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THE OPTIONS MARKET MAKER EXCEPTION TO SEC REGULATION SHO

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Abstract

Until 2008, options market makers engaged in bona-fide market making were exempt from locate and certain close-out requirements for short sales (the "Exception"). This Exception applied only to short sales that qualified as bona fide hedges of options positions that were established before a stock went on the SEC Regulation SHO Threshold List. In this paper, we examine the consequences of eliminating this close-out Exception. Specifically, we test the hypothesis that eliminating the Options Market Maker Exception to SEC Regulation SHO reduced the incentive to naked short-sell stocks through the options market. We compare data from the second and fourth quarters of 2008. Consistent with our predictions, we find that eliminating the Exception led to fewer fails-to-deliver and higher stock borrow rates for optionable stocks as compared to non-optionable stocks. Further, removing the Exception reduced fails-to-deliver for optionable stocks when the price of borrowing stock was high. Finally, options market trading volume declined after the Exception was eliminated.

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1. Introduction

Trading in the U.S. stock market is shaped by myriad rules and institutions that govern the conduct of market participants. These rules not only set boundaries on trading but also create opportunities for novel trading strategies designed to lower costs and increase profits. Thus, the stock market provides an excellent opportunity to study the economic incentive effects associated with institutional change.

An important area of securities regulation concerns the clearance and settlement of trades. In the U.S. stock market, trade settlement does not occur on the date of the trade. While cash and securities in customer accounts are generally credited or debited instantly, actual share transfers are delayed through a netting process that allows broker-dealers and the clearinghouse to offset transactions among multiple counterparties.

When one party does not deliver shares to the clearinghouse by the trade date plus three days ("T+3"), a settlement failure occurs. This "fail-to-deliver" (FTD) is documented as a delivery obligation in the clearinghouse account of the broker-dealer that executed the trade. The stock settlement system accommodates settlement failures to promote market liquidity.

Regulations established by the U.S. Securities and Exchange Commission (SEC) require delivery of shares for long and short sales. Delivered shares, long or short, result in a change in "beneficial ownership" while naked short sales do not. To ensure prompt trade close-out and reduce settlement failures from short sales, the SEC enacted Regulation SHO in 2005. Regulation SHO incorporated and formalized some concepts found in older rules governing short sales and settlement. These rules evolved through rulemaking by the self-regulatory organizations (SROs). SROs are U.S. stock exchanges like the New York Stock Exchange (NYSE) and NASDAQ.

Regulation SHO strengthened an SRO Exception from trade locate and close-out requirements for market makers engaged in bona-fide market making. The Exception allowed options market makers to delay delivering shares sold short in connection with hedging activities. The Exception applied only to shorting that served market liquidity.

This Exception to the close-out requirement for optionable stocks was eliminated in September 2008. The repeal was due in part to complaints by some market participants that short sellers took advantage of this "loophole" in the rules to build artificially large synthetic short positions through the options market.[1] Other commenters were concerned that market makers unnecessarily incurred more FTDs than necessary to ensure market liquidity. Finally, the SEC was concerned about abuse in the form of circumventing short sale delivery requirements, a practice exposed in the 2007 Arenstein disciplinary decisions by the American Stock Exchange and the Financial Industry Regulatory Authority (FINRA).[2]

The SEC and FINRA have since brought numerous disciplinary actions against options market makers (OMMs) for naked short selling and failing to deliver in connection with market making that is not bona fide.[3] For example, the SEC (2012) outlines how one options market maker used complex conversion trades to satisfy demand for hard-to-borrow securities. The buyers of the conversions were "large prime brokers," a division of large broker-dealers that

[1] SEC, "Comments on Amendments to Regulation SHO," http://sec.gov/comments/s7-19-07/s71907.shtml.
[2] American Stock Exchange, "American Stock Exchange Announces Two Disciplinary Actions for Violations of Regulation SHO Short Sale Rules," Press Release, http://www.prnewswire.com/news-releases/american-stock-exchange-announces-two-disciplinary-actions-for-violations-of-regulation-sho-short-sale-rules-52788882.html.
[3] Disciplinary actions include Securities and Exchange Commission, "In the Matter of Hazan Capital Management and Steven M. Hazan," Administrative Proceeding, File No. 3-13570, August 5, 2009; International Securities Exchange, "Final Disciplinary Actions as of December 31, 2011," 2011; NASDAQ OMX PHLX, "Notice, Pursuant to Exchange By-Law 18-2, of Disciplinary Action against Keystone Trading Partners, Member Organization, and Timothy D. Lobach, Associated Person of Keystone," FINRA Matter No. 20100229926, July 7, 2011; and NYSE AMEX LLC, "Labranche Structured Products, Member and Harsh Padia, Trader," Hearing Board Decision 11-Amex-5, 2011.

services hedge funds and institutional clients. These prime brokers obtained scarce stock that "command[ed] large fees in the stock loan market" (SEC 2012, pages 3-4).

Our economic model predicts that the removal of the Exception raised costs for OMMs who hedged long options positions with short positions in the underlying equity markets. This is because the Exception allowed OMMs who had sold short without borrowing stock, and who had failed to deliver, to avoid close-out. Economic theory predicts that lower marginal costs due to naked shorting reduced options prices, consequently lowering the price to short through options as opposed to the stock loan market. Thus, theory predicts that higher shorting costs for OMMs reduced the incentive for short sellers to use the options market for shorting as opposed to the stock lending market.

The different treatment of optionable versus non-optionable stocks, coupled with the fact that the regulation was changed, offers a unique opportunity to test the effects of a financial regulation on trading behavior. We hypothesize that eliminating the Exception increased the cost of shorting optionable stocks and thus reduced FTDs relative to non-optionable stocks. We further predict that, because the Exception gave short sellers an incentive to short through the options market instead of the stock loan market, the elimination of the Exception yielded higher borrow prices for optionable stock relative to non-optionable stock in the stock loan market. This is because higher demand for short selling through the equity market means that there is more demand for borrowing stock.

We test our hypotheses about FTDs and stock borrow costs using a difference-in-difference framework. We identify the effects of eliminating the Option Market Maker Exception by exploiting its different effect on optionable and non-optionable stocks both before and after the rule change in 2008. While our article explores data and concepts unique to finance,

our analysis is rooted in economics. This is because we analyze the sensitivity of trading behavior to changes in economic incentives.

Our research is related to Evans et al. (2009), who use pre-regulation SHO data from 1998 and 1999 to assess how and why put-call parity diverges from predicted values when stock borrow costs are high. The authors conclude that OMMs account for this divergence because they tend to fail to deliver stock to cover short sales of hard-to-borrow stocks. Evans et al. (2009, p. 1975) describe the impact of delivery requirements arising from Regulation SHO as "an important new empirical question."

We test how changes to Regulation SHO that removed the failure "option" for market makers affected short sale pricing, FTDs, and options liquidity using 2008 data. Within a panel data framework, we exploit the fact that the Exception applied only to optionable stocks insofar as it was used by OMMs. Thus, our "control" group is non-optionable stocks. Within this framework, we test the effect of price changes in the stock lending market on FTDs.

We find that eliminating the Options Market Maker Exception to SEC Regulation SHO led to fewer and less persistent FTDs in optionable stocks. We also find that optionable stocks became more expensive to borrow after the Exception was eliminated, which is consistent with higher demand to borrow stocks to cover short sales. These results suggest that eliminating the Exception raised the cost to short through the options market and thus made options a less attractive alternative for short sellers. Finally, we find that elimination of the Exception lowered options market liquidity.

Our research demonstrates that prices and trading are very sensitive to rules and rule changes. In other words, subtle institutional choices can have real economic consequences.

In the following sections, we describe relevant institutions and related research. Next, we present our hypotheses, data, empirical model, and results. The last section presents conclusions.

2. Institutions

A. Trade settlement

In the U.S. stock market, buying and selling is facilitated by broker-dealers with accounts at a central clearinghouse. In typical market trading, individual broker-dealers first filter customer buy and sell orders through an internal "pre-netting" process. Next, the Continuous Net Settlement (CNS) system, managed by the clearinghouse, facilitates the actual movement of stock between broker-dealer accounts by netting trade obligations among the clearing brokers at the end of the day.[4] The role of the clearinghouse is to step in between two parties to a trade and net each party's obligation to trade over multiple trades, so that each obligation to receive or deliver can be combined together into one.

The CNS system is operated by the National Securities Clearing Corporation (NSCC), a subsidiary of the Depository Trust & Clearing Corporation (DTCC). Through oversight of the NSCC, the DTCC clears and settles all stock trades in U.S. markets. An undetermined amount of settlement occurs outside the NSCC. These trades are known as "ex-clearing" and are handled directly between brokers in a private contractual setting. Currently, no data are available on the magnitude or persistence of ex-clearing FTDs.[5] SEC Regulation SHO, discussed below, does not govern non-CNS trades.

[4] DTCC, "Continuous Net Settlement (CNS)," http://www.dtcc.com/ProductsAndServices/clearing/cns.html.
[5] The NSCC offers non-CNS trade tracking to broker-dealers through the Obligation Warehouse (OW). See http://www.dtcc.com/products/cs/equities_clearance/obligation_warehouse.php.

If stock is not delivered to the clearinghouse to settle a trade by settlement date T+3, an electronic FTD is registered at the DTCC.[6] FTDs act as electronic IOUs.[7] While the CNS system serves to promote market liquidity, the anonymous and fungible nature of the stock settlement system allows some market participants to sell stock without timely delivery. Because of the netting system, most buyers do not know when sellers have failed to deliver.

The DTCC also oversees the Depository Trust Company (DTC). As a member of the U.S. Federal Reserve System and a central stock depository, the DTC acts as a custodian for all securities traded. All major broker-dealers hold stock in accounts at the DTC. While physical payment and stock transfer occur within DTC, the NSCC provides final settlement instructions to customers and participant firms.

B. Short selling and stock lending

Short selling is a bet that a stock price will decline. According to the SEC (2004), "short selling is used to profit from an expected downward price movement, to provide liquidity in response to unanticipated demand, or to hedge the risk of a long position in the same security or in a related security." A short seller can execute a short sale with only a "locate" on stock available to borrow; no pre-borrow is required. After execution, a short seller may borrow stock for a fee, which is quoted as an interest rate. While some retail investors might expect a short sale to occur after stock is borrowed, T+3 settlement allows short sellers three days to borrow stock for delivery after trade date. To close a short position, a short seller must purchase stock for return to the lender.

[6] For the technical details, see DTCC, "The T+3 Settlement Cycle," http://www.dtcc.com/about/business/tplus3.php.
[7] See DTCC, "Clearance and Settlement," http://www.dtcc.com/products/cs/equities_settlement/ps_index.php.

Individual stock borrow prices vary according to supply and demand in the stock lending market. A stock borrow price is quoted as a rebate rate. A short seller borrows shares by posting collateral equivalent to the market value of the shares borrowed. A stock lender then invests the collateral in a low risk asset. The "price" to borrow shares is a spread between the return on the collateral investment and the amount "rebated" to the short seller. For easy to borrow stocks, the "rebate" is generally higher (that is, closer to the investment yield). If a rebate is negative, such as for a hard-to-borrow stock, then a short seller pays a fee in addition to posting collateral.

For example, a short seller borrows $100,000 worth of XYZ stock from a prime broker and posts $100,000 cash as collateral.[8] This collateral is placed in an overnight account that earns 5 percent or something close to the risk-free Federal Funds Rate. In an easy to borrow stock, the rebate "spread" might be 20 basis points; 4.8 percent of the 5 percent would be rebated to the short seller. Thus, 20 basis points, or 0.20 percent, is the rebate rate spread. In hard-to-borrow stocks, the rebate rate may be negative, perhaps negative 200 basis points, or -2 percent. Thus, in this example, the prime broker would keep 5percent and ask for an additional 2 percent.

Naked short selling is selling stock short without borrowing that stock. Selling stock short without borrowing is possible because, as discussed above, three days separate the trade date and settlement date (i.e., the date when the stock is due for delivery). If a short seller does not deliver stock to the clearing broker by the settlement date, then a naked short sale has occurred. Short sellers generally trade through accounts with prime brokers who bear responsibility for satisfying delivery obligations to the clearing corporation. Thus, depending on how a prime broker manages customer accounts, a naked short sale by a customer may or may not result in an FTD

[8] The collateral is commonly the proceeds of the short sale. Short positions are marked-to-market and a prime broker usually requires a short seller to post additional collateral in case the price of the underlying stock increases. Typically, the short seller in this example would post $102,000 as collateral, or 102 percent of the position. We use $100,000 for simplicity.

at the clearing corporation. This is because a prime broker may choose to borrow stock to meet a delivery obligation created by a customer. Regardless, a naked short seller that fails to deliver stock benefits by not posting collateral and perhaps avoids paying negative rebates. Naked short selling is virtually impossible without some involvement by broker-dealers who execute and clear trades for clients such as market makers and short sellers.

Short sellers can also construct synthetic short positions through options by buying puts, selling calls, or both. In order to establish, through options, a short position that mirrors perfectly a traditional equity short position, a short seller must buy a put option and sell a call option with the same strike price and expiration on the underlying stock. This creates a payoff profile that is linear and continuous insofar as it mimics perfectly the profit and loss profile of a real short position. Such a position is a "synthetic" short position.

C. Short selling and settlement regulations

SEC Regulation SHO, enacted in January 2005, was designed to reduce delivery failures related to short selling. Regulation SHO requires the five major U.S. stock exchanges to publish a daily list, referred to as the Regulation SHO Threshold List, of stocks with high FTDs. Those exchanges are the NASDAQ, NYSE, NYSE Arca, NYSE Amex, and the Chicago Stock Exchange (CHX). To qualify for the Threshold List, a stock must have, for five consecutive settlement days at a clearing agency, an aggregate FTD position totaling 10,000 shares or more and equal to at least 0.5 percent of the issuer's total shares outstanding (SEC 2004). Thus, taking into account the three-day settlement window, a stock with large and persistent net FTDs will appear on the Threshold List eight trading days after fail date.

Regulation SHO imposes locate and close-out requirements for short sales. The close-out requirement obliges broker-dealers to settle FTD positions for threshold securities that have persisted for 13 consecutive settlement days. Closing out requires the broker-dealer to purchase securities of like kind and quantity and to settle the trade on behalf of the customer. The locate requirement is satisfied if a broker-dealer has reasonable grounds to believe that a security can be located (for borrow) prior to delivery date. A broker-dealer must document a locate prior to executing a short sale. Specifically, the rule prohibits execution of a short sale unless a broker-dealer has either borrowed the security or "has reasonable grounds to believe that the security can be borrowed so that it can be delivered on the date delivery is due" (SEC 2004).

Regulation SHO draws on 20 years of short sale rulemaking by the SROs. The "locate" and "reasonable grounds" language above is borrowed from NASD Rule 3370 and NYSE Rule 440C, which predate Regulation SHO. The NYSE permitted use of an "Easy to Borrow" list to satisfy the "reasonable grounds" standard that a security sold short was available for borrowing. Note, however, that "repeated failures to deliver in securities included on an 'Easy to Borrow' list would indicate that the broker-dealer's reliance on such a list did not satisfy the 'reasonable grounds' standard" (NYSE 1997, p. 4662).

Similarly, the NASD required a member firm to make an "affirmative determination" that stock sold short would be available to borrow by settlement date. The NASD approved use of a so-called "Hard to Borrow" List in satisfying the affirmative determination requirement insofar as "a specific security absent from the list is easy to borrow" (NASD 2000, p. 171). Furthermore, Rule 3370 "was designed to prevent abusive short selling and ensure that short sellers satisfy their settlement obligations" (NASD 2000, p. 171).

NASD 3370 incorporated recommendations on the reporting and settlement of short sales contained in a 1986 NASD study by former SEC Commissioner Irving M. Pollack. Pollack (1986) concluded that, given the structure of the CNS system, it was possible for large FTD positions to accumulate at the clearinghouse "in perpetuity." "While these procedures generally protect the clearing corporation, they permit short selling brokers to assume much larger positions than they might otherwise be able to undertake if they were prevented from continually rolling over short positions without borrowing securities for delivery" (Pollack 1986, page 61).

D. Market Makers

Securities market makers are representatives of banks, broker-dealers or specialist firms that facilitate exchange between securities buyers and sellers. Market makers display bid and offer prices for specific securities, and, if these prices are met, they will immediately buy for, or sell from, their own accounts. When a sell order is placed, the market maker purchases stock in the absence of another buyer, thereby providing liquidity in the market. In doing so, they are literally "making a market" for the stock. Thus, market makers accept, sell, or buy orders even when there are short-term buy-and-sell-side imbalances in customer orders.

Market makers add to the liquidity and thickness of the market by taking temporary short or long positions. They profit from the spread, which is the difference between bid and ask prices. Some market-making operations are housed within large broker-dealers. Broker-dealers are expected to separate their market-making and proprietary trading divisions. Some large broker-dealers also provide trade clearing services to market maker clients. In general, broker-dealers engage in trade execution and clearing for customers across many securities, whereas market makers facilitate trading in specific securities without knowledge of counterparties.

E. The Options Market Maker Exception

Market makers act as temporary counterparties to buyers or sellers in order to foster liquidity. Thus, market makers may sell stock they do not have (at that moment) in order to hedge long positions.[9] Option market makers, for example, hedge long options positions with short positions. While most market maker positions are closed out at the end of each trading day, OMMs take short positions that last until an option contract expires. This may be weeks or months in the future.

For market makers, Regulation SHO contained an exception to the locate and close-out requirements for short sales. Specifically, SEC (2004) allowed an "exception from the uniform 'locate' requirement, as Rule 203(b)(2)(iii), for short sales executed by market makers… including specialists and options market makers, but only in connection with bona-fide market making activities." SEC (2003a) describes how the Exception was intended to mean that all market makers were permitted to sell stock short without locating that stock.

NASD 3370 and NYSE 440C also contained limited short sale locate and close-out exceptions for market makers engaged in bona fide market making, but the proposal to establish Regulation SHO notes that "the SRO requirements [had] not fully addressed the problems of naked short selling and extended fails to deliver" (SEC 2003a). Thus, Regulation SHO did not create a new exception per se. Rather, the rule was written to strengthen and narrow pre-existing exceptions without disrupting legitimate market making activity. Regulation SHO was also designed to "establish a uniform standard specifying the procedures for all short sellers to locate securities for borrowing" (SEC 2003a).

[9] "Positions" refers to a portfolio of trades. In general, an options market maker strives to offset long positions with short positions of similar magnitude and duration. This is known as maintaining a "delta neutral" portfolio, where delta captures the sensitivity of changes in options prices to changes in the underlying stock price.

The Exception did not apply to stocks already on the Regulation SHO Threshold List; an options market maker could only maintain FTDs "if the options positions were created prior to the time that the underlying security became a threshold security" (SEC 2004). Thus, all FTDs in Threshold stocks are subject to the mandatory close-out requirement if they are older than 13 days and were not executed to hedge a preexisting options position.

According to the SEC (2007b), "The options market maker exception was created to address concerns regarding liquidity and the pricing of options." When OMMs sell put options or buy call options, they are in a long position. They can hedge their long options position by selling short the underlying equity. The Exception allowed OMMs to hedge the risk of long options positions for the duration of an options contract if unable to borrow, which allowed them to delay short sale close-out until options expiration if necessary.

An example of this situation is when a market maker writes a put option with a future expiration date (a long position for the market maker). The Exception allowed the market maker to hedge that long position by shorting an equivalent quantity of the underlying stock and delaying delivery if unable to borrow. At option expiration, the put buyer either (a) sells stock back to the market maker (which the OMM can use to settle his short hedge), or (b) the put expires out of the money, and the market maker buys stock to settle the short hedge.

With negative rebate stocks, shorting is most costly because a short seller has to pay to borrow the underlying equity in addition to posting collateral. Due to the Exception, OMMs did not have to pay interest on short sales of stocks with negative rebates for the options contract duration if unable to borrow. For contracts with expiration dates far in the future, this Exception could result in large cost savings.

The SEC limited the Exception to bona-fide market making, which "does not include activity that is related to speculative selling strategies or investment purposes of the broker-dealer" (SEC 2004). Further, "bona-fide market making does not include transactions whereby a market maker enters into an arrangement with another broker-dealer or customer in an attempt to use the market maker's exception for the purpose of avoiding compliance with [Regulation SHO]" (SEC 2004).

While the Exception was written to promote legitimate hedging by market makers, some traders were not engaged in bona-fide market making and were consequently fined and barred from trading. In 2007, the AMEX found that Scott and Brian Arenstein, "who were not bona-fide options market makers, improperly utilized the Reg SHO market maker location exemption to avoid locating shares prior to effecting short sale transactions in Reg SHO threshold securities…[and] engaged in transactions that circumvented delivery obligations" (AMEX 2007a, page 2).[10]

The Arenstein case also alerted the SEC to a fraudulent trading strategy to "reset" the settlement date for a failed trade. "Options market makers' practice of 'rolling' positions from one expiration month to the next potentially allows these options market makers to not close out positions as required by the close-out requirements of Regulation SHO" (SEC 2007b, page 22).

The Arenstein case caused the SROs to restate the existing requirement that all exceptions were limited to bona-fide market making. For example, the Chicago Board Options Exchange states that, "only options market-makers that are engaged in *bona-fide* options market-making may utilize the exception to Regulation SHO's 'locate' requirement when effecting a short sale in the underlying security as a hedge" (CBOE 2007).

[10] "This violative activity was detected and investigated by the Financial Industry Regulatory Authority (FINRA), formerly the NASD, acting on behalf of the Amex's Regulatory Division" (AMEX, "American Stock Exchange Announces Two Disciplinary Actions," 2007).

In August of 2007, the SEC proposed eliminating the Options Market Maker Exception to Regulation SHO. "The ability of options market makers to sell short and never have to close out a resulting fail to deliver position… may have a negative impact on the market for those securities" (SEC 2007b, page 21). The SEC eliminated the Exception in September 2008. In the final rule, the SEC wrote that FTDs in threshold securities that "result from hedging activities by options market makers will no longer be excepted from Regulation SHO's close-out requirement" (SEC 2008).

The SEC (2009, 2011, and 2012) and FINRA found evidence that the OMM abuse continued.[11] The Wolfson case, for example, documents how one options market maker,

> improperly utilized the Market Maker Exception to avoid locating shares before effecting short sales as part of "reverse conversion" and "assist" transactions… As a result, [Wolfson was]… able to attract the business of prime brokerage firms seeking to create inventory for stock loans on hard to borrow securities. (SEC 2012, pages 3-4)

This is important because hedge funds and large institutional investors often rely on prime brokers to locate and borrow stock for short sales. Options market makers like Arenstein and Wolfson executed complex options trades known as "reverse conversions" to generate stock loan inventory for prime brokers.[12] For this purpose, a reverse conversion does not qualify as bona-fide market making. Rather, as discussed in SEC (2012, pp. 3-4),

> Reverse conversions are executed to meet a one-sided demand for hard-to-borrow threshold securities. The buyers of the threshold securities, in this case large prime brokerage firms, engaged in the conversion transaction that allowed them to

[11] SEC (2009), which concerned Steven Moses Hazan and Hazan Capital Management, LLC, was a joint enforcement action by the SEC, NYSE and FINRA. "NYSE Regulation appreciates the assistance of the Financial Industry Regulatory Authority (FINRA) Market Regulation Department, whose Staff initially detected the violative activity and provided assistance throughout the course of the investigation. Separately, the SEC initiated and settled an enforcement action against Hazan and HCM based on their parallel investigation of this conduct,"(NYSE Euronext, "Steven Moses Hazan and Hazan Capital Management, L.L.C. Settle Enforcement Actions Involving Violations of Regulation SHO Short Sale Rules," 2009).

[12] AMEX describes the components of the reverse conversion transaction used by Arenstein in American Stock Exchange, "In the Matter of Scott H. Arenstein and SBA Trading LLC," Case No. 07-71 [AMXC07013], July 20, 2007.

> acquire a long stock position that is hedged by the synthetic short options position. The brokerage firm could then loan out the shares of the threshold securities and received fees from the borrowers. Those loan fees can be quite significant when the stock is a threshold security, because threshold securities are generally hard to borrow and therefore command large fees in the stock loan market.

Thus, the options market is an alternative to the securities lending market when borrowing constraints exist.

3. Previous Research

Academic research on stock settlement failures has developed only recently. Boni (2006) and Evans et al. (2009) both examine the relationship between options market making and trade settlement. Boni (2006) uses pre-Regulation SHO FTD data from three dates in 2003 and 2004, a period without a formal close-out requirement, and finds evidence that short sale borrowing constraints may lead to "strategic" FTD in optionable stocks.

Evans et al. (2009) analyze the relationship between put-call parity and short sale borrow costs using data provided by an OMM from 1998 and 1999. They establish that, as shorting costs increase, stock prices diverge from values implied by put-call parity. This effect is weaker, however, when rebates are negative. They claim that this weaker relationship is consistent with OMMs refusing to cover short sales, i.e., failing to deliver, when stock is costly to borrow.[13]

Our work is also related to the literature on short sale constraints. This literature finds that when short sale constraints increase, stocks can become overvalued (Diamond and Verrecchia, 1987; Pontiff, 1996; Duffie, Garleanu, and Pedersen, 2002; Jones and Lamont, 2002; Mitchell,

[13] A market maker "never accepts a negative rebate, always choosing to fail instead." See Evans et al., "Failure Is an Option: Impediments to Short Selling and Option Prices," *Review of Financial Studies* 22 (2009), p. 1956. Other research finds no evidence that short selling during IPOs leads to increased FTDs. See Edwards and Weiss Hanley, "Short Selling in Initial Public Offerings," Journal of Financial Economics 98 (2010), 21–39. Fleming and Garbade (2002) discuss strategic FTDs in the Treasury markets. See Fleming and Garbade, "When the Back Office Moved to the Front Burner: Settlement Fails in the Treasury Market after 9/11," Federal Reserve Bank of New York Economic Policy Review 8 (2002), 35–57

Pulvino, and Stafford, 2002; Lamont and Thaler, 2003). For example, Jones and Lamont (2002) find that stocks that are expensive to borrow tend to be overpriced. Further research on rules that affect short sale constraints includes Danielsen and Sorescu (2001), Chang, Cheng, and Yu (2007), Jones (2012), Boehmer, Jones, and Zhang (2009), and Diether, Lee, and Werner (2009). With respect to borrowing costs, D'Avolio (2002) describes how short sale constraints arise in the market for borrowing and lending U.S. equities. Similarly, Geczy, Musto, and Reed (2002) focus on how short sale costs and constraints affect short selling profits.

Kolasinksi, Reed, and Thornock (2009) study the effects of a 2008 SEC short sale ban. The authors find that, while short sale constraints limited opportunities for "uninformed" investors, trading by sophisticated short sellers actually increased. Further, negative rebates led to increased demand for synthetic short positions through the options market. Battalio and Schultz (2011) study how the 2008 short sale ban affected equity options prices and conclude that OMMs faced higher costs as a result of short sale constraints. Boulton and Braga-Alves (2010) find that securities of firms subject to the short sale ban experienced overpricing, as well as a widening of bid-ask spreads.

An important related literature studies naked short selling. Finnerty (2005) presents a theoretical model that illustrates how FTDs may be part of a manipulative trading strategy. Culp and Heaton (2007) develop a model wherein the economic effects of naked short selling are similar to those of covered short selling. The authors do suggest, however, that naked short selling can be used to manipulate prices. Fotak, Raman, and Yadav (2009) provide evidence that naked short selling tends to follow price declines and may improve liquidity and price efficiency. Putniņš (2010) discusses the U.S. equity settlement system and the relationship between naked short selling and FTDs. Lecce et al. (2012) use data from the Australian Stock Exchange to show

that market quality declines under regulatory regimes that permit naked short selling. The authors also find that naked short selling improves price efficiency when stock lending costs rise. Boulton and Braga-Alves (2012) find evidence of positive abnormal returns immediately before stocks appear on the Threshold List and while they are on the List.

Much of what is known about options market making and FTDs comes from the SEC. A 2003 SEC Interpretive Release discusses how short sellers can use the options market as a substitute for the stock loan market via so-called "married put" transactions, which are functionally similar to the reverse conversions discussed above. SEC (2003b) remarks, "Even viewed in the most favorable light, these married put transactions appear to be nothing more than temporary stock lending agreements designed to give the appearance of a 'long' position in order to effect sales of stock in a manner that would otherwise be prohibited."

Our work is related to an SEC Office of Economic Analysis (OEA 2008a) study that examines how elimination of a grandfather provision in Regulation SHO affected fails in optionable and non-optionable stocks. Using a nonparametric comparison of means, the OEA shows that fails in optionable stocks increased relative to optionable stocks after elimination of the Grandfather Clause in 2007.[14] The OEA (2008a) finds that

> the investors who previously failed to deliver in the equity market have now moved to the options market to establish a synthetic position. Since the option market makers still enjoy an exception to the close-out rule and tend to hedge their positions in the equity markets, the fails may now be coming from the option market makers instead of the equity investors themselves.

[14] The Grandfather Clause exempted pre-2005 fails from the new close-out requirements of Regulation SHO. One rationale for this exemption was that trades execute prior to enactment of Regulation SHO should not be subject to ex post rule changes by the SEC. In addition, "the grandfathering provisions of Regulation SHO were adopted because the Commission was concerned about creating volatility where there were large pre-existing open positions." See SEC, "Grandfathering Under Regulation SHO," 2005.

The OEA (2009) describes how eliminating the Options Market Maker Exception to Regulation SHO affected FTDs. Using nonparametric methods, the OEA (2009) finds "some evidence that optionable stocks experienced larger declines [in fails-to-deliver] than non-optionable stocks."

Our analysis is distinct from the OEA (2008, 2009) and Evans et al. (2009) studies in important ways. First, we employ various measures of FTDs as well as test the impact of the Exception removal on stock rebates and liquidity. Further, while the SEC studies test for differences in unconditional means, we use a panel data framework that allows us to control for stock fixed effects and time effects. By controlling for these effects and by focusing on the periods before and after a major rule change, we are better able to isolate the causal effect of the Exception. Finally, Evans et al. (2009) lack borrow rate data and infer price changes indirectly from put-call parity and for a time period prior to the existence of regulation SHO. In contrast, we use actual stock borrow rates to assess the price effects of institutional change.

4. Hypotheses

Prices in the options market are determined by customer demand and the cost to OMMs of opening and maintaining options positions. These costs include hedging options by buying or selling short the underlying equity. The Options Market Maker Exception to Regulation SHO allowed OMMs to avoid borrowing costs and delay settlement in situations where the Exception applied. This may have kept the cost of shorting through the options market lower than it otherwise would have been. As a result, the removal of the Exception may have lowered the options market trading volume.

While the Exception applied to market makers in options and equities, theory suggests that OMMs had an incentive to fail to deliver optionable stocks as opposed to non-optionable

stocks. Thus, we predict that the Exception removal affected optionable and non-optionable stocks differently and led to a decrease in FTDs for optionable relative to non-optionable stocks.

Hypothesis 1: *Removal of the Options Market Maker Exception to Regulation SHO led to fewer settlement failures in optionable stocks relative to non-optionable stocks*.

Settlement failures may be temporary, lasting a few days, or may persist for many trading days. Short term FTDs can occur for many reasons, including delayed custodial transfers or operational errors. In general, there is no obvious reason why settlement failures would systematically persist except intent. We adopt the SEC's criterion of persistent failure, i.e., whether a stock is on the Threshold List, and test Hypothesis 1 for both types of failures: temporary and persistent.

Hypothesis 2: *The marginal effect of stock borrow prices on FTDs was larger for optionable stocks than for non-optionable stocks while the Options Market Maker Exception was in effect. After removal of the OMM Exception, settlement patterns in optionable stocks became less sensitive to rebate changes.*

Demand for short sales does not necessarily decrease when shorting costs increase. For example, D'Avolio (2002) shows that negative rebates may encourage short sales. Nevertheless, the incentive to borrow stock for covered short sales decreases if borrow costs are high. When close-out is enforced, we predict no correlation between FTDs and rebate rates because short sellers are not allowed to fail when borrowing becomes costly.

When FTDs are permitted, however, the incentive to avoid close-out increases as stock borrow costs rise. This consideration motivates Hypothesis 2. We predict that the OMM Exception provided an incentive to naked short sell. We hypothesize that, while the OMM Exception was in effect, higher borrow costs led to more FTDs in optionable stocks, and we therefore predict a negative correlation between borrow prices and the quantity of fails. Further, because non-optionable stocks were not exempt from the close-out requirement in early 2008, we predict that, in early 2008, fails in optionable stocks were more sensitive to borrow rate movements than after the removal of the OMM Exception.

Hypothesis 3: *Removing the OMM Exception to Regulation SHO increased the price to borrow optionable stocks relative to non-optionable stocks*.

We predict that the Exception had a direct effect on optionable stock borrow rates. This is because short sellers can establish short positions either through the equity or the options markets. By keeping the costs to short through the options market low, Regulation SHO may have driven demand for short options positions. While we cannot study stock borrow volumes directly, borrow rates are affected by the demand to borrow stock.[15] Thus, we test whether borrowing rates for optionable stocks are higher after the removal of the Exception than before.

Hypothesis 3 follows from Hypothesis 1. If OMMs pay less to short stocks prior to the removal of the exemptions, then they can offer better options prices to customers and satisfy

[15] Short sale data for dates prior to August 2009 are generally unavailable, incomplete, and/or inaccurate. No single source provides aggregate short sale activity per ticker across all exchanges, so one must gather data from specific exchanges. Many SROs do not publish short sale data. Of those that do, there is often double-counting of short trades. Finally, and perhaps most importantly, data do not allow us to tie specific short sales to market makers (or other market participants) due to trade netting at the clearinghouse. Stock borrow rates are, therefore, a superior measure of demand for borrow than actual short sale volume.

greater demand. This greater demand for short option positions, in turn, puts downward pressure on rebate rates in the stock loan market. At the same time, the Exception had no direct effect on the demand for borrowing non-optionable stock.

Hypothesis 4: *Removing the OMM Exception reduced the availability, and thus liquidity, of option contracts*.

Hypothesis 4 also follows from Hypothesis 1. Many commenters on the SEC's proposal to eliminate the OMM Exception to Regulation SHO, such as Finadium (2007), opined that the Exception improved options liquidity, i.e., the volume of trades, and that the rule change would reduce options liquidity. Thus, we consider whether eliminating the OMM Exception reduced options liquidity. The Exception was intended to provide liquidity to the options market so that market makers could write or buy options from customers and satisfy demand. If OMMs used the Exception to create markets, then elimination of the Exception may have reduced the number of outstanding option contracts. To test Hypothesis 4, we use a sample of optionable stocks and compare options open interest volume while the Exception was in effect and after it was lifted. We compare total options open interest volume, both puts and calls, as short positions may require the buying and selling of both.

5. Data

We use data from the Russell 3000 Index to test for differences between optionable and non-optionable stocks before and after the elimination of the OMM Exception to Regulation SHO. The Russell 3000 Index provides a broad sample of companies, and we use stocks that

were in the Index in 2008. We obtain price and volume data for stocks and options from FinancialContent. Data on shares outstanding come from Bloomberg. Historical FTD data are available from the SEC Freedom of Information Act (FOIA) Office.[16] Data on which firms are on the SEC Regulation SHO Threshold List are from websites for the NYSE, NASDAQ, NYSE ARCA, AMEX, and CHX.

Our stock borrow data are from Finadium, a consulting firm for the financial services and financial technology industries. Finadium provided stock borrow data from a top-tier prime broker.[17] As discussed above, stock borrow rates are quoted as a rebate on collateral investment. Our metric of interest is the spread between the federal funds rate and daily rebate rates by stock. We use the daily opening federal funds rate, available through Bloomberg, rather than the daily average rate, as stock borrow rates are also quoted at the market open.

We compare data from one financial quarter prior to the proposal of the OMM Exception elimination, which is the second quarter of 2008 (2008:Q2), to one financial quarter after the OMM Exception was formally eliminated, which is the fourth quarter of 2008 (2008:Q4). The SEC opened comment on July 7, 2008, and formally eliminated the rule on September 17, 2008; both SEC actions were in the third quarter. If rule change seemed likely after the SEC opened the comment period, then it is possible that OMMs reacted immediately to reduce outstanding FTDs during the third quarter of 2008.[18] Since it is not clear whether market participants changed behavior early or late in the third quarter, we do not include that quarter in our analysis. We

[16] SEC, "Frequently Requested FOIA Document: Fails-to-Deliver Data," http://www.sec.gov/foia/docs/failsdata.htm. Archival FTD data is available from 2004 onward.
[17] Please visit www.finadium.com for more information. Data used in this paper are available on request.
[18] In fact, the SEC considered narrowing or eliminating the OMM Exception in 2007 and subsequently let the comment period expire without changing or modifying the regulation. See SEC, "Amendments to Regulation SHO," Release No. 34-55520, 2007, and SEC, "Amendments to Regulation SHO," Release No. 34-56213, 2007.

address the question of whether our results are sensitive to the inclusion of 2008:3, however, in Section 7 of this paper.

In our empirical analysis, we first test whether removal of the OMM Exception led to fewer FTDs in optionable stocks relative to non-optionable stocks. Next, we test whether eliminating the OMM Exception reduced the persistence of fails in optionable stocks. We measure persistence by the number of days each stock is on the Threshold List over a specific time period.[19] Finally, we use stock rebate rates to test whether borrow prices for optionable stocks increased after OMM Exception elimination.

6. Empirical model and results

A. Summary statistics and figures

Table 1 shows summary statistics for Russell 3000 stocks before and after elimination of the OMM Exception to Regulation SHO. Our full sample contains data on 2,952 unique tickers from the second and fourth quarters of 2008. Membership on the Russell 3000 Index is not static. Membership changes over time as companies are acquired, merge with other companies, or exit the market. Our Russell 3000 membership list dates from the spring of 2009; we exclude tickers not traded in 2008.

Options exchange members or professional traders, and not equity issuers, determine whether to list options in a stock, i.e., whether the stock is "optionable." This determination is based largely on the volume and volatility of the underlying equity (Mayhew and Mihov, 2004). Stocks with more volume and more volatility tend to have options traded, while thinly-traded

[19] For example, between April 1, 2008 and June 30, 2008, stock CROX was on the Threshold List for 50 trading days. In contrast, between October 1, 2008 and December 31, 2008, CROX was on the list for 20 trading days.

stocks do not. In our sample, about 25 percent of stocks are non-optionable while about 75 percent are optionable.

The top panel in Table 1 presents descriptive statistics of our data for the second quarter of 2008 and the bottom panel for the fourth quarter of 2008. The variable *Fails-to-Deliver (FTDs)* is aggregate FTDs in excess of 10,000 shares on settlement date (T+3).[20] FTDs are the net number of shares traded that have failed to settle on a given day; this is the stock of existing fails, plus new fails, minus old fails. Eighty-one percent of all observations have no settlement failures. In the second quarter of 2008, average daily net settlement failures are 51,717 shares; this number falls to 15,386 shares in the last quarter of that year. We do not report results for a subsample of stocks with settlement failures above zero, but we note that the daily net fails in this group declined between the second and fourth quarter of 2008 from an average of 198,827 shares per day to 124,035.

A similar pattern is present in the ratio of FTDs to shares outstanding. Here, settlement failures fall from 0.11 percent in the second quarter of 2008 to 0.02 percent in the last quarter of 2008. For the subsample of stocks with settlement failures, this ratio falls from 0.44 to 0.18. These differences in the overall FTDs and FTDs as a percentage of shares outstanding before and after the rule change are statistically different. Consistent with these differences, there is also a statistically significant drop in the average percentage of stocks on the Threshold List from 0.05 percent to 0.01 percent per day. Some stocks were on the Threshold List for every day in each quarter while others were never on the List.

Table 1 shows that daily trading volume in the fourth quarter of 2008 was roughly 40 percent higher than in the second quarter. The mean stock borrow spread is 118 basis points in

[20] For the time period examined in this paper, the SEC does not report daily net FTDs less than 10,000 shares. In July 2009, the SEC increased the frequency of FTD reporting from quarterly to bimonthly and expanded the data to include all daily net FTDs.

the second quarter of 2008 and 108 basis points in the last quarter of that year. This indicates that it was generally more expensive to borrow stock in the fourth quarter of 2008 than in the second quarter. Table 1 also shows that the average daily options open interest is higher in the second quarter compared to the fourth quarter of 2008.

Figure 1 shows the aggregate daily number of settlement failures in Russell 3000 stocks in 2008 for optionable and non-optionable securities. For an individual stock, daily FTDs are the accumulated net FTDs by all market participants, including retail investors, brokers, and market makers. Figure 1 also shows the dates when the OMM Exception elimination was announced (July 7, 2008) and implemented (September 17, 2008). Over the entire time period, non-optionable stocks have significantly lower FTDs than optionable stocks. There is a steady increase in optionable stock FTDs until the elimination of the Exception, after which there is a sharp drop in settlement failures.

Figure 2 shows the ratio of optionable and non-optionable Regulation SHO Threshold securities in the Russell 3000 Index to the total number of optionable and non-optionable securities in the Russell 3000 Index. This figure also shows that the number of Threshold stocks increased until the third quarter of 2008. After elimination of the Exception, the daily number of Threshold stocks dropped sharply. For almost all days in 2008, the ratio of optionable Threshold stocks to all optionable stocks was higher than the corresponding ratio for non-optionable stocks.

The story these figures tell is complicated by additional SEC rulemakings concurrent with OMM Exception elimination in September of 2008. First, the SEC enacted Interim Temporary Final Rule 204T, which imposed a hard delivery requirement for all stocks. A hard delivery requirement means that participants of a registered clearing agency must close out FTDs by one day after settlement date, or "T+4." Participants that do not comply with this close-out

requirement will be in violation of the rule and "will not be able to short sell the security for itself or for the account of another, unless it has first arranged to borrow or borrowed the security, until the fail to deliver position is closed out."[21]

Second, the SEC also enacted Rule 10b-21, which "expressly targets fraudulent short selling transactions" by "short sellers who deceive broker-dealers or any other market participants."[22] Rule 10b-21 clarified responsibility between broker-dealers and their clients when FTDs occur. Both 204T and 10b-21 affected optionable and non-optionable stocks equally.

Third, on September 19, 2008, the SEC used its emergency authority to impose an outright ban on short selling for 799 financial stocks. The SEC later expanded this list to include other issuers from the financial services industry; no nonfinancial stocks were in the short sale ban. The SEC Emergency Order expired on October 8, 2008.

Although we cannot attribute the overall drop in FTDs in Figures 1 and 2 to the repeal of the OMM Exception alone, additional SEC rulemaking during this period does not affect our analysis of whether the repeal had a differential effect on optionable versus non-optionable stocks. This is because the other SEC rules in September 2008 affected optionable and non-optionable stocks equally. So while 204T, 10b-21, and the short sale ban reduced the overall magnitude of FTDs, they did not affect optionable and non-optionable stocks differently. In our analysis, we are concerned solely with the difference in the changes in FTDs and borrow rates between optionable and non-optionable stocks before and after elimination of the Exception.

The patterns observed in Figures 1 and 2 are statistically significant in a simple difference-in-difference framework. Table 2 presents these difference-in-difference estimates of

[21] SEC, "Amendment to Regulation SHO to Adopt Exchange Act Rule 204T — A Small Entity Compliance Guide," http://www.sec.gov/divisions/marketreg/tmcompliance/regsho204t-secg.htm.
[22] SEC, "Adoption of 'Naked' Short Selling Antifraud Rule, Exchange Act Rule 10b-21 — A Small Entity Compliance Guide," http://www.sec.gov/divisions/marketreg/tmcompliance/rule10b21-secg.ht.

unconditional means for optionable and non-optionable stocks, both before and after OMM Exception elimination. Mean comparisons show that the natural logarithm of FTDs for optionable stocks relative to non-optionable stocks declined 37 percent and FTD deliver as a percentage of shares outstanding declined by over 7 percentage points with the elimination of the OMM Exception (Table 2, Panels A and B). Further, compared to the second quarter of 2008, an optionable stock was two percentage points less likely than a non-optionable stock to be on the Threshold List (Table 2, Panel C). These difference-in-difference estimates are statistically significant using simple *t*-tests. Next, we study whether these results hold up in a regression framework, which adds control variables, allows for time and stock effects, and uses clustered standard errors.

B. Hypothesis 1: Eliminating the OMM Exception reduced FTDs in optionable stocks

To test this hypothesis, we estimate the following regression equation:

$$FTD_{it} = \beta_1 2008{:}Q4 + \beta_2 OMM\ Exception\ Elimination_{it} + \beta_3 Volume_{it} + \beta_4 Optionable_{it} + \gamma_i + \varepsilon_{it.} \quad (1)$$

The dependent variable is FTDs for stock *i* on day *t* in the second and fourth quarter of 2008. We employ three measures of FTDs: the natural logarithm of fails, fails as a percentage of shares outstanding, and an indicator variable equal to one when a stock is on the Regulation SHO Threshold List. The latter captures the persistence of FTDs.

The indicator variable *2008:Q4* equals one for each day of the fourth quarter of 2008 and zero otherwise. The indicators γ_i are stock fixed effects and capture everything that is constant to

stock *i* (in 2008). For example, these fixed effects control for stock-specific characteristics, which may result in high or low average fails. We include a separate indicator variable $Optionable_{it}$, which equals one for optionable stocks.[23] The variable *OMM Exception Elimination* equals one for optionable stocks in the fourth quarter of 2008 and zero otherwise. To control for the possibility that FTDs are correlated with trading activity, we include the natural logarithm of total daily trading volume, $Volume_{it}$, in the regression equation. In all regressions, we cluster standard errors by stock and trading day (Thompson, 2009; Cameron et al., 2011). Consistent with Hypothesis 1, we predict that β_2 will be negative.

We estimate equation (1) with ordinary least squares (OLS). There are two reasons for estimating our model with OLS rather than with Tobit, in which the dependent variable would be FTDs (which includes zeros) or with probit, in which the dependent variable would be an indicator equal to one if stock *i* is on the Threshold List and zero otherwise. First, we have close to 3,000 stock fixed effects in our regressions. With this many regressors, nonlinear estimators such as Tobit and probit do not converge. Second, for practical purposes, the marginal effects from Tobit and probit estimates are very close to OLS estimates (Angrist and Prischke, 2009).

Table 3 shows our regression results when the dependent variable is the log of FTDs (Columns 1 and 2).[24] We exclude trade volume from the first column but include it in the second column. In both specifications, the estimate for the fourth quarter is negative and statistically significant, indicating that overall FTDs were lower in the fourth quarter than in the second quarter of 2008.

[23] For the time period of our analysis, very few stocks in our sample change from optionable to non-obtainable or vice versa.

[24] We add one fail to each of the fails for each daily stock, so that the log of fails variable takes the value of zero when no settlement failures occur.

Columns 1 and 2 in Table 3 show that the point estimate on the OMM Exception elimination is negative and statistically significant regardless of whether the specification controls for trade volume. Both point estimates show that eliminating the OMM Exception led to 33–37 percent fewer fails in optionable stocks relative to non-optionable stocks. This finding provides support for our first hypothesis.

In Table 3, columns 5 and 6, the dependent variable is FTDs as a percentage of shares outstanding. Relative to column 5, column 6 includes trade volume as an additional control variable. In both specifications, the point estimates on the effect of the OMM Exception elimination are negative and statistically significant. They show that the Exception elimination led to a 0.07 percentage point decrease in FTDs as a percentage of shares outstanding. By comparison, the dependent variable in the fourth quarter of 2008 has a mean of 0.02. This implies that eliminating the OMM Exception reduced FTDs as a percentage of shares outstanding by a factor of 3.5 relative to the mean of the data. This finding provides further support for Hypothesis 1.

The regression shown in Table 4 repeats the specifications of Table 3 but excludes all stocks affected by the SEC ban on the short selling of financial stocks in September 2008. This allows us to test the sensitivity of our results to this related SEC action.[25] Roughly half of the stocks affected by the shorting ban were in the Russell 3000 Index. We find that the results in Table 4 are similar to those in Table 3, both in direction and magnitude. The results show that eliminating the OMM Exception reduced FTDs by 35-39 percent for optionable stocks (Table 4,

[25] The effect of the shorting ban on volatility, liquidity, stock prices, and the stock lending market has been examined by Alessandro Beber and Marco Pagano, "Short Selling Bans around the World: Evidence from the 2007-09 Crisis," *Journal of Finance* (forthcoming); Ekkehart Boehmer, Charles M. Jones, and Xiaoyan Zhang, "Shackling Short Sellers: The 2008 Shorting Ban," Working paper, Columbia University, 2009; Lawrence Harris, Ethan Namvar, and Blake Phillips, "Price Inflation and Wealth Transfer during the 2008 SEC Short-Sale Ban," Working paper, University of Southern California, 2009; and Adam Kolasinski, Adam V. Reed, and Jacob R. Thornock, "Prohibitions versus Constraints: The 2008 Short Sales Regulations," Working paper, University of Washington, 2009.

columns 1 and 2) and reduced FTDs as a percentage of shares outstanding by 0.08 percentage points (Table 4, columns 5 and 6). In both Table 3 and 4, we find that trading volume is positively correlated with fails. For example, a one percentage point increase in volume is associated with a statistically significant 0.48 percent increase in FTDs (Table 4, column 2).

Our final test of Hypothesis 1 is to determine whether eliminating the OMM Exception reduced the likelihood that optionable stocks appear on the Regulation SHO Threshold List. The number of days a stock is on the Threshold List measures FTD persistence, whereas previous specifications measure FTD magnitude. The Threshold List has been used by policymakers to judge the efficacy of Regulation SHO (Kaufman, 2009).

All specifications in Table 5 contain the same explanatory variables as the specifications in Tables 3 and 4. Columns 1 and 2 use the entire sample, whereas columns 5 and 6 present results from the subsample that excludes short sale ban stocks. The specifications in these four columns of Table 5 show that the point estimate on the OMM Exception elimination is negative and statistically significant, lending support to Hypothesis 1. The point estimates show that the eliminating the Exception reduced the likelihood of being on the Threshold List by 2-3 percent.

C. Hypothesis 2: Eliminating the OMM Exception removed an incentive for market makers to incur more FTDs when stock borrow prices increased

To test this hypothesis, we augment equation 1 by including the price to borrow stock:

$$FTD_{it} = \beta_1 2008{:}Q4 + \beta_2 OMM\ Exception\ Elimination_{it} + \beta_3 Spread_{it} +$$
$$\beta_4 Spread_{it} * OMM\ Exception\ Elimination_{it} + \beta_5 Volume_{it} + \beta_6 Optionable_{it} + \gamma_i + \varepsilon_{it.} \quad (2)$$

We calculate the price to borrow stock using the spread between the daily opening Federal Funds rate and the daily rebate rate. We label this variable $Spread_{it}$. Increases in this variable indicate higher stock borrow costs.

To test Hypothesis 2, our variable of interest is $Spread_{it}$*$OMM\ Exception\ Elimination_{it}$, which is non-zero for optionable stocks in the fourth quarter of 2008. A negative coefficient on β_4 indicates that, after the OMM Exception was eliminated in September of 2008, market makers incurred fewer fails when the cost of borrowing stock increased.

In Table 3, columns 3 and 4 show our estimation results when the dependent variable is the number of fails. Similarly, columns 7 and 8 show the results when the dependent variable is FTDs as a percentage of shares outstanding. The resulting point estimates on *Spread* are all positive and statistically significant. This implies that, prior to elimination of the Exception, more fails occurred when the price of borrowing stock increased. However, the sensitivity of fails to stock borrow costs vanishes once the Exception was eliminated. This is because the coefficient on $Spread_{it}$*$Exception\ Elimination_{it}$ is negative, statistically significant, and roughly of equal magnitude as the coefficients on $Spread_{it}$. The corresponding coefficient in column 3 of Table 3 indicates that, when OMMs were exempt from the close-out requirement, a 100 basis point increase in stock borrow costs led to a 44 percent increase in fails in optionable stocks relative to when the Exception was in effect. Given that the coefficient on the interaction term is -42, we find that the effect of spreads on fails is not statistically different from zero after the elimination of the Exception.

Column 8 of Table 3 shows that a 100 basis point increase in stock borrow costs led to a 0.13 percent increase in fails as a percentage of shares outstanding prior to the Exception elimination. This estimate implies that a one standard deviation increase in stock borrow costs

led to a 0.38 percent (0.13 x 2.99) increase in FTDs as a percentage of shares outstanding. After the elimination, the sensitivity of spreads to FTDs as a percentage of shares outstanding goes to zero.

In Table 4, columns 3 and 7, where we omit financial stocks, our results are similar to the corresponding columns in Table 3. To summarize, during the fourth quarter of 2008, higher optionable stock borrow costs led to fewer optionable stock settlement failures relative to the first quarter of that year. In fact, our results show that, after the exemption was eliminated, the sensitivity of stock borrow spreads with respect to fails goes to zero.

In columns 4 and 8 of Tables 3 and 4, we include a specification with an interaction term between $Spread_{it}$ and an indicator variable equal to one for optionable stocks (and zero for non-optionable stocks). The coefficient indicates the extent to which rebate rates affect FTDs in optionable stocks in all time periods, irrespective of the settlement regime. The coefficients on this variable are negative in all specifications, but they are only statistically significant when FTDs as a percentage of shares outstanding is the dependent variable.[26]

In Table 5, the results in columns 3, 4, 7, and 8 are consistent with the corresponding findings in Tables 3 and 4. They show that, after OMM Exception elimination, the sensitivity of optionable stocks to spreads goes toward zero. The point estimates indicate that, prior to the OMM Exception elimination, a 100 basis point increase in stock borrow costs decreases the likelihood of being on the Threshold List between 3.6 and 3.7 percentage points. Given that 5 percent of the observations were on the Threshold List in the fourth quarter of 2008, the point

[26] In specifications 7 and 8 of both Table 3 and 4, the point estimate on *OMM Exception Elimination* is positive. This, however, does not imply that the marginal effect is positive. This is because these specifications include the interaction term between *Spread* and *OMM Exception Elimination*. Thus, the total effect *OMM Exception Elimination* on *Spread* is the point estimate on that variable plus the negative term on the interaction multiplied by the mean value of *Spread*. The sum of this is negative, which is consistent with our previous findings.

estimate suggests that the Exception accounted for about 75 percent of the placement on the Threshold List.

D. Hypothesis 3: Removal of the OMM Exception raised stock borrow costs for optionable stocks

We test Hypothesis 3 using a difference-in-difference framework similar to the model above:

$$Spread_{it} = \beta_1 2008{:}Q4 + \beta_2 OMM\ Exception\ Elimination_{it} + \beta_3 Optionable_{it} + \beta_4 Volume_{it} + \gamma_i + \varepsilon_{it}. \quad (3)$$

As in equations 1 and 2, *OMM Exception Elimination* equals one for optionable stocks in the fourth quarter of 2008 and zero otherwise. We hypothesize that optionable stocks were more expensive to borrow after the OMM Exception elimination. Thus, we predict that β_2 will be positive, which means that the difference between the fed funds rate and the rebate rate (for stock *i*) is higher after elimination. A positive β_2 is consistent with the hypothesis that the OMM Exception led to increased "synthetic" short selling through the options market and lower demand in the stock loan market.

Table 6 shows estimation results. The dependent variable is the stock borrow spread. The first two columns are based on our entire sample and the next two columns exclude short sale ban stocks. For each sample, we estimate one specification where we include trade volume and one where we do not.

The point estimate on the OMM Exception elimination variable is positive and statistically significant at the 1 percent level. The results imply that the removal of the OMM Exception from the close-out requirement led to an increase in stock borrow spreads for

optionable stocks by between 35 and 36.5 basis points. The point estimate on the Exception is similar across all specifications and is not sensitive to whether the regression includes trade volume. These results are consistent with our hypothesis.

E. Hypothesis 4: Eliminating the OMM Exception reduced options liquidity

We test this prediction by comparing the total outstanding options contracts written on each optionable security in our sample during and after the Exception. Options contracts are written and traded in lots of 100 shares. The net volume of outstanding option contracts on any given day is called "open interest" (OI). By definition, we can only apply this test to optionable stocks; non-optionable stocks cannot have options contracts. Open interest measures options market activity and, therefore, liquidity. As a stock variable, open interest is the net result of the total opening and closing options volume at the end of a trading day.

We therefore test Hypothesis 4 using the subsample of optionable stocks.

$$OI_{it} = \beta_1 2008{:}Q4 + \beta_2 Volume_{it} + \gamma_i + \varepsilon_{it}. \quad (4)$$

The dependent variable OI_{it} is the sum of put and call options open interest for stock i on date t. As before, our sample is from trading days in the second and fourth quarter of 2008. As in the previous specifications, *Volume* is log of total stock trading volume. As before, *2008:Q4* equals one for the fourth quarter and zero otherwise. A negative β_1 is consistent with the hypothesis that the options market was more liquid while the OMM Exception was in effect. Following Lakonishok et al. (2007), we normalize both *OI* and *Volume* by shares outstanding because

changes in shares outstanding can affect both stock trading volume and the volume of options contracts written. We again cluster standard errors by stock and trading day.

Table 7 contains regression results that compare options open interest before and after the rule change as a fraction of shares outstanding. The first column presents results for the entire sample, and the second column presents results for the subsample that excludes short sale ban stocks. For both specifications, the point estimate on the fourth quarter is negative and statistically significant at the 5 percent level, indicating that options market trading volume declined after the OMM Exception was eliminated. The point estimate suggests that options open interest as a fraction of shares outstanding was about 3 percent higher while the Options Market Maker Exception was in effect.

7. Robustness Tests

We test the robustness of the results using alternative specifications, samples, and time periods. In so doing, we also address a potential concern that the timing of the repeal of the OMM Exception, which affected only optionable stocks, coincided with changes in regulations that affected all stocks.

A. Robustness Tests 1 and 2: Difference-in-difference analysis of alternate time periods

Our first robustness test adds data from the third quarter of 2008. Here, we separate the data periods by the rule change announcement date, September 17, 2008, and compare the periods before and after that date. The results from this specification are identical in direction and similar in magnitude to those when the third quarter is omitted. For optionable stocks relative to non-optionable stocks, after the OMM Exception elimination, FTDs are 30 percent

lower and FTDs as a percentage of shares outstanding are 6.5 percent lower. The likelihood of optionable stocks being on the Threshold List declines by 2 percentage points relative to non-optionable stocks. After the Exception removal, the cost to borrow optionable stocks is 26 basis points higher than the spread to borrow non-optionable stocks.

Our second robustness test compares the second quarters of 2008 and 2009. We do this to test whether our results persist. In 2008, FTDs in optionable stocks are 65 percent higher and FTDs as a percentage of shares outstanding are almost 9 percent higher than those in non-optionable stocks in 2009. Further, we find a 3 percentage point drop in the mean likelihood that an optionable stock will appear on the Threshold List relative to a non-optionable stock. Finally, mean stock borrow costs for optionable stocks range between 21 and 23.5 basis points higher for optionable stocks in 2009. For both robustness tests, all results are statistically significant at the 1 percent level.

B. Robustness Test 3: Russell 3000 stocks that changed optionability

We test the hypotheses that the trading pattern of optionable stock differs from that of non-optionable stock due to the OMM Exception, using only the second quarter of 2008 data (when the OMM Exception was in effect). Here, we exploit variations in 82 Russell 3000 stocks that changed from being non-optionable to optionable in the second quarter of 2008.

In this new specification, the point estimates are identified by the variation of these 82 stocks. These stocks are our treatment group. Our control group is Russell 3000 stocks whose options status did not change in the second quarter of 2008. Given that there are relatively few stocks in our treatment group, we expect that the precision of the estimates is much lower than those reported before. Using this subsample also likely produces weaker results than those in

previous specifications because many of the 82 stocks became optionable at the end of the second quarter, generating only a few observations to estimate the effect of the option status.

Finally, we expect that both the magnitude and the persistence of the effects of changes in the optionable stock status are smaller than in previous estimates. This is because we analyze only a relatively short time period, and it takes several days for FTDs to register at the clearinghouse and even longer for stocks to appear on the Threshold List.

Table 8 contains results from this new specification, using only data from the second quarter of 2008 when the OMM Exception was in effect. As with previous specifications, we include the stock borrow spread and the natural log of volume. The point estimates of interest are the indicators for whether a stock is optionable and the interaction of this variable with the stock borrow spread.

The dependent variables in Table 8 are log FTDs in columns 1 and 2, FTDs as a percentage of shares outstanding in columns 3 and 4, and whether a stock was on the Threshold List in the columns 5 and 6. For each dependent variable, we estimate the base specification first and then include the spread, trading volume, and an interaction term between spread and optionability. In all base specifications, the coefficient on optionability has the predicted positive sign. When a stock becomes optionable, log FTDs, FTDs as a percentage of shares outstanding, and the likelihood of being on the Threshold List all increase.

The point estimates on optionable stock are statistically significant in the regressions with log FTDs and FTDs as a percentage of shares outstanding as the dependent variables. When we control for volume and spread, the point estimates on the option status become insignificant. Further, when the dependent variable is FTDs as a percentage of shares outstanding or presence

on the Threshold List, the spread for optionable stock has the predicted positive and statistically significant sign, lending support to Hypothesis 2.

We also estimate specifications as in Table 8 using alternative reference groups in just the second quarter of 2008. In one specification, we estimate the effects of the OMM Exception using those stocks that had a change in their option status and only the subsample of stocks that were optionable throughout that quarter. In another, we estimate the effects using the group of stocks that experienced a change in their option status and only the subsample of stocks that were not optionable throughout that quarter. In a final specification, we exclude stocks from the regression that did not incur a change in their optionable status. As in Table 8, all these specifications include ticker fixed effects. The estimates for these alternate specifications are similar to those reported in Table 8.

C. Robustness Test 4: Daily indicator variables

Another concern may be that daily overall market activity in the second and fourth quarters of 2008 is correlated with the SEC rule change and that this daily activity may explain our results. Thus, we include an indicator variable for each trading day. This allows for a functional form more flexible than a control for the overall market activity, such as daily volatility or the Russell 3000 Index. When we include an indicator for each trading day, we obtain results that are quantitatively and qualitatively similar to those reported above.

D. Robustness Test 5: Dollar value of FTDs

We have heretofore discussed FTDs in terms of shares that have failed to settle, both as a logarithm and as a percentage of shares outstanding. An alternative is to analyze the dollar value

of daily net fails. We therefore re-estimate equations (1) and (2) using the logarithm of the dollar value of fails as the dependent variable.

When we re-estimate equation (1) using dollar values, the point estimates show that eliminating the OMM Exception reduced the dollar value of fails by 57–59 percent. These results are statistically significant at the 1 percent level and provide additional support for Hypothesis 1.[27]

When we re-estimate equation (2) using the logarithm of the dollar value of fails, the point estimate on *Spread*OMM Exception Elimination* is 0.53. This indicates that, after the rule change, a 100 basis point increase in borrow rates decreases the value of fails by 53 percent. Again, all point estimates are statistically significant at the 1 percent level. Thus, our results hold regardless of whether we consider FTD quantities or dollar values for our analysis.

E. Robustness Test 6: Hard-to-borrow stocks

We re-estimate equation (3) to examine the effects of the Exception rule change on hard-to-borrow stocks only. First, we limit the sample to threshold securities. For this subsample, elimination of the OMM Exception increased stock borrow spreads by 157 basis points. This is about four times higher than the 35-36.5 basis point increase for the full sample documented in Table 6. Next we re-estimate equation (3) using the subsample of negative rebate stocks, which we characterize as hard-to-borrow. For this group, elimination of the Exception increased stock borrow spreads by 530 basis points. All results are significant at the 1 percent level.

[27] We omit results for an additional robustness test in which we shift FTDs back in time by three days to account for the T+3 settlement cycle. The point estimates are identical in direction, and similar in magnitude and statistical significance, to those reported in the tables. All non-reported results are available on request from the authors.

8. Conclusion

This paper investigates how changes to financial market rules and institutions affect incentives to trade stocks. We show that elimination of the OMM Exception to SEC Regulation SHO's trade close-out requirements changed traders' incentives to fail to deliver optionable and non-optionable stocks differently. Optionable stocks incurred smaller and less persistent FTDs than non-optionable stocks after the Exception elimination was in effect, and FTDs in optionable stocks were less sensitive to changes in stock borrow spreads.

We also show that, after the Exception was eliminated, optionable stocks became more expensive to borrow. This is consistent with the prediction that there was lower demand to borrow optionable stocks while the Exception was in effect. These results suggest that elimination of a market making close-out exception raised the cost to sell short through the options market. Finally, we find that elimination of the Exception reduced the quantity of outstanding options contracts. From this, we conclude that the OMM Exception elimination raised options prices and thus lowered options market liquidity.

Elimination of the Exception closed a loophole that allowed OMMs to incur fewer costs by failing when the cost of borrowing stock for shorting purposes was high. These results are consistent with SEC, SRO, FINRA concerns about abuses by market makers who were not engaged in bona-fide market making. These abuses resulted in multiple enforcement actions against OMMs including Arenstein (AMEX 2007a and 2007b) and Wolfson (SEC 2012). Though the Exception had reasonable origins, it ultimately produced opportunities for misuse and fraud.

Due to the incomplete and imprecise nature of settlement data, however, little can be known about trade origination from public data sources. Continuous net settlement makes it impossible for parties other than the clearing firms to distinguish between trades executed by

market makers and customers or to associate fails with specific trades. As a result, publicly available data regarding unsettled positions at the clearinghouse cannot be linked to specific market makers or specific trades by investors or institutions.

Nevertheless, the AMEX (2007a and 2007b), SEC (2012), and other enforcement actions suggest that OMMs may have played a role in the rise in FTDs between 2005 and 2008. Moreover, the Wolfson case (SEC 2012) shows that OMMs had an incentive to naked short sell and continuously fail to deliver threshold stocks to provide inventory to large prime brokers.

Our analysis documents a tension between certain institutions that foster liquid markets and the potential misuse of those institutions. Regulations designed to promote liquidity may alter incentives, create new trading opportunities, distort prices, and undermine prompt trade settlement. Thus, our paper underscores the fact that well-intentioned regulations can have important unintended economic consequences.

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Table 1
Descriptive statistics: Russell 3000 Index

The sample is 2,952 stocks from the Russell 3000 Index. The unit of observation is daily trading data per stock in the second and fourth quarters of 2008.

Variable	Mean	Std. Dev.	Min	Max	N
		Second Quarter 2008			
Fails to deliver (FTDs)	51,717.43	249,626.8	0	1.65E+07	186,439
Volume	1,575,539	5,042,370	0	3.66E+08	186,439
Shares Outstanding (in millions)	143.22	467.15	1.24	9,980	186,439
(FTDs/Shares Outstanding)*100	0.114	0.706	0	37.30203	186,439
Regulation SHO Threshold List	0.048	0.214	0	1	186,439
Spread	1.180	2.985	-2.89	40.625	178,554
Options Open Interest (in millions)	0.446	0.938	0	31.558	130,438
		Fourth Quarter 2008			
Fails to deliver (FTD)	15,386	129,682.4	0	1.14E+07	179,670
Volume	2,164,941	8,826,681	0	1.03E+09	179,670
Shares Outstanding (in millions)	143.32	467.00	1.24	9,950	179,670
(FTDs/Shares Outstanding)*100	0.022	0.242	0	31.73378	179,670
Regulation SHO Threshold List	0.0088	0.093	0	1	179,670
Spread	1.080	4.265	-4.8	63.05	178,667
Options Open Interest (in millions)	0.399	0.767	0	19.49	131,818

Table 2
OMM Exception elimination: difference-in-difference tables

N=366,109. The two periods compared are (a) one financial quarter before OMM Exception elimination (2008:Q2) and (b) one financial quarter after OMM Exception elimination (2008:Q4). Standard errors are in parentheses. Fails-to-deliver data are from the SEC Freedom of Information Act (FOIA) Office. Shares outstanding data are from Bloomberg. Regulation SHO Threshold List data are from the NYSE, NASDAQ, NYSE ARCA, AMEX, and CHX.

A: Log of fails-to-deliver

	2008:Q2	2008:Q4	Difference
Optionable Stocks	3.322	1.610	-1.711
	(0.014)	(0.011)	(0.018)
Non-optionable stocks	1.904	0.566	-1.34
	(0.018)	(0.011)	(0.022)
Difference	-1.419	-1.045	-0.374
	(0.025)	(0.019)	(0.032)

B: FTDs as a percentage of shares outstanding

	2008:Q2	2008:Q4	Difference
Optionable Stocks	0.139	0.025	-0.113
	(0.002)	(0.001)	(0.002)
Non-optionable stocks	0.055	0.012	-0.043
	(0.001)	(0.001)	(0.001)
Difference	-0.084	-0.013	-0.070
	(0.004)	(0.001)	(0.004)

C: Likelihood on the Regulation SHO Threshold List

	2008:Q2	2008:Q4	Difference
Optionable Stocks	0.057	0.011	-0.046
	(0.001)	(0.000)	(0.001)
Non-optionable stocks	0.029	0.004	-0.025
	(0.001)	(0.000)	(0.001)
Difference	-0.028	-0.007	-0.021
	(0.001)	(0.001)	(0.001)

Table 3

The impact of the OMM Exception elimination on settlement failures

The dependent variable in (1) through (4) is the log of FTDs; the dependent variable in (5) through (8) is daily FTDs as a percentage of shares outstanding. The two periods compared are 2008:Q2 and 2008:Q4, one financial quarter before and after OMM Exception elimination. All regressions include stock (ticker) fixed effects, and, in all regressions, we cluster standard errors by stock and trading day. Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.1.

	Log of fails-to-deliver				Fails as a percentage of shares outstanding			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fourth Quarter = 1, 0 otherwise	-1.303***	-1.424***	-1.430***	-1.396***	-0.042***	-0.050***	-0.054***	-0.048***
	(0.134)	(0.137)	(0.137)	(0.141)	(0.006)	(0.007)	(0.008)	(0.007)
OMM Exception Elimination=1, 0 otherwise	-0.372**	-0.325**	0.199	0.169	-0.071***	-0.070***	0.093***	0.087***
	(0.156)	(0.154)	(0.144)	(0.149)	(0.017)	(0.017)	(0.021)	(0.020)
Spread			0.457***	0.548***			0.116***	0.134***
			(0.056)	(0.099)			(0.021)	(0.025)
Spread*OMM Exception Elimination			-0.436***	-0.439***			-0.132***	-0.132***
			(0.052)	(0.053)			(0.025)	(0.025)
Spread*Optionable Stock				-0.110				-0.022***
				(0.074)				(0.007)
Log volume		0.432***	0.387***	0.383***		0.038***	0.022***	0.022***
		(0.043)	(0.042)	(0.042)		(0.009)	(0.004)	(0.004)
Optionable stock=1	-0.010	-0.247	-0.241	-0.154	-0.008	-0.017*	-0.004	0.013
	(0.216)	(0.207)	(0.207)	(0.202)	(0.010)	(0.010)	(0.010)	(0.011)
N	366,109	363,249	355,560	355,560	366,109	363,249	355,560	355,560
R-squared	0.36	0.37	0.38	0.38	0.49	0.49	0.60	0.61

Table 4
The impact of the OMM Exception elimination on settlement failures: short sale ban stocks excluded

The dependent variable in (1) through (4) is the log of fails-to-deliver; the dependent variable in (5) through (8) is daily fails-to-deliver as a percent of shares outstanding. The two periods compared are 2008:Q2 and 2008:Q4, one financial quarter before and after OMM Exception elimination. All regressions include stock (ticker) fixed effects, and, in all regressions, we cluster standard errors by stock and trading day. Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.10.

	Log of fails-to-deliver				Fails as a percentage of shares outstanding			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fourth Quarter = 1, 0 otherwise	-1.302***	-1.426***	-1.435***	-1.406***	-0.040***	-0.049***	-0.054***	-0.046***
	(0.142)	(0.144)	(0.145)	(0.152)	(0.007)	(0.008)	(0.009)	(0.007)
OMM Exception, Elimination=1, 0 otherwise	-0.389**	-0.348**	0.177	0.151	-0.078***	-0.078***	0.093***	0.086***
	(0.167)	(0.164)	(0.154)	(0.161)	(0.019)	(0.019)	(0.022)	(0.020)
Spread			0.437***	0.507***			0.117***	0.137***
			(0.056)	(0.106)			(0.022)	(0.026)
Spread*OMM Exception Elimination			-0.422***	-0.425***			-0.134***	-0.135***
			(0.051)	(0.052)			(0.026)	(0.026)
Spread*Optionable Stock				-0.082				-0.023***
				(0.083)				(0.008)
Log volume		0.476***	0.423***	0.420***		0.044***	0.026***	0.025***
		(0.048)	(0.046)	(0.046)		(0.010)	(0.006)	(0.005)
Optionable stock=1	0.043	-0.269	-0.258	-0.199	-0.007	-0.022*	-0.003	0.013
	(0.271)	(0.258)	(0.256)	(0.250)	(0.012)	(0.013)	(0.012)	(0.013)
N	316,913	314,988	308,309	308,309	316,913	314,988	308,309	308,309
R-squared	0.36	0.36	0.38	0.38	0.49	0.49	0.61	0.61

Table 5
The Impact of the OMM Exception Elimination on Persistent Settlement Failures

The dependent variable is an indicator variable equal to one if a stock is on the Regulation SHO Threshold List. Specifications (1) through (4) use the full sample; specifications (5) through (8) omit short sale ban stocks. The two periods compared are 2008:Q2 and 2008:Q4, one financial quarter before and after OMM Exception elimination. All regressions include stock (ticker) fixed effects, and, in all regressions, we cluster standard errors by stock and trading day. Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.10.

	On Threshold List = 1, 0 otherwise All stocks				On Threshold List = 1, 0 otherwise Short sale ban stocks excluded			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fourth Quarter	-0.025*** (0.005)	-0.027*** (0.005)	-0.027*** (0.005)	-0.026*** (0.005)	-0.019*** (0.005)	-0.021*** (0.005)	-0.021*** (0.005)	-0.020*** (0.005)
OMM Exception Elimination=1, 0 otherwise	-0.021*** (0.007)	-0.020*** (0.007)	0.024*** (0.006)	0.023*** (0.006)	-0.027*** (0.007)	-0.027*** (0.007)	0.017*** (0.006)	0.017*** (0.005)
Spread			0.037*** (0.004)	0.040*** (0.005)			0.036*** (0.004)	0.037*** (0.005)
Spread*OMM Exception Elimination			-0.037*** (0.004)	-0.037*** (0.004)			-0.036*** (0.004)	-0.036*** (0.004)
Spread*Optionable Stock				-0.004 (0.003)				-0.002 (0.002)
Log volume		0.007*** (0.002)	0.003** (0.001)	0.003** (0.001)		0.008*** (0.002)	0.003** (0.001)	0.003** (0.001)
Optionable stock=1	-0.002 (0.009)	-0.006 (0.009)	-0.003 (0.009)	0.0004 (0.0086)	0.002 (0.011)	-0.003 (0.011)	0.001 (0.010)	0.003 (0.010)
N	366,109	363,249	355,560	355,560	316,913	314,988	308,309	308,309
R-squared	0.43	0.43	0.52	0.52	0.44	0.44	0.54	0.54

Table 6
The impact of the OMM Exception elimination on stock rebate spreads

The dependent variable is the difference between the daily opening federal funds rate and the stock rebate. All regressions include ticker fixed effects. The two periods compared are 2008:Q2 and 2008:Q4, one financial quarter before and after OMM Exception elimination. All regressions include stock (ticker) fixed effects, and, in all regressions, we cluster standard errors by stock and trading day. Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.10

	Full sample		Short sale ban stocks excluded	
	(1)	(2)	(3)	(4)
Optionable Stock=1	0.377**	0.374**	0.403**	0.406**
	(0.165)	(0.167)	(0.180)	(0.184)
Fourth Quarter	-0.374**	-0.362**	-0.401**	-0.394**
	(0.169)	(0.168)	(0.182)	(0.181)
OMM Exception Elimination	0.352***	0.347***	0.365***	0.364***
	(0.114)	(0.115)	(0.123)	(0.124)
Log volume		-0.034		-0.037
		(0.050)		(0.057)
N	357,221	355,560	309,184	308,309
R-squared	0.72	0.72	0.72	0.72

Table 7
Open interest before and after the OMM Exception Elimination

The dependent variable is the sum of put and call open interest divided by shares outstanding, multiplied by 1,000. The two periods compared are 2008:Q2 and 2008:Q4, one financial quarter before and after OMM Exception elimination. All regressions include stock (ticker) fixed effects, and, in all regressions, we cluster standard errors by stock and trading day. Standard errors in parentheses; *** p<.01, ** p<.05, * p<.10.

	Full Sample	Short Sale Ban Stocks Excluded
	(1)	(2)
Fourth Quarter	-0.031**	-0.030**
	(0.016)	(0.015)
Volume / Shares Outstanding	2.911***	2.244***
	(0.888)	(0.548)
N	262,256	237,784
R-squared	0.90	0.91

Table 8
Effect of change in option status during the OMM Exception

The treatment group is stocks whose option status changed during the second quarter of 2008, one financial quarter before OMM Exception elimination. The control group is Russell 3000 stocks whose option status did not change during this time. All regressions include stock (ticker) fixed effects and, in all regressions, we cluster standard errors by stock and trading day. Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.10.

	Dependent Variables					
	Log fails		Fails as a percentage of shares outstanding		On Threshold List =1, 0 otherwise	
	(1)	(2)	(3)	(4)	(5)	(6)
Optionable stock=1, 0 otherwise	0.935***	0.196	0.043*	-0.032	0.016	-0.001
	(0.303)	(0.218)	(0.024)	(0.024)	(0.024)	(0.024)
Log volume		0.184***		0.009***		-0.003***
		(0.026)		(0.002)		(0.0001)
Spread		0.097***		0.007		-0.0026
		(0.037)		(0.005)		(0.004)
Spread*Optionable Stock		0.055		0.057***		0.012*
		(0.040)		(0.015)		(0.0065)
N	186,439	177,634	186,493	177,634	186,493	177,634
R-squared	0.54	0.54	0.88	0.88	0.74	0.75

Figure 1
Daily Settlement Failures

The vertical axis measures the number of settlement failures in Russell 3000 Index for optionable and non-optionable securities.

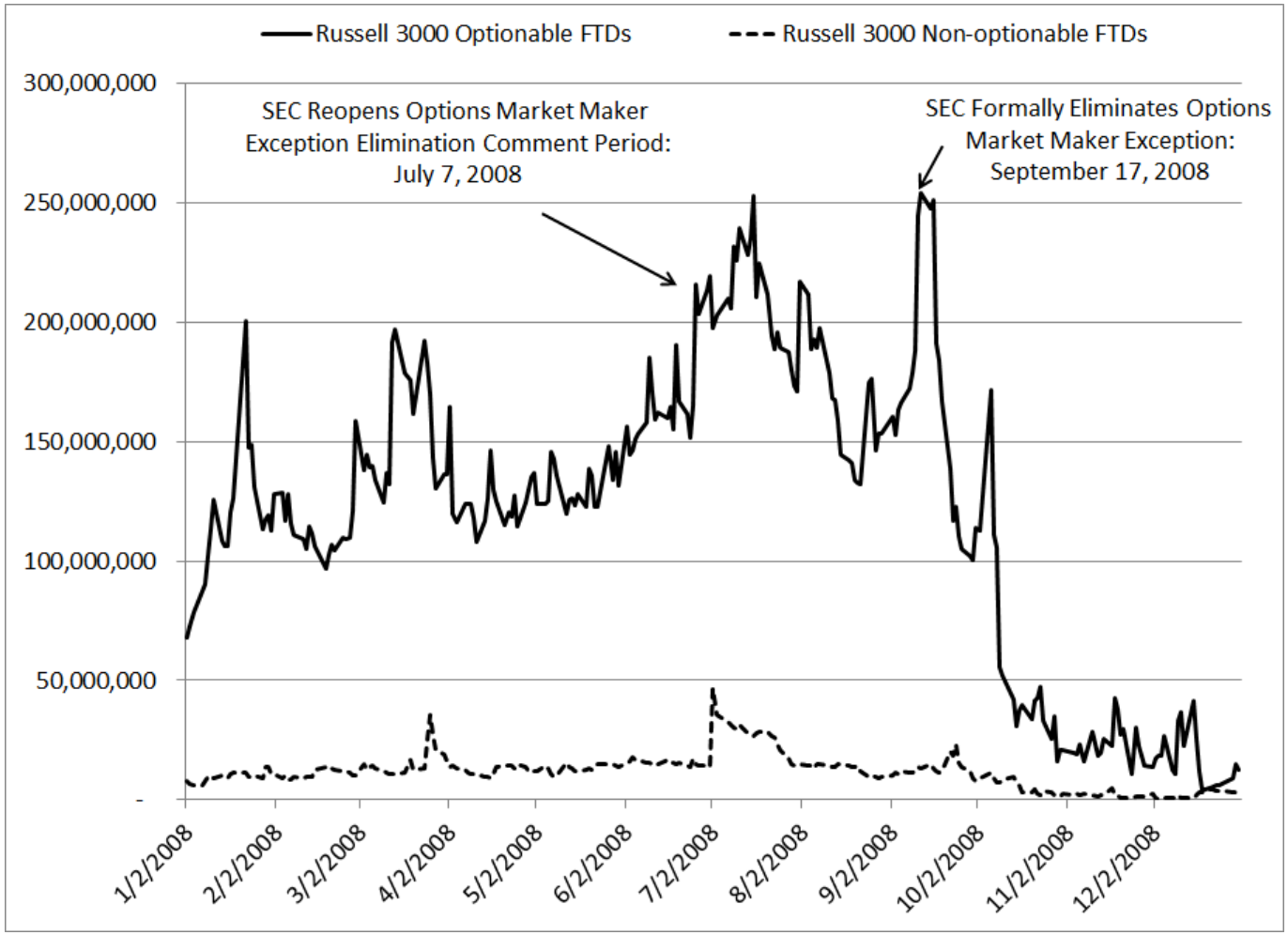

Figure 2
Stocks on the Regulation SHO Threshold List

The vertical axis measures the ratio of optionable and non-optionable Regulation SHO Threshold securities in the Russell 3000 Index to the total number of optionable and non-optionable securities in the Russell 3000 Index.