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# The 2008 Short-Sale Restriction on US Stocks and Its Impact on Their Futures and Corresponding ETFs

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## Abstract

The U.S. September 2008 short sale restriction provoked researchers to explore its various effects. In this paper, three tests are run respectively on samples of equity market, single stock future (SSF) market and exchange traded fund (ETF) market. The findings support the hypotheses that shorting ban reduces liquidity of banned stocks in spot market during ban period, in terms of decreased share volume, return and increased spread; to a limited extent, drives informed investors who can create synthetic short positions from spot market to SSF market; and harms relevant ETF performances, in terms of decreased volume, return and increased spread.

Key Words: Short sale restriction, market liquidity, single stock future market, exchange traded fund market

# Contents

## 1. Introduction

The impact of short selling has always been a topic of discussion. While one side praises short sellers' contribution on market liquidity and price discovery, the other side blames them as sinner responsible for the financial market collapse during the 1930s.

On September 18, 2008, the U. S. Securities and Exchange Commission (SEC) surprised market with an emergency announcement to temporarily restrict short selling on a long list of stocks in spot market in order to support prices of financial stocks and prevent deeper crisis. Did they really succeed in stabilizing market? What are the exact effects and side-effects of this decision? Financial economists and empirical researchers have done various studies during the past two years. Without doubt, the conclusions never converge. However, major areas of study are concentrated on equity market efficiency and derivative market reactions. In derivative markets topics, most are related to option market analysis, in terms of trading volume, delta volume, intraday quoted spread, effective spread, so on and so forth. Thus it might be more interesting and important to find out other derivative market performances during the short sale restriction.

By running three sets of tests, this paper analyzes empirical phenomena on how equity market, single stock future market and exchange traded fund market were impacted by the U.S. September 2008 shorting ban. It is different from previous studies in the several factors below. Firstly, unlike most research limited on a single exchange market, this paper includes sample from three major stock exchange markets. Secondly, this paper combines data from future markets to prove effects of the shorting ban. Thirdly, this paper introduces study of relevant ETF performance to see further the impact of shorting ban on market liquidity. The aim of this analysis is to confirm that shorting ban have significant effects on underlying stock markets regardless of exchange, and to explore relationships in short sale restriction between spot market and derivative markets.

The rest of this paper is organized in the following way. In section 2, previous studies and findings of the topic are reviewed, and the history, detailed timeline and

characteristics are described of the September 2008 shorting ban. Then data selection, hypotheses and methodology are explained in section 3. Section 4 is mainly focused on market-by-market results from the analysis and their implications. Finally in section 5, I conclude the entire paper and foresee future study directions in extension of this one.

## 2. Timeline and Literature Review

### 2.1 Timeline of the U.S. September 2008 Shorting Ban

The earliest market-wide short sale restriction was implemented back in 1931 when the world economy was going down deeper and short selling was condemned as cause of Wall Street crash[1]. On Sunday, September 20, 1931, UK announced that it abandoned the revised gold standard. In wake of this event, the New York Stock Exchange (NYSE) decided to completely ban short sales for the next day. The ban lasted for two days and prohibited all short sales including those by specialists and other market makers [2]. It was considered successful on preventing the price jump but provoked a likely short squeeze as Boehmer, Jones, and Zhang (2008) recount. From 1932, the lending of shares was controlled by authorization; the NYSE tick was tested and extended into a rule banning shorting activities during a downtick. The rule was also known as uptick rule which was repealed on July 3, 2007 by the SEC release (Release No. 34-55970) under Securities Exchange Act of 1934.

The restriction on short selling of financial stocks in 2008 was a series of regulatory actions aiming on cracking down abuses of naked short sales and failures to deliver on the settlement date during the market plunge. The first step was the March 2008 SEC Chairman Christopher Cox speech entitled "'Naked' Short Selling Anti-Fraud Rule". A second move was the SEC emergency order announcement (Emergency Order 34-58166) on July 15, in which 'naked' short sales were blamed for it "threatens the stability of

[1] Shorts came under fire after the U.S. stock market crash of 1929, and U.S. President Herbert Hoover condemned short selling in 1932. This is cited in a September 26, 2008 Reuters article "Short sellers have been the villain for 400 years".

[2] Richard Whitney, the president of the NYSE, reported later that, due to the fact that specialists and dealers were also prohibited from shorting: Within two hours after short selling was forbidden, the Governing Committee found there was a real danger of technical corners and of crazy and dangerous price advances. Jones, Charles M., 2008, Shorting restrictions: revisiting the 1930's, working paper, Columbia Business School.

financial institutions" [3] and banned on securities of several government sponsored enterprises (GSEs), including Fannie Mae and Freddie Mac, Lehman Brothers Holdings and other 16 companies. The "naked" shorting ban was effective at 12:01 a.m. EDT on July 21, intended to terminate at 11:59 p.m. EDT on July 29, and later extended till August 12, 2008.

After market close of Wednesday, September 17, SEC issued another emergency notice (Emergency Order 34-58572) with a ban on naked shorting in all U.S. stocks, concerning "substantial threat of sudden and excessive fluctuations of securities prices and disruption in the functioning of the securities markets that could threaten fair and orderly markets". [4] The very next day, on September 18, the UK Financial Services Authority (FSA) introduced the provisions on active creation or increase of net short positions in 32 publicly quoted financial companies, effective from midnight that day until January 16, 2009. In addition, from Tuesday, September 23, the FSA required daily disclosure of all net short positions in excess of 0.25% of the ordinary share capital of the relevant companies held at market close on the previous working day.[5]

Following that action, the SEC, on the same day, issued two emergency orders. The first one (Emergency Order 34-58591) required the institutional investment managers to file their daily detailed short sale information during the past week of position value higher than $100,000,000 or higher than 0.25% of the security's outstanding capital, except for short sales in option market. The second order (Emergency Order 34-58592) restricted all persons from short selling of 797 companies[6], majorly in the financial sector. This order was immediately effective as well. It is interesting to notice that the SEC, unlike the NYSE in 1931, allowed a limited exception for "certain bona fide market makers" [7], such as registered market makers, block positioners, or other market makers obligated

[3] SEC Enhances Investor Protections Against Naked Short Selling, Immediate Release 2008-143, Washington, D.C., July 15, 2008, http://www.sec.gov/news/press/2008/2008-143.htm
[4] SEC, Securities Exchange Act of 1934, Release No. 34-58572/September 17, 2008.
[5] FSA statement on short positions in financial stocks, FSA/PN/102/2008, September 18, 2008 http://www.fsa.gov.uk/pages/Library/Communication/PR/2008/102.shtml
[6] There initially were 799 companies, 2 was not listed at that time. Cited Boehmer, Jones, and Zhang (2008)
[7] SEC, Securities Exchange Act of 1934, Release No. 34-58592/September 18, 2008.

to quote in the over-the-counter market. Moreover, the SEC granted a 24-hour delay of effectiveness for option market makers who sell short as bona fide market making or hedge as directly linked to the so-called market making, in order to facilitate the expiration of options on September 20. This order intended to cover 10 business days till 11:59 p.m. EDT on October 2, with a possibility of further extension to 30 calendar days.

As the orders were announced all of sudden, on Sunday, September 21, 2008, the SEC added supplementary details in the amendment (Release No. 34-58611). In the Amendment, the SEC ordered that i) listing markets were authorized to add or remove companies they considered necessary in the initial ban list; ii) short sales were not banned of equity options or future contracts that were drawn before the ban remained effective in execution; all market makers were excluded from the ban, including over-the-counter market makers who effected bona fide market making in derivatives based on securities in the initial banned list, exchange traded funds (ETFs) or exchange traded notes; iii) the exempted market makers should not knowingly effect a short sale as part of their bona fide market making "if the customer's or counterparty's transaction will result in the customer or counterparty establishing or increasing an economic net short position (i.e., through actual positions, derivatives, or otherwise) in the issued share capital of a firm covered by the Order".[8] Boehmer, Jones, and Zhang (2009), Battalio and Schultz (2010) speculate that the vague wording of the last element seems to give market makers an incentive to avoid learning their customers' net positions.

On Monday, September 22, echoing the Amendment, the NYSE added 31 companies in the morning and 40 additional ones after market close. Another 4, 12, 9, 7 stocks were added respectively on Tuesday, Wednesday, Thursday, and Friday. [9] These firms included those seemingly industrial ones but having large finance subsidiaries, such as General Motors and General Electric, and those only considered financial stocks on a broad definition, such as CVS Caremark and IBM. Several broker dealer and asset management stocks asked for removal and were voluntarily opted out from NYSE or

[8] SEC, Securities Exchange Act of 1934, Release No. 34-58611/September 21, 2008.
[9] NYSE Final Consolidated Exchange Covered Short Sell List October 08, 2008.
http://www.nyse.com/about/listed/1222078675703.html

Nasdaq in the following days for their revenues rely on viability of short sales.[10] Consequently, authorities of several other countries, for example, Australia and Spain also implemented similar shorting bans.

On October 2, 2008, the SEC announced an extension (Order 34-58723) to postpone the expiration of the shorting ban until either three business days following President's signing of enactment of the bailout package (formally known as H.R. 1424, the Emergency Economic Stabilization Act of 2008) or October 17, 2008. As the package is passed by both houses of Congress and signed by President Bush immediately after, the SEC then extended the ban until 11:59 p.m. EDT on October 8, 2008. Short selling was again permitted in all listed stocks as long as with compliance to the naked shorting ban.

Later in the year end of 2008, the SEC regretted over the unintended market consequences and side effects caused by the ban[11], which proved the importance to analyze and understand the effects of this temporary shorting ban.

## 2.2 Literature Review

The discussion of short sale restriction and its effects is not a recently developed topic. Financial economics have long viewed the shorting ban as counterproductive on market efficiency. Miller (1977) suggests that pessimists are kept away from the market during the ban, leaving only optimistic opinions which lead to potentially overpriced shares. The Harrison and Kreps (1978) model also agrees that short sale restriction in a market with heterogeneous expectations would result in higher market price whether or not the market would reopen. Diamond and Verrecchia (1987), on the other hand, contend that rational market players are aware of the absence of pessimists during the shorting ban. They conclude that short sale prohibitions do not necessarily lead to overpriced stocks but do slow down the pace of price adjustments to negative information and decline

[10] These removals included broker-dealers and asset managers who did not want to look hypocritical, as their revenues relied on the continued viability of short sales. Boehmer, Ekkehart, Charles M. Jones and Xiaoyan Zhang, 2009, Shackling short sellers: The 2008 shorting ban, Columbia Business School Working Paper.

[11] Cox told Reuters in a telephone interview from the SEC's Los Angeles office late on Tuesday. "The costs appear to outweigh the benefits." This is cited in a Reuters article. http://www.reuters.com/article/2008/12/31/us-sec-cox-interview-idUSTRE4BU3FL20081231

market liquidity.

Other researchers provide some theories on market structure changes caused by short sale restriction. Allen and Gale (1991) argue that short sale could cause market crash and potentially harm economy stability. Bernardo and Welch (2002) minimalist model of a run on a financial market implies that shorting constraints could prevent financial crisis by deterring some market players from front-running others and that crisis are not caused by liquidity shocks, but by the fear of future liquidity shocks. Hong and Stein (2003) model finds when short sale is unconstrained market tends to display extreme negative returns more frequently.

Empirical studies support both sides on theories of stock valuation. Figlewski (1981), Figlewski and Webb (1993) are consistent with Miller (1977)'s overvaluation effect from shorting ban by finding subsequently low returns on stocks with relatively high short interests. Jones and Lamont (2002) show future low return and high price earnings ratio evidence from those stocks with high shorting costs in the 1920s and 1930s. Similarly, Chen, Hong, and Stein (2002) find overpricing and consequent underperformance for stocks with a decreased ownership breadth[12]. Lamont and Thaler (2003), Mitchell, Pulvino, and Stafford (2002) and Lamont and Stein (2004) show that restriction on establishing short selling positions hinders arbitrage during the early 21st century internet bubble. By analyzing prohibition of access on stock options, another possible way for shorting ban, Ofek and Richardson (2003) suggest that high prices were artificially driven for those internet stocks and removing the constraints caused the price collapse. Diether, Werner, and Lee (2009) study the 2005 Regulation SHO's pilot program to temporarily suspend price tests in the U.S. and find increased intraday volatility but limited effects on daily volatility thus insignificant impacts on prices and market liquidity.

[12] A decrease in breath of ownership indicates limitations on short seller access to stocks to borrow. See Helmes, Uwe, Julia Henker and Thomas Henker (Working Paper), "The effect of the ban on short selling on market efficiency and volatility".

The implementation of short selling ban in other countries around the world also draws researchers to apply theories to their domestic markets. Ho (1996) studies the shorting ban during 1985 crisis of Singapore and finds increased volatility in stock returns. , Frino, McCorry, and Swan (1998) show evidence from the Australian Stock Exchange (ASX) that short sellers are well-informed market players so they have more impacts on share price. Biais, Bisiere, and Decamps (1999) find the Paris Bourse spot market reflects faster to good information than bad information with presence of short sale restriction. Rhee (2003) suggests that Japanese uptick rule has affected positively the stock prices. Chang, Cheng, and Yu (2007) see upward bias[13] in 1994-2003 Hong Kong Market for short-sales constrained stocks. This is unique as Hong Kong stock market only allows short sales on a designated security list.

Studies also concern empirical results of short sale restrictions on market structure and market quality. Charoenrook and Daouk (2005) contend that short selling would benefit overall market quality by proving less volatile aggregate market returns across 111 countries. Bris, Goetzmann, and Zhu (2007) analyze 47 countries and find significantly less negative skewness for individual stock returns and slower downward moves for bad news in markets under short sale constraints. Boehmer and Wu (2008) see reduced drift after earnings announcement with short selling and indirectly prove price efficiency. Jones (2008) explores regulation changes in the U.S. history and their impacts on liquidity and price discovery. He shows significant price effects during 1930s' shorting prohibition and tightened bid-ask spreads after the introduction of uptick rule.

The 2008 shorting ban was implemented under the extreme market conditions and had worldwide implications thus become a big topic discussed by researchers. Using Goldman Sachs order flow, Gurliacci, Jeria, and Sofianos (2008) find shorting executed value of stocks on the initial banned list decreased sharply during the ban and bounced back after the ban, while buying value has little fluctuation. Boehmer, Jones, and Zhang

[13] We find that short-sales constraints tend to cause stock overvaluation and that the overvaluation effect is more dramatic for individual stocks for which wider dispersion of investor opinions exists. We also document higher volatility and less positive skewness of individual stock returns when short sales are allowed. See Chang, Cheng, and Yu, October 2007, "Short-sales constraints and price discovery: Evidence from the Hong Kong market", The Journal of Finance, Vol.62.

(2009) examine the banned and unbanned stocks listed on NYSE and find huge decrease in shorting activity of 85%, increase in prices and severe degradation in market quality of banned stocks, in terms of spreads, volume, price impacts and intraday volatility. Gagnon and Witmer (2009) see obvious increase in differences of prices between the U.S. and Canada and migration of trading volume for cross-listed stocks during the ban and conclude overpricing of shares under restriction. In addition, Boulton and Braga-Alves (2009) suggest that the July 2008 naked shorting ban on 19 stocks proves to have negative impact on liquidity of banned stocks.

The analysis on short sale restrictions does not stop on the equity market. As sophisticated investors would always compose synthetic short positions in the equity derivative markets, researchers have done various work and found important evidences on relationships between financial markets.

On the option market side, Danielsen and Sorescu (2001) show existence of listed option could slightly decrease stock prices and somehow lessen effects of short sale prohibitions. Kolasinksi, Reed, and Thornock (2009) interpret the falling of stock market quality and uprising of short selling cost during the ban as evidence that shorting activity is transferred from equity market to option market for informed investors search exposure in the latter. Harris, Namvar, and Phillips (2009) show that abnormal returns are mostly concentrated on stocks without listed options during the restriction and remain their level even after the ban. By using daily closing data on options, Grundy, Lim and Verwijmeren (2010) see significant lower option volumes and higher option spreads of banned stocks in comparison to unbanned control group. Contrarily, using intraday trading data, Battalio and Schultz (2010) and Cakici, Goswami and Tan (2010) document insignificant dollar and size volume results for put options, and do not agree to disagree that short sellers migrate from stock market to option market during the ban. However, all three papers converge in the statement that put-call parity violation for banned stocks becomes more frequent during the short sale restriction.

On the future market side, Fung and Draper (1999) contend that short selling increased

market efficiency from evidence of index future contracts on Hong Kong Hang Seng Index under short sale constraints. Hietala, Jokivuolle and Koskinen (2000) study the 1988-1994 Finland index future markets and conclude that stock price is less informative than the future price under short sale restrictions even for positive information. Danielsen, Van Ness and Warr (2009) document that when shorting is not prohibited, introduction of single stock future (SSF) results in declining short selling activities and cost of borrowing in underlying stock and prove migration of informed investors from spot market with microstructure evidence.

On the equity related fund side, Koski and Pontiff (1996) provide evidence that closed-end equity mutual funds investing in derivatives have similar risk and net return performance with those not doing so, and derivatives might dampen negative changes for equity mutual funds. Cherry (2004) studies exchange traded funds and finds them 17% more volatile than underlying stocks. They also assert that 70% of the excess volatility can be explained by explained by inverse price, dividend yield and asset class of a fund, i.e. transaction and holding costs, which repress arbitrage application.

## 3. Data, Hypotheses and Methodology

### 3.1 Data

Compared to previous studies, the data used in this paper are to a certain extent constrained to availability. Majorly there are from five data sources, most of which public information. Firstly, SEC emergency order 34-58592 provides the list of 797 initially banned companies. A second list of stocks added or removed later on can be found on NYSE website. Then all stock relevant profiles are retrieved from Center for Research in Security Prices database (CRSP), which is available through our school partnership with Wharton Research Data Services (WRDS). From OneChicago website, I downloaded listed single stock future product profiles. The historical information is in daily frequency. Last but not least, historical daily performance of exchange traded funds (ETFs) is also accessible in CRSP, with share code of 73. However, as not all the ETFs publish their components, especially historical asset value composition in 2008, I concentrated on iShares ETFs with equity underlying assets. Detailed historical end of

month composition can be found on us.ishares.com. CRSP US Stock Database maintains comprehensive stock information from as early as 1925, and of price, return and volume in NYSE, American Stock Exchange (AMEX) and National Association of Securities Dealers Automated Quotations (NASDAQ). Regulated by the SEC, OneChicago offers more than 2000 products, clears at the Options Clearing Corporation (OCC). iShares is the largest ETFs provicer in the world. As a partner of BlackStone, it also guarantees the liquidity and transparency of traded funds. The quality of databases I used supports the validity of my results.

The sample period includes 42 trading days in 2008, 14 days from August 29 to September 18 (pre-ban), 14 days from September 19 to October 8 (during ban), and 14 days from October 9 to October 28 (post-ban). It's noticeable that the pre-ban period is two weeks after the expiration of SEC July 2008 shorting ban (end on August 12) on 19 stocks. Therefore the side-effects from the July naked ban could be avoided in the tests.

Raw data are also processed from the original versions through sources. By using CRSP share code of 11 (common stock), I filtered out preferred stocks, warrants, American Depositary Receipts (ADRs), closed-end funds, and Real Estate Investment Trust (REITs), and found 739 common stocks from the SEC initial banned list and 3393 unbanned common stocks. I further excluded the stocks on NYSE's add or remove list since September 22, 2008. To meet the requirement of the study on shorting ban effects, stocks in the sample should have complete information for all 42 days of the analysis (14 days each, respectively for pre-ban, during ban and post-ban periods). Hence those underlying securities with null number of trades, null or lower than 1000 share volume in any of the 42 days are dropped out of the sample. These two criteria leave 184 stocks from the initial banned list and 1102 stocks never banned during the test period, regardless of the markets on which they are traded. The 1150 single stock future data and their underlying stock symbols are extracted from OneChicago list of all ETFs, Exchange for Physical Trades (EFPs) and SSFs products. Due to limitation in transparency of ETFs components, I focused on 6 financial sector equity funds on iShares, and their historical net asset compositions end of September and October 2008. Similar criteria have been

used to select corresponding underlying stocks in SSF and ETF market. Table 1 summarizes the stock selection procedure.

### 3.2 Hypotheses

As this paper aims to examine short sale restriction effects on underlying stock market and relating SSF and ETF market, based on literature, I build the following three hypotheses.

Hypothesis 1: The shorting ban reduces liquidity of banned stocks in spot market during ban period, in terms of decreased share volume, return and increased spread.

Hypothesis 2: The shorting ban drives informed investors who are willing to create synthetic short positions from spot market to SSF market, in terms of increased trading volume and return.

Hypothesis 3: The shorting ban harms relevant ETF performances, in terms of decreased volume, return and increased spread.

### 3.3 Methodology

In order to test the three hypotheses, two groups of stocks are formed. The stocks in initial banned list include those common stocks in SEC emergency order 34-58592 and the stocks in never banned list include those neither in 797 stocks nor in NYSE add/remove list. For spot market and ETF market variables, I run the ordinary least square (OLS) regression on equation (1) below.

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 D_{Banned\ Stock} + \beta_5 D_{Ban\ Period} + \beta_6 D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (1)$$

The dependent variable $y$ indicates the variable to be tested, such as share volume, spread or return. The independent variables $x_1, x_2, x_3$ indicate factors contributing to variations of dependent variable. They can be number of trades, S&P 500 index, Chicago Board Options Exchange Market Volatility Index (VIX) etc, depending on the variable to be tested. $D_{Banned\ Stock}$ , $D_{Ban\ Period}$ , $D_{Banned\ Stock\ \&\ Ban\ Period}$ are dummy variables. $D_{Banned\ Stock}$ equals to one if and only if the stock is in the initial banned list. $D_{Ban\ Period}$ equals to one if and only if the time series is in the ban period from September 19 to

October 8. $D_{Banned\ Stock\ \&\ Ban\ Peridod}$ equals to one if and only if the stock is in the initial banned list and the time series of variable falls into ban period.

For future market variables, similar to Grundy, Lim, and Verwijmeren (2010) test on option market, I run OLS regression on equation (2) below.

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 D_{Banned\ Stock} + \beta_5 D_{Ban\ Period} + \beta_6 D_{Banned\ Stock\ \&\ Ban\ Period} + \beta_7 D_{Post\ Ban\ Period} + \beta_8 D_{Banned\ Stock\ \&\ Post\ Ban\ Period} + \varepsilon \quad (2)$$

The dependent variable $y$, independent variable $x_i$s and first three dummy variables have similar definition as in equation (1), $D_{Post\ Ban\ Period}$ is a dummy variable that equals to one if and only if the time series falls into post-ban period of 14 trading days. $D_{Banned\ Stock\ \&\ Post\ Ban\ Period}$ is another dummy variable that equals to one if and only if the stock is in initial banned list and the time series feature of stock falls into post-ban period. The reason to count in these two additional dummy variables is that expectation on future performance of underlying stock impacts SSF price.

## 4. Results on Testing Effects of September 2008 Shorting Ban

### 4.1 The Effects of Shorting Ban on Equity Market

To test the effects of short sale restriction on equity market, I focus on share volume, return, and percentage quoted spread for both 184 stocks on initial banned list and never banned 1102 stocks. As I have limited access on CRSP, only the daily closing data information of stocks are available, not intraday information. Share volume is defined as total number of shares traded on a single day, without taking over-allotments into account. Return is mainly measured as simple compounding daily holding period return, without dividend, i.e. dividends are considered to be reinvested on ex-distribution date. Percentage quoted spread is defined as ratio of quoted spread (difference between bid and ask) over midpoint, as equation (3) describes below.

$$Percentage\ Quoted\ Spread = \frac{Ask - Bid}{(Ask + Bid)/2} \quad (3)$$

From Table 2 summarized statistics, a clear decline of trading volume can be noticed for stocks in the initial banned list during the ban period. On average, the share volume on

banned stocks decreased by 29.85% whereas volume on never banned stocks increased 3.41% between September 19 and October 8. After the ban relieved, share volumes on banned stocks rose a bit, but still 15.91% lower compared to period prior to the restriction, and never banned stocks gained another 8.51% volume. Returns without dividend show harmful effects of the short sale restriction to banned stocks, since in general their return dropped to negative from 0.94% level pre-ban. For never banned stocks, the performance remained slightly negative through the 42 sample days. In terms of percentage quoted spread, average banned stocks witnessed 64.59% wider spreads (from 0.0697 to 0.1184) during the ban period compared to pre-ban, and another 5.92% wider after the prohibition. Meanwhile, never banned stocks also suffered 45.25% wider spreads during the ban, but experienced extremely tightening in spreads post-ban, as average percentage quoted spread jumped from 0.0910 during ban to -0.0066 two weeks after the ban expiration. These findings are not consistent with Boehmer, Jones, and Zhang (2009) document on NYSE 146 banned stocks and 1066 unbanned stocks, where they see share volume increased by 818,411 shares daily during the ban period for initially banned stocks. They interpret the unexpected increase in share volume as growth in market confidence to the bailout package progress[14]. The possible reason for the discrepancies is that data sample in this paper is larger than previous work and that Boehmer, Jones, and Zhang (2009) consider 34 trading days before the ban, which actually cover the July 2008 naked shorting ban (expired on August 12) on 19 stocks. The overall unprepared market on the sudden ban might count for their lower average 34-day pre-ban share volume. However, the findings in this paper are consistent with previously mentioned research in a way that they report shorting volume decrease to 1.96% from 14.29% during the ban. The decline in share volume cited before could be explained by reduction in shorting volume.

To locate the causes for liquidity diminution, I estimated three OLS regressions on share volume, share return and percentage quoted spread.

[14] "But it is probably not appropriate to causally associate this to the shorting ban. There is considerable news about the progress of the bailout and about the health of financial firms during the ban period, so perhaps this increase in trading volume simply reflects these other influences." See Boehmer, Ekkehart, Charles M. Jones and Xiaoyan Zhang, 2009, Shackling short sellers: The 2008 shorting ban, Columbia Business School Working Paper.

$$Share\ Volume = \alpha + \beta_1\ Number\ of\ Trades + \beta_2\ S\&P\ 500\ Index + \beta_3\ D_{Banned\ Stock} + \beta_4\ D_{Ban\ Period} + \beta_5\ D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (4)$$

$$Share\ Return = \alpha + \beta_1\ Quoted\ Spread + \beta_2\ S\&P\ 500\ Index\ Return + \beta_3\ D_{Banned\ Stock} + \beta_4\ D_{Ban\ Period} + \beta_5\ D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (5)$$

$$Percentage\ Quoted\ Spread = \alpha + \beta_1\ Share\ Return + \beta_2\ S\&P\ 500\ Index\ Return + \beta_3\ D_{Banned\ Stock} + \beta_4\ D_{Ban\ Period} + \beta_5\ D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (6)$$

From Table 3, Panel A, the results from regressions show three significant factors related to share volume, all at 1% level, namely Number of trades, S&P 500 Index and Banned Stock & Ban Period Dummy. The explanation for the first factor is obvious since share volume would definitely decrease with declining times of trading on a banned stock during the restriction. It is also not uncommon to see market index highly related to share volume, as the former is always a performance indicator for market as a whole. The relationships with initially banned stocks and ban period are only significant at 25% level. Thus it is indicated that drop in share volume described earlier can be explained by banned shares and only during ban period.

Panel B reveals positive correlations of excluding dividend share return with Banned Stock Dummy and S&P 500 Index return, and negative correlations of return with quoted spread, Ban Period Dummy and Banned Stock & Ban Period Dummy. All of those are significant at 1% level, with only Banned Stock & Ban Period Dummy significant at 5% level. This finding suggests the initial ban list and ban period contributes largely to the lowered average returns.

Regression results as displayed in Panel C imply that percentage quoted spread is negatively affected by share return, S&P 500 Index return, and Banned Stock & Ban Period Dummy, but positively affected by Banned Stock Dummy and Ban Period Dummy. All of the results are significant at 1% level. This is supportive to the Hypothesis 1 that uprising of stocks spreads is highly due to the shorting ban. My results in

percentage quoted spread echoes Lobanova, Hamid and Prakash (Working Paper) which performed the Wilcoxon matched-pairs signed rank test to prove percentage quoted spread for the banned stocks became statistically significantly larger during the ban period compared to the period before the ban, for both NYSE/AMEX and NASDAQ markets.

To this extent, summarizing results from the regressions, Hypothesis 1 is accepted. The shorting ban indeed reduces liquidity of banned stocks in spot market during ban period, in terms of decreased share volume, returns and increased spread.

In addition, and as Boehmer, Jones, and Zhang (2009), I calculated equally-weighted cumulative raw returns for both initially banned group and never banned group and cumulative abnormal returns (return in excess of S&P 500 index) for the entire sample. Figure 1 shows gradually damaged cumulative raw returns for both banned and unbanned stocks during the short sale prohibition. Even after the ban, cumulative returns did not bounce back to the level prior to the ban. Interestingly, both the banned and unbanned stocks express similar fluctuation, with close performances pre-ban, large decrease to negative during the ban and resembling pattern post-ban. Another point also important to notice is that cumulative raw returns on September 19 for both groups surged. Grundy, Lim and Verwijmeren (2010) argue that one possible explanation can be the announcement on bailout American Insurance Group (AIG) on the same day, which might have boosted market a bit. Figure 2 describes sharp increase in abnormal returns when the ban is announced (the upper curve) and drop in abnormal returns when the ban expires (the lower curve).

### 4.2 The Effects of Shorting Ban on SSF Market

The underlying stocks of SSF market analysis are selected similarly as for spot market. A further requirement is that corresponding data are available from OneChicago. Following these criteria, I confirmed 76 stocks in the initial ban list and 658 stocks in the never banned list. On the SSF market side, as there are limited information on spreads and prices, I concentrated on two factors, price change and volume. Price change in

OneChicago products file refers to daily settlement changes on each future contract compared to the previous day. As each underlying stock has at least two future contracts listed, I further filtered out contract with less than 30 days to expiration to make sure all future contracts data consistent with 42-day sample period. Fortunately, each of the reminding future contracts is on 100 shares of underlying. For the contracts on the same underlying asset, I took average of tested SSF change variable and sum of tested volume variable. The following two OLS regressions are run to test the hypothesis.

$$\begin{aligned} SSF\ Change = {} & \alpha + \beta_1\, Share\ Volume\ in\ Million + \beta_2\, Share\ Return + \beta_3\, VIX \\ & + \beta_4 D_{Banned\ Stock} + \beta_5\, D_{Ban\ Period} + \beta_6\, D_{Banned\ Stock\ \&\ Ban\ Period} \\ & + \beta_7 D_{Post\ Ban\ Period} + \beta_8 D_{Banned\ Stock\ \&\ Post\ Ban\ Period} + \varepsilon \end{aligned} \quad (7)$$

$$\begin{aligned} SSF\ Volume = {} & \alpha + \beta_1\, Share\ Volume\ in\ Million + \beta_2\, Share\ Return + \beta_3\, VIX \\ & + \beta_4 D_{Banned\ Stock} + \beta_5\, D_{Ban\ Period} + \beta_6\, D_{Banned\ Stock\ \&\ Ban\ Period} \\ & + \beta_7 D_{Post\ Ban\ Period} + \beta_8 D_{Banned\ Stock\ \&\ Post\ Ban\ Period} + \varepsilon \end{aligned} \quad (8)$$

The independent variable Share Volume in Million is calculated by dividing share volume of underlying stocks by 1,000,000. The reason is that future contract volumes are much smaller relative to underlying stock. This improvement in independent variable brings underlying share volume down to the same scale of future contract volume. The rest of variables are defined as mentioned before in Data.

The regression results are displayed in Table 4. Panel A gives negative relationships between SSF change and underlying share volume in million, as well as VIX index, significant at 5% and 1% level respectively. On the other hand, significant positive correlations are only found with share return, Ban Period Dummy and Post Ban Period Dummy, all at 1% level. The reminder of variable correlations is not significant even on 10% level. Thus the finding suggests decreased trading volume on the spot market is partially transferred to SSF market, which results in higher changes in settlement prices. Furthermore, the change is strongly related to ban period and post ban period (actually the results are significant at 0.1% level for these two dummy variables), but not necessarily to the banned stocks. One possible explanation is that short sale restriction brought those who intend to have short exposures from the spot market to SSF market

during the ban and on, but they did not just searching for liquidity on banned stocks but also on unbanned ones, therefore impact the SSF market as a whole.

The figures in Panel B tell a more convincing story on relative future contract volume changes associated with underlying assets. A more significant negative correlation is witnessed between future contract volume and underlying stock volume, at level of 1%. Except for Banned Stock & Post Ban Period Dummy, all other variables are significantly positively correlated with future contract volume. Grundy, Lim and Verwijmeren (2010) construct SSF volume per stock by summarizing all daily trading volumes in all future contracts for each stock, then take average on banned and unbanned stock groups. They find trivial volume changes during the short sale restriction and attribute the result to obscurity of SSF market to those market makers looking for short positions. The low adjusted R square for both my tests might due to this factor. This as well suggests that my regression equations can be used on researching correlations between variables, but not as estimation formulas for future performance. The same database of their study as mine makes it plausible to adopt part of their explanations here in this paper. After integrating their findings, it can be conjectured that limited liquidity in spot market has indeed drawn informed investors to SSF market, which can be cited from high correlation with Ban Period Dummy. However, the SSF market is not an easy solution of low-cost stock market substitute as asserted by Danielsen, Van Ness and Warr (2009). The volumes transferred from the spot market are not as large as expected. The increases in volume and settlement changes are widely dispersed all over the market during the ban, not clustered in banned stocks. One possible explanation to this outcome is that future market requires higher margins (both initial margin and maintenance margin) to participate than option market; future contracts less flexible than option ones.

To this extent, Hypothesis 2 is not fully accepted. The shorting ban drives to a limited level of informed investors from equity market to SSF market. The time series of the ban impacts greatly on the SSF market rather than the cross-sectional features of the banned stocks.

4.3 The Effects of Shorting Ban on ETF Market

For the transparency of ETF composition, six financial sector ETFs incepted before 2008 are selected from iShares.com, namely, Dow Jones U.S. Broker-Dealers Index Fund (IAI), Dow Jones U.S. Regional Banks Index Fund (IAT), Dow Jones U.S. Insurance Index Fund (IAK), S&P Global Financials Sector Index Fund (IXG), Dow Jones U.S. Financial Sector Index Fund (IYF), and Dow Jones U.S. Financial Services Index Fund (IYG). The underlying stocks are selected in a similar procedure as described in Data. An additional standard is used here. Stocks should count for at least 3% of net asset value for ETFs with less than 100 underlying stocks and for 1% of net asset value for ETFs with more than 100 underlying stocks. This standard is used so to filter out those stocks with only minor effects on ETF performances, as those stocks with at least 3% or 1% of net asset value compose more than 50% of ETF net assets. Using these criteria, I finalized 92 stocks and estimated the following three OLS regressions.

$$ETF\ Volume = \alpha + \beta_1\ Share\ Volume + \beta_2\ Percentage\ of\ Net\ Asset + \beta_3\ VIX + \beta_4 D_{Banned\ Stock} + \beta_5\ D_{Ban\ Period} + \beta_6\ D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (9)$$

$$ETF\ Return = \alpha + \beta_1\ Share\ Volume\ in\ Million + \beta_2\ Share\ Return + \beta_3\ Percentage\ of\ Net\ Asset + \beta_4 VIX + \beta_5 D_{Banned\ Stock} + \beta_6\ D_{Ban\ Period} + \beta_7\ D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (10)$$

$$ETF\ Percentage\ Quoted\ Spread = \alpha + \beta_1\ Share\ Percentage\ Quoted\ Spread + \beta_2\ Share\ Volume\ in\ Million\ + \beta_3\ Percentage\ of\ Net\ Asset + \beta_4 VIX + \beta_5 D_{Banned\ Stock} + \beta_6\ D_{Ban\ Period} + \beta_7\ D_{Banned\ Stock\ \&\ Ban\ Period} + \varepsilon \quad (11)$$

The independent variable Percentage of Net Asset is the average of September and October net asset value of a stock held by the corresponding ETF. The consideration of these two months is consistent with sample period of 42-trading-day sample period, which only includes one day in month of August (August 29). Other dependent, independent and dummy variables are defined in similar way as above analysis.

Data in Table 5 imply significances of positive relationships on ETF volume with underlying share volume (at 1% level) and Banned Stock Dummy (at 5% level), negative

relationships with percentage of net asset in ETF, Ban Period Dummy (both at 1% level) and VIX (at 5% level), and insignificance of relationship with Banned Stock & Ban Period Dummy. ETF return has only significantly positive correlation with underlying stock returns (at 1% level), and significantly negative correlations with VIX (at 1% level) and Banned Stock & Ban Period Dummy (at 10% level). On the percentage quoted spread side, besides one significant negative relationship found on Banned Stock Dummy, all other independent and dummy variables are significantly positively correlated with ETF percentage quoted spread. Synthesis information from Panel A, B and C suggest the shorting ban in general attracts investors willing to have short positions on banned stocks from spot market to ETF market (positive correlation between ETF volume and Banned Stock Dummy), but actually hurt ETF liquidity and return during ban period, in terms of decreased volume (much more negative significance between ETF volume and Ban Period Dummy), decreased return (positive correlation between ETF return and Banned Stock & Ban Period Dummy) and increased spread (positive correlations between ETF percentage quoted spread and Ban Period Dummy). Therefore, contrary to expectation that market makers migrate to ETF market in search of shorting positions on underlying assets, the finding of this part suggests that short sale restriction in fact did harm to relating ETF performance. Cherry (2004) explains that ETF is a costly arbitrage method to adopt. The transaction costs and holding costs occurred along with the creation of position on ETF might not attract too many informed investors to the market.

To this extent, Hypothesis 3 is accepted. The shorting ban harms relevant ETF performances, in terms of decreased volume, return and increased spread.

## 5. Conclusion and Future Studies

This paper briefly analyzes the September 2008 shorting ban and its effects on equity market and relating derivative markets. Unlike most of the literature's focus on option market, this paper concentrates on single stock future market and exchange traded funds market, by performing three tests respectively on the two markets and their underlying spot market.

The results on spot market suggest effectiveness of the short sale restriction on maintaining and push up performances of stocks in the initial banned list. These stocks exhibited more and positive cumulative abnormal returns. The side-effect also exists. As significantly less trading volume (possibly most of which shorting volume), reduced raw return without dividend and increased spreads are witnessed, liquidity of underlying stocks is diminuated. The findings on single stock future market imply little significance of volume and change variations during the shorting ban. Thus prove the fact that informed investors who wish to take short positions did not directly turn away from spot market to future market. The test on ETF market shut down another door of shorting flows, since it indicates that ETF performance is also harmed by the ban. The decreased volume, return and increased spread indirectly support the statement that trading ETF, as an alternative way for shorting underlying shares, is costly as well.

If shorting volume from the spot market neither flew to single stock future market, nor to ETF market, then where did it go? The initial thought is to the option market. However, as previous studies conclude, trading volumes of banned stocks options also dropped during the restriction. Therefore, firstly, it might be interesting to analyze relative effect occurred to option market versus future market. As most of the sample stocks also have traded options, once with option data in hand, it is possible to separately test impacts on option market and future market. Secondly, a more detailed database on future market might provide some insight on the reason of trivial future trading flows during the restriction. Thirdly, given components of all public traded ETFs, a broader sample could be established to test influence of shorting ban on ETF market and the link with underlying stock market, especially on the way spot market liquidity changes transferred to ETF market.

**Bibliography**


Battalio, Robert and Paul Schultz, 2010, "Regulatory Uncertainty and Market Liquidity: The 2008 Short Sale Ban's Impact on Equity Option Markets", Working Paper, University of Notre Dame.

Beber, Alessandro and Marco Pagano, 2010, "Short-selling bans around the world: Evidence from the 2007-09 crisis," CSEF Working Paper 241, University of Naples.

Boehmer, Ekkehart, Charles M. Jones and Xiaoyan Zhang, 2009, "Shackling Short Sellers: The 2008 Shorting Ban", Working Paper, Columbia Business School.

Bris, Arturo, William N. Goetzmann and Ning Zhu, 2007, "Efficiency and the bear: short sales and markets around the world", *Journal of Finance*, Vol. 62, pages 1029-1079.

Boulton, Thomas J. and Marcus V. Braga-Alves, 2008, "The skinny on the 2008 naked short sale restrictions," Working Paper, Miami University.

Cakici, Nusret, Gautam Goswami and Sinan Tan, 2010, "Equity Options During the Shorting Ban of 2008", Working Paper, Fordham University.

Chang, Eric C., Joseph W. Cheng, and Yinghui Yu, 2007, "Short-Sales Constraints and Price Discovery: Evidence from the Hong Kong Market", *Journal of Finance*, Vol. 62, pages 2097-2122.

Charoenrook. Anchada and Hazem Daouk, 2005, "A Study of Market-Wide Short-Selling Restrictions", Working Paper, Cornell University, Vanderbilt University.

Cherry, Josh, 2004, "The Limits of Arbitrage: Evidence from Exchange Traded Funds", Working Paper, University of California – Berkeley.

Danielsen, Bartley R., Robert A. Van Ness and Richard S. Warr, 2009, "Single Stock Futures as a Substitute for Short Sales: Evidence from Microstructure Data", *Journal of Business Finance & Accounting*, Vol. 36, pages 1273–1293.

Diamond, Douglas W. and Robert E. Verrecchia, 1987, "Constraints on Short-selling and Asset Price Adjustment to Private Information", *Journal of Financial Economics*, Vol. 18, pages 277-311.

Figlewski, Stephen and Gwendolyn Webb, 1993, "Options, Short Sales, and Market Completeness," *Journal of Finance*, Vol.48, pages 761-777.

Gagnon, Louis and Jonathan Witmer, 2010, "Short Changed? The Market's Reaction to the Short Sale Ban of 2008", Working Paper, Queen's University.

Grundy, Bruce D., Bryan Lim, and Patrick Verwijmeren, 2010, "Do Option Markets Undo Restrictions on Short Sales? Evidence from the 2008 Short-Sale Ban", Working Paper, University of Melbourne.

Hamm, Sophia J.W., 2010, "The Effect of ETFs on Stock Liquidity", Working Paper, University of Pennsylvania.

Harrison, J Michael and David M. Kreps, 1978, "Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations," *The Quarterly Journal of Economics*, Vol. 92, pages 323-36.

Helmes, Uwe, Julia Henker and Thomas Henker, 2010, "The effect of the ban on short selling on market efficiency and volatility", Working Paper, University of New South Wales.

Hietala, Pekka, Esa Jokivuolle and Yrjö Koskinen, 2000, "Informed Trading, Short Sales Constraints and Futures' Pricing", Bank of Finland Discussion Paper.

Jones, Charles M., 2008, "Shorting Restrictions: Revisiting the 1930's", Working Paper, Columbia Business School.

Jones, Charles M. and Owen A. Lamont, 2002, "Short Sale Constraints and Stock Returns", *Journal of Financial Economics* Vol. 66, pages 207-239.

Koski, Jennifer L. and Jeffrey Pontiff, 1996, "How Are Derivatives Used? Evidence from the Mutual Fund Industry", Working Paper, University of Pennsylvania.

Kumar, Raman, Atulya Sarin and Kuldeep Shastri, 1998, "The Impact of Options Trading on the Market Quality of the Underlying Security: An Empirical Analysis", *Journal of Finance,* Vol. 53, pages 717-732.

Lamont, Owen A. and Richard H. Thaler, 2003, "Can the Market Add and Subtract? Mispricing in Tech Stock Carve-outs", *Journal of Political Economy*, Vol.111, pages 227-268.

Lobanova, Olesya, Shahid S. Hamid and Arun J. Prakash, 2010, "The Impact of Short - Sale Restrictions on Volatility, Liquidity, and Market Efficiency: the Evidence from the Short-Sale Ban in the U.S.", Working Paper, Florida International University.

Miller, Edward, 1977, "Risk, uncertainly and divergence of opinion," *Journal of Finance*, Vol.32, pages 1151-1168.

Mitchell, Mark, Todd Pulvino, and Erik Stafford, 2002, "Limited Arbitrage in Equity Markets", *Journal of Finance*, Vol.57, pages 551-584.

Ofek, Eli and Matthew Richardson, 2003, "DotCom Mania: The Rise and Fall of Internet Stock Prices," *Journal of Finance*,Vol. 58, pages 1113–1137.

Westerholm, P. Joakim and Mostafa Ahmed, 2009, "The Impact of Actual Market Wide Short Selling Restrictions and Liquidity Constraints during the Financial Crisis of 2008", Working Paper, University of Sydney.

## Table 1. Data Selection Procedure

Panel A. Data selection on equity market

| | Initially Banned Stocks | Never Banned Stocks |
|---|---|---|
| Raw data | 797 | n/a |
| Excluded preferred stocks, warrants, ADRs, closed-end funds, and REITs | -58 | n/a |
| Common stocks | 739 | 3,393 |
| | | |
| Excluded stocks in NYSE add/removal list | 0 | -104 |
| Excluded for incomplete stock information, or daily share volume <1000 | -555 | -2,187 |
| Stocks in equity market sample list | 184 | 1,102 |

Panel B. Data selection on single stock future market

| | Initially Banned Stocks | Never Banned Stocks |
|---|---|---|
| Stocks in equity market sample list | 184 | 1,102 |
| Excludes as no single stock future contract or with incomplete information | -108 | -444 |
| Stocks in single stock future market sample list | 76 | 658 |

Panel C. Data selection on exchange traded fund market

| | Initially Banned Stocks | Never Banned Stocks |
|---|---|---|
| Underlying stocks for the six ETFs | 785 | |
| Excluded for less than 3% net asset value in ETFs with less than 100 stocks | -130 | |
| Excluded for less than 1% net asset value in ETFs with more than 100 stock | -563 | |
| Stocks in exchange traded fund market sample list | 48 | 44 |

## Table 2. Summarized Statistics

The sample includes 184 stocks in the initial banned list and 1102 stocks in the never banned list. The pre-ban period covers 14 trading days from August 29, 2008 to September 18, 2008. The ban period covers 14 days from September 19, 2008 to October 8, 2008. The post-ban period covers 14 days from October 9, 2008 to October 28, 2008. Share volume refers to daily trading volume on a certain security. Return without dividend refers to daily holding period return where dividends are considered to be reinvested on ex-distribution date. Percentage quoted spread refers to the ratio of quoted bid-ask spread over midpoint.

Panel A. Mean

| | Initial banned list | | | Never banned list | | |
|---|---|---|---|---|---|---|
| Timeline | Pre-ban | Ban | Post-ban | Pre-ban | Ban | Post-ban |
| Number of stocks | 184 | 184 | 184 | 1102 | 1102 | 1102 |
| Number of days | 14 | 14 | 14 | 14 | 14 | 14 |
| Share volume | 936,715 | 657,140 | 787,671 | 1,717,704 | 1,776,333 | 1,927,493 |
| Number of trades | 4,632 | 2,699 | 3,987 | 7,496 | 7,739 | 8,757 |
| Return without dividend | 0.0094 | -0.0127 | -0.0025 | -0.0054 | -0.0203 | -0.0071 |
| Percentage quoted spread | 0.0697 | 0.1148 | 0.1216 | 0.0627 | 0.0910 | -0.0066 |

Panel B. Median

| | Initial banned list | | | Never banned list | | |
|---|---|---|---|---|---|---|
| Timeline | Pre-ban | Ban | Post-ban | Pre-ban | Ban | Post-ban |
| Number of stocks | 184 | 184 | 184 | 1102 | 1102 | 1102 |
| Number of days | 14 | 14 | 14 | 14 | 14 | 14 |
| Share volume | 154,928 | 105,886 | 143,730 | 372,754 | 379,882 | 381,689 |
| Number of trades | 999 | 566 | 840 | 2,099 | 2,029 | 2,087 |
| Return without dividend | 0.0026 | -0.0115 | -0.0129 | -0.0059 | -0.0184 | -0.0179 |
| Percentage quoted spread | 0.0554 | 0.0934 | 0.1039 | 0.0521 | 0.0750 | -0.0026 |

## Table 3. Regression Results on Equity Market

The sample includes 184 stocks in the initial banned list and 1102 stocks in the never banned list. Banned Stock Dummy equals to one if and only if the stock is in the initial banned list. Ban Period Dummy equals to one if and only if the time series is in the ban period from September 19 to October 8, 2008. Banned Stock & Ban Period Dummy equals to one if and only if the stock is in the initial banned list and the time series of variable falls into ban period. *, ** indicate significance at the 1% level and 5% level respectively.

Panel A.

| | Share volume | |
|---|---|---|
| Constant | -835,017.7 | * |
| | -(9.407) | |
| Number of trades | 259.4 | * |
| | (544.237) | |
| S&P 500 Index | 507.4 | * |
| | (6.292) | |
| Banned stock | 29,770.2 | |
| | (0.769) | |
| Ban period | 25,943.8 | |
| | (1.008) | |
| Banned stock & Ban period | 158,369.5 | * |
| | (2.364) | |
| Number of observation | 54,012 | |
| Adjusted R^2 | 84.63% | |

Panel B.

| | Share return | |
|---|---|---|
| Constant | -0.0028 | * |
| | -(8.359) | |
| Quoted spread | -0.0238 | * |
| | -(6.025) | |
| S&P 500 Index | 0.8688 | * |
| | (159.607) | |
| Banned stock | 0.0114 | * |
| | (13.163) | |
| Ban period | -0.0035 | * |
| | -(5.880) | |
| Banned stock & Ban period | -0.0032 | ** |
| | -(2.222) | |
| Number of observation | 54,012 | |
| Adjusted R^2 | 33.07% | |

Panel C.

| | Percentage quoted spread | |
|---|---|---|
| Constant | 0.0277 | * |
| | (81.831) | |
| Share return | -0.0282 | * |
| | -(6.025) | |
| S&P 500 Index return | -0.0458 | * |
| | -(6.369) | |
| Banned stock | 0.0679 | * |
| | (75.943) | |
| Ban period | 0.0621 | * |
| | (105.518) | |
| Banned stock & Ban period | -0.0439 | * |
| | -(28.405) | |
| Number of observation | 54,012 | |
| Adjusted R^2 | 24.19% | |

## Table 4. Regression Results on SSF Market

The sample includes 76 stocks in the initial banned list and 658 stocks in the never banned list. Share volume in million is calculated by dividing share volume of underlying stocks by 1,000,000. VIX is the CBOE Market Volatility Index. Banned Stock Dummy equals to one if and only if the stock is in the initial banned list. Ban Period Dummy equals to one if and only if the time series is in the ban period from September 19 to October 8, 2008. Banned Stock & Ban Period Dummy equals to one if and only if the stock is in the initial banned list and the time series of variable falls into ban period. Post Ban Period Dummy equals to one if and only if the time series falls into post-ban period of 14 trading days. Banned Stock & Post Ban Period Dummy equals to one if and only if the stock is in initial banned list and the time series feature of stock falls into post-ban period. *, ** indicate significance at the 1% level and 5% level respectively.

| Panel A. | Settlement change | |
|---|---|---|
| Constant | 0.9147 | * |
| | (5.163) | |
| Share volume in million | -0.0037 | ** |
| | -(1.757) | |
| Share return | 27.4402 | * |
| | (43.485) | |
| VIX | -0.0387 | * |
| | -(6.339) | |
| Banned stock | 0.0993 | |
| | (0.401) | |
| Ban period | 3.0790 | * |
| | (21.116) | |
| Post ban period | 1.6450 | * |
| | (6.168) | |
| Banned stock & Ban period | -0.1863 | |
| | -(0.537) | |
| Banned stock & Post ban period | -0.2639 | |
| | -(0.760) | |
| Number of observations | 30,828 | |
| Adjusted R^2 | 8.09% | |

| Panel B. | SSF volume | |
|---|---|---|
| Constant | 8.6166 | * |
| | (19.266) | |
| Share volume in million | -0.1538 | * |
| | -(28.643) | |
| Share return | 5.0029 | * |
| | (3.141) | |
| VIX | 0.0587 | * |
| | (3.805) | |
| Banned stock | 1.0998 | ** |
| | (1.761) | |
| Ban period | 7.0391 | * |
| | (19.124) | |
| Post ban period | 5.5317 | * |
| | (8.217) | |
| Banned stock & Ban period | 2.7844 | * |
| | (3.178) | |
| Banned stock & Post ban period | -1.0357 | |
| | -(1.182) | |
| Number of observations | 30,828 | |
| Adjusted R^2 | 6.14% | |

## Table 5. Regression Results on ETF Market

The sample includes underlying stocks of six ETFs traded on iShares.com, namely 48 stocks in the initial banned list and 44 stocks in the never banned list. Share volume in million is calculated by dividing share volume of underlying stocks by 1,000,000. VIX is the CBOE Market Volatility Index. Percentage of net asset is the average of September and October net asset value of a stock held by the corresponding ETF. Banned Stock Dummy equals to one if and only if the stock is in the initial banned list. Ban Period Dummy equals to one if and only if the time series is in the ban period from September 19 to October 8, 2008. Banned Stock & Ban Period Dummy equals to one if and only if the stock is in the initial banned list and the time series of variable falls into ban period. *, **, *** indicate significance at the 1% level, 5% level and 10% level respectively.

Panel A.

| | ETF volume | |
|---|---|---|
| Constant | 4,940,256.2 | * |
| | (16.453) | |
| Share volume in million | 0.019 | * |
| | (11.516) | |
| Percentage of net asset | -376,566.7 | * |
| | -(14.938) | |
| VIX | -7,900.6 | ** |
| | -(1.817) | |
| Banned stock | 478,234.7 | ** |
| | (1.903) | |
| Ban period | -2,561,997.7 | * |
| | -(6.774) | |
| Banned stock & Ban period | 34,345.3 | |
| | (0.082) | |
| Number of observations | 3,570 | |
| Adjusted R^2 | 13.62% | |

Panel B.

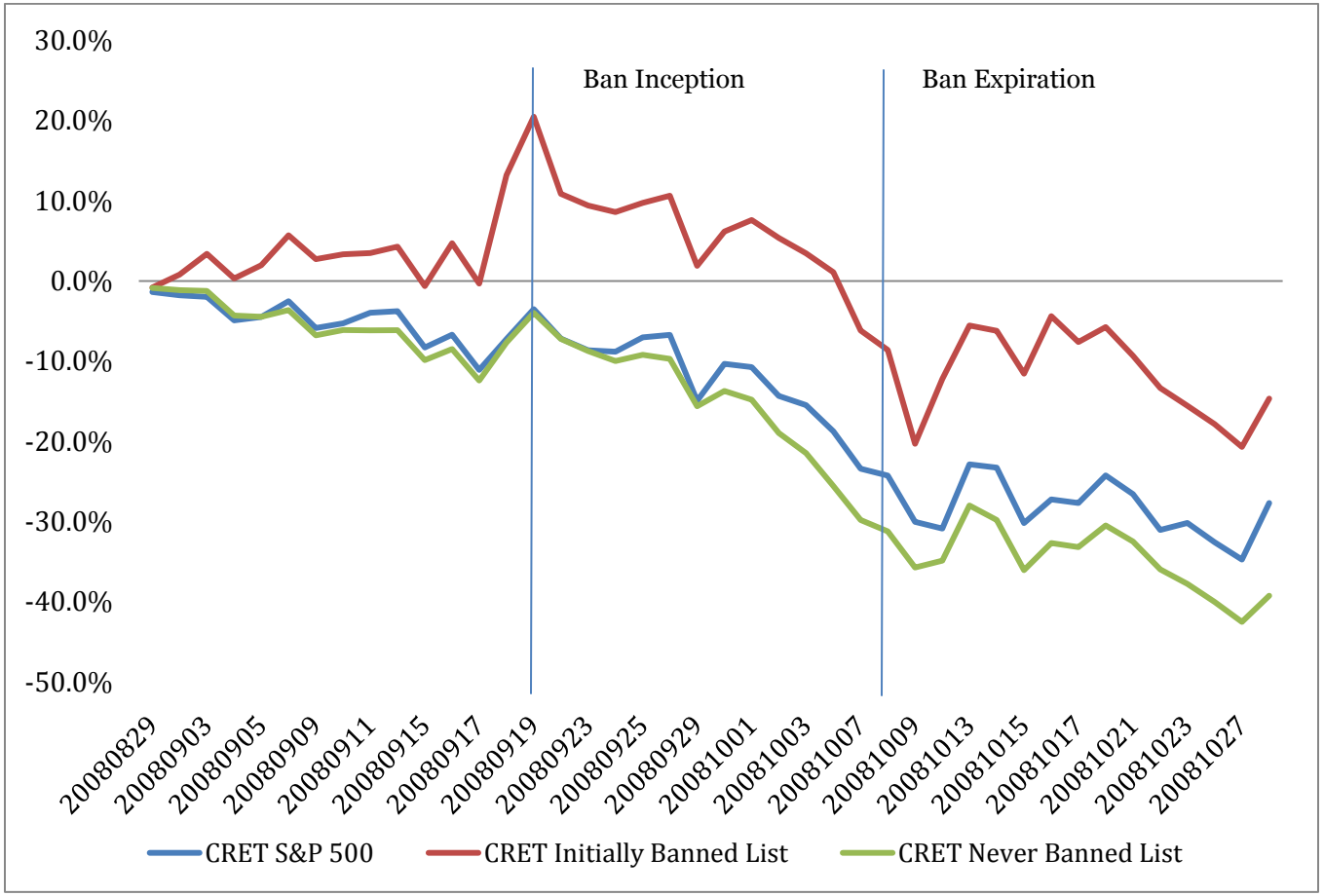
| | ETF return | |
|---|---|---|
| Constant | 0.009713 | * |
| | (3.779) | |
| Share volume in million | 0.000014 | |
| | (0.981) | |
| Share return | 0.458229 | * |
| | (61.436) | |
| Percentage of net asset | 0.000006 | |
| | (0.029) | |
| VIX | -0.000300 | * |
| | -(8.029) | |
| Banned stock | 0.000043 | |
| | (0.020) | |
| Ban period | -0.002139 | |
| | -(0.662) | |
| Banned stock & Ban period | -0.005506 | *** |
| | -(1.538) | |
| Number of observations | 3,570 | |
| Adjusted R^2 | 53.36% | |

Panel C.

| | ETF percentage quoted spread | |
|---|---|---|
| Constant | -0.000827 | ** |
| | -(1.673) | |
| Percentage quoted spread | 0.133287 | * |
| | (7.576) | |
| Share volume in million | 0.000006 | ** |
| | (2.073) | |
| Percentage of net asset | 0.000110 | * |
| | (2.642) | |
| VIX | 0.000144 | * |
| | (19.942) | |
| Banned stock | -0.001047 | * |
| | -(2.532) | |
| Ban period | 0.002536 | * |
| | (4.058) | |
| Banned stock & Ban period | 0.001269 | ** |
| | (1.840) | |
| Number of observations | 3,570 | |
| Adjusted R^2 | 15.47% | |

**Figure 1. Cumulative Raw Returns on Initially Banned List and Never Banned List**

Cumulative raw returns (CRET) are calculated on each of the 42 trading days for each stock in the Initially Banned List and Never Banned List. Then equally-weighted cross-sectional averages are calculated for the two groups and S&P 500 Index. The sample includes 184 stocks in the Initially Banned List and 1102 stocks in the Never Banned List.



## Figure 2. Cumulative Abnormal Returns on Initially Banned List and Never Banned List

Cumulative abnormal returns (CAR) are calculated on each of the 42 trading days for each stock in the Initially Banned List and Never Banned List. Daily abnormal return refers to return in excess of S&P 500 index. Equally-weighted cross-sectional averages are calculated for the two groups. The sample includes 184 stocks in the Initially Banned List and 1102 stocks in the Never Banned List. Event day zero is the ban inception date (September 19, 2008) for the upper curve, and ban expiration date (October 8, 2008) for the lower curve.