4-1-2008

The Uptick Rule of Short Sale Regulation: Can It Alleviate Downward Price Pressure from Negative Earnings Shocks?

Lin (Lynn) Bai
University of Cincinnati College of Law, lin.bai@uc.edu

RUTGERS BUSINESS LAW JOURNAL

VOLUME 5 SPRING 2008 NUMBER 1

THE UPTICK RULE OF SHORT SALE REGULATION: CAN IT ALLEVIATE DOWNWARD PRICE PRESSURE FROM NEGATIVE EARNINGS SHOCKS?

Lynn Bai

TABLE OF CONTENTS

THE UPTICK RULE OF SHORT SALE REGULATION: CAN IT ALLEVIATE DOWNWARD PRICE PRESSURE FROM NEGATIVE EARNINGS SHOCKS?

Lynn Bai[*]

This paper empirically examines the effect of the uptick rule (including the bid test applicable to NASDAQ stocks) of short sale regulations on stock prices and short selling activities immediately after negative earnings surprises that occurred during the period of May to November 2005. It compares price paths and short selling activities of stocks restricted by the uptick rule with stocks that were exempted from the rule as a result of the SEC's Pilot Program. The study has not found any evidence that prices of stocks subject to the rule declined at a slower speed than prices of exempted stocks at times of stress. The two groups of stocks had similar levels of short sale volumes despite the rule's prohibition on short selling at minus or zero-minus ticks. For NYSE and AMEX stocks, this study shows that market short orders whose immediate executions were barred by the uptick rule found execution opportunities against the upcoming buy orders within 15 minutes after their conversion into limit orders at the legally shortable price. For NASDAQ stocks, this study shows that up bids occurred with high frequency after negative earnings surprises and jointly with price improvements they offered generous execution opportunities to short sale orders. This study lends support to the SEC's recent suspension of the rule in absence of severe market conditions.

SECTION 1. INTRODUCTION

This paper empirically examines the effect of the uptick rule (including the bid test applicable to NASDAQ stocks) of short sale regulations on stock prices and short selling activities immediately after negative earnings surprises that occurred during the period of

[*] Assistant Professor of Law, University of Cincinnati College of Law. J.D., University of Texas at Austin, School of Law; Ph.D., Duke University, Fuqua School of Business. The author thanks Michael Brandt of Duke University Fuqua School of Business, Alon Brav of Duke University Fuqua School of Business, James Cox of Duke University Law School, and Robert Whaley of Vanderbilt University Owen School of Management for comments. The author is responsible for all errors in this paper. The author can be contacted by email at lin.bai@uc.edu.

May to November 2005. A short sale is a sale of a security that the seller does not own or any sale that is consummated by the delivery of a security borrowed by the seller. Up until as recent as July 3, 2007, the Securities and Exchange Commission ("SEC") had Rule 10a-1[1] under the Securities Exchange Act of 1934,[2] which provided that a listed security might be sold short, either at a price above the price at which the immediately preceding sale was effected (plus tick), or at the last sale price if it was higher than the last different price (zero-plus tick). Short sales were not permitted on minus ticks or zero-minus ticks, subject to narrow exceptions.[3] Rule 10a-1 was first adopted in 1938[4] for the purpose of, among others, "preventing short sellers from accelerating a declining market by exhausting all remaining bids at one price level, causing successively lower prices to be established by long sellers."[5] Rule 10a-1 applied only to securities listed on the New York Stock Exchange and the American Stock Exchange and did not apply to short sales of NASDAQ securities. Short sales in NASDAQ stocks were subject to NASDAQ Rule 3350, which was similar in spirit to Rule 10a-1 and prohibited short sales

[1] 17 C.F.R. § 240.10a-1 (2007). This rule has been removed by the SEC Final Rule that was issued on July 3, 2007. 72 F.R. 36348-01 (July 3, 2007).

[2] 15 U.S.C. § 78a *et seq.* (2006).

[3] *See* 17 C.F.R. § 240 (2007). Rule 10a-1(e) listed numerous exemptions from the uptick rule, which included, among others, the odd-lot dealer exemption, the exemption that allowed a specialist or market maker to execute a short sale for its own account at a zero-minus, the exemption that allowed market makers to execute transactions at their offer following a trade-through, and the exemption for bona fide arbitrage activities.

[4] *See* Regulation SHO and Rule 10a-1, Exchange Act Release No. 34-55970 (June 28, 2007), *available at* http://www.sec.gov/rules/final/2007/34-55970.pdf [hereinafter Regulation SHO Release].

[5] *See* Short Sales, Exchange Act Release No. 34-42037 (Oct. 20, 1999) [hereinafter SEC Release]. The other two purposes of the uptick rule are: (i) allowing relatively unrestricted short selling in an advancing market, and (ii) preventing short selling at successively lower prices, thus eliminating short selling as a tool for driving the market down.

in NASDAQ National Market (NNM) securities at, or below, the best bid when the best bid displayed was below the preceding best bid.[6]

The core provisions of Rule 10a-1 remained virtually unchanged since its adoption, but the U.S. financial market went through fundamental changes including, for example, real-time surveillance, pricing decimalization, and reduction in spread and minimum tick moves. Requests for exemptive relief increased dramatically in the past decade and prompted the SEC to reconsider the plausibility of continued application of the rule in the current market framework. In an effort to gather data and create a controlled environment for a thorough study on the effect of the rule on market prices, volatility, liquidity and trading activities, the SEC implemented a Pilot Program from May 2, 2005 to July 3, 2007, whereby the uptick rule was suspended on one-third of Russell 3000 Index constituent stocks with high levels of liquidity. The SEC requested public opinion on a number of specific questions regarding the effects of the uptick rule, including: "Does Rule 10a-1 continue to serve a valid purpose in a declining market by preventing short sellers from accelerating declines in securities prices, or 'depressing' the market?" [7] The price-supporting hypothesis was one of the main reasons for the rule's initial adoption and was invoked by some market participants when the SEC was considering abandoning the rule on a number of occasions in the past.[8] A verification of this

[6] NASDAQ Rule 3350 exempted registered NASDAQ market makers in connection with bona fide market making activities and options and warrants market makers for hedging activities. NASDAQ Rule 3350 replaced NASD Rule 3350 when NASDAQ became a stock exchange on August 1, 2006. The bid test applicable to short selling was identical under both rules. NASDAQ, Inc., NASDAQ Manual Online, *available at* http://www.complinet.com/nasdaq/display/display.html?rbid=1705 (last visited Aug. 1, 2006). The sample period of this paper was prior to August 1, 2006. Thus, the term NASD Rule 3350 is used when referring to the bid test applicable to NASDAQ securities. Moreover, Rule 10a-1 and NASD Rule 3350 are used collectively as the "uptick rule" in this paper unless the context requires a distinction of one from the other.

[7] *See* SEC Release, *supra* note 5, at 16.

[8] In 1976, the SEC ordered a public investigation of the feasibility and effects of certain proposed changes in the short sale regulation including a suspension of the

hypothesis would carry a substantial weight in the SEC's consideration of whether the rule should be abolished.

During the course of the Pilot Program, the SEC received comments from a long list of institutions and individuals, as well as four completed outside studies (in addition to SEC's own empirical study carried out by the SEC's Office of Economic Analysis) that utilized the pilot data in examining various aspects of the uptick rule.[9] The study, which this paper records, was the only one among those four studies to focus on the price supporting hypothesis. The results suggested that the uptick rule had no impact on the magnitude and speed of price decline at times when stocks were subject to downward pressure caused by unfavorable earning shocks, offering the SEC one additional piece of evidence on the ineffectiveness of this rule in the current market framework. Finally, on July 3, 2007, the SEC abolished Rule 10a-1 and any rule of exchanges (including NASDAQ 3350) that applied a price test or bid test on short sale orders.[10] The SEC cited the results of this study and other studies completed during the Pilot Program as evidence supporting its decision.[11]

In analyzing the intraday price effect of the uptick rule, this study took the following approach. First, negative earnings surprises were identified for pilot and nonpilot stocks during the period from May 2, 2005 to November 30, 2005 (within the Pilot Program period). This period provided events of two or three earnings reports for most

uptick rule. The SEC received 12 comment letters in response to the 1976 proposals. Eight commenters, including the NYSE and AMEX, strongly opposed any suspension of the uptick rule for the reason that the suspension would have damaging effects, such as accelerating price declines and increasing volatility. *See id.* at 6. In 1980, the SEC withdrew the proposals, principally due to public comments opposing the elimination of the uptick rule on short selling. In 1991, the House Committee on Government Operations released a report on short selling, which made numerous findings and recommendations, including that the uptick rule acted as a price stabilizing force and should be retained. *See* H.R. REP. NO. 102-414 (1991).

[9] *See* Regulation SHO Release, *supra* note 4, at 8 n. 20.

[10] *Id.* at 1-2.

[11] *Id.* at 21 n.71.

of the stocks included in the study. Negative earning surprises were identified by comparing the actual quarterly earnings per share with the consensus analyst forecast. Negative earnings surprises are considered a major cause of stress in stock prices, and thus provide good opportunities to study the price effect of the uptick rule. It was shown, via the Wilcoxon Rank Sum test, that the sample earnings surprises were comparable to those typically seen in the past three years, and that the sample events exhibited signs of stress such as lower returns and higher short sale volumes compared to days before earnings announcements.

Next, the study examined if there was any difference in overnight price adjustments between pilot and nonpilot stocks from market close that occurred prior to earnings announcement to market open immediately after earnings announcement. A regression of the overnight return on the pilot dummy and other variables revealed no difference in the overnight return between pilot and nonpilot stocks. Then, the study compared the intraday returns of pilot and nonpilot stocks and the speed of their respective price declines during different time periods on the first trading day after earnings announcements (the "Event Day"). There was no evidence of any price supporting effect of the uptick rule.

Since the common belief was that the uptick rule could support prices by limiting short volumes, the lack of difference in the intraday returns of pilot and nonpilot stocks prompted a further study on whether short sale volumes differed between these two groups of stocks. The comparison of short volumes at market open and during regular trading hours on the Event Day revealed that for NYSE and AMEX stocks, short sale volumes of pilot stocks were higher than those of nonpilot stocks at market open but not during regular trading hours. For NASDAQ stocks, short sale volumes of pilot stocks were lower than those of nonpilot stocks at market open, but there was no difference between the two groups of stocks during regular trading hours.

To identify the sources of execution opportunities that "neutralized" the intended restrictive effect of the uptick rule, this study analyzed short volumes at different relations among the minimum shortable price (the "MSP", i.e., the lowest price without

violating the uptick rule), the execution price, and the prevailing quotes. For NYSE and AMEX stocks, the uptick rule was preventing immediate executions for most of the times but market short sale orders were able to be matched with buy orders soon after their conversion into limit orders at the MSP. This meant that at a stress level generated by negative earnings shocks of magnitudes typical in recent history, there was still sufficient buy interest in the market, which, aided by enhanced execution priorities due to shortened execution lines under the 1 cent minimum tick rule, offered ample execution opportunities to short sale orders. The uptick rule achieved at most a delay in the execution of those orders that was less than 15 minutes. For NASDAQ stocks, the bid test was not binding for a majority of the times and, together with price improvements, provided generous execution opportunities to short sales. This meant that movements in best quotes did not coincide with movements in prices during short time intervals. Quotes bounced back and forth rather than declining consecutively during short time intervals, rendering the bid test inapplicable most of the times on a stressful day despite the occurrence of consecutive declines in prices. In addition, there was evidence of price improvements to allow the immediate executions of short orders that were otherwise barred by the uptick rule. In sum, the uptick rule was ineffective in reducing short sale volumes and supporting prices when the market was experiencing stress triggered by earnings shocks.

The rest of this paper proceeds as follows: Section 2 reviews literature on short sale constraints; Section 3 discusses the SEC Pilot Program in detail; Section 4 describes the data and compares characteristics of pilot and nonpilot stocks in the sample; Section 5 compares overnight and intraday price movements of pilot and nonpilot stocks; Section 6 compares short sale volumes of the two groups of stocks and provides explanations to the lack of restrictiveness of the uptick rule; and Section 7 concludes this paper.

SECTION 2. LITERATURE REVIEW

There are two major components to short sale regulations: the requirement of stock borrowing before short sales and the uptick

rule. Thus far, there has not been any literature published in law reviews or any other law journals that empirically examines the effect of the uptick rule. Studies carried out by finance academics have focused on the price effect of the stock borrowing requirement, rather than the price effect of the uptick rule. These papers examine the relation between market-to-book ratio and subsequent returns over a period of time, or the relation between institutional ownership of stocks, which is a proxy for the difficulty in stock borrowing, and subsequent returns. They reached different conclusions as to whether short sale regulations in general, or the inability to borrow stocks in particular, have caused overpricing. Representative papers include those authored by Miller,[12] Diamond, & Verrecchia,[13] and Jones & Lamont.[14] While there have been a number of papers, represented by Bris, Goetzmann, & Zhu,[15] and Charoenrook & Daouk,[16] which study whether short sale regulations have the effect of reducing the severity of market panic, their approach was to compare the skewness in daily stock return distributions across jurisdictions that have different degrees of short sale restrictions, without singling out the effect of the uptick rule price test from the stock borrowing requirement. They found no evidence that short sale regulations have reduced the severity of market panic.

[12] Edward M. Miller, *Risk, Uncertainty, and Divergence of Opinion*, 32 J. FIN. 1151, 1151-1168 (1977). This paper establishes a theory that short-sale constrained securities become overpriced when investors disagree about their values.

[13] Douglas W. Diamond & Robert E. Verrecchia, *Constraints on Short-Selling and Asset Price Adjustment to Private Information*, 18 J. FIN. ECON. 277, 277-311 (1987). This paper finds that short sale constraints cause overpricing.

[14] Charles M. Jones & Owen A. Lamont, *Short-Sale Constraints and Stock Returns*, 66 J. FIN. ECON. 207, 207-239 (2002). This paper empirically shows that stocks that are costly to borrow have a higher market-to-book ratio and low subsequent returns, consistent with the overpricing hypothesis.

[15] Arturo Bris *et al.*, *Efficiency and the Bear: Short Sales and Markets around the World,* Working Paper No. 9466, NAT'L BUREAU OF ECON. RESEARCH, 1-30 (2003).

[16] Anchada Charoenrook & Hazem Daouk, *Market-Wide Short-Selling Restrictions* (Aug. 2005) (unpublished manuscript, on file with the Owen Graduate Sch. of Mgmt., Vanderbilt University).

This paper extends the above lines of literature in two directions. Firstly, it focuses on the price effect of the uptick rule, rather than the price effect of the stock borrowing requirement or the joint effect of these two components of short sale regulations. Secondly, it compares the intraday price path of restricted and unrestricted stocks in studying whether the uptick rule reduces the severity of downward pressure on prices. This is a more direct approach to studying this question than analyzing the skewness in daily return distributions. The SEC's Pilot Program offered a window of opportunity which made this comparison feasible.

Concurrent with this study and also utilizing the pilot data, Diether, Lee, & Werner (2006)[17] have studied the effect of the uptick rule on various market quality measures such as the spread, volatility, and short sale volume by comparing these measures before and after the start of the Pilot Program. Alexander and Peterson (2006) have compared paired pilot and nonpilot stocks around both the announcement and initiation date of the pilot program in terms of short sales volume, price volatility, and different measures of market efficiency.[18] However, none of these papers have focused on the price effect of the uptick rule at times of market stress.

SECTION 3. SEC'S PILOT PROGRAM

On May 2, 2005, the SEC started a Pilot Program whereby one-third of the Russell 3000 index constituent stocks were exempted

[17] The study has found that for NYSE stocks, the suspension of the uptick rule has increased the spreads, but only for stocks with high short-sale activities, and for NASDAQ stocks, the suspension of the bid test is not associated with any significant change in the spread. In addition, the study has found no evidence to suggest that pilot NYSE and NASDAQ stocks experienced more down-side volatility after the suspension of the uptick rule. The uptick rule has resulted in more ask-side depth and more orders executed above the mid-quote, and this phenomenon is more evident for NYSE stocks than for NASDAQ stocks. *See id.*

[18] Gordon J. Alexander and Mark A. Peterson, *The Effects of Price Tests on Market Behavior and Market Quality: An Analysis of Reg. SHO*, 11 J. FIN. MARKETS 1, 84-111 (2008). The study has found no difference between pilot and nonpilot stocks in these aspects.

from the uptick rule initially for a period of one year until April 28, 2006, and subsequently extended up to July 3, 2007. The purpose of the Pilot Program was for the SEC to collect data to study the effect of the uptick rule on stock prices, volatility, liquidity, and trading behavior. The SEC concluded the Pilot Program with a rule, effective on July 3, 2007, abolishing the uptick rule price test and the bid test in NASDAQ Rule 3350.[19]

There were three categories of pilot stocks: Category A securities were never subject to the uptick rule; Category B securities were not subject to the rule from 4:15 p.m. EST until the open of the consolidated tape the next day (4:00a.m.). All other securities were included in Category C and were not subject to the rule from the close of the consolidated tape (8:00p.m. EST) until the open of the consolidated tape the next day. Category A pilot stocks were the subject of this study and are referred to as the "pilot stocks" throughout this paper.

The Russell 3000 index consists of 3000 US stocks with the largest market capitalization and is reconstructed annually to ensure that new and growing equities are reflected. According to the SEC Pilot Order[20] that established the Pilot Program, in selecting pilot stocks, the SEC first excluded thirty two stocks that were not NASDAQ securities, listed on NYSE, or listed on the American Stock Exchange because short sales in those securities were not subject to the uptick rule anyway. Next, the SEC excluded stocks whose initial public offerings or spin-offs commenced after April 30, 2004. After the above exclusions, the SEC sorted the remaining stocks into three groups according to their listing exchanges: AMEX, NASDAQ NNM, and NYSE, and then ranked the securities in each group by the average daily dollar volume over a one year period from June 25, 2003 through June 25, 2004. In each group, the SEC then selected every third stock from the remaining stocks, starting from the second stock on the list.

[19] Regulation SHO Release, *supra* note 4.

[20] Order Suspending the Operation of Short Sale Price Provisions for Designated Securities and Time Periods, Exchange Act Release No. 50104 (July 28, 2004), available at http://www.sec.gov/rules/other/34-50104.htm#P21_433.

The names of the stocks included in the pilot program were announced on June 25, 2004 in the Pilot Order. Stocks designated as pilot stocks remained so except in limited circumstances, such as a delisting of a security from an exchange and its trading as an OTCBB security. Name changes of securities included in the pilot list did not affect their status. If a security included in the pilot changed its name and ticker symbol, the security would remain in the pilot but would be identified by its new name and ticker symbol. Mergers and other business combinations involving securities included in the pilot program might affect their status. For example, if a Category A pilot security merged with another Category A pilot security, then the security resulting from the transaction would be a Category A pilot security. However, if a Category A pilot security merged with a Category B pilot security or a Category C pilot security, then the status of the security resulting from the transaction would depend on the market capitalization of the companies involved in the transaction. The company with the larger market capitalization, based on the most recent share number and price information as of the close of trading on the day before the transaction was announced, would have the pilot status of its securities applied to the security resulting from the transaction.

During the period of the Pilot Program, each exchange provided a daily update of the lists of Category A pilot securities and Category B pilot securities for which they maintained the primary listing. In the instant study, only pilot and nonpilot stocks that remained on the pilot and nonpilot list from May 2, 2005 to November 30, 2005 were included in the sample.

SECTION 4. DATA SAMPLE AND DESCRIPTIVE STATISTICS ON PILOT AND NONPILOT STOCKS

The basic approach of this study was to identify events of negative earnings surprises and compare the overnight and intraday price behaviors and short selling activities of pilot and nonpilot stocks on the Event Day. The sample selection process started with a list of 900 pilot stocks and 2000 nonpilot stocks that maintained their pilot or nonpilot status from May 2, 2005 to November 30, 2005. For

each stock, the consensus (median) analyst forecast and the actual Earnings Per Share ("EPS") were obtained from Institutional Brokers' Estimate System ("IBES") during the sample period. Negative earnings surprises were defined as events in which the actual EPS was lower than the consensus analyst forecast. There were about 1,500 such events after excluding commercial banks and Real Estate Investment Trusts ("REITs") from the sample. Earnings announcement times were collected from news wires reporting the events. Two hundred events in which earnings were announced during regular trading hours or for which the exact announcement times could not be ascertained were excluded from the sample. Since there was a gap of seventeen or eighteen days between the last calculation day of analyst forecasts and the actual earnings release, it was possible that new and positive information on earnings was brought to the market during this period but not recorded in the database used in the study. To reduce the possibility of misclassification of positive earnings surprises as negative earnings surprises, the sample events was further restricted to those which caused a nonpositive first response in price movements, i.e., events with negative overnight returns.

Information on shares outstanding for sample stocks as of the end of 2004 and book values as of the end of April 2005 were obtained from COMPUSTAT. Market-to-book ratio and market capitalization for each sample stock were calculated by using the close prices on the day immediately before the Event Day. Outliers and stocks for which data were unreported in the database were further excluded from the sample. After all criteria were applied, there were 945 events remaining in the sample.

Table 1 Panel A shows the exchange listing of sample stocks. The number of pilot stocks that remained in the sample was about 49% of that of nonpilot stocks, roughly in line with the SEC's pilot/nonpilot ratio of 50%. The weights of NYSE, NASDAQ, and AMEX stocks in the sample were also in line with the SEC's original design in the Pilot Order. About 17% and 18% of pilot and nonpilot stocks had multiple appearances in the sample.

Table 1 Characteristics of Sample Stocks

Panel A Composition of Sample Stocks by Listing Exchanges

	Total Number	NYSE	%	NNM	%	AMEX	%
Exchange Listing							
- Pilot	311	164	52.7%	141	45.3%	6	1.9%
- Nonpilot	634	327	51.5%	293	46.3%	14	2.2%
Multiple Appearance							
- Pilot	56/311						
- Nonpilot	109/634						

Table 1 Panel B compares pilot and nonpilot stocks in terms of market capitalization,[21] trading volume,[22] options trading volume, market-to-book ratio,[23] and earnings surprise levels. Options trading volume was calculated for each sample stock by taking an average of its daily combined number of call and put options traded during April 2005. Pilot stocks had higher market capitalizations and trading volumes but lower options trading volumes. About 30% of both pilot and nonpilot stocks had no options trading, which was consistent with the SEC's initial design of the Pilot Program. Pilot and nonpilot stocks had comparable market-to-book ratios and earnings surprise levels. Pilot stocks had a slightly bigger time gap between IBES' last calculation of median analyst forecast and the actual earnings release, but this difference should be inconsequential because sample events had been filtered by including only events that had both negative earnings surprises as well as negative first responses in price movements, i.e., negative overnight returns.

[21] Market capitalization was calculated by multiplying shares outstanding as of the end of 2004 by the close price on the trading day before the Event Day.

[22] Trading volume was the average daily dollar trading volume during December of 2004.

[23] Market-to-book ratio was calculated as the close price on the trading day before the Event Day divided by the book value as of April 30, 2005.

Table 1 Characteristics of Sample Stocks

Panel B Comparison of Pilot and Nonpilot Stocks

	# Observation	Mean	Median	Maximum	Minimum	Stdev
Market Cap. ($mil.)						
- Pilot	311	$3,861	$764	$198,192	$36	$15,170
- Nonpilot	634	$3,002	$713	$175,391	$37	$10,122
Market-to-Book Ratio						
- Pilot	311	2.89	2.18	68.64	0.48	4.44
- Nonpilot	634	3.31	2.18	63.73	0.25	5.01
Trade Volume ($mil)						
- Pilot	311	$25,826	$6,373	$556,083	$117	$51,089
- Nonpilot	634	$18,477	$5,144	$504,547	$157	$41,433
Options Volume (# contracts)						
- Pilot	311	1,486	108	53,771	0	5,277
- Nonpilot	634	1,645	154	91,451	0	6,499
Stocks without Options						
- Pilot	93					
- Nonpilot	205					
Earnings Surprise						
- Pilot	311	-0.007	-0.002	0	-0.44	0.03
- Nonpilot	634	-0.005	-0.002	0	-0.33	0.02
Time between Earnings Forecast and Release						
- Pilot	311	17	18	54	0	9
- Nonpilot	634	16	14	55	0	9

Table 1 Panel C compares the sample stocks' average negative earnings surprises with those of Russell 3000 stocks in the previous three years (January 2002 to April 2005), the daily returns[24] and short sale volumes (scaled by shares outstanding) of the sample stocks on the Event Day with those on Nonevent (historical) days, which were defined as the two-week period starting from three weeks before earnings announcements.

[24] "Daily Return" was calculated as $\ln(P_{t,close}) - \ln(P_{t,open})$, where $P_{t,close}$ and $P_{t,open}$ were the stock's close and open prices on the Event Day.

Table 1 Characteristics of Sample Stocks

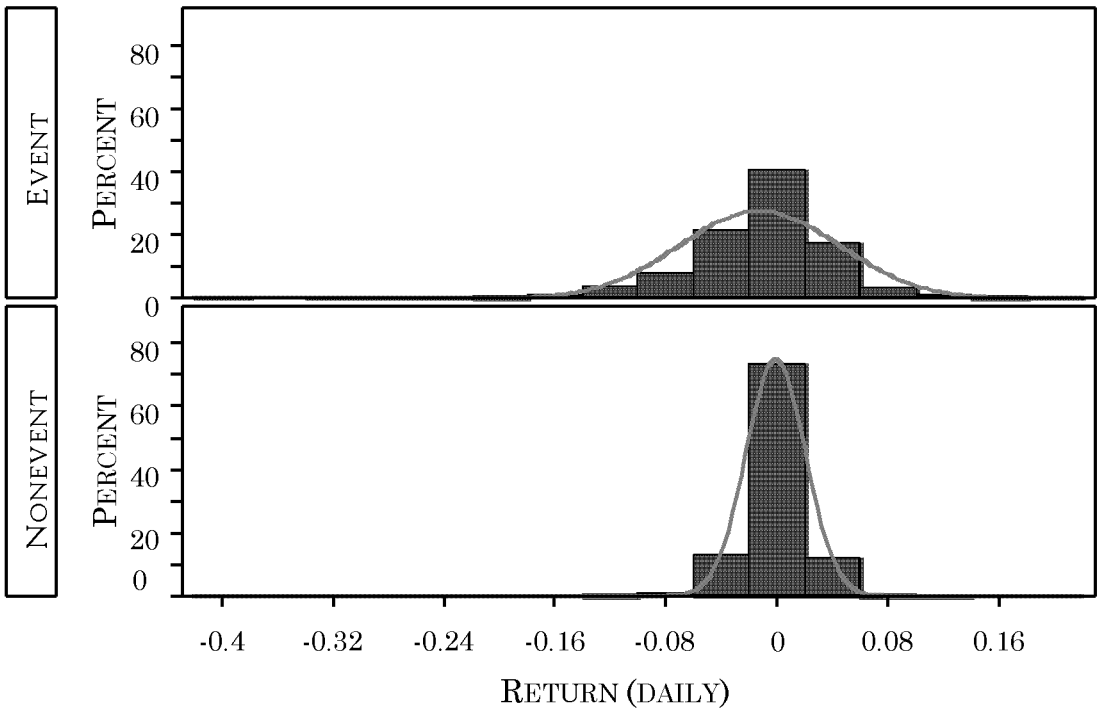
Panel C Comparison of Sample and Historical Earnings Surprises, Event Day Returns, and Event Day Short Sale Volumes

	Surprise	Daily Return	ShortVolm/Shares Outstdg
Mean			
- History	-0.01	-0.001	0.002
- Sample Event	-0.01	-0.01	0.01
Median			
- History	-0.002	-0.001	0.001
- Sample Event	-0.002	-0.01	0.004
Maximum			
- History	0	0.12	0.01
- Sample Event	0	0.21	0.07
Minimum			
- History	-0.45	-0.12	0
- Sample Event	-0.44	-0.39	0
Stdev			
- History	0.03	0.02	0.002
- Sample Event	0.02	0.06	0.01
Skewness			
- History	-8.7	-0.15	2.16
- Sample Event	-14.76	-1.00	3.59
Wilcoxon Rank Sum Test			
- Z statistics	1.13	-6.69	7.08
- One-sided p value	0.13	<0.0001	<0.0001

Daily returns as well as short sale volumes on every other trading day during this two-week period were averaged and compared with the daily returns and short sale volumes on the Event Day. The sample surprises were comparable to those in the previous three years in the mean, median and standard deviation, although they were more negatively skewed. The Wilcoxon Rank Sum Test did not reject the null hypothesis that sample surprises had a similar distribution to those of historical events. Event Day returns appeared

to be lower than Nonevent Day returns according to the mean, median, and skewness numbers, while Event Day short sale volumes appeared to be higher. These visual impressions were confirmed by the Wilcoxon Rank Sum Test and the histograms shown in Figure 1.

FIGURE 1: COMPARISON OF DAILY RETURNS—EVENT DAY V. NONEVENT DAYS



These numbers and figures confirmed the representativeness of the sample events for negative earnings shocks typically seen in the recent history and the presence of stress on the Event Day. As shown in the sections to follow, this study did not reveal any restrictive effect of the uptick rule on intraday price movements and short selling activities. This finding was not attributed to any abnormal "mildness" of the surprise magnitudes of the sample events compared to those typical of recent history or any inertia in the stock market after receiving the negative earnings shocks.

SECTION 5. OVERNIGHT AND INTRADAY PRICE EFFECT OF THE UPTICK RULE

Since earnings announcements occurred either before or after regular trading hours in the sample events, this study began a comparison of the price adjustment process by examining overnight returns of pilot and nonpilot stocks. It was possible that earnings shocks were fully absorbed in open prices and thus not reflected in price movements during regular trading hours. The following paragraphs will first discuss briefly how open prices are set at NYSE, AMEX, NASDAQ and regional exchanges, and then show the comparison results of pilot and nonpilot stocks open prices.

5.1. Overnight Trading and Market Open System of NYSE, AMEX, NASDAQ, and Regional Exchanges

With the exception of Archipelago Exchange whose regular trading hours were from 4:00a.m. to 8:00p.m. EST, regular trading hours of exchanges to which the uptick rule applied started from 9:30a.m. to 4:00p.m. EST. Most exchanges had after hour crossing sessions but they lasted no later than 6:30p.m.[25] There were no overnight trading programs sponsored by any of the exchanges from 8:00p.m. to 4:00a.m. the next day. In addition to exchange-sponsored after-hour crossing sessions, Electronic Communication Networks ("ECN") were also major venues for after-hour trading. Their operation hours varied but typically did not extend beyond 8p.m.

[25] Both the NYSE and AMEX provide crossing sessions in which matching buy and sell orders can be executed at 5:00 p.m. at the exchanges' 4:00 p.m. closing prices. In addition, four regional exchanges had post-primary trading sessions: the Boston Stock Exchange and the Philadelphia Stock Exchange had post-primary sessions that operate from 4:00 p.m. to 4:15 p.m.; the Chicago Stock Exchange ("CHX") operated their post-primary sessions until 4:30 p.m. Since October 29, 1999, the CHX had also operated an "E-Session" to handle limit orders from 4:30 p.m. to 6:30 p.m.

EST.[26] After-hour trading could be influenced by earnings information released after market close at 4:00p.m. EST.

Among the three categories of pilot stocks, Category A pilot stocks were never subject to the uptick rule. Category B pilot stocks were exempt from the uptick rule from 4:15p.m. to the time the consolidated tapes opened
the next day. All other stocks belonged to Category C and were exempt from the uptick rule from the time the consolidated tape was closed to the time the tape opened the next day. Since April 2005, the consolidated tape has opened at 4:00a.m. and closed at 8:00p.m.

The stocks in the sample were either listed on NYSE or AMEX, or traded at NASDAQ NNM. At NYSE and AMEX, limit and market orders to be executed at the open were submitted to the specialist overnight, who determined the opening price. If the market-clearing price determined by customer orders was close to the previous day's close, the specialist had the option of not participating in the opening batch auction. In this case, the market-clearing price was the opening price. If the market-clearing price was not near the previous day's close, then the specialist's obligation to maintain a fair and orderly market required the specialist to participate in the batch auction and mitigate the price change by either buying to increase the price, or selling to decrease the price. If the market-clearing price was far from the previous day's close, the specialist could request a floor governor to deem the obligation to maintain a small price change too onerous and delay the opening to give market participants a chance to change their orders. The specialist would then post a potential opening price range. New orders were then placed within the new

[26] A short list of typical brokers that offer ECN access and the extended hours available is listed below. This list is meant to be illustrative, not exhaustive. Ameritrade (via Island ECN): Hours: 8:00 a.m.-8:00 p.m. EST; limit orders only during extended hours. E*Trade (via Archipelago ECN): Hours: 8:00 a.m.-8:00 p.m. EST; limit orders only during extended hours. Fidelity (via Redibook): Hours: 7:30-9:15 a.m. and 4:15-8:00 p.m. EST; restrictions on order types. Harris Direct (via Redibook ECN): Hours: 8:00-9:15 a.m. and 4:15-7:00 p.m. EST; limit orders only; round lots. Schwab (via Redibook ECN): Hours: 7:30-9:15 a.m. and 4:15-8:00 p.m. EST., Monday - Friday; limit orders only.

price range. If the new clearing price was outside the posted range, the process was repeated with a new posted price range until the specialist found a market-clearing price. In addition to delays caused by an order imbalance, NYSE trading could be delayed in the face of a specific news release, initiated either by the company, which informed the exchange of the news release, or by the exchange itself in anticipation of news from another source. The uptick rule also played a role at market open in the sense that short sale orders for execution at market open price could not be executed at the open price if the open price was a down tick from the previous day's close price. Regional exchanges that trade NYSE or AMEX listed stocks typically set the open prices equal to the open prices of the primary exchanges.

The NASDAQ NNM regular trading session started at 9:30a.m., but pre-market trading started at 7:30a.m. Starting from April 2005, there were three sessions of NASDAQ pre-market trading: (1) the quote/order entry session from 7:30a.m. to 8:00a.m. EST, during which time quotes could be updated, opened and broadcasted, but no automatic execution could occur; (2) 8:00a.m. to 9:25a.m. EST, during which time automatic execution could occur, but volume was typically negligible; and (3) 9:25-9:30a.m., during which time NASDAQ opened and entered quotes for any participant with no open interest. In the second session, market makers transmitted their bid-ask quotes, observed other dealers' quotes and identity, and revised their own quotes in response to the quotes of others. Pre-opening quotes differed from quotes in regular trading hours in that they were nonbinding, while dealers were required to honor their quotes for the minimum quantity of up to 1,000 shares during regular trading hours. In addition, market makers were under no obligation to quote during the pre-opening period but were required to provide two-way quotes during regular trading hours. In session 3, if the firm chose to zero out its quotes overnight, NASDAQ would enter a quote for the participant of $.01 bid and $2000 ask. If the firm chose not to zero out its quotes overnight, NASDAQ would enter a quote based on the last update by the firm. At 9:30 a.m., NASDAQ market makers began entering trades into the system. Individual market makers were expected to report transactions in

chronological sequence within 90 seconds of execution. These conditions prevailed throughout the trading day. NASDAQ implemented an Opening Cross in late 2004 to provide execution opportunities to on-open orders. Starting from 7:30a.m., NASDAQ systems began to accept such orders. At around 9:28a.m., NASDAQ systems began disseminating information about order imbalance in the opening book along with an indicative opening price. Opening Cross occurred at 9:30a.m. when the opening book and the NASDAQ Market Center continuous book were brought together to create a single NASDAQ opening cross. Following the cross, regular market hours trading proceeded as usual.

5.2. Comparison of Overnight Returns

Overnight returns were calculated as $ln(P_{t,open}) - ln(P_{t-1,close})$, where P_{open} was the price at 9:30a.m. when the regular trading sessions of the primary exchanges began on the Event Day, and $P_{t-1,close}$ was the market close price at 4:00p.m. on the day before the Event Day. Summary statistics of overnight returns are reported in Table 2.

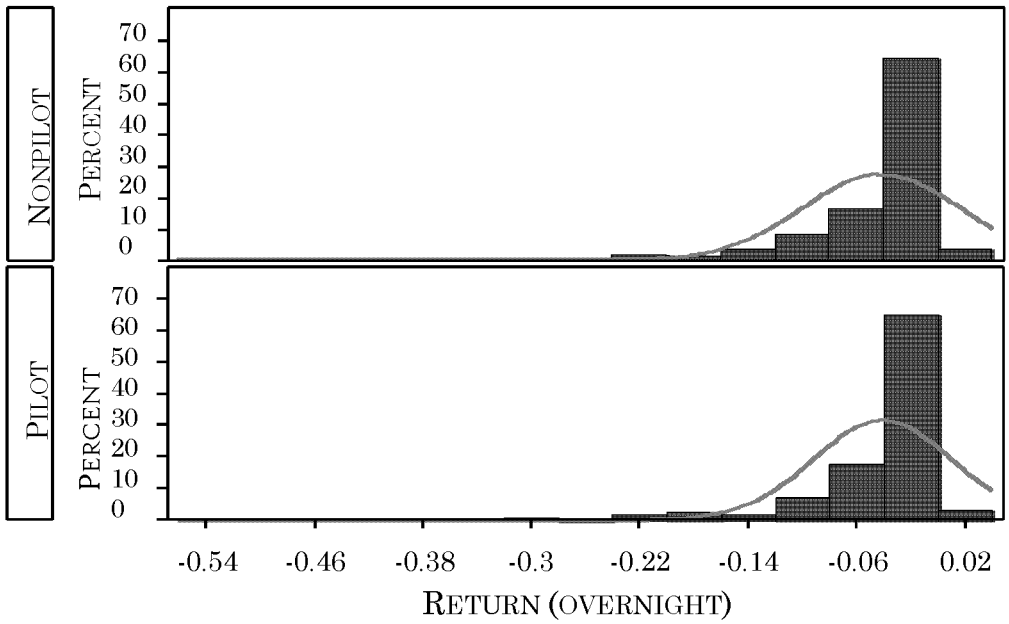
Table 2 Summary Statistics of Overnight Returns

	Mean	Median	Maximum	Minimum	Stdev	Skewness
Pilot	-0.04	-0.02	0	-0.30	0.05	-2.37
Nonpilot	-0.04	-0.02	0	-0.54	0.06	-3.39

Pilot and nonpilot stocks had comparable mean and median overnight returns, but nonpilot stocks were slightly more negatively skewed. Their identical maximum value of '0' was due to the restriction of sample selection to events with nonpositive overnight returns. The standard deviations of the two groups of stocks were similar. Figure 2 shows the histograms of the overnight returns after adjusting for overnight market returns. The summary statistics and

the histogram do not suggest any difference in the overnight returns of the two groups of stocks.

FIGURE 2: DISTRIBUTION OF OVERNIGHT RETURN—PILOT V. NONPILOT



For each stock in the sample, a cross-sectional regression of the overnight return (after adjusting for overnight market return) was run on: 1) a pilot dummy; 2) earnings surprise; 3) an interaction term of pilot and surprise; 4) a dummy variable for NASDAQ stocks; 5) an interaction term of the pilot dummy and the NASDAQ dummy; and 6) firm market capitalization and 7) firm market-to-book ratio. The NASDAQ dummy variable was intended to capture any difference of NASDAQ stocks from NYSE and AMEX stocks because, as a prior study has shown, the NASDAQ bid test under NASD Rule 3350 was less restrictive than Rule 10a-1 that applied to NYSE and

AMEX stocks. Moreover, NASDAQ stocks traded outside NASDAQ NNM were typically exempted from the bid test.[27]

The overnight return on the Russell 3000 iShare ETF was used to proxy for overnight market returns. This ETF tracked the performance of Russell 3000 index and its liquidity level was reasonably high compared to other Russell 3000 ETFs. Regression results are reported in Table 3.[28]

[27] *See, e.g.,* American Stock Exchange Rule 7.02. This Rule exempted short sales of NASDAQ stocks from the bid test. American Stock Exchange Rule 7 provided "[n]o member or member organization shall for his or its own account or for the account of any other person effect on the Exchange any short sale of a security admitted to dealings on the Exchange unless such sale is based upon a sale in the unit of trading (1) at a price higher than the price at which the latest sale thereof, regular way, was effected on the Exchange, or (2) at such latest price and such price is above the latest different price at which a sale in the unit of trading of such security, regular way, was effected on the Exchange; provided, however, that transactions exempted or excepted by paragraph (e) or paragraph (f) of Rule 10a-1 or by Regulation SHO and any orders issued by the SEC pursuant to Regulation SHO, each under the Securities Exchange Act of 1934, are also exempted or excepted, as the case may be, from this Rule 7." *Id.* However, Rule 7.02 explicitly exempted short sales in NASDAQ stocks by providing that "[t]his Rule [] does not apply to transactions on the Exchange in NASDAQ securities effected under Exchange Rule 118." *Id.*

[28] In this table, "$R_{i,t}$" was the excess return of stock *i* over the market return from market close on the day before the Event Day to market open on the Event Day. Overnight return of stock *i* was calculated as $\ln(P_{t,open}) - \ln(P_{t-1,close})$, and overnight return of the market was proxied by the overnight return of the iShare Russell 3000 ETF. "Pilot" was a dummy variable that took the value of 1 if the stock was a pilot stock and 0 otherwise. "Srps" was earnings surprise calculated as (actual EPS - median analyst forecast)/(price as of end of the fiscal quarter). "Pilot*Srps" was an interaction term of "Pilot" and "Srps". "NNM" was a dummy variable that took the value of 1 if the stock was listed on NASDAQ and 0 otherwise. "Pilot*NNM" was an interaction term of "Pilot" and "NNM". "MC" was the stock's market capitalization calculated as the close price on the day before the Event Day multiplied by shares outstanding as of the end of 2004. "MtB" was the stock's market-to-book ratio calculated as the close price on the day before the Event Day divided by the stock's book value at the end of April 2005. T-statistics are in parentheses.

Table 3 Regression of Overnight Excess Return

The regression of overnight excess return was based on the model:

$$R_{i,t} = \alpha + \beta_1 Pilot_i + \beta_2 Srps_i + \beta_3 Pilot_i * Srps_i + \beta_4 NNM_i + \beta_5 Pilot_i * NNM_i + \beta_6 \ln(MC_i) + \beta_7 \ln(MtB_i) + \varepsilon_{i,t}$$

Intercept	Pilot	Srps	Pilot*Srps	NNM	Pilot*NNM	MC	MtB	Adj. R^2
-0.08	-0.01	-0.01	-0.01	-0.02	0.01	0.002	0.001	0.05
-2.82	(-1.19)	(-0.12)	(-0.09)	**(-5.33)***	(1.14)	(1.81)	(0.67)	

* Significant at 5% level.

The coefficient on the pilot dummy was negative but statistically insignificant with a *t* - statistics of -1.19. Moreover, the coefficient on the pilot dummy and surprise interaction term was insignificant, suggesting that pilot stock returns were no different from nonpilot stocks returns even when the magnitude of negative surprises were high. NASDAQ stocks had lower overnight returns compared to NYSE and AMEX stocks, but within the NASDAQ stock group, there was no difference between pilot and nonpilot stocks.

For NYSE and AMEX stocks, the uptick rule applied to short selling at market open prices. Thus, if the open price was lower than the previous day's close price, short sale orders in nonpilot stocks could not be executed while short sale orders in pilot stocks could. It is interesting to note that this regulatory disparity did not cause any difference in the open price.

5.3. Comparison of Intraday Returns

For intraday returns, returns were calculated between Designated Times on the Event Day defined as every 15 minute interval from 9:30a.m. to 11:30a.m., and every 30 minute interval from 11:30a.m. to 2:00p.m., and finally, every 60 minute interval from 2:00p.m. to market close at 4:00p.m. Price data were obtained from the New York Stock Exchange Trade and Quote ("TAQ")

database.[29] If the uptick rule was indeed slowing price decline at times of stress, pilot stocks were expected to have lower returns during most periods. Summary statistics for noncumulative intraday returns are provided in Table 4.

The summary statistics suggest that pilot stocks actually had higher, rather than the expected lower, mean and median returns from 9:30a.m. to 10:45a.m. than nonpilot stocks. Afterwards, pilot stocks had lower mean returns in 7 out of 10 periods, and lower median returns in 3 out of 10 periods. Pilot stocks returns were slightly more negatively skewed than nonpilot stocks in just about half of the time periods. The standard deviations of pilot and nonpilot stocks were comparable. These numbers do not suggest that returns of pilot stocks were systematically lower than returns of nonpilot stocks.[30]

A cross-sectional regression of returns, after adjusting for market returns, was run on a pilot dummy, earnings surprise, an interaction term of pilot and surprise, positive net order flow during the Designated Time period, negative net order flow, an interaction of pilot stock and negative net order flow, the NASDAQ dummy, the interaction of pilot stock and NASDAQ dummy, market capitalization, market-to-book ratio, market-adjusted return in the previous period, and historical volatility. Historical volatility was calculated by taking the average of $ln(Price_h) - ln(Price_l)$ on April 1, 5, 13, 18, 21, and 29, 2005 for each Designated Time period. $Price_h$ was the highest price and $Price_l$ was the lowest price of each period. April was the month immediately before the start of the Pilot Program. The selection of the dates within this month for the purpose of calculating historical volatility and later on historical liquidity was arbitrary, but the selected dates covered each day of a week and the

[29] The TAQ data are recorded by the New York Stock Exchange and cover intraday transactions data (trade and quote) for all securities listed on the New York Stock Exchange, NASDAQ and regional exchanges. The database is the primary source of historical trade and quote data for US equities.

[30] Summary statistics for intraday returns calculated on a cumulative basis since market open on the Event Day were consistent with Table 4. They will be provided upon request.

beginning, middle and end of the month. Net order flow was defined as $\frac{BI - SI}{BI + SI}$, where BI was buyer-initiated trade volumes and SI was seller-initiated trade volumes. Whether an order was buyer or seller initiated was determined by the Lee and Ready[31] algorithm, i.e., a trade was buyer initiated if $price > midquote$ and seller initiated if $price < midquote$. Trades with $price = midquote$ could be initiated by either the buyer or the seller and thus were not included in the calculation of order imbalance. Since the uptick rule might have caused some seller-initiated market short orders to be converted into limit orders at the legally shortable prices, these trades would appear to be buyer-initiated under the above algorithm when indeed they were initiated by short sellers. Thus, short sale orders were excluded from the calculation of order imbalance. Regression results are consistent with the summary statistics and are reported in Table 5.[32]

[31] Charles Lee & Mark J. Ready, *Inferring Trade Direction from Intraday Data*, 46 J. FIN. 733, 733-46 (1991). Since trade data provides only the execution price and volume of a particular trade and does not offer any information on whether the trade was initiated by buy orders or sell orders, this algorithm is widely used by researchers to infer direction of the trade.

[32] *See supra* note 28 (defining "Pilot", "Srps", "Pilot*Srps", "NNM", "Pilot*NNM", "MC", "MtB" in the table). In addition, in this table, "$R_{i,t}$" was the excess return of stock *i* over the market return during periods between each Designated Time on the Event Day, "OI^{+}" and "OI^{-}" were the net positive order flow and net negative order flow, respectively. "HVol" was the stock's historical volatility calculated by taking the average of $\ln(Price_h) - \ln(Price_l)$ on April 1, 5, 13, 18, 21, and 29, 2005 for each Designated Time period, where $Price_h$ was the highest price and $Price_l$ was the lowest price of the time period. "$R_{i,t-1}$" was the stock's return immediately before the current period *t*. For the interval of 9:30 - 9:45 a.m., "$R_{i,t-1}$" was the stock's overnight return. *t*-statistics are in parentheses.

Table 4 Summary Statistics of Intraday Returns

	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	12:00	12:30	13:00	14:00	15:00	15:55	16:00
Mean															
- Pilot	-0.004	-0.001	0.0004	0.0003	-0.0004	-0.001	-0.0004	-0.0003	-0.001	0.00003	-0.0002	0.001	-0.002	0.001	0.001
- Nonpilot	-0.006	-0.003	-0.002	-0.002	-0.002	-0.0005	0.00005	0.001	-0.001	0.0003	-0.0003	-0.001	-0.001	0.001	0.001
Median															
- Pilot	0	0	0	0	0	0	0	0	-0.001	0.0004	0	0	-0.001	0	0
- Nonpilot	-0.005	-0.001	-0.001	-0.001	-0.001	0	0	0.0004	-0.001	0	0	-0.0005	-0.001	0.001	0
Maximum															
- Pilot	0.20	0.07	0.05	0.05	0.04	0.03	0.05	0.05	0.05	0.07	0.05	0.05	0.04	0.05	0.02
- Nonpilot	0.20	0.09	0.06	0.07	0.03	0.04	0.05	0.05	0.05	0.06	0.05	0.06	0.07	0.06	0.02
Minimum															
- Pilot	-0.20	-0.17	-0.03	-0.07	-0.03	-0.03	-0.05	-0.06	-0.04	-0.06	-0.05	-0.04	-0.05	-0.04	-0.02
- Nonpilot	-0.21	-0.14	-0.09	-0.06	-0.07	-0.03	-0.05	-0.05	-0.06	-0.05	-0.04	-0.06	-0.06	-0.05	-0.02
Stdev															
- Pilot	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.005
- Nonpilot	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.005
Skewness															
- Pilot	-0.13	-2.20	0.50	-0.71	0.21	0.02	-0.65	-0.80	0.06	0.70	0.17	0.83	-0.47	0.66	0.78
- Nonpilot	0.32	-1.09	-1.01	-0.09	-1.47	-0.11	0.26	-0.07	-0.19	0.39	0.43	0.32	-0.03	0.14	-0.01

Table 5 Intraday Excess Return Regression

The regression of intraday excess return was based on the model:

$$R_{i,t} = \alpha + \beta_1 Pilot_i + \beta_2 Srps_i + \beta_3 Pilot_i * Srps_i + \beta_4 OI_{i,t}^{+} + \beta_5 OI_{i,t}^{-} + \beta_6 Pilot_i * OI_{i,t}^{-} + \beta_7 NNM_i + \beta_8 Pilot_i * NNM_i + \beta_9 \ln(MC_i) + \beta_{10} \ln(MtB_i) + \beta_{11} R_{i,t-1} + \beta_{12} HVol_i + \varepsilon_{i,t}$$

	Intercept	Pilot	Srps	Pilot*Srps	OI^{+}	OI^{-}	Pilot*OI^{-}	NNM	Pilot*NNM	MC	MtB	$R_{i,t-1}$	HVol	Adj. R^2
9:45	-0.06	0.01	0.01	0.07	0.01	-0.001	-0.01	0.003	-0.01	-0.02	-0.003	0.002	0.003	0.02
	-2.76	(1.63)	(0.08)	(0.39)	**(3.01)***	(-0.14)	(-0.62)	(0.92)	(-1.88)	(-0.93)	(-0.09)	**(2.21)***	(1.87)	
10:00	-0.03	0.005	-0.06	0.12	0.001	0.001	0.004	0.003	-0.001	0.04	-0.14	0.001	-0.001	0.01
	-2.18	**(2.34)***	(-1.15)	(1.93)	(0.26)	(0.31)	(0.71)	(1.49)	(-0.29)	**(2.3)***	(-1.23)	**(2.09)***	(-0.78)	
10:15	-0.001	-0.0002	0.03	-0.03	0.003	0.003	-0.01	-0.001	0.002	0.07	-0.02	0.00004	-0.0003	0.01
	(-0.1)	(-0.13)	(0.85)	(-0.75)	(1.68)	(1.37)	(-1.66)	(-0.94)	(0.93)	**(2.81)***	(-0.35)	(0.12)	(-0.52)	
10:30	-0.01	0.002	-0.02	-0.01	0.002	0.001	0.001	0.002	-0.0002	-0.03	-0.08	0.0003	-0.001	0.01
	(-0.95)	(1.58)	(-0.55)	(-0.23)	(0.91)	(0.70)	(0.31)	**(2.15)***	(-0.12)	(-1.12)	(-1.15)	(0.90)	**(-2.48)***	
10:45	-0.02	0.001	-0.01	0.03	0.005	-0.002	0.003	-0.002	0.004	0.05	-0.01	0.001	0.00002	0.04
	-3.77	(0.85)	(-0.27)	(1.06)	**(2.91)***	(-0.96)	(1.32)	(-1.83)	**(2.45)***	(1.62)	(-0.87)	**(3.56)***	(0.05)	
11:00	-0.004	0.001	0.01	-0.004	0.004	0.0003	0.001	-0.0002	-0.002	-0.02	0.08	0.0001	-0.0002	0.01
	(-0.71)	(1.01)	(0.69)	(-0.16)	**(2.99)***	(0.23)	(0.50)	(-0.29)	(-1.73)	(-0.77)	(0.85)	(0.56)	(-0.59)	
11:15	-0.01	-0.00003	-0.03	0.04	0.004	0.001	-0.0002	-0.001	-0.001	0.12	0.06	0.0003	-0.001	0.03
	(-1.13)	(-0.03)	(-1.48)	(1.38)	**(2.7)***	(0.98)	(-0.1)	(-0.63)	(-0.66)	**(3.35)***	(0.60)	(1.18)	(-1.45)	
11:30	0.003	-0.0003	0.01	-0.03	0.0002	0.001	0.003	-0.001	0.00004	0.04	-0.04	-0.0001	0.0002	0.01
	(0.63)	(-0.33)	(0.63)	(-1.26)	(0.13)	(1.10)	(1.77)	(-0.68)	(0.04)	(1.41)	(-0.33)	(-0.45)	(0.65)	
12:00	-0.01	-0.0002	-0.05	0.03	0.001	0.001	0.002	-0.001	0.001	0.17	0.11	0.0002	-0.0001	0.01
	(-0.77)	(-0.14)	(-1.85)	(1.00)	(0.64)	(0.61)	(0.69)	(-0.91)	(0.95)	**(3.84)***	(0.99)	(0.62)	(-0.22)	
12:30	-0.002	0.0001	-0.01	0.03	-0.0004	0.001	0.002	0.001	0.001	0.06	-0.09	0.0002	-0.0003	0.001
	(-0.37)	(0.09)	(-0.42)	(1.03)	(-0.25)	(0.84)	(0.88)	(0.63)	(0.68)	**(2.11)***	(-0.9)	(0.59)	(-0.7)	
13:00	0.0005	0.001	0.01	-0.03	0.0005	-0.0001	-0.0001	0.0003	-0.002	0.03	-0.05	-0.0001	0.001	0.002
	(0.10)	(0.91)	(0.41)	(-1.33)	(0.36)	(-0.04)	(-0.05)	(0.42)	(-1.86)	(1.16)	(-0.58)	(-0.29)	**(2.5)***	
14:00	-0.004	0.002	-0.06	0.01	-0.001	0.003	-0.001	0.001	-0.002	-0.14	-0.04	0.0001	0.0004	0.01
	(-0.56)	(1.81)	**(-2.03)***	(0.34)	(-0.3)	(1.32)	(-0.3)	(1.03)	(-1.14)	**(-3.22)***	(-0.48)	(0.42)	(0.90)	
15:00	0.005	-0.0002	-0.02	-0.01	0.003	-0.003	0.003	0.001	-0.001	0.07	-0.14	-0.0002	-0.001	0.003
	(0.55)	(-0.15)	(-0.54)	(-0.33)	(1.13)	(-1.21)	(0.85)	(0.60)	(-0.43)	(1.84)	(-1.49)	(-0.57)	(-1.19)	
15:55	0.02	0.0003	-0.05	0.03	-0.002	0.001	0.005	0.001	0.002	-0.04	-0.11	-0.001	-0.0003	0.01
	(1.94)	(0.23)	(-1.5)	(0.65)	(-0.69)	(0.34)	(1.21)	(0.62)	(1.15)	(-1.21)	(-1.28)	(-1.83)	(-0.61)	
16:00	0.001	-0.0003	0.02	0.00	0.001	0.0004	0.0002	-0.0002	0.0003	0.01	0.02	0.00001	-0.00004	-0.002
	(0.20)	(-0.42)	(1.28)	(-0.04)	(1.47)	(0.56)	(0.17)	(-0.5)	(0.44)	(0.39)	(0.29)	(0.07)	(-0.16)	

* Significant at 5% level.

The coefficients on the pilot dummy were insignificant throughout the Event Day except for the period of 9:45 – 10:00 am. However, the sign of the coefficient for this period was positive, indicating (and consistently with the summary statistics) that pilot stocks actually had higher returns than nonpilot stocks during this period. These numbers do not reveal any evidence that pilot stocks with higher degrees of negative shocks had lower returns than their nonpilot counterparts because the coefficients on the interaction term of pilot and surprise were insignificant for all time periods. The plotted histograms for each time period were visually consistent with the above regression results. Due to limited space, they are not included in this paper, but are available upon request. The coefficients on the NASDAQ dummy, the pilot, and NASDAQ interaction term were mostly insignificant, suggesting the lack of difference between NASDAQ and NYSE/AMEX stocks and between NASDAQ pilot and nonpilot stocks. The same regression was run again but using cumulative intraday returns and produced results highly consistent with those discussed above. Details of this regression are available upon request.

5.4. Robustness Checks

Three robustness checks were performed on the intraday return regression results discussed above. First, the sample was further restricted to stocks with big increases in daily trading volume from nonevent days because previous research had documented strong positive correlation between high trading volumes and market stress levels. Next, the sample was restricted to periods of high negative net order flow as the imbalance toward stronger selling interest was likely to produce consecutive down ticks that barred the immediate execution of short sale orders. Finally, the existence of an active put options market provided an alternative trading channel to short sellers by allowing them to buy put options instead of shorting stocks. Through arbitrage and hedging trades of options market makers and other market professionals, the increased interest in put options might eventually be transformed into short sales in the underlying stocks but some of these trades were likely subject to the

arbitrage exemptions and market maker exemptions granted by Rule 10a-1(e) and NASD Rule 3350.[33] The effect of the uptick rule on stocks without active options trading might be more acute. Therefore, the sample was restricted to stocks without an active options market.

Corresponding to the first robustness check, sample stocks were divided into ten groups according to the changes in their trading volumes on the Event Day from their trading volumes on nonevent days. Stocks belonging to the top three groups were selected and this reduced sample maintained the pilot/nonpilot ratio of 50%, which was similar to the ratio for the full sample and in line with the SEC's design of the Pilot Program. There was no indication that this reduced sample of high volume stocks were disproportionally filled by pilot stocks. Corresponding to the second robustness check, net order flow as defined in section 5.3 was calculated for each Designated Time Period for every sample and the entire sample was divided into ten groups according to the net order flow value. The sample was then restricted to observations belonging to the three groups with the biggest negative net order flow. Corresponding to the third robustness check, the sample was reduced to include stocks without an active options market. The regression discussed in section 5.3 was run on each of these three reduced samples and produced results highly consistent with the full sample results discussed in the previous section. To conserve space, tables recording these robustness check results are not included in this paper but are available upon request.

5.5. Comparison of Time to Reach a Specified Level of Negative Return

To further examine whether prices of pilot stocks declined faster than nonpilot stocks after receiving negative shocks, this study specified a threshold level of negative intraday return and compared the speed at which pilot and nonpilot stocks reached this level. First, the lowest price for each sample stock on the Event Day was

[33] NASDAQ Rule 3350, *supra* note 6.

identified. There were about 120 observations with the minimum intraday cumulative returns lower than 10% at some time on the Event Day, about 210 observations with the minimum intraday returns between -5% and -10%, and about 150 observations with the minimum intraday returns between -3% and -5%. The remaining 450 observations had the minimum intraday returns higher than -3%. This study arbitrarily picked -3% as the threshold level for the purpose of comparing the speed of price decline because this level produced enough observations (more than 480) and was a big enough level of decline to suggest the existence of a downward price pressure. The characteristics of the stocks in the remaining sample are reported in Table 6.

The ratio of pilot to nonpilot stocks in the remaining sample was 144/340, roughly in line with the ratio of the SEC's design of the Pilot Program. The average level of the lowest point in the intraday cumulative return was -.08 for pilot stocks, slightly higher than -.09 for nonpilot stocks. The median time that pilot stocks took to reach their minimum intraday prices was ninety seven minutes, about forty minutes shorter than that for nonpilot stocks. Again, pilot stocks in the remaining sample had bigger market capitalizations, but the market-to-book ratio, volatility and earnings surprises were comparable for both groups of stocks. Historical volatility was calculated by taking the average of the daily volatility (proxied by the difference in the log of highest price and the log of lowest price) on April 1, 5, 13, 18, 21, and 29, 2005.

Table 6 Comparison of Pilot and Nonpilot Stocks with Minimum Intraday Returns Lower than or Equal to -3%

	Full Sample	Sample with Minimum Intraday Return <=-3%
Number of Observations		
- Pilot	311	144
- Nonpilot	634	340
Average Minimum Cumulative Return		
- Pilot	-0.04	-0.08
- Nonpilot	-0.05	-0.09
Median Time to Reach Minimum Price		
- Pilot	37 min	97 min
- Nonpilot	65 min	140 min
Median Surprise		
- Pilot	-0.002	-0.002
- Nonpilot	-0.002	-0.002
Median Market Capitalization		
- Pilot	$764 mil	$660 mil
- Nonpilot	$711 mil	$516 mil
Median Market-to-Book Ratio		
- Pilot	2.18	2.24
- Nonpilot	2.18	2.21
Median Historical Volatility		
- Pilot	0.03	0.03
- Nonpilot	0.03	0.04

For each stock in the remaining sample, this study identified the point in time when the cumulative intraday return was closest to the pre-specified level of -0.03. This time was regressed on a pilot dummy, earnings surprise, the market return (proxied by the returns on Russell 3000 iShares ETF), the stock's market capitalization, market-to-book ratio, historical volatility, and historical liquidity (proxied by the average ratio of the daily trading volume on April 1,

5, 13, 18, 21, and 29 to the stock's shares outstanding). The regression results are reported in Table 7.[34] The insignificant *t*-statistics on the pilot dummy indicated a lack of difference in the time to reach -0.03 intraday return between pilot and nonpilot stocks, confirming the previous finding that the prices of pilot stocks did not decline faster than nonpilot stocks after negative earnings shocks.

Table 7 Regression of Time to Reach -0.03 Intraday Cumulative Return

This table presents the result of regression:

$$\ln(Time_i) = \alpha + \beta_1 Pilot_i + \beta_2 Srps_i + \beta_3 Pilot * Srps + \beta_4 R_m + \beta_5 HVol + \beta_6 Liq_i + \beta_7 \ln(MC)_i + \beta_8 \ln(MtB)_i + \varepsilon_i$$

	Intercept	Pilot	Srps	Pilot*Srps	R_m	HVol	Liq	MC	MtB	Adj. R^2
Estimate	3.94	0.03	11.45	-13.96	-68.54	-0.98	-3.55	0.19	-0.09	0.04
t -statistics	(3.52)	(0.16)	(1.50)	(-1.3)	**(-3.88)***	(-0.96)	(-0.51)	**(3.57)***	(-0.9)	

* Significant at 5% level.

In sum, this study found no evidence that the uptick rule provided support to stock prices after negative earnings shocks. Since the hypothesis that the uptick rule impedes price decline builds on the belief that the rule reduces short sale volume by prohibiting execution of short sale orders at minus or zero minus ticks, this study next examined whether the pilot stocks had a higher short sale volume than nonpilot stocks at market open and Designated Times on the Event Day.

[34] *See supra* note 28 (defining "Pilot", "Srps", "Pilot*Srps", "NNM", "Pilot*NNM", "MC", "MtB" in the table) and note 34 (defining "HVol"). In addition, in this table, "R_m" stands for market return, and "Liq" was the average of daily trade volume divided by shares outstanding for the same 6 days in April of 2005. *t*-statistics are in parentheses.

SECTION 6. COMPARISON OF SHORT SALE VOLUMES

Per request of the SEC at the beginning of the Pilot Program, each stock exchange made tick by tick short sale data available to the public. With the exception of the NASD's Alternative Display Facility, which recorded short sales executed at the NASDAQ NNM for a limited number of stocks, each exchange recorded only short sales that were executed on that particular exchange. Short sale data from each exchange were combined and a time series of executed short sales for each stock in the sample was constructed for the period of May 2 to November 30, 2005. To examine changes in short sale volumes on the event day from non-event days, this study also obtained short sale volumes for every other trading day during a two-week period starting from three weeks before the event day. The average of short sale volumes on non-event days for each time interval examined was subtracted from the event day short sale volumes. The difference was then divided by the stock's non-event day average.[35] The study examined how changes in short sale volumes, calculated both on a noncumulative basis for each time period between Designated Times and on a cumulative basis since market open, were related to the pilot or nonpilot status of the stock.

6.1. Comparison of Short Sale Volumes at Market Open

Summary statistics of change in short sale volumes at market open are reported in Table 8. They show that pilot stocks had a higher mean and median short sale volume at market open.

[35] The difference was also scaled by the stock's shares outstanding and by total trading volumes, respectively, and the change in this ratio was calculated for each sample stock from its historical level. Each regression discussed in this section was repeated using the change in this ratio as the dependant variable. The results were consistent with those reported in this section.

Table 8 Summary Statistics of Change in Open Short Volume

	Mean	Median	Maximum	Minimum	Stdev	Skewness
Pilot	3.90	0.84	87.95	-1.00	8.48	4.70
Nonpilot	3.83	0.09	98.66	-1.00	11.12	4.75

Table 9[36] reports the results of a cross-sectional regression of changes in open short sale volumes on a pilot dummy, earnings surprise and its interaction with pilot, a dummy for NASDAQ stocks and its interaction with pilot, market return and firm characteristics. A dummy variable for NASDAQ stocks was included because the uptick rule applied to NYSE and AMEX stocks at market open by referencing to the previous close price, but the NASD bid test did not apply to NASDAQ stocks at market open. How the market open short volumes differed between pilot and nonpilot stocks could depend on where the stocks were traded.

The regression revealed a highly significant and positive coefficient on the pilot dummy, a highly significant and positive coefficient on NASDAQ dummy, and a highly significant but negative coefficient on the interaction term of the pilot dummy and the NASDAQ dummy. These results suggested that for NYSE and AMEX stocks, pilot stocks had significantly higher open short volumes than nonpilot stocks. This was hardly surprising because the uptick rule applied to short sales at market open and our sample was restricted to stocks with negative overnight returns.

[36] *See supra* notes 28, 34 (defining the variables used in this regression).

Table 9 Regression of Change in Open Short Sale Volumes

The regression of changes in open short volume was based on the model:

$$\Delta S_{i,open} = \alpha + \beta_1 Pilot_i + \beta_2 Srps_i + \beta_3 Pilot_i * Srps_i + \beta_4 NNM_i + \beta_5 Pilot_i * NNM_i + \beta_6 R_{m,i} + \beta_7 \ln(MC)_i + \beta_8 \ln(MtB)_i + \varepsilon_{i,t}$$

	Intercept	Pilot	Srps	Pilot*Srps	NNM	Pilot*NNM	R_m	MC	MtB	Adj. R^2
Market Op	10.93	2.56	7.92	-1.98	5.74	-5.17	107.08	-0.46	-0.29	0.06
	(1.81)	**(2.61)***	(0.31)	(-0.06)	**(6.32)***	**(-3.57)***	(0.96)	(-1.60)	(-0.64)	

* Significant at 5% level.

It is worth noting that the higher short sale volumes of pilot stocks at market open did not cause specialists to set lower open prices for pilot stocks, as evidenced by the lack of difference in overnight returns between the two groups of stocks discussed earlier. The higher market open short volumes for NASDAQ stocks relative to NYSE and AMEX stocks were likely reflective of the inapplicability of the bid test at market open. Within the group of NASDAQ stocks, pilot stocks had lower short volumes at market open. This was likely reflective of short sellers taking advantage of the inapplicability of the bid test at market open and placing short sale orders before regular trading hours began. Despite the difference between the open short volumes of pilot and nonpilot stocks, open short sale volumes accounted for just a small fraction of total Event Day short sale volumes—for NYSE and AMEX stocks, the ratio averaged 2.4% for pilot stocks and 1.4% for nonpilot stocks; for NASDAQ stocks, the ratio averaged 1.7% for pilot stocks and 2.5% for nonpilot stocks. Thus, the difference at market open was unlikely to have any significant impact on the pattern of short selling activities during regular trading hours.

6.2. Comparison of Intraday Short Sale Volumes

This study compared intraday short sale volumes of pilot and nonpilot stocks on both a noncumulative basis as well as a cumulative basis. The results on cumulative short volumes were

similar to those for noncumulative short volumes.[37] Summary statistics of noncumulative intraday short sale volumes for each period between Designated Times are reported in Table 10. They show that pilot stocks had a higher mean in nine out of fifteen time periods, and a higher median in eleven out of fifteen periods, offering some preliminary evidence that pilot stock short volumes might be higher than short volumes of nonpilot stocks. This difference was not necessarily associated with the regulatory disparity between pilot and nonpilot stocks; rather, it could be attributed to a wide range of economic factors such as: the size of the firm; the volatility level; order imbalance in the market; and the location of the trade (e.g., NYSE as opposed to NASDAQ), among others.

Cross-sectional regressions of changes in noncumulative short sale volumes were run for each time period between the Designated Times on: 1) a pilot dummy; 2) earnings surprise; 3) interaction of pilot and surprise; 4) positive net order flow; 5) negative net order flow; 6) a NASDAQ dummy; 7) an interaction term of the NASDAQ dummy and the pilot dummy; 8) market return; 9) a firm's market capitalization; 10) market-to-book ratio, lag1 change in short sale volumes (except for the first time period of 9:30 – 9:45), lag1 return; and 11) historical volatility. For the time period of 9:30 – 9:45, the overnight returns were used for lag1 returns. The results are reported in Table 11.[38] The coefficients on the pilot dummy were insignificant for each of the fifteen time periods. The coefficients on the interaction term of pilot and surprise were significant in one period but its sign was positive, suggesting again that pilot stocks with bigger negative earnings shocks had lower (rather than the expected higher) short sale volumes. Periods of high order imbalance, both positive and negative, were associated with lower short volumes, but there was no difference between pilot and nonpilot stocks at such

[37] To conserve space, results on cumulative short volumes are not included in this study.

[38] *See supra* notes 28, 34 (defining "Pilot", "Srps", "Pilot*Srps", "NNM", "OI^{+}", "OI^{-}", "MC", "MtB", and "$R_{i,t-1}$"). In addition, "Pilot*NNM" in this table is an interaction term of "Pilot" and "NNM."

times as indicated by the insignificant coefficients on the interaction term of the pilot dummy and negative net order flow.

Table 10 Summary Statistics of Change in Intraday Short Sale Volume

	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	12:00	12:30	13:00	14:00	15:00	15:55	16:00
Mean															
- Pilot	10.97	10.42	9.22	7.17	7.45	6.31	7.07	7.28	5.53	4.20	5.29	3.94	4.90	3.00	2.41
- Nonpilot	10.25	10.69	11.51	6.65	6.48	5.53	6.63	5.13	5.18	4.84	4.33	4.00	3.25	3.14	3.17
Median															
- Pilot	3.32	2.56	2.47	1.72	1.83	1.75	1.65	1.80	1.76	1.16	1.51	1.46	1.66	1.49	0.51
- Nonpilot	3.62	2.78	2.39	1.65	1.74	1.50	1.65	1.63	1.44	1.14	1.36	1.48	1.17	1.16	0.77
Maximum															
- Pilot	131.00	215.83	211.58	240.71	148.86	114.38	138.42	141.21	101.97	73.03	78.62	42.51	118.89	78.85	58.62
- Nonpilot	143.50	249.46	355.89	239.14	148.09	140.02	172.63	105.61	125.98	124.23	81.11	97.79	85.87	83.08	92.13
Minimum															
- Pilot	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
- Nonpilot	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
Stdev															
- Pilot	20.20	23.71	23.30	19.53	17.79	12.57	15.61	18.26	10.68	8.51	9.86	6.91	12.82	5.85	6.18
- Nonpilot	18.56	26.30	34.50	19.57	15.18	13.60	15.36	10.32	13.52	12.32	8.94	9.76	7.25	6.68	7.74
Skewness															
- Pilot	3.24	4.88	5.73	7.76	5.12	4.09	4.21	4.74	4.11	4.27	3.40	2.88	6.04	8.06	4.86
- Nonpilot	3.72	4.98	6.62	8.26	5.08	5.48	5.66	4.01	5.91	5.79	4.35	5.97	5.99	6.55	5.23

Table 11 Regression of Change in Intraday Short Sale Volume

The regression of changes in intraday short volume was based on the model:

$$\Delta S_{i,t} = \alpha + \beta_1 Pilot_i + \beta_2 Srps_i + \beta_3 Pilot_i * Srps_i + \beta_4 OI^+_{i,t} + \beta_5 OI^-_{i,t} + \beta_6 Pilot_i * OI^-_{i,t} + \beta_7 NNM_i + \beta_8 Pilot_i * NNM_i + \beta_9 R_{m,t} + \beta_{10} \ln(MC)_i + \beta_{11} \ln(MtB)_i + \beta_{12} \Delta S_{t-1} + \beta_{13} R_{i,t-1} + \beta_{14} HVol_i + \varepsilon_{i,t}$$

	Intercept	Pilot	Srps	Pilot*Srps	OI^+	OI^-	Pilot*OI^-	NNM	Pilot*NNM	R_m	MC	MtB	ΔS_{t-1}	$R_{i,t-1}$	HVol	Adj. R^2
9:45	62.16	3.07	-10.50	78.72	1.82	3.95	2.66	-1.90	-5.66	302.92	-2.79	-0.64		-273.56	-17.87	0.15
	2.79	(0.76)	(-0.12)	(0.45)	(0.35)	(0.54)	(0.27)	(-0.56)	(-1.14)	(0.38)	**(-2.74)***	(-0.42)		**(-11.07)***	(-0.52)	
10:00	92.60	1.45	-334.18	395.67	33.22	23.74	-34.84	17.87	-20.14	1581.95	-3.84	-0.12	0.07	-229.33	-833.27	0.01
	(1.12)	(0.10)	(-1.09)	(0.62)	(1.46)	(1.03)	(-1.01)	(1.51)	(-1.10)	(0.56)	(-1.01)	(-0.02)	(0.14)	(-1.77)	(-1.18)	
10:15	120.22	-1.22	20.01	-4.29	-9.41	12.71	-9.34	3.52	-7.41	-145.75	-5.02	-0.41	0.12	-12.53	-256.76	0.11
	4.17	(-0.24)	(0.17)	(-0.03)	(-1.27)	(1.48)	(-0.77)	(0.85)	(-1.15)	(-0.14)	**(-3.79)***	(-0.20)	**(9.05)***	(-0.15)	(-1.16)	
10:30	18.83	-2.29	-16.69	66.92	-1.74	15.48	-16.64	7.29	2.19	905.27	-0.59	-1.21	0.35	-508.47	-275.59	0.23
	(0.85)	(-0.62)	(-0.19)	(0.38)	(-0.31)	**(2.72)***	(-1.87)	**(2.29)***	(0.44)	(0.97)	(-0.58)	(-0.77)	**(13.93)***	**(-6.21)***	(-1.26)	
10:45	33.12	-0.66	5.87	-93.03	-6.24	6.26	0.49	1.97	5.96	261.26	-1.32	0.05	0.17	-98.09	2.30	0.20
	3.19	(-0.38)	(0.14)	(-1.80)	**(-2.38)***	**(2.32)***	(0.12)	(1.32)	**(2.53)***	(0.75)	**(-2.74)***	(0.07)	**(12.08)***	(-1.91)	(0.22)	
11:00	26.74	3.22	-217.97	294.22	-4.06	-3.36	4.51	6.87	-7.17	503.87	-0.90	-2.47	0.47	-113.14	-851.78	0.08
	(1.13)	(0.86)	**(-2.44)***	**(2.59)***	(-0.73)	-0.56	(0.47)	**(2.06)***	(-1.38)	(0.45)	(-0.84)	(-1.53)	**(6.56)***	(-0.94)	**(-2.04)***	
11:15	12.32	2.52	61.80	-122.62	-2.66	-2.85	13.39	-0.46	3.46	2098.66	-0.93	1.07	0.14	-170.38	2222.62	0.09
	(0.64)	(0.78)	(0.82)	(-0.81)	(-0.56)	-0.60	(1.75)	(-0.17)	(0.80)	**(2.03)***	(-1.06)	(0.80)	**(4.89)***	(-1.37)	**(6.28)***	
11:30	45.80	2.12	44.30	-20.66	-6.75	9.96	-2.73	6.49	-3.33	-78.81	-1.75	-0.19	0.19	253.08	-835.75	0.07
	2.51	(0.68)	(0.60)	(-0.22)	(-1.48)	**(2.16)***	(-0.40)	**(2.40)***	(-0.81)	(-0.09)	**(-2.09)***	(-0.14)	**(6.37)***	**(2.27)***	**(-2.03)***	
12:00	15.73	-0.26	-19.26	28.72	-1.85	3.03	-3.33	1.77	-0.42	213.03	-0.53	-0.23	0.22	-85.74	-107.49	0.26
	2.07	(-0.21)	(-0.66)	(0.78)	(-0.92)	(1.49)	(-1.02)	(1.63)	(-0.26)	(0.83)	(-1.55)	(-0.44)	**(16.57)***	(-1.81)	(-0.87)	
12:30	8.51	0.11	-69.30	78.74	-1.38	-1.63	1.13	4.39	-3.06	888.02	-0.28	-0.52	0.43	-71.09	-174.28	0.11
	(0.71)	(0.06)	(-1.50)	(1.36)	(-0.46)	-0.52	(0.24)	**(2.55)***	(-1.18)	**(2.21)***	(-0.51)	(-0.63)	**(9.33)***	(-1.21)	(-0.88)	
13:00	22.62	-0.49	34.27	-33.24	-1.71	1.56	-0.39	0.69	3.88	-515.36	-0.90	-0.26	0.35	-63.87	-57.65	0.19
	2.34	(-0.31)	(0.91)	(-0.70)	(-0.68)	(0.62)	(-0.10)	(0.50)	(1.82)	(-1.64)	**(-2.05)***	(-0.38)	**(13.34)***	(-1.19)	(-0.33)	
14:00	20.64	-1.34	1.67	4.26	-2.79	1.43	-12.98	2.42	-0.65	-154.74	-0.77	0.50	0.22	-66.94	-308.70	0.11
	2.53	(-1.00)	(0.05)	(0.11)	(-1.22)	(0.57)	**(-3.42)***	**(2.10)***	(-0.37)	(-0.82)	**(-2.08)***	(0.89)	**(8.36)***	(-1.35)	**(-2.85)***	
15:00	14.61	0.32	-22.29	38.29	-1.51	2.60	-1.21	1.19	2.25	-6.97	-0.52	-0.79	0.20	-47.68	-48.29	0.07
	(1.87)	(0.25)	(-0.75)	(1.03)	(-0.67)	(1.05)	(-0.34)	(1.09)	(1.37)	(-0.05)	(-1.48)	(-1.49)	**(6.69)***	(-1.35)	(-0.53)	
15:55	10.95	-0.01	-22.22	13.79	0.92	2.57	-0.01	0.90	-1.32	58.05	-0.41	0.18	0.27	-21.27	-52.06	0.21
	2.40	(-0.01)	(-1.24)	(0.62)	(0.59)	(1.85)	(0.00)	(1.41)	(-1.39)	(0.58)	**(-1.98)***	(0.60)	**(14.14)***	(-1.20)	(-1.12)	
16:00	13.11	-0.54	5.36	1.34	-1.51	-0.54	3.26	0.24	1.20	622.78	-0.47	-0.40	0.34	45.35	-210.04	0.11
	2.47	(-0.59)	(0.26)	(0.05)	(-1.38)	(-0.44)	(1.77)	(0.31)	(1.06)	**(2.24)***	(-1.93)	(-1.10)	**(8.81)***	**(2.10)***	**(-2.02)***	

* Significant at 5% level.

The lack of difference in short sale volumes between pilot and nonpilot stocks was surprising, given that the uptick rule was designed to reduce short sale volumes by preventing execution of short orders at down-ticks. This result might attribute to one or more of the following factors: (1) the frequent occurrence of market conditions when the rule was not binding, that is, the minimum shortable price ("MSP") <= bid for market short sale orders and MSP<= ask for limit short sale orders, which allowed short selling at the prevailing quotes without violating the rule; (2) the concentration of short sale orders to limited windows of opportunities when the uptick rule was not binding; (3) the exemptions to the rule, that is, short sale orders were mostly placed by market professionals or arbitrageurs who were exempt from the rule; (4) the provision of price improvements by specialists to short orders up to the MSP so that they could be executed without violating the rule; and (5) existence of sufficient buy interest to provide execution opportunities to short orders that had been converted to limit orders at the MSP. The following subsections are dedicated to analyzing these scenarios by examining short volumes occurring at different relations among the bid, the ask, the MSP, and the execution price.

6.3. Did Upticks or Zero-plus Ticks Occur Frequently Enough to Make the Uptick Rule Inapplicable Most of the Time?

To answer this question, the TAQ Consolidated Quote data was merged with the TAQ Consolidated Trade data in time sequence, and the MSP required by the uptick rule at each point in time was calculated and compared with the prevailing bid. The time during which the MSP was lower than or equal to the best bid was categorized as "non-binding" and was aggregated for each Designated Time period on the Event Day. Then the ratio of the aggregated non-binding times (in seconds) to the total number of seconds for each Designated Time period was calculated. In doing so, the NYSE and AMEX listed stocks were separated from NASDAQ stocks because, as discussed in earlier sections, they were subject to different short sale

rules and there was a disparate application of the short sale rule on NASDAQ stocks by different exchanges.[39]

Summary statistics on the non-binding time ratio for NYSE and AMEX stocks are reported in Table 12 Panel A. They show that non-binding times accounted for only about 8-12% of the Event Day for nonpilot stocks. Moreover, the ratio for nonpilot stocks was lower than the ratio for pilot stocks (averaged at about 8-14%). These numbers do not support the hypothesis that unrestrictive execution opportunities occurred with high frequency to render the uptick rule inapplicable for most of the time. In contrast to NYSE and AMEX stocks, the non-binding time ratios for NASDAQ stocks, which are reported in Table 12 Panel B, accounted for 50-60% of the time.

[39] *See* AMEX Rule 7, *supra* note 27 and accompanying text.

Table 12 Summary Statistics of Nonbinding Time Ratio

Panel A NYSE and AMEX Stocks

	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	12:00	12:30	13:00	14:00	15:00	15:55	16:00
<u>Mean</u>															
- Pilot	0.08	0.14	0.14	0.14	0.14	0.13	0.14	0.14	0.13	0.14	0.13	0.13	0.13	0.15	0.14
- Nonpilot	0.08	0.12	0.11	0.11	0.12	0.11	0.12	0.12	0.10	0.10	0.10	0.11	0.11	0.12	0.11
<u>Median</u>															
- Pilot	0.07	0.13	0.12	0.13	0.13	0.12	0.13	0.13	0.12	0.13	0.11	0.12	0.13	0.14	0.09
- Nonpilot	0.05	0.10	0.10	0.09	0.10	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.06
<u>Maximum</u>															
- Pilot	0.49	0.63	0.48	0.97	0.47	0.64	0.58	0.75	0.63	0.46	0.49	0.30	0.38	0.35	0.91
- Nonpilot	0.53	0.62	0.48	0.41	0.78	0.67	0.81	0.70	0.88	0.56	0.61	0.47	0.63	0.47	1.00
<u>Minimum</u>															
- Pilot	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Nonpilot	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<u>Stdev</u>															
- Pilot	0.08	0.11	0.10	0.11	0.10	0.10	0.10	0.12	0.10	0.09	0.10	0.07	0.07	0.06	0.16
- Nonpilot	0.09	0.10	0.09	0.09	0.10	0.10	0.13	0.12	0.09	0.08	0.08	0.07	0.07	0.07	0.14

Table 12 Summary Statistics of Nonbinding Time Ratio

Panel B NASDAQ Stocks

	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	12:00	12:30	13:00	14:00	15:00	15:55	16:00
Mean															
- Pilot	0.58	0.59	0.58	0.56	0.57	0.53	0.60	0.56	0.59	0.60	0.59	0.59	0.55	0.60	0.60
- Nonpilot	0.57	0.55	0.53	0.55	0.53	0.53	0.53	0.55	0.53	0.55	0.54	0.55	0.55	0.57	0.58
Median															
- Pilot	0.55	0.58	0.59	0.59	0.59	0.56	0.62	0.60	0.59	0.63	0.61	0.59	0.56	0.61	0.63
- Nonpilot	0.59	0.56	0.53	0.55	0.52	0.53	0.53	0.57	0.53	0.56	0.56	0.56	0.56	0.57	0.62
Maximum															
- Pilot	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
- Nonpilot	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00
Minimum															
- Pilot	0.02	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0
- Nonpilot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stdev															
- Pilot	0.18	0.20	0.21	0.24	0.27	0.25	0.25	0.28	0.22	0.24	0.23	0.18	0.19	0.16	0.26
- Nonpilot	0.18	0.21	0.21	0.23	0.25	0.27	0.26	0.26	0.22	0.24	0.24	0.20	0.20	0.17	0.28

To see whether this difference was caused by economic conditions in the market or by the artificial difference in the short sale rules that applied to the two groups of stocks differently, the mean and median nonbinding time ratios of NYSE-AMEX stocks were re-calculated using NASDAQ's bid test. The results, which are reported in Table 12 Panel C, showed comparable ratios to those of NASDAQ stocks and the *t* test confirmed the indifference throughout the Event Day except for the period of 14:00 – 15:00. The increased restrictiveness of NYSE and AMEX rules relative to the NASDAQ rules could be illustrated with the following data. On November 2, 2005, at 9:52:24 a.m., stock AEL's best bid moved from 11.51 to 11.55. Under the NASDAQ's bid test, this increase in bid would permit short selling at any price. However, under Rule 10a-1, we would have to examine whether the previous trade occurred at a down tick. The previous trade occurred at 9:52:19 a.m. at the price of $11.63, which was a down tick compared to the earlier trade at $11.65. Thus, under Rule 10a-1, short sellers could only trade at $11.64 or higher. Since this price was higher than the prevailing best bid, market short orders could not be executed immediately.

In sum, the nonbinding time ratios for NYSE and AMEX stocks were too low to explain the lack of difference between the short volumes of pilot and nonpilot stocks. The ratios for NASDAQ stocks were much higher and could potentially explain the lack of difference between pilot and nonpilot stocks.

Table 12 Summary Statistics of Nonbinding Time Ratio

Panel C NYSE and AMEX Stocks under NASDAQ Rule

	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	12:00	12:30	13:00	14:00	15:00	15:55	16:00
Mean															
- Pilot	0.46	0.44	0.58	0.60	0.59	0.56	0.60	0.59	0.57	0.61	0.61	0.61	0.60	0.59	0.58
- Nonpilot	0.49	0.50	0.58	0.58	0.60	0.62	0.61	0.63	0.62	0.63	0.62	0.63	0.61	0.60	0.59
Median															
- Pilot	0.54	0.61	0.59	0.62	0.59	0.58	0.62	0.59	0.58	0.62	0.61	0.61	0.59	0.60	0.62
- Nonpilot	0.57	0.58	0.59	0.58	0.60	0.62	0.61	0.64	0.63	0.64	0.62	0.63	0.62	0.61	0.60
T Test for Equal Mean	-1.03	-0.92	0.08	1.64	0.73	0.91	-0.29	1.24	-1.07	0.56	0.66	1.03	**(2.29)***	-0.54	-0.97
Pr>|t|	0.30	0.36	0.93	0.10	0.46	0.36	0.77	0.22	0.28	0.58	0.51	0.30	0.02	0.59	0.33

*Significant at 5% level.

6.4. Were Short Sellers Timing the Market to Concentrate Orders to Times When the Uptick Rule was Nonbinding?

To answer this question and the questions in the following paragraphs, this study took the approach of analyzing the relation among the MSP, the prevailing bid and ask, and the execution price when short sales occurred. The relation between the MSP and the quotes would reveal whether short sales occurred at times when the uptick rule was binding, the relation between the prices, and the quotes would reveal whether the trades involving short sales were initiated by sellers or buyers. Following the Lee and Ready algorithm,[40] trades with $price < midquote$ as were regarded as seller initiated and trades with $price > midquote$ were regarded as buyer initiated. The relation between the MSP and execution prices would reveal whether the short sales were exempt from the uptick rule, either under the Pilot Program or any of the exemptions listed in Rule 10a-1(e) and NASD Rule 3350. The different combinations of the above elements resulted in 45 execution scenarios listed in Table 13.

For each stock in the sample and for each Designated Time period on the Event Day, the short sale volumes in each scenario and their weight in the total short sale volumes were calculated. This weight was then averaged across pilot stocks and nonpilot stocks, respectively. Since the weight exhibited no big variation across different Designated Time periods for any scenario, an average was also taken across different Designated Time periods to obtain a single weight number for each execution scenario provided in Table 13.

[40] Lee & Ready, *supra* note 31.

Table 13 Short Sale Execution Scenarios

	Price < Bid	Price = Bid	Bid < Price < Ask	Bid < Price = Ask	Bid < Ask < Price
MSP < Bid	MSP<Price<Bid MSP=Price<Bid Price<MSP<Bid	MSP<Price=Bid	MSP<Bid<Price<Ask**	MSP<Bid<Price=Ask	MSP<Bid<Ask<Price
MSP = Bid	Price<MSP=Bid	MSP=Price=Bid	MSP=Bid<Price<Ask**	MSP=Bid<Price=Ask	MSP=Bid<Ask<Price
Bid < MSP	Price<Bid<MSP*	Price=Bid<MSP*	Bid<MSP<Price<Ask** Bid<MSP=Price<Ask** Bid<Price<MSP<Ask** Bid<Price<MSP=Ask** Bid<Price<Ask<MSP**	Bid<MSP<Price=Ask Bid<MSP=Price=Ask Bid<Price=Ask<MSP	Bid<MSP<Ask<Price Bid<MSP=Ask<Price Bid<Ask<MSP<Price Bid<Ask<MSP=Price Bid<Ask<Price<MSP

* Ask could be at any position relative to MSP.

** Each scenario was further categorized as seller-initiated with price<midquote, buyer-initiated with price>midquote and indeterminate initiation origin with price=midquote.

Table 14 Short Sales at Nonrestrictive Times

		NYSE-AMEX Stocks			NASDAQ Stocks		
	Scenarios	Pilot	Nonpilot	*t* -stat	Pilot	Nonpilot	*t* -stat
Seller-initiated, Price<=Bid	MSP<Short Price<Bid	0.31%	0.29%	(-0.34)	3.14%	3.01%	(-0.45)
	MSP=Short Price<Bid	0.30%	0.87%	**(7.27)***	0.00%	0.00%	
	Short Price < MSP<Bid	0.24%	0.10%	**(-2.4)***	0.00%	0.01%	(1.00)
	Short Price<MSP=Bid	0.40%	0.04%	**(-8.7)***	0.00%	0.00%	
	MSP<Short Price=Bid	2.10%	1.93%	(-0.89)	13.57%	13.56%	(-0.09)
	MSP=Short Price=Bid	4.57%	8.24%	**(15.56)***	0.00%	0.00%	
	Subtotal	7.92%	11.47%		16.71%	16.59%	
Buyer-initiated, Price>=Ask	MSP<Bid<Short Price=Ask	0.81%	1.04%	**(2.11)***	11.84%	12.87%	**(2.01)***
	MSP=Bid<Short Price=Ask	2.17%	2.97%	**(6.44)***	0.00%	0.00%	
	Bid<MSP<Short Price=Ask	6.07%	7.69%	**(5.71)***	5.95%	6.77%	**(2.14)***
	Bid<MSP=Short Price=Ask	10.01%	38.96%	**(65.6)***	3.58%	4.70%	**(3.57)***
	MSP<Bid<Ask<Short Price	0.15%	0.10%	(-1.25)	1.59%	1.20%	(-1.75)
	MSP=Bid<Ask<Short Price	0.16%	0.12%	(-1.18)	0.00%	0.00%	
	Bid<MSP<Ask<Short Price	0.45%	0.24%	**(-3.06)***	1.51%	1.27%	(-1.27)
	Bid<MSP=Ask<Short Price	0.47%	0.26%	**(-2.90)***	0.59%	0.59%	(-0.06)
	Subtotal	20.29%	51.39%		25.06%	27.39%	
Price Improvement							
Seller-initiated	MSP<Bid<Short Price<Ask	0.56%	0.67%	(1.17)	6.87%	7.86%	**(2.46)***
	MSP=Bid<Short Price<Ask	0.93%	0.96%	(-0.29)	0.00%	0.00%	
Buyer-initiated	MSP<Bid<Short Price<Ask	0.74%	0.72%	(-0.53)	11.02%	11.97%	(1.80)
	MSP=Bid<Short Price<Ask	0.79%	0.80%	(-0.03)	0.00%	0.00%	
Price=Midquote	MSP<Bid<Short Price<Ask	0.35%	0.21%	**(-2.32)***	2.33%	2.51%	(0.90)
	MSP=Bid<Short Price<Ask	0.47%	0.48%	(0.19)	0.00%	0.00%	
	Subtotal	3.85%	3.84%		20.22%	22.33%	
	Total	32.05%	66.70%		61.99%	66.31%	

* Significant at 5% level.

Table 14 compares pilot and nonpilot stocks in terms of the short volumes at times when the uptick rule was not binding, i.e., $MSP \le bid$ for seller-initiated short sales and $MSP \le ask$ for buyer-initiated short sales. For NYSE and AMEX stocks, about 32% and 67% of short volume for pilot stocks occurred at such times, respectively. The scenario $bid < MSP = short\ price = ask$ accounted for 38.96% of the total short volume for nonpilot stocks and most of

the difference in the ratio between pilot and nonpilot stocks. Arguably this scenario could be explained as short sellers entering limit orders at the ask when it was equal to the MSP so that the uptick rule would not bar execution. However, this hypothesis could not explain why short sellers were less inclined to utilize opportunities when $MSP < ask$ as suggested by the low ratios for scenarios $MSP < bid < short\ price = ask$ and $MSP = bid < short\ price = ask$. Jointly they accounted for only 10% of the total short volume. In addition, scenarios $MSP \leq short\ price \leq bid$ jointly accounted for only 11% of the total short volume. These scenarios captured short sales initiated by the seller when the uptick rule was not binding. The big difference between scenarios $bid < MSP = short\ price = ask$ and $MSP \leq short\ price \leq bid$ could not plausibly be explained by short sellers favoring limit orders to market orders. Alexander and Peterson (1999) have shown that there were more market short orders than limit short orders during its sample period of May 1996.[41] The scenario $bid < MSP = short\ price = ask$ was more likely reflective of the story that market short orders whose immediate execution were barred by the uptick rule were converted to limit orders at the MSP, which in turn were matched with the upcoming buy orders. Short sale volumes that could be explained by concentration of short selling to nonbinding times accounted for at most 25% of the total short volumes.

For NASDAQ stocks, about 66% of the total short sale volumes occurred at times when the bid test was not binding,[42] significantly higher than the ratio for NYSE and AMEX stocks, but roughly in proportion to the nonbinding time ratios shown in Table 12 Panel B. Although differences between pilot and nonpilot stocks in some scenarios were statistically significant, they were not economically significant. The scenario $bid < MSP = short\ price = ask$ accounted for about 4% of total short sale volumes for both pilot and nonpilot

[41] *See* Alexander & Peterson, *supra* note 18, at 90-116.

[42] About 25% (24.5% for pilot stocks and 26.8% for nonpilot stocks) of total short sale volumes occurred at times when the bid test was binding but without violating the bid test due to price improvements at or above the MSP.

stocks, in contrast to the striking difference between these two groups for NYSE and AMEX stocks.

6.5. Could Exemptions Explain the Lack of Difference in Short Volumes Between Pilot and Nonpilot Stocks?

For NYSE and AMEX stocks, Rule 10a-1(e) provided numerous exemptions from the uptick rule, mostly to market professionals and arbitrageurs.[43] If short sale orders were mostly placed by traders who were subject to exemptions, the suspension of the uptick rule on pilot stocks naturally would not have any impact on short volumes and returns. To examine whether this was the case, this study compared pilot and nonpilot stocks in terms of short volumes at prices lower than the MSP and thus in violation of the uptick rule. The idea was that if most of the players in the short selling market were subject to exemptions in the first place, there should not be any significant increase in exempt short volumes after the uptick rule was suspended. In other words, the exempted short volumes of pilot stocks should not be significantly higher than those of nonpilot stocks. The results are reported in Table 15.

Exempted short sales accounted for 49.81% of the total short volumes for pilot stocks, 42.19% of which occurred at times when the uptick rule was binding, i.e., when $MSP > bid$ for seller-initiated trades and $MSP > ask$ for buyer-initiated trades. In comparison, exempt short sales accounted for only 7.7% of the total short sales for nonpilot stocks, 6.46% of which occurred at times when the uptick rule was binding. For pilot stocks, seller-initiated exempt short sales accounted for about 30% of the total short volume, while buyer-initiated accounted for only about 10% of the total short sales. For nonpilot stocks, the volumes for seller-initiated short sales were slightly lower than the volume for buyer-initiated short sales. The big difference between pilot and nonpilot stocks in exempt short volumes was not at all surprising, as it was the direct result of suspending the uptick rule on pilot stocks. It also suggested that market

[43] 17 C.F.R. § 240; *see also* s*upra*, note 3 and accompanying text.

professionals who benefited from the exemptions under Rule 10a-1(e) were not the only players in the short selling market and thus exemptions alone could not explain why the uptick rule did not make any difference in the short sale volumes.

For NASDAQ stocks, short sales executed in violation of the bid test accounted for 13.8% for pilot stocks and 7.04% for nonpilot stocks. While the difference was economically significant, the number was not nearly as dramatic as that for NYSE and AMEX stocks. Since the bid test was nonbinding for about 60% of the times, and these times absorbed about 60% of the total short volume, short orders in pilot stocks whose executions relied on exemptions provided by the Pilot Program were greatly reduced, and as a result, the difference between pilot and nonpilot stocks listed on NASDAQ was substantially reduced.

Table 15 Comparison of Short Sale Volumes Violating the Uptick Rule

Panel A

	NYSE-AMEX Stocks		NASDAQ	
Scenario	Pilot	Nonpilot	Pilot	Nonpilot
Seller-initiated, Price<=Bid	21.01%	1.35%	12.90%	6.31%
Buyer-initiated, Price>=Ask	7.88%	3.86%	0.00%	0.00%
Price Improvement, Bid<Price<Ask				
Seller-initiated, Price<Midquote	9.71%	1.05%	0.30%	0.25%
Buyer-initiated, Price>Midquote	6.86%	0.83%	0.34%	0.48%
Price=Midquote	4.36%	0.60%	0.26%	0.00%
Total	49.81%	7.70%	13.80%	7.04%

Panel B

	NYSE-AMEX Stocks		NASDAQ	
Scenario	Pilot	Nonpilot	Pilot	Nonpilot
Binding				
Seller-initiated, Price<=Bid	20.37%	1.21%	12.90%	6.30%
Buyer-initiated, Price>=Ask	7.88%	3.86%	0.00%	0.00%
Price Improvement, Bid<Price<Ask				
Seller-initiated, Price<Midquote	9.71%	1.05%	0.30%	0.25%
Buyer-initiated, Price>Midquote	2.63%	0.25%	0.03%	0.00%
Price=Midquote	1.61%	0.08%	0.00%	0.00%
Subtotal	42.19%	6.46%	13.23%	6.55%
Nonbinding				
Seller-initiated, Price<=Bid	0.64%	0.14%	0.00%	0.01%
Price Improvement, Bid<Price<Ask				
Buyer-initiated, Price>Midquote	4.24%	0.58%	0.31%	0.48%
Subtotal	4.88%	0.72%	0.31%	0.49%
Uncertain*	2.74%	0.52%	0.26%	0.00%
Total	49.81%	7.70%	13.80%	7.04%

* Whether or not the uptick rule was binding depended on whether the trade was seller initiated or buyer initiated. Trade initiation could not be determined with accuracy when price was equal to the midquote.

6.6. Where Did Nonpilot Stocks Find Execution Opportunities that "Neutralized" the Effect of the Uptick Rule

For NYSE and AMEX stocks, the previous paragraphs have shown that the uptick rule was limiting short sales at down ticks and zero-minus ticks, but the overall short volumes for pilot and nonpilot stocks remained the same. It is likely that nonpilot stocks found more execution opportunities elsewhere that made up the difference caused by the disparate application of the uptick rule. To examine the source of execution opportunities for nonpilot stocks, this study ranked the execution scenarios in which nonpilot stocks had higher short volumes than pilot stocks. The results are reported in Table 16 Panel A.

Nonpilot stocks had higher short volumes than pilot stocks in fourteen out of forty-five scenarios, among which scenario $bid < MSP = short\ price = ask$ ranked the highest with a striking difference of 28.96%. This scenario alone offset 65% (28.96%/49.81%) of the surplus short volumes of pilot stocks due to the suspension of the uptick rule. As discussed earlier, this scenario was likely reflective of the matching of market buy orders with short orders which were initially placed as market orders but converted into limit orders at the MSP when the uptick rule barred immediate execution.

Two observations could be made out of the higher ratio of nonpilot stocks in this scenario. First, nonpilot stocks had more limit orders piling at the MSP than pilot stocks. This was hardly surprising because pilot stocks were not restricted by the uptick rule so market short orders arriving at the trading floor when $bid < MSP$ could be executed immediately without being converted into limit orders at the MSP.

Table 16 Scenarios in which Nonpilot Stocks Had Higher Short Volumes than Pilot Stocks

Panel A NYSE and AMEX Stocks

Scenario		Weight	Diff.	*t* - stat	Cum. Diff.
Bid<MSP=Short Price=Ask	1		28.96%	(65.6)*	28.96%
- Pilot		10.01%			
- Nonpilot		38.96%			
MSP=Short Price=Bid	2		3.66%	(15.56)*	32.62%
- Pilot		4.57%			
- Nonpilot		8.24%			
Bid<MSP=Short Price<Ask, Price<Midquote	3		3.18%	(12.2)*	35.80%
- Pilot		3.56%			
- Nonpilot		6.74%			
Bid<MSP=Short Price<Ask, Price>Midquote	4		2.36%	(9.68)*	38.16%
- Pilot		4.33%			
- Nonpilot		6.69%			
Bid<MSP=Short Price<Ask, Price=Midquote	5		1.78%	(8.94)*	39.94%
- Pilot		2.81%			
- Nonpilot		4.59%			
Bid<MSP<Short Price=Ask	6		1.62%	(5.71)*	41.56%
- Pilot		6.07%			
- Nonpilot		7.69%			
MSP=Bid<Short Price=Ask	7		0.80%	(6.44)*	42.36%
- Pilot		2.17%			
- Nonpilot		2.97%			
Bid<Ask<MSP=Short Price	8		0.70%	(6.00)*	43.06%
- Pilot		0.72%			
- Nonpilot		1.43%			
MSP=Short Price<Bid	9		0.57%	(7.27)*	43.63%
- Pilot		0.30%			
- Nonpilot		0.87%			
MSP<Bid<Short Price=Ask	10		0.23%	(2.11)*	43.86%
- Pilot		0.81%			
- Nonpilot		1.04%			
MSP<Bid<Short Price<Ask, Price<Midquote	11		0.11%	(1.17)	43.97%
- Pilot		0.56%			
- Nonpilot		0.67%			
MSP=Bid<Short Price<Ask, Price<Midquote	12		0.02%	(0.29)	43.99%
- Pilot		0.93%			
- Nonpilot		0.96%			
MSP=Bid<Short Price<Ask, Price>Midquote	13		0.01%	(0.03)	44.00%
- Pilot		0.79%			
- Nonpilot		0.80%			
MSP=Bid<Short Price<Ask, Price=Midquote	14		0.01%	(0.19)	44.01%
- Pilot		0.47%			
- Nonpilot		0.48%			

* Significant at 5% level.

Second, most of the converted short orders were successfully executed, rather than unfilled or cancelled, by matching buy orders within fifteen minutes, which was the shortest time span that was used in this intraday study - of their conversion.

Scenario 2, in which $MSP = short\ price = bid$, had the second highest ranking with a difference of 3.66%. In this scenario, market short sales were matched with a bid equal to the MSP. The higher short volume of nonpilot stocks in this scenario suggested more efficient utilization of the window of opportunities when the uptick rule was nonbinding. Scenario 4, in which $bid < MSP = short\ price < ask$ with $price > midquote$, had a difference of 2.36%. In this scenario, trades were more likely buyer-initiated and "price improved" by a short sale order up to the MSP level. It was again an indication that short sellers were more efficiently utilizing opportunities when the uptick rule was nonbinding.

Scenario 3, in which $bid < MSP = short\ price < ask$ and $short\ price < midquote$, had a difference of 3.18%. It was likely initiated by market short sale orders but because $bid < MSP$, the short sale could not be executed at the bid price. Instead of allowing the order to convert to a limit order at the MSP level and waiting for execution against future buy orders, a specialist or a floor broker offered price improvement to the short sale order and allowed it to be executed immediately. Scenario 5, in which $bid < MSP = short\ price < ask$ and $short\ price = midquote$, had a difference of 1.78%. Trades in this scenario could either be seller-initiated, and thus the same as scenario 3, or buyer initiated, and thus the same as scenario 4. However, since the short price was at the midquote, trade initiation could not be ascertained, and thus this scenario was considered separately.

In sum, scenarios 1 through 5 had a cumulative difference of 39.94%, offsetting most of the surplus volumes of pilot stocks attributed to the suspension of the uptick rule. These scenarios represent three main sources of execution opportunities received by short sellers in nonpilot stocks: (1) there was sufficient buy interest matching with market short orders after their conversion into limit

orders at the MSP; (2) short sellers subject to the uptick rule were more efficiently utilizing the times when the uptick rule was not binding to execute their trades; and (3) specialists or floor brokers were providing price improvements to short sale orders up to the MSP to allow for their immediate execution. The first factor was the dominating factor among the three.

Two robustness checks were performed on the above findings. First, the procedures were repeated on a sub-sample of observations belonging to periods of the highest negative net order flow.[44] The reason for this is that short sale orders, which were converted to limit orders at the MSP, were facing a reduced chance of execution due to a limited buy interest, but more sell orders were waiting for execution. The restricted sample had approximately 700 observations with a pilot/nonpilot ratio of 302 to 446, and a mean net order flow of -0.76 for pilot stocks and -0.73 for nonpilot stocks. The procedures reported in Tables 14, 15, and 16 Panel A were repeated and produced results highly consistent with those discussed in this section.

The second robustness check was based on a sub-sample of pilot and nonpilot stocks, carefully paired in terms of market capitalization, trade volume (scaled by shares outstanding) during each Designated Time period, and short volume (scaled by trade volume) during each Designated Time period. This procedure ranked the observations for each stock in the full sample according to these three criteria. There were ten ranks for each criterion. Observations for pilot and nonpilot stocks that occurred in the same Designated Time period and had the same rank in all three criteria were paired. For example, during 14:00 – 15:00 on the Event Day, pilot stock A had a trade volume rank of eight and a short sale volume rank of nine. Nonpilot stock B also had a trade volume rank of eight and a short sale volume rank of nine during the same time period. Both stocks were large stocks with a market capitalization rank of nine. These two observations formed a pair for the purpose of this

[44] *See supra*, section 5.3 (discussing the methods in identifying periods of negative net order flow).

robustness check. There were 635 such pairs. Again, procedures reported in Tables 14, 15, and 16 Panel A were repeated on this subsample and produced results highly consistent with those discussed above.[45]

The story was completely different for NASDAQ stocks. As shown in Table 16 Panel B, there was no dominating scenario that made up the 7% difference in short sale volumes due to the suspension of the bid best on pilot stocks. The biggest positive difference between pilot and nonpilot stocks was 1.11%, given by scenario $Bid < MSP = Short\ Price = Ask$, which was not significant in the economic sense. In sum, the bid test was not binding on short selling for 60% of the time, allowing for more than 60% of short sales to take place during such periods without violating the uptick rule.

[45] To conserve space, the results of these robustness checks are not reported in this paper but are available upon request.

Table 16 Scenarios in which Nonpilot Stocks Had Higher Short Volumes than Pilot Stocks

Panel B NASDAQ Stocks

Scenario		Weight	Diff.	*t* - stat	Cum. Diff.
Bid<MSP=Price=Ask	1				
- Pilot		3.58%	1.11%	**(3.57)***	1.11%
- Nonpilot		4.70%			
Bid<MSP=Price<Ask, Price<Midquote	2				
- Pilot		4.85%	1.09%	**(3.15)***	2.20%
- Nonpilot		5.94%			
MSP<Bid<Price=Ask	3				
- Pilot		11.84%	1.04%	**(2.01)***	3.24%
- Nonpilot		12.87%			
MSP<Bid<Price<Ask, Price<Midquote	4				
- Pilot		6.87%	0.99%	**(2.46)***	4.23%
- Nonpilot		7.86%			
MSP<Bid<Price<Ask, Price>Midquote	5				
- Pilot		11.02%	0.95%	(1.80)	5.18%
- Nonpilot		11.97%			
Bid<MSP<Price=Ask	6				
- Pilot		5.95%	0.82%	**(2.14)***	6.00%
- Nonpilot		6.77%			
Bid<MSP<Price<Ask, Price>Midquote	7				
- Pilot		10.00%	0.73%	(1.55)	6.73%
- Nonpilot		10.73%			
Bid<MSP<Price<Ask, Price<Mdiquote	8				
- Pilot		5.21%	0.28%	(0.82)	7.01%
- Nonpilot		5.49%			
Price<Bid<MSP<Ask	9				
- Pilot		0.55%	0.28%	(1.80)	7.29%
- Nonpilot		0.83%			
Bid<MSP=Price<Ask, Price>Midquote	10				
- Pilot		0.34%	0.23%	**(2.54)***	7.53%
- Nonpilot		0.57%			
MSP<Bid<Price<Ask, Price=Midquote	11				
- Pilot		2.33%	0.17%	(0.90)	7.70%
- Nonpilot		2.51%			
Bid<Price<MSP=Ask, Price>Midquote	12				
- Pilot		0.26%	0.13%	**(2.02)***	7.83%
- Nonpilot		0.39%			
Bid<MSP=Price<Ask, Price=Midquote	13				
- Pilot		2.69%	0.02%	(0.03)	7.85%
- Nonpilot		2.70%			
Price< MSP<Bid	14				
- Pilot		0.00%	0.01%	(1.00)	7.86%
- Nonpilot		0.01%			
Bid<Price<MSP<Ask, Price>Midquote	15				
- Pilot		0.06%	0.03%		7.89%
- Nonpilot		0.09%			

*Significant at 5% level.

When the rule was binding, short sellers received price improvements at or above the MSP level so that another 25% of short sales occurred during such period without violating the rule. As a result, only 13% of the short sales in pilot stocks relied on the exemptions provided by the Pilot Program. This lead to a scant 7% difference between short volumes of pilot and nonpilot stocks that violated the bid test. This difference was made up in 15 scenarios in which nonpilot stocks had higher short volumes, none of which were economically dominating.

6.7. A Comment on the Effect of the Uptick Rule in the 1 Cent Minimum Tick Move Environment

This study has shown that short sale orders subject to the restrictions of the uptick rule were able to find execution opportunities shortly after their conversion into limit orders at the MSP. This result is consistent with the findings of Alexander and Peterson (2002),[46] which has shown that the reduction in the tick size led to more frequent occurrences of the MSP being lower than the ask and a reduction in the depth across the order book, and that both factors made it easier for the execution of market short orders after their conversion into limit orders. In the data sample used in this study, the MSP was between the quotes for approximately 25% of the times. During such times, market short orders that were converted into limit orders at the MSP had priority in the execution queue ahead of existing limit orders in the book. The MSP was equal to the ask for approximately 30-35% of the times and higher than the ask for approximately 40-45% of times in our sample. During such times, existing limit orders in the book at the same price level or lower had priority over the converted short sale orders at those times. If the level of the MSP changed before converted short orders were executed, the unexecuted orders would be deemed limit short orders at the new MSP

[46] Gordon J. Alexander & Mark A. Peterson, *Implications of a Reduction in Tick Size on Short-Sell Order Execution*, 11 J. FIN. INTERMED. 37, 37-60 (2002).

level and take priority after existing limit orders in the book at the same price level. Since the Pilot Program did not make the data on initial order submissions available to the public, the actual time gap between order submission and execution could not be determined. However, the results of this study suggested the time gap was not longer than 15 minutes.

SECTION 7. CONCLUSION

This study examined the effect of the short sale uptick rule on the overnight and intraday price movements and short sale volumes. It took advantage of the SEC pilot program that started on May 2, 2005, whereby one-third of Russell 3000 Index constituent stocks were exempted from the uptick rule. The returns and short sale volumes of these exempted stocks were compared to the returns and short sale volumes of nonexempted stocks at market open and at different times on the days immediately after negative earnings surprises. The study found no evidence that the uptick rule had reduced the speed of price decline on those days, nor any evidence that the rule was limiting short sale volumes during regular trading hours. By analyzing executed short volumes at different relations among the minimum shortable price, the execution price, and the prevailing quotes, the study found that the short sale uptick rule for NYSE and AMEX stocks and the bid test for NASDAQ stocks were not reducing short sale volumes for different reasons.

For NASDAQ stocks, up bids occurred about 60% of the time and absorbed 61-66% of the short sale volumes for pilot and nonpilot stocks. Price improvements, which allowed executions of short orders at or above the legally shortable price levels when the bid test would otherwise prevent execution of short orders at the bid, absorbed another 25-27% of the total short volume. The availability of execution opportunities through these two channels significantly reduced the reliance on the exemption granted by the Pilot Program and, as a result, the Pilot Program caused only a 7% of difference in short sale volume between pilot stocks and nonpilot stocks. This narrow difference was easily eliminated by price improvements and

short sellers' increased utilization of limit orders at the ask to avoid the restriction of the bid test.

For NYSE and AMEX stocks, neither the frequency of occurrence of upticks or zero-plus ticks (which occurred for only 10-12% of the times) nor exemptions to the uptick rule could explain why the uptick rule was not reducing short sale volumes; rather, market short orders whose immediate executions were barred by the uptick rule were able to find execution opportunities from the upcoming market buy orders shortly after their conversion into limit orders at the legally shortable prices. There was also evidence of more efficient utilization of execution opportunities when the uptick rule was not binding and price improvements from specialists or floor brokers up moved to the legally shortable prices. The results of this study are consistent with the hypothesis that the reduction of minimum tick movement to 1 cent has made it easier for short orders to be executed by allowing the minimum shortable prices to be lower than the best ask more often and reducing depth at each price level across the order book. This study lends support to the viewpoint of some market participants that the reduction in the minimum tick size had made it difficult for the uptick rule to limit short selling activities as originally intended by Congress.

In terms of regulatory significance, this study lends support, albeit conditionally, to the SEC's recent decision to abolish the uptick rule, the condition being the absence of extreme market conditions that substantially exceed the typical pressure levels following negative earnings news. During the period of the Pilot Program, few US stocks experienced catastrophic shocks that resulted in overwhelming negative order imbalances and plummeting stock prices to just a fraction of their levels before the shocks. Researchers were unable to evaluate the performance of the uptick rule in that extreme negative environment. For this reason, the SEC's complete abolishment rather than a selective application of the rule to extreme market declines is beyond the scope of research results produced by the Pilot Program. However, as stated in the SEC release, should a market emergency occur, the SEC is equipped with a general power

under Section 12(k)(2)[47] of the Securities Exchange Act of 1934 to impose additional restrictions, including reviving the uptick rule, to protect market integrity. How quickly the uptick rule could be revitalized after a long period of idleness is beyond the scope of this paper.

[47] 15 U.S.C. § 78l-12(k)(2) (2008). This provision provides that the Commission, in an emergency, may by order summarily take such action to alter, supplement, suspend, or impose requirements or restrictions with respect to any matter or action subject to regulation by the Commission or a self-regulatory organization under securities laws, as the Commission determines is necessary in the public interest and for the protection of investors. *Id.*