MEMORANDUM

TO: File No. S7-08-09

FROM: The Division of Trading and Markets

DATE: February 22, 2010

SUBJECT: Proposed Amendments to Regulation SHO

On February 22, 2010, Staff in the Division of Trading and Markets met with Professor Yaneer Bar-Yam, President of New England Complex Systems Institute ("NECSI"), Dion Harmon, and Peter Lejeune. The meeting was held to discuss Professor Bar-Yam's prior studies.[1] Representatives of NECSI also provided the attached report titled "Regulation of Short Selling: The Uptick Rule and Market Stability."

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[1] See Dion Harmon and Yaneer Bar-Yam, 2008, Technical Report on the SEC Uptick Repeal Pilot, New England Complex Systems Institute; Dion Harmon and Yaneer Bar-Yam, April 2009, Technical Report on SEC Uptick Rule Proposals, New England Complex Systems Institute. The 2008 study was cited in the proposing release. See Securities Exchange Act Release No. 59748 (Apr. 10, 2009), 74 FR 18042, 18047, n.64 (Apr. 20, 2009).

New England Complex Systems Institute

Regulation of Short Selling: The Uptick Rule and Market Stability

Report presented at the Securities and Exchange Commission February 22, 2010

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Section 1: Introduction with historical overview

Following the market crash in 1929-1930, Congress created the Securities and Exchange Commission (SEC) in 1934 with a mandate to regulate short selling of securities to protect investors and the public interest.[1] In 1938, the SEC instated the uptick rule to allow relatively unrestricted short selling in advancing markets while preventing short selling from driving the market down or accelerating a declining market.[2] In 2005, the SEC conducted a pilot study, to investigate the effect of the uptick rule, removing it from 943 stocks of the Russell 3000. Data collected over six months starting in May 2006 were interpreted to mean that the uptick rule had no significant impact on market behavior, and the uptick rule was repealed on July 3, 2007.[3] In 2008-2009 US markets experienced a crisis of similar proportions to the market crash in 1929-1930. Here we show that the original pilot study provides evidence predicting a market crash as an outcome of the repeal of the uptick rule.

The market crisis has prompted many calls for reinstating the uptick rule. Beginning in April 2009, the SEC has announced two comment periods on short-selling regulations,[4,5] the last of which ended on September 21, 2009. The purpose of these comment periods is to consider whether to reinstate the uptick rule, and whether alternatives to the uptick rule should be implemented instead. These include the original uptick rule, an upbid rule, or these rules only implemented after large market drops, i.e. as "circuit breakers." Here we provide a method for analysis of the impact of alternative rules. We show that the upbid rule weakens the uptick rule by a small but quantifiable amount, while the circuit breaker alternatives would have much less effect. Our analysis of the uptick rule and its alternatives also shows that decimalization and electronic markets weaken but do not eliminate the effect of these rules. Still, the weakening could be reversed by setting a price increment for short selling above the recent price or bid.

Chronology

1934: Securities and Exchange Commission created by Congress, mandated to regulate short selling.

1938: Uptick rule instated.

May 2, 2005: Uptick rule pilot study begins. Six month sample period used.

July 6, 2007: Uptick rule repealed.

April 10, 2009: Start of SEC 3 month comment period on proposed regulations.

August 17, 2009: Start of SEC 30 day comment period on proposed regulations.

Uptick rule

The uptick rule requires that a trade involving the sale of borrowed shares (a short sale) execute at a price above the most recent trade price, or at the most recent trade price if the last trade was at an increased price (an uptick). This prevents the sale from causing price decreases from the current price.

According to the SEC:[6] "The [Securities and Exchange] Commission adopted the tick test after considering the effects of short selling in downward moving markets. In adopting this approach, the Commission sought to achieve three objectives:

(i) allowing relatively unrestricted short selling in an advancing market;
(ii) preventing short selling at successively lower prices, thus eliminating short selling as a tool for driving the market down; and
(iii) preventing short sellers from accelerating a declining market by exhausting all remaining bids at one price level, causing successively lower prices to be established by long sellers."

Section 2: Uptick rule pilot

	Market	Pilot	Control	Difference
Return	NYSE	9.18%	11.56%	-2.38%
Return	NASDAQ	14.21%	16.30%	-2.08%
Market-Adjusted Return	NYSE	-2.10%	0.00%	-2.07%
Market-Adjusted Return	NASDAQ	2.26%	4.01%	-1.74%

Table 1: Difference in returns between unregulated and regulated stocks during the pilot study on the NYSE and NASDAQ markets.

The SEC's repeal of the uptick rule on July 3, 2007 [2] was based largely on the findings of a pilot study conducted over a 6-month period starting in May of 2005.[3] The pilot removed the uptick rule regulation on one third of the stocks in the Russell 3000. The stocks were selected with an even distribution of market cap and principle trading markets. We show that during the pilot, unregulated stocks had statistically and economically significantly lower returns.[7] We also note the significance of extreme price movements reported by the SEC.

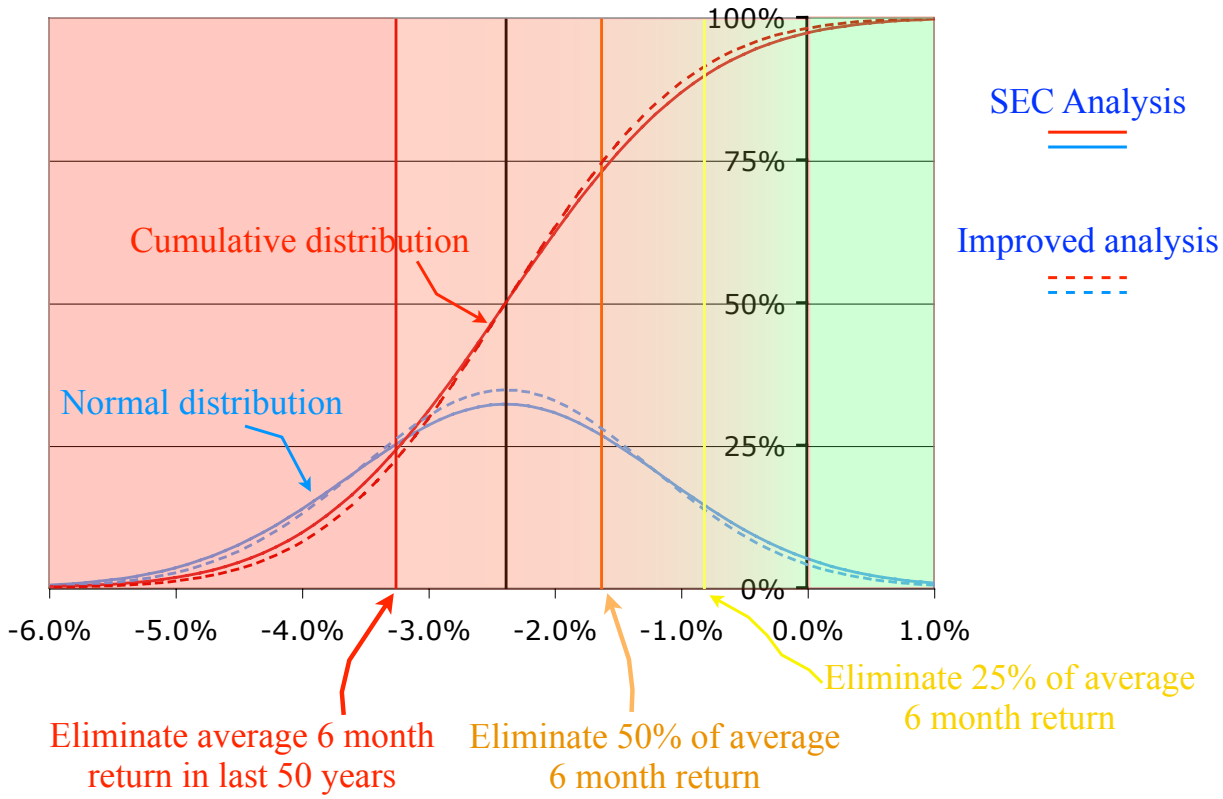

Fig. 1: Distribution of change in average 6 month returns according to the SEC pilot study compared with average returns over the past 50 years.

Economic significance

The SEC pilot study report[3] stated that there was no statistically significant difference in returns between the regulated and unregulated stocks. The results of the pilot (reproduced here in Table 1) were a -2.38% cumulative 6-month return difference between unregulated and regulated NYSE stocks, and a -2.09% difference in NASDAQ stocks regulated by a similar rule. The 2.38% decrease in average return found by the SEC represents an *economically significant* decline in return on investment. On average, stocks have appreciated annually in the range of 6 to 7% since World War II.[8]

The distribution of the changes in returns based on the pilot study and the average returns over 6-months for the past fifty years are compared in Figure 1. The figure plots the distribution of expected changes in stock market returns according to the pilot study results. The horizontal axis shows the difference in percent of average returns of regulated compared to unregulated stocks. The vertical axis shows the probability of that level of difference as a result of repealing the uptick rule. The cumulative distribution, also shown, gives the probability that repeal of the uptick rule will give a return difference that is at that level or higher.

From the plot we see that according to the pilot study:

- There is a 50% probability that the repeal will eliminate more than 2/3 of market gains.
- There is a 75% probability that the repeal will eliminate more than 1/2 of market gains.

Either difference would radically change the risk vs. reward of stocks compared to other more secure investment opportunities and could be expected to motivate a dramatic change in investor behavior.

Statistical significance

According to the SEC analysis of the pilot data, the difference of the mean is not statistically significant.[3] This corresponds to considering whether the distribution in Fig. 1 has more than 2.5% (1 in 40) chance of having a positive change of return. The SEC analysis obtained a probability of 2.7%, missing the statistical sig-

nificance test by 0.2%. Translated into the language of statistical significance, the study found the difference was likely to be significant at the 94.5% level, but not at the 95%.

By improving the statistical tests (dashed lines) we found statistical significance. For example, including both NYSE and NASDAQ data provided a probability of positive return values of 1.9%. This is statistically significant at the 96% level, above the 95% level threshold.

An example of a curve obtained from our reanalysis is shown as dashed lines in Fig. 1. What is most important to recognize is the small difference between our curves and the original SEC analysis curves. While ours indicates statistical significance, the original curves do not.

We found that each of the following tests gave statistical significance for the difference in returns of regulated and unregulated stocks at two standard deviations (95% confidence): (1) combining both the NYSE and NASDAQ data into a single test, (2) using daily average NYSE return differences (not market adjusted) as individual samples, (3) using a fitting to a normal distribution or the Full Width at Half Maximum for the NYSE stocks to obtain the standard deviation, (4) removing 0.5% outliers (7 stocks) of NYSE stocks with over 100% six month returns.

The logic behind the discussion of statistical significance is as follows: If we assume that the distribution is centered on zero, what is the probability that we can reject this claim? Given the observed average change in return, if the expected probability of a return different from zero, or higher, is not less than 5% (1 in 20) the original assumption that the distribution is centered on zero is considered not invalid. The analysis also assumed that a positive deviation would be equivalent to a negative deviation in testing the hypothesis, so that a decrease or an increase in return have the same conclusion. Thus, if the value obtained is not in the 2.5% tail, the deviation does not give more than 5% probability of the hypothesis being incorrect.

Extreme reversals

The pilot study[3] documented a statistically significant increase in extreme reversals in stock valuation of unregulated stocks relative to regulated ones (see Table 2), but discounts this based on the observation that increased numbers of reversals

	NYSE Stocks			
	Negative Reversals		Positive Reversals	
Reversal Size	**Pilot**	**Control**	**Pilot**	**Control**
>2	338.4**	281.3	339.1**	281.1
>3	76.7**	65.1	75.4**	63.5
>4	25.0**	20.4	24.4**	19.3
>5	10.0**	8.8	11.33**	8.4
>6	4.9	4.6	5.8**	4.8
>7	2.8	2.8	3.4	3.1
>8	1.7	1.8	2.0	2.2
>9	1.1	1.3	1.2**	1.7

	NASDAQ Stocks			
	Negative Reversals		Positive Reversals	
Reversal Size	**Pilot**	**Control**	**Pilot**	**Control**
>2	273.4**	257.4	284.1**	267.8
>3	71.9**	62.8	72.7**	67.0
>4	25.1**	22.4	27.6**	24.6
>5	10.5	9.1	13.2**	11.2
>6	5.3	4.2	6.9*	5.9
>7	3.0	2.2	3.6	3.6
>8	1.9	1.2	2.2	2.2
>9	1.2	0.6	1.6	1.4

Table 2: Extreme movements measured by the number of reversals in stock price per 100,000 intervals as reported in the SEC pilot study.[3] A negative (positive) reversal was defined as a negative (positive) return immediately followed by a positive (negative) return. The reversal size was defined as the minimum absolute value of the two adjacent returns, normalized by the pre- pilot standard deviation of the stock's return over a four-month period, and the second return is computed as a percentage of the lagged price. Statistical significance relative to the control is denoted by * and ** at the 5% and 1% levels, respectively.

occur both upward and downward. However, the reduction in rapid movements in both directions due to the uptick rule is significant as it can impact the stability of the market in response to external events.

Extreme movements

We performed a study of the number of stocks experiencing large declines in a single day both pre- and post-uptick repeal. These sharp declines serve as a proxy for bear raids. Our analysis shows a dramatic, statistically significant, increase in the number of stocks with drops of over 40% of their value in one day (see Table 3) between 2 pre-selected periods: 12 months following March 31, 2000 (pre-repeal), and 12 months following Sept 30, 2007 (post-repeal). These periods both had overall similar market behaviors. There were no drops greater than 70% in the earlier period, but a total of 7 in the later period.

When considering all (rolling) 12-month periods starting in July 1999 up to October 2008, we found that the most recent period had 45 drops of over 40% while no prior interval had more than 27 such drops.

Drop size in percent (Q)	**40%**	**50%**	**60%**	**70%**	**80%**
Number of stocks with one day drops greater than Q% in 2000/01	14	4	2	0	0
Number of stocks with one day drops greater than Q% in 2007/08	32	17	11	7	4
% change in number of drops	129%	325%	450%	∞	∞
Two-proportion z-test	2.52	2.73	2.22	1.89	1.0
Statistical certainty	99.4%	99.7%	98.7%	97%	84%

Table 3: Evaluation of a proxy for bear raids: the number of stocks with maximum drops over a threshold percentage over a 12-month period. Stocks included are NYSE securities in the Russell 3000 over two 12 month preselected periods after 3/31/00 and 9/30/07 respectively. The number of sharp declines is significantly greater after the repeal of the uptick rule. For comparisons of other periods see text.

Section 3: Analysis of short sale regulation proposals

The Securities and Exchange Commission (SEC) has proposed reinstating the uptick rule, or replacing it with one of several alternatives, in order to stabilize the stock markets. The proposals are in two categories --- with or without a circuit breaker condition. On April 8, 2009, the SEC announced that it will consider five different alternatives for a new uptick rule replacement. The original uptick rule, an upbid rule (which weakens the limitation of short selling to be above the current national bid rather than the most recent price), and three options based upon a circuit breaker. In the circuit breaker approach there would be no short selling restriction unless a significant drop (e.g. 10%) in security price occurred. On August 17, 2009, additional comments were requested during a period of 30 days, on an alternative uptick rule, which strengthens the upbid rule by requiring a price increment for short sales above the recent national bid.

The effect of short selling regulations (including the uptick rule) depends on the impact of short selling on the market with and without the regulations. The impact of short selling depends on the rate at which short selling can be performed. Limitations on the rate, limit the impact of short selling. With the uptick rule, the maximum rate of short-selling is the rate of market buy orders and buy limit orders at or above an uptick or above a downtick.

Here we show the difference of the effects of enacting the different short selling regulation proposals on price movements under short sale attack (bear raids). The primary role of the uptick rule as it has been articulated, is to limit the possibility of driving the price down. This occurs when a large sell order is executed during a short period of time. We analyze the effect of a large sell order using as a test case the stock of Lehman Bros on July 10, 2008.

Figure 2 illustrates the different possible rules by showing the price at which orders may be set. The uptick rule requires executed short sale prices to be above the last sale price. The upbid rule is above the highest current bid. The circuit breaker allows prices at all values until the total price drop reaches e.g. 10% in a day, and there is no limitation without a rule. The alternative uptick rule (not shown), sets the price above the highest current bid with a to be specified price margin.

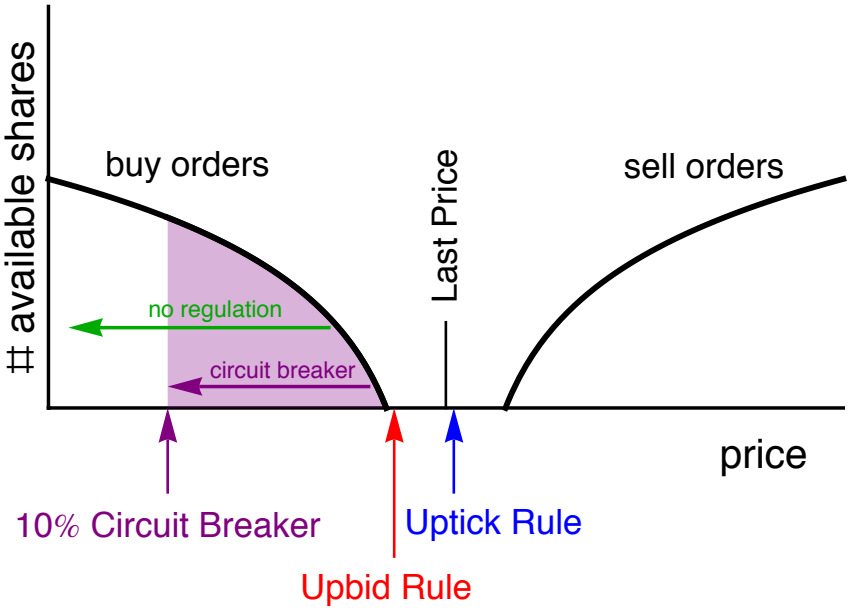

Fig. 2: Illustration of the price of short sales for the uptick rule and alternatives.

We compare the effect of the different rules on a large volume of rapid short selling in Figure 3. This plot shows the effect of a large short sell order on the price of Lehman Brothers (LEH) if the short sale order occurred on July 10, 2008 at 9:49:17 AM. The calculations for this effect are based upon the actual order book at that time, i.e. the number of standing orders.

Selling short with the full uptick rule (blue) would not give rise to a price reduction as the price would be the most recent price. The "upbid" rule (red) would reduce the price by a small amount --- the difference between the most recent order and the most recent bid. For the case of no uptick rule (green) or a circuit breaker based rule (purple), the short sale will be met by standing orders and the price would decline till the entire order is fulfilled or the circuit breaker condition is met (purple).

Figure 3 shows that the objectives of the uptick rule as stated by the SEC are not met by circuit breaker based versions of the uptick rule.

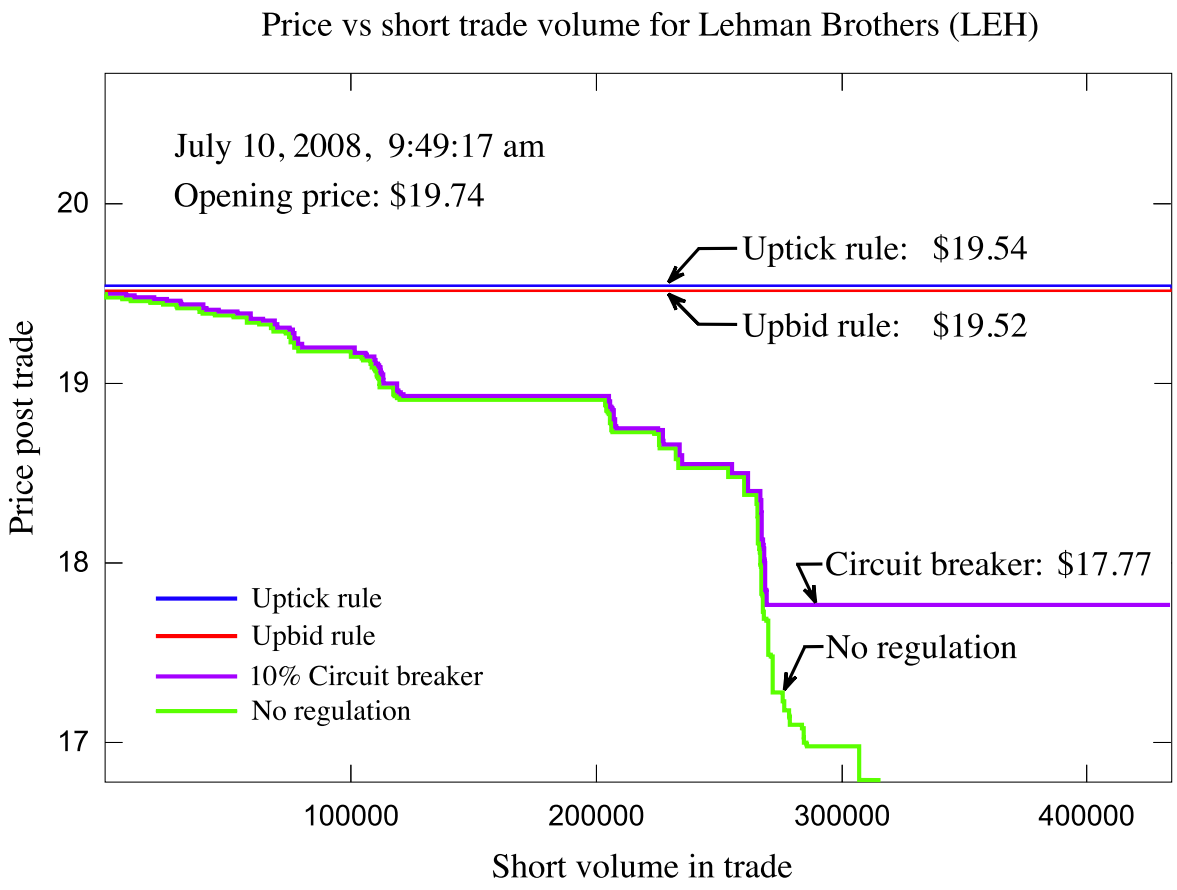

Figure 3: Comparison of the current SEC uptick rule proposals if they were active on July 10, 2008 for Lehman Brothers (LEH) stock price. Horizontal axis is the current short volume. Vertical axis is the stock price.

The alternative uptick rule that would require a price increment above the current upbid price would limit the amount of short selling in comparison to the upbid rule, allowing sales only against a more limited fraction of market orders, particularly in decreasing markets. Such strengthening of the impact of the rule might be used to compensate for several of the recent market changes, including decimalization, that have weakened the uptick rule through enabling a larger fraction of market orders to be met by short selling. Counter to earlier concerns, while decimalization has weakened the effect of the uptick rule, it has not eliminated the impact of the uptick rule on rapid selling as shown in Figure 3.

References

[1] Securities Exchange Act of 1934, http://www.law.uc.edu/CCL/34Act/

[2] Regulation SHO and Rule 10a–1, 17 CFR Parts 240 and 2423, Securities and ExchangeCommission, Federal Register, 72, 36348, July 3, 2007, http://www.sec.gov/rules/final/2007/34-55970.pdf

[3] Economic Analysis of the Short Sale Price Restrictions Under the Regulation SHO Pilot, Office of Economic Analysis, U.S. Securities and Exchange Commission, Feb. 06, 2007.

[4] Amendments to Regulation SHO, 17 CFR Part 242, Securities and Exchange Commission. Release No. 34-59748; File No. S7-08-09. http://www.sec.gov/rules/proposed/2009/34-59748.pdf

[5] Amendments to Regulation SHO, 17 CFR Part 242, Securities and Exchange Commission. Release No. 34-60509; File No. S7-08-09. http://www.sec.gov/rules/proposed/2009/34-60509.pdf

[6] SEC Concept Release: Short Sales. http://www.sec.gov/rules/concept/34-42037.htm

[7] D. Harmon, Y. Bar-Yam. Technical Report on SEC Uptick Repeal Pilot. NECSI Technical Report 2008-11. November 2008.

[8] M. James, Inconsistent Reports of Long-Term Stock Returns, Jan 22, 2008, http://michaeljamesmoney.blogspot.com/2008/01/inconsistent-reports-of-long-term-stock.html