## Hypotheses

The abandon of the Uptick Rule and the introduce of the Short-sale Circuit Breaker offers a perfect time to compare the effects of difference level of short-sale constraints. First, we have the long-existed Uptick Rule since 1938; then the Uptick Rule was repealed in 2007, leaving no restrictions for short-sales at all (there was an emergency short sale ban on financial firms in 2008 but we will exclude that period from our data); in 2010, the SEC introduced the short-sale circuit breaker, also known as the “alternative uptick rule”. Thus, it is possible to closely compare the effects of difference short-sale restrictions, from the strictest Uptick Rule to the moderate Short-sale Circuit breaker to no restriction at all.

We focus on the effects of the short-sale breaker. The SEC introduced this rule to prevent another “flash crash” from happening, or more generally, prevent extreme downside volatility. If the downside volatility is mainly caused by short sellers, then this rule should be able to restrain the downside volatility to nearly 10%.

Previous literatures (see Diether, Lee, and Werner (2009)) investigated in the effects of the classic uptick rule. They applied Miller’s overvaluation theory\* to see if the restriction on short sale is causing the market to be misplaced. In the case of the SSCB, however, the chance of causing overvaluation is very limited as it is only triggered with a 10% intraday price downside movement, it would be extremely rare, if not impossible, for a stock to be mispriced by 10% of its price. IN addition, the rule is only effective for that day and the following trading day.

*Bai et al. (2006) develop a rational expectations equilibrium model to investigate the ability of investors to trade risks and speculate on private information in a short-sale constrained market, they conclude that the presence of short-sale constraints can both increase and decrease volatility. Kraus and Rubin (2003) state whether the short-sale restrictions will reduce the volatility depends on the exogenous economy variables.*

## Data

This study is based on the intraday price tick data, daily order placement, and daily option trading data. The time should range from 2004 to 2013 (3 years for Uptick Rule period, 3 years for the repeal period, and 3 years for short-sale circuit breaker period). The intraday price tick data can be obtained from Bloomberg terminal, and the daily order placement are recorded in NYSE TAQ data set. The option data is collected by CBOE. The TAQ and option data can be downloaded from WRDS.

Requirements:

daily price; daily market return;

intraday price ticks (midquote volatility)

(daily) # of shares shorted; # of short orders; monthly shares outstanding; monthly short positions; daily trading volume;

(Daily) # of long orders; # of shares sold long; placement time; execute time; execute ratio;

option price; option volume;

|  |  |  |
| --- | --- | --- |
| data | source | Time Availability |
| Daily price/market return | WRDS | 1953 - now |
| Intraday quotes | TAQ | May 2008 – Dec 2011 |
| Daily short sales | NSX | Jan 2006 - now |
| Daily long orders | TAQ | May 2008 – Dec 2011 |
| Daily option | Option metrics | 1996 - now |

## Methodology

### Effects on volatility

This paper first questions whether the short-sale circuit breaker can reduce the volatility of the covered stocks, especially when a stock experienced a significant intraday price decline. Bai et al. (2006) and Kraus and Rubin (2003) develop economical models and conclude that short-sale restrictions can both increase and decrease the volatility, depending on other factors. Three measures of volatility are presented. They are the standard volatility, the semivariance, and the intraday volatility.

The standard volatility is calculated as the variance of the return. The semivariance volatility includes two parts. The positive(up) semivariance is calculated as  and the negative (down) semivariance is calculated as , where is the number of observations and Xt is the daily closing price from CRSP. The intraday volatility is the variance of the price ticks of the stock during the trading day. (Or use midquote volatility which is essentially the k-minute return, k=5, 15, 30).

The Diff13(Diff23) column reports the Circuit Breaker dummy coefficient from a time-series regression on the data from the Circuit Breaker period and the Uptick Rule period (N/A Period) of each variable on an intercept (not reported) and the Circuit Breaker dummy. The significance is calculated using Newey-West (1987) standard errors.

Requirements: daily price; intraday price ticks (midquote volatility)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Uptick Rule | N/A | Circuit Breaker | Diff13 | Diff23 |
| Volatility |  |  |  |  |  |
| Semivariacne (up) |  |  |  |  |  |
| Semivariance (down) |  |  |  |  |  |
| Intraday |  |  |  |  |  |
| # Obs. |  |  |  |  |  |

Since the short-sale circuit breaker is significantly less restrictive than the Uptick Rule, one could expect an increase in volatility (Diff13>0). The circuit breaker only triggers when the price of a stock declines by 10% or more from that last closing price, thus it should be fairly rare to happen. This should have little impact on the market comparing to the 2007-2010 period which has no short-restriction at all. Thus, the difference between the two is expected to be small and insignificant.

Extensive investigation can be performed on portfolios sorted on size, price, volatility, and turnover.

### Effects on short selling and long selling

The short-sale circuit breaker directly impacts the short selling-activity of the covered securities. In line with Diether et al (2009) and Boehmer et al. (2008)., the proxies for short-selling activity is chosen to be shares sold short, number of short sales, average trade size, relative short sales, and short interests. The relative short sales is the number of shorted shares divided by daily trading volume. Short interestis the monthly mean ratio of net short positions reported on the 15th of each month to shares outstanding at the start of the month.

Requirements: # of shares shorted; # of short orders; monthly shares outstanding; monthly short positions; daily trading volume;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Uptick Rule  (period 1) | N/A  (period 2) | Circuit Breaker  (period 3) | Diff13 | Diff23 |
| Shares sold short |  |  |  |  |  |
| # of short sales |  |  |  |  |  |
| Avg. trade size |  |  |  |  |  |
| Relative short sales |  |  |  |  |  |
| # Obs. |  |  |  |  |  |

The restrictions on short sales are most restrictive in Period 1 (Uptick Rule), modest restrictive in period 2(N/A), and least restrictive in period 3 (Circuit Breaker). Thus the popularity of short selling activities is expected in order of p2 > p3 > p1.

Once the circuit breaker is triggered, short sales are only allowed with a price above the current national best bid. This effectively put short sellers in a line behind long sellers. In fact, facilating the ability for long sellers to sell in declining market is one of the goals identified by the SEC in the official document. Several straightforward measures for long sell order execution efficiency are shares sold long, numbers of long sales, execute ratio, and execution time. Execute ratio is defined as the ratio of executed long orders on total long sale orders. Execution time is the average time a long sell order need to wait before being executed.

Requirements: on long-sell: # of orders; # or shares sold long; placement time; execute time; execute ration;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Uptick Rule  (period 1) | N/A  (period 2) | Circuit Breaker  (period 3) | Diff13 | Diff23 |
| Shares sold long |  |  |  |  |  |
| # of long sales |  |  |  |  |  |
| Execute time |  |  |  |  |  |
| Execute ratio |  |  |  |  |  |
| # Obs. |  |  |  |  |  |

Short sales at a price lower than the current national best bid will drive down the stock price before most long sellers could complete their trades, hence it is expected that long sellers experienced the worst time in period 2 and the best time before the Uptick Rule was repealed. Ordering by the execution efficiency from easy to hard, the relation is expected to be p1 > p3 > p2.

The short-sale circuit breaker prohibits short selling at a price equal to or lower than the current national best bid, but it does not cover the option market. Dedicated short sellers can easily find a work-around of this rule. It is of interests to see if the short-sale circuit breaker will push short sellers in a declining stock to the option markets. Firms with options available for trading are collected in to a subgroup to investigate the relation of stock price and options. Number of put options, put spread, number of call options, and call spread are selected as measures for the option market. Put spread (call spread) is the monthly average difference between the strike prices of put (call) options and the issue-day stock prices.

Requirements: option price; option amount; daily stock price;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Uptick Rule  (period 1) | N/A  (period 2) | Circuit Breaker  (period 3) | Diff13 | Diff23 |
| Number of puts |  |  |  |  |  |
| Put spread |  |  |  |  |  |
| Number of calls |  |  |  |  |  |
| Call spread |  |  |  |  |  |
| # Obs. |  |  |  |  |  |

Although it is possible that short sellers use options to avoid the short sale restriction, the option market is not the only way and probably not the best way of doing this. Other work-around include long/short synthetic stocks or highly correlated stocks. Thus the statistics for put options should be similar for period 1 and period 3 with period 2 as the most active period.

Still, none of these methods can replicate the movement of the stock with 100% accuracy, which means short-sellers have to bear more risks. In turn, this ensures that the short-sale circuit breaker would not be completely bypassed.

### Effects on stock prices

When effective, the short-sale circuit breaker will largely prevent short sellers from placing aggressive short-sale orders. This leads to less downward pressure on the stocks. This paper tests if there are significant abnormal returns when short-sale circuit breaker is triggered. The event study methodology with event windows including [-1,1], [0,0], and [-10, 7] is used. Two measures of anomalies are presented in the table. The first one is the daily abnormal return, which is defined as the difference between the firms’ daily returns and the value weighted daily return of the market. The second measure is the BHAR equivalent, it is the buy-and-hold abnormal return compounded daily over the period considered.

Requirements: daily market return; daily stock return;

|  |  |  |  |
| --- | --- | --- | --- |
|  | [-1,1] | [0,0] | [-10,7] |
| Daily alpha |  |  |  |
| BHAR |  |  |  |
| # Obs. |  |  |  |

Another popular method to capture the long-run abnormal returns created by events like this is the portfolio approach. One could argue that a stock triggered the circuit breaker has more likelihood to decline than those do not. A way to test this is to construct a short portfolio consists of only the stocks that have reached the circuit breaker. Each stock will stay in the portfolio for K-month (K=6, 12, 24). The short portfolio is maintained by adding the newly triggered stocks and cover the positions of those have reached their holding time. After all positions in the portfolios have been covered, the abnormal return of the portfolio is simply derived by subtracting market index return from the portfolio return.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Six month | One year | Two years |
| Abnormal returns |  |  |  |
| # Obs. |  |  |  |

There should not be significant abnormal returns.

### Market quality

If one has to put a rule on the market, the rule should treat every stock equally, no matter small cap or big cap, barely traded or intensively traded. The rule should also have minimal impact on market liquidity.

Portfolios sorted on size, price, volatility, and turnover are to find out if the rule affects all kinds of stocks equally. Panel A (Panel B) reports the results on the data from period 1 (period 2) and period 3. The numbers in the small/low (large/high) columns are the period 3 dummy coefficients from a time-series regression of the difference of each variable between period 1 (perod2) and period 3 stock portfolios in the lowest (highest) quintile on an intercept (not reported) and the period 3 dummy. The F-statistics are derived from the SUR test of equality between the coefficient from the lowest and highest quintile portfolios.

Requirements: daily price; intraday price ticks (or mid-quote volatility)

Panel A. Uptick rule and short-sale circuit breaker

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Size portfolio  Small (diff-diff) – Large(diff-diff) - F | Price portfolio  Low (diff-diff) – High(diff-diff) -F | Volatility portfolio  Low(diff-diff) – High(diff-diff) - F | Turnover portfolio  Low(diff-diff) – High(diff-diff) - F |
| Volatility |  |  |  |  |
| Semivariacne (up) |  |  |  |  |
| Semivariance (down) |  |  |  |  |
| Intraday |  |  |  |  |
| # Obs. |  |  |  |  |

Panel B. No short-sale restriction and short-sale circuit breaker

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Size portfolio  Small – Large - F | Price portfolio  Low – High -F | Volatility portfolio  Low – High - F | Turnover portfolio  Low – High - F |
| Volatility |  |  |  |  |
| Semivariacne (up) |  |  |  |  |
| Semivariance (down) |  |  |  |  |
| Intraday |  |  |  |  |
| # Obs. |  |  |  |  |

The short-sale circuit breaker has mild influence on the market, the result should be small and insignificant between period 2 and period 3, whereas there are some changes from period 1 to period 3.

The bid-ask spread is used to represent the market liquidity, a smaller spread means the orders can be executed faster and there are more orders in the market. To measure difference aspects of the spreads, this paper uses quoted, effective, and realized spread. Relative bid depth and buy imbalance/volume are also included to measure market asymmetries.

Requirements: Intraday quote data

Panel A. Uptick rule and short-sale circuit breaker

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Size portfolio  Small (diff-diff) – Large(diff-diff) - F | Price portfolio  Low (diff-diff) – High(diff-diff) -F | Volatility portfolio  Low(diff-diff) – High(diff-diff) - F | Turnover portfolio  Low(diff-diff) – High(diff-diff) - F |
| Quoted spread |  |  |  |  |
| Effective spread |  |  |  |  |
| Realized spread |  |  |  |  |
| Relative bid depth |  |  |  |  |
| Relative bid depth |  |  |  |  |
| Buy imbalance/volume |  |  |  |  |
| # Obs. |  |  |  |  |

Panel B. No short-sale restriction and short-sale circuit breaker

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Size portfolio  Small – Large - F | Price portfolio  Low – High -F | Volatility portfolio  Low – High - F | Turnover portfolio  Low – High - F |
| Quoted spread |  |  |  |  |
| Effective spread |  |  |  |  |
| Realized spread |  |  |  |  |
| Relative bid depth |  |  |  |  |
| Relative bid depth |  |  |  |  |
| Buy imbalance/volume |  |  |  |  |
| # Obs. |  |  |  |  |

### References

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