of rules to protect quotes offered by limit order traders and further increase competition between market centers has yielded a reduction in bid-ask spreads.

As seen in Table 5, a regression model taking into consideration other factors that may also impact quoted spreads, suggests a statistically significant impact of the rule change on the reduction in quoted spreads. The regression model provides insignificant changes in quoted spreads as a result of the volume of the sampled firms, but a statistically significant positive

impact of the price of the security. The volume result enables us to eliminate one of two alternative variables beyond the rule change that could have also lead to a significant decline in spreads. On the other hand, the regression model suggests price has a significant positive impact on the spreads of each security. But, it alone was not sufficient enough to create a net increase in dollar and percentage spreads. From these assessments we can reasonably conclude that for the sample of firms, the reduction in trading costs was due primarily to the implementation of Regulation NMS.

D. Market Depth (Liquidity) – Volume, Turnover, and Average Size Hypotheses

Regulation NMS desired to achieve both a reduction in trading costs and an increase in market depth. The increase in market depth would therefore increase the liquidity of the shares traded within the system. Liquid markets are enticing to market participants as the speed at which a trade can be executed is greater, the impact of one's trade on the system is subdued, and, the ability to efficiently price a security is improved. As a result, market depth, and by extension, liquidity, is an important aspect of the quality of a market system, much like the bid-ask spreads.

Regulation NMS introduced two rules, the Order Protection and Market Access Rules, which were expected to lead to an increase in liquidity. By reducing trade-throughs, market orders are executed against limit orders more frequently thereby improving price discovery. Such a system is characterized by greater efficiency in trading and execution and therefore attractive to investors. The outcome of the rules adopted by the SEC should therefore be an increase in the liquidity within the system as more offsetting quotes (from limit orders) become available and more investors flock to the market. A null hypothesis to test this anticipated result is thus:

Hypothesis 2: *The introduction of Regulation NMS had no impact on the liquidity within the system.*

Three tests shall be performed in order to assess the market's overall liquidity following the full implementation of Regulation NMS. First, I will assess the changes in volume during the pre- and post-event periods. A more liquid system yields a higher percentage of quotes and trades in a particular security. As such, the volume of trades within these securities should also increase as a result of the presence of more offers for a particular security.

The second test involves the turnover in a particular security. Turnover is defined as:

$$\text{Turnover}_z = \text{Average Daily Volume}_z / \text{Shares Outstanding}_z$$

This metric provides a relative assessment of the activity within the stock of a particular company. Turnover, much like percentage spread, enables one to analyze the movement in a security as a proportion of the size of the pool of available securities.

The final metric to be considered in assessing liquidity shall be the total number of shares quoted at the bid and ask prices for a particular firm at 10:30AM on a trading day within the pre- and post-event periods. As described above, the entrance of a greater number of investors into the market for a security raises liquidity within the system. More investors providing quotes within a share should yield an overall increase in the number of shares offered at the bid and ask price. As such, a final measure shall be the arithmetic average of the sum of the shares quoted at the bid and ask price per security per trading day.

Market Depth (Liquidity) Results

As seen in Table 6, univariate tests on the pre- and post-event period show a statistically significant decrease in the volume and turnover within the sample of securities following the implementation of Regulation NMS. On the other hand, the tests demonstrated a statistically significant increase in the number of shares quoted at the bid and ask prices within the sample. Initially, these results appear to be contradictory. Whereas a decline in volume and turnover for a security should produce reductions in the number of shares offered to be traded, the opposite has occurred. This would lead one to believe that the implementation of Regulation NMS has increased the size of trades quoted within the system rather than the volume of trades. With more shares quoted for a security at any given time, the overall depth of the market is therefore improved. As a result, Regulation NMS has been successful in reducing the costs to investors and indirectly increased liquidity through the creation of deeper markets based on the statistical tests performed on the sample.

VI. Conclusion and Implications

A. Recap

This study provides an assessment of the impact of the regulatory environment on the market for securities within the United States. We began with a consideration of the fragmentation versus consolidation debate that has dominated the regulatory framework for more than three decades. A fragmented system is characterized by the mutually exclusive market centers wherein orders are executed within each center with limited communication between centers. This market system provides for sufficient competition amongst market centers for order flow. This competition fosters a strong degree of innovation and yields lower trading costs as

defined by the bid-ask spread. Conversely, a fragmented market also yields several unwanted results. A lack of communication between market centers creates undue search costs for market participants seeking to execute a trade at a better price. Moreover, this search process hinders the price discovery processes as a lack of communication impedes the ability of securities to converge on its true value. A final note of concern within such a market is the reduced liquidity in the system resulting from the greater time needed to match orders and execute trades. To compensate for these flaws, an alternative market system is available.

A consolidated market provides investors with a singular network from which to derive quickly quote information and match orders. As a result, this system provides a level of transparency not found within a fragmented market. Transparency reduces the time needed to match orders and increases the depth within the market through the presence of a far greater number of counterparties with whom to trade. The result is a reduction in trade execution costs and a self-perpetuating system that attracts a greater number of investors. This market system is not without faults, however. Principal among these is the assumption that each investor seeks a homogenous set of attributes from the system. On the contrary, investors routinely diverge in their degree of risk aversion, immediacy needs, desired trade sizes, and so forth. Moreover, a consolidated system produces characteristics similar to that of a monopoly, namely impediments on innovation.

The Securities and Exchange Commission, in compliance with the will of Congress, has weighed the benefits and detriments of each market system and chosen to implement a compromise system characterized by adequate competition, but greater transparency. This is known as a segmented market. Segmentation provides for independent market centers that are free to innovate and forced to compete for order flow while simultaneously offering investors

access to a consolidated network of information. Such a system allows investors to route orders to the center providing the best price. The costs of such a system exist in the abilities of dealers to trade-through prices of clients by executing against their own, albeit inferior, price.

Through a dynamic thirty year history, the SEC has attempted to fully implement what has come to be known as a national market system characterized by the benefits of segmentation, but limited in its costs. This journey has culminated in the introduction and full implementation of Regulation NMS in 2005. Regulation NMS consists of four primary rules meant to upgrade and enhance the US securities market framework by creating sufficient competition amongst market centers and between individual orders, and appeasing the needs of long-term investors. The most important provisions of Regulation NMS are the restrictions placed on the practice of trade-throughs and the improvement of access to information by investors. Overall, it is expected that these rules should have sufficiently reduced the trading costs faced by market participants and increased the liquidity of the system. This study aims to test the degree to which those expectations have been met.

Using statistical analysis, tests are conducted on the period leading to and immediately following the implementation of Regulation NMS. These tests assess the degree to which a statistically significant change occurred within an assortment of variables including the dollar spread, percentage spread, daily average trading volume, daily turnover, and bid-ask offer size. The results demonstrated that there was indeed a statistically significant reduction in the dollar and percentage spread following the implementation of Regulation NMS, even after controlling for other known to impact spreads. With regard to trading volume and turnover there appears to have been a similar reduction following the implementation of Regulation NMS. While, the size of quotes offered at the bid and ask prices have increased following the rule change.

Taken together, the empirical results corroborate the expectation that the implementation of regulation providing for a segmented market system has been successful in reducing the trading costs to market participants. The growth in size of shares offered add to the notion that market depth as a whole may have improved for all market participants. These results can likely be attributed to the increase in competition for orders on organized and over-the-counter exchanges. Market makers are forced to compete with limit order traders in the supply of both bid and ask quotes. Moreover, these quotes are available to all investors within the system. The result is a tightening of the bid-ask spread within a security.

B. Concluding Remarks

In conclusion, it is clear that the implementation of rules protecting the orders of individual investors and exacerbating competition within a securities market is beneficial to all market participants overall. By achieving a compromise between the benefits of consolidation against those of fragmentation, the US securities market has been successful in creating a more meaningful and efficient system wherein orders are executed easily and at lower costs. A conclusion such as this may be of particular importance for securities markets around the world who presently maintain a system closer to the bounds of the fragmentation and consolidation debate. It should be noted that the degree to which a country or region may adequately impose rules on its market to increase competition varies based on a medley of factors. These include the current regulatory framework of the nation in question, the level of technological innovation within the market, and the present needs of market participants. Overall, each of these factors, and those not mentioned, are important considerations to be had in attempting to satisfy the

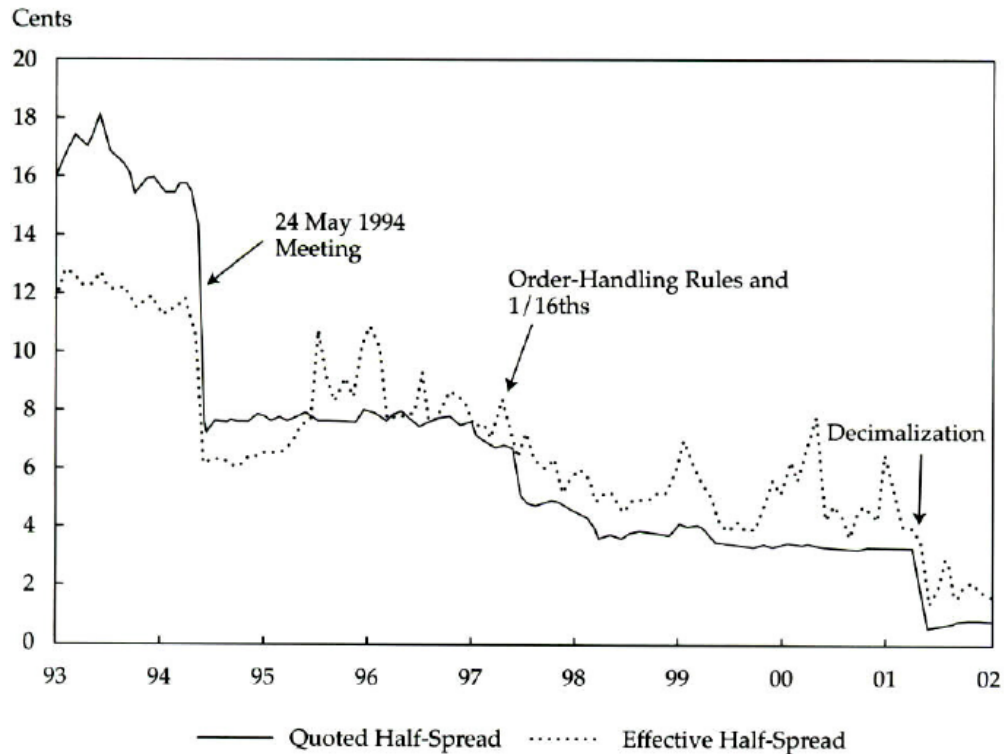
fragmentation and consolidation debate to achieve the most beneficial outcome for all concerned parties.

C. Areas for Further Studies

Looking forward, there are many additional areas in which research can be done to further enhance the discussion of fragmentation versus that of consolidation. First, the sample of companies considered should be expanded to include companies of differing volume and market capitalization quartiles. This may provide insight into the impact of the regulation on companies of varying size and volume. It may in fact yield results suggesting certain companies have not been affected or have been adversely affected by the rule change. A second aspect to consider is the time period considered within the study. There may be evidence to suggest that the volume or spreads within a security differs between the summer and winter months. If this was the case, a more comprehensive study to accommodate for time would be invaluable. Finally, the implementation of Regulation NMS was a two staged process with the first phase being implemented on each major exchange for 100 representative stocks effective June 29, 2006. A test on the impact on cost and liquidity for these securities may also be beneficial. Additionally, this test could also assist in determining whether the anticipation of Regulation NMS may have been priced into securities prior to the full implementation on August 31, 2006.

Figure 1

Microsoft's Average Daily Quoted and Effective Half-Spread, 1993 – 2002³⁵



Notes: The quoted half-spread is $(A - B)/2$, where A is the ask price and B is the bid price. The effective half-spread is $|P - M|$, where P is the trade price and M is the quote midpoint.

Source: The figure comes from Stoll and Schenzler (2006).

³⁵ Stoll 17.

Table 1

A Roadmap to Regulation NMS

Year	Event
1975	The Securities Acts Amendments to the 1934 Acts are passed abolishing fixed commissions and mandating the implementation of a National Market System.
1976	The NYSE replaces Rule 394 with the weaker Rule 390 allowing members to engage in off-board order execution.
1980	The SEC institutes Rule 19c-3 allowing brokers to internally match buy and sell orders in lieu of using the specialist. This further allows brokers to make off-board markets for exchange listed securities.
1983	The Intermarket Trading System becomes effective with linkages mandated between market centers and introducing a segmented market framework.
1998	The SEC institutes the Order Handling Rules, effectively creating competition on the NASDAQ market by requiring the display of limit orders and the public display of quotes by private markets, notably ECNs.
2000	NYSE Rule 390 is rescinded.
2001	Decimalization of minimum tick sizes is introduced thereby reducing dollar spreads in securities by removing a lower bound on these spreads.
2005	Regulation NMS is instituted by the SEC with new rules meant to reduce trade-throughs, improve the access to quotes by investors, and enhance the quality of market data in the system and efficiency of communicating the information to the investing public.

Table 2

Descriptive Statistics on Sample of Companies

Metric	Value
Number of Securities	50
Mean Share Price	\$19.71
Mean Market Capitalization (\$million)	\$727 M
Minimum Market Capitalization (\$million)	\$116 M
Maximum Market Capitalization (\$million)	\$2590 M
Mean Average Daily Volume	295,520
Minimum Average Daily Volume	137,000
Maximum Average Daily Volume	484,000

Table 3

Industries Considered within Sample

Industries Considered	
	Basic Materials
	Capital Goods
	Consumer Cyclical
	Energy
	Finance
	Health
	Services
	Technology
	Transportation
	Utilities Service

Figure 2

Average Daily Dollar Spreads – Jun 12, 2006 to November 17, 2006

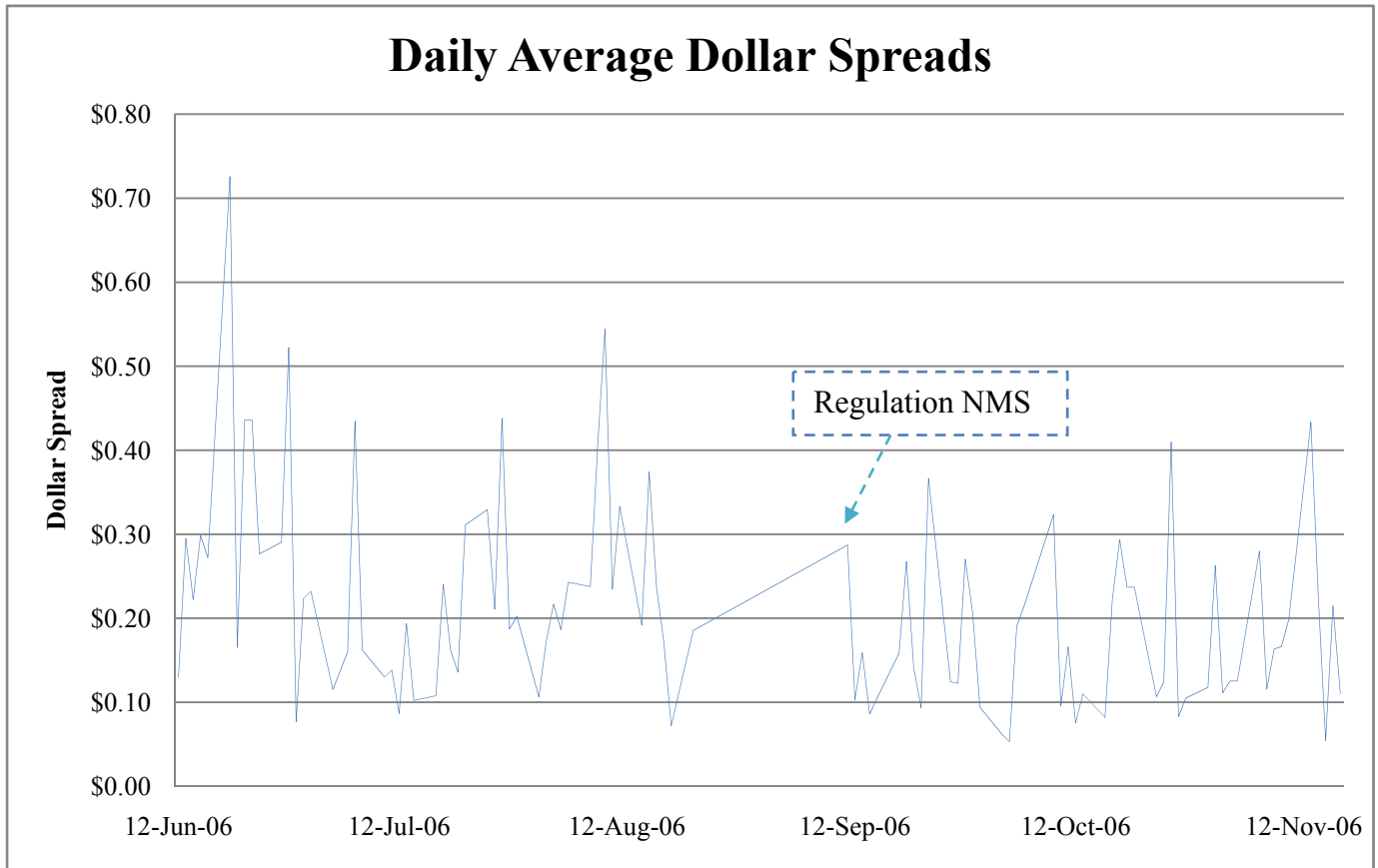


Figure 3

Average Daily Percentage Spreads – Jun 12, 2006 to November 17, 2006

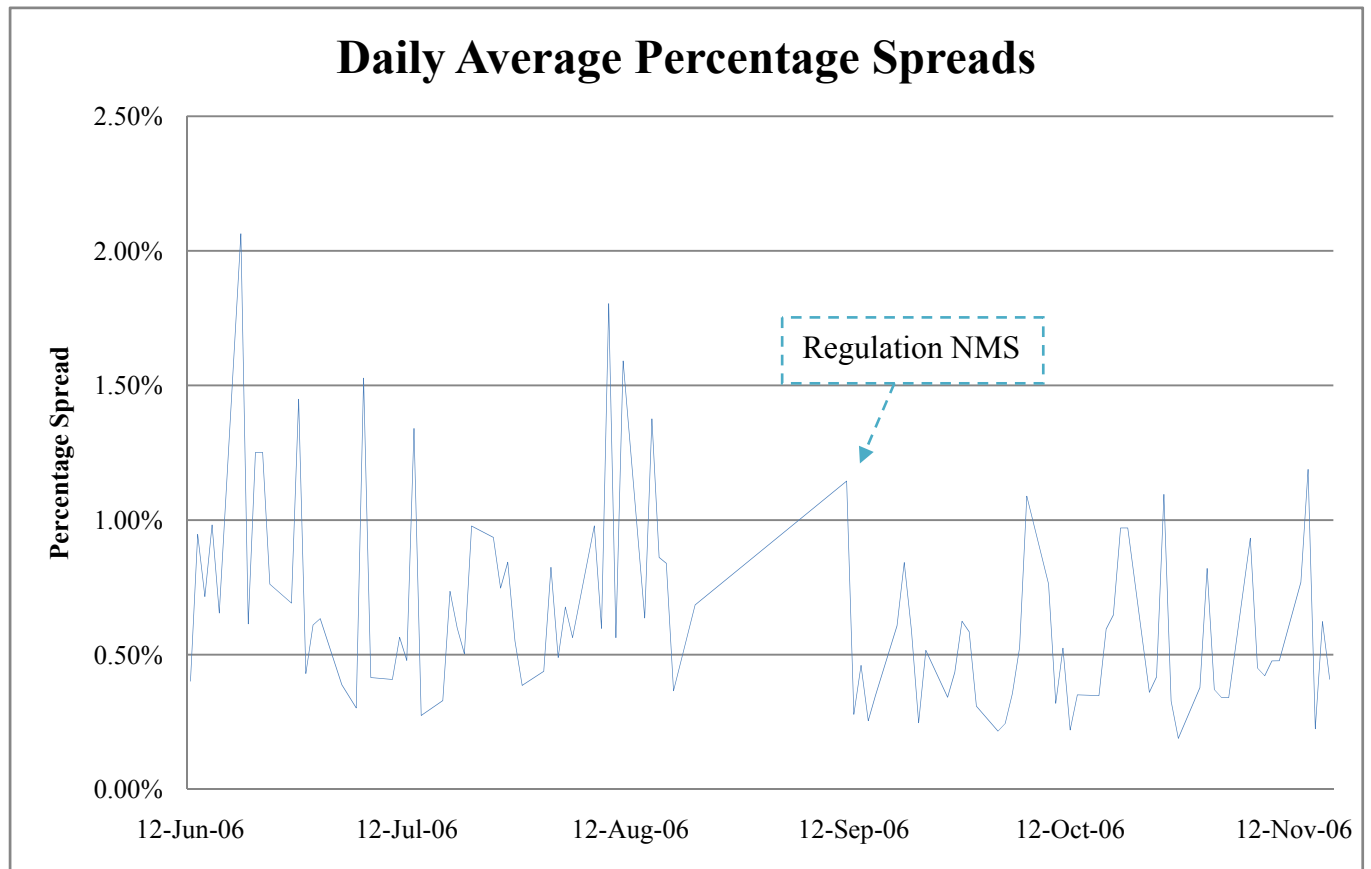


Table 4

Univariate Results – Dollar and Percentage Spread

Dollar Spread		Percentage Spread	
Mean Pre-Event Period	\$0.26	Mean Pre-Event Period	0.81%
Mean Post-Event Period	\$0.17	Mean Post-Event Period	0.53%
Change	-\$0.09	Change	-0.28%
Standard Deviation	\$0.09	Standard Deviation	0.27%
T Statistic	-6.790	T Statistic	-7.332
Significance Level	-3.496 (0.001 level)	Significance Level	-3.496 (0.001 level)
P-value	<0.001	P-value	<0.001

Table 5

Regression Results – Dollar and Percentage Spreads

Predictor	β_0	$\beta_1 \text{LogVolume}_x$	$\beta_2 \text{Price}_x$	$\beta_3 \text{Dummy_Rule_Change}_x$
Coefficient	0.11765	-0.00009	0.00425	-0.12003
T Statistic	2.92	-0.59	3.60	-3.04
P Value	0.004	0.555	0.001	0.003
R^2	18.3%			

Table 6

Univariate Results – Volume, Turnover, and Offer Size

	Average Daily Volume	Daily Turnover	Offer Size
Mean Pre-Event Period	270,213	0.009027	2,671
Mean Post-Event Period	238,963	0.007760	3,310
Change	-31,250	-0.001268	639
Standard Deviation	43,024	0.001637	2,697
T Statistic	-5.136	-5.476	1.676
Significance Level	-3.496 (0.001 level)	-3.496 (0.001 level)	1.676 (0.10 level)
P-value	<0.001	<0.001	0.10

Works Cited

- Atkins, Paul S. "Enhancement and Modernization of the National Market System." Washington, D.C. SEC News. Apr. 2005. Securities and Exchange Commission. 1 January 2009 <<http://www.sec.gov/news/speech/spch040605psa.htm>>.
- Blume, Marchall E. "Competition and Fragmentation in the Equity Markets: The Effects of Regulation NMS," *The Rodney L. White Center for Financial Research* (2007). 1 April 2009 <<http://ssrn.com/abstract=959429>>.
- Cohen, Kalman J., and Robert M. Conroy. "An Empirical Study of Rule 19c-3." *Journal of Law and Economics* 33.1 (1990): 277-305. *Chicago Journals*. JSTOR. Bobst Library, NY. 1 April 2009 <<http://jstor.org/stable/725517>>.
- McInish, Thomas H. "The Effect of the SEC's Order-handling Rules on NASDAQ," *Journal of Financial Research* (1998). 1 April 2009 <<http://ssrn.com/abstract=89072>>.
- Murphy, Albert J. Financial Market Consolidation Versus Fragmentation: A Comparative Analysis. Diss. The City University of New York, 2002. *ProQuest Digital Dissertations*. ProQuest. Bobst Library, NY. 10 October 2008 <<http://www.proquest.com>>.
- Securities and Exchange Commission. Final Rule: Adoption of Amendments to the Intermarket Trading System Plan to Expand the ITS/Computer Assisted Execution System Linkage to all Listed Securities. Washington, D.C., 2000. 2000. Securities and Exchange Commission. 1 April 2009 <<http://www.sec.gov/rules/final/34-42212.htm>>.
- Stoll, Hans R.. "Future of Securities Markets: Competition or Consolidation?" *Financial Analysts Journal* 64.6 (2008): 15-26. *ABI/INFORM Global*. ProQuest. Bobst Library, NY. 1 April 2009 <<http://www.proquest.com/>>.

Securities and Exchange Commission, Regulation NMS [Release No. 34-49325]. Washington, D.C., 2004. Securities and Exchange Commission. 10 October 2008 <<http://www.sec.gov/rules/proposed/34-49325.htm#I>>.

Securities and Exchange Commission, Regulation NMS: Final Rules and Amendments to Joint Industry Plans. Washington, D.C., 2005. Securities and Exchange Commission. 10 October 2008 <<http://www.sec.gov/rules/final/34-51808.pdf>>.