

# Evidence of market manipulation in the financial crisis\*

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## Abstract

We provide direct evidence of market manipulation at the beginning of the financial crisis in November 2007. The type of market manipulation, a “bear raid,” would have been prevented by a regulation that was repealed by the Securities and Exchange Commission in July 2007. The regulation, the uptick rule, was designed to prevent market manipulation and promote stability and was in force from 1938 as a key part of the government response to the 1929 market crash and its aftermath. On November 1, 2007, Citigroup experienced an unusual increase in trading volume and decrease in price. Our analysis of financial industry data shows that this decline coincided with an anomalous increase in borrowed shares, the selling of which would be a large fraction of the total trading volume. The selling of borrowed shares cannot be explained by news events as there is no corresponding increase in selling by share owners. A similar number of shares were returned on a single day six days later. The magnitude and coincidence of borrowing and returning of shares is evidence of a concerted effort to drive down Citigroup’s stock price and achieve a profit, i.e., a bear raid. Interpretations and analyses of financial markets should consider the possibility that the intentional actions of individual actors or coordinated groups can impact market behavior. Markets are not sufficiently transparent to reveal or prevent even major market manipulation events. Our results point to the need for regulations that prevent intentional actions that cause markets to deviate from equilibrium value and contribute to market crashes. Enforcement actions, even if they take place, cannot reverse severe damage to the economic system. The current “alternative” uptick rule which is only in effect for stocks dropping by over 10% in a single day is insufficient. Prevention may be achieved through a combination of improved transparency through availability of market data and the original uptick rule or other transaction process limitations.

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## I. INTRODUCTION TO BEAR RAIDS AND MARKET MANIPULATION

On July 6, 2007, the Securities and Exchange Commission (SEC) repealed the uptick rule, a regulation that was specifically designed to prevent market manipulations that can trigger market crashes. While it is widely accepted that the causes of the crash that began later that year were weaknesses in the mortgage market and financial sector, the close proximity of the repeal to the market crash suggests that market manipulation may have played a role.

Here we present quantitative evidence of a major market manipulation, a “bear raid,” that would not have been possible if the uptick rule were still in force. The timing of the bear raid, in autumn 2007, suggests that it may have contributed to the financial crisis. Bear raids are an illegal market strategy in which investors manipulate stock prices by collectively selling borrowed shares. They profit by buying shares to cover their borrowed positions at a lower price. While bear raids are often blamed for market events, including financial crises [1, 2], this paper is the first to demonstrate the existence of a specific bear raid.

The sale of borrowed shares, called short selling, is a standard form of market trading. Short sellers sell borrowed shares, then buy them back later and return them to their owners. This practice yields profits when prices decline. In a bear raid, investors engage in short selling with the addition of market manipulation. Instead of profiting from a natural decline in the fundamental value of a company stock, the executors of a bear raid themselves cause the price to decline. Large traders combine to sell shares in high volume, “driving” the price down [3, 4].

A bear raid is profitable if other investors are induced to sell their shares at the lower price. This may happen for two reasons: margin calls and panic. Margin calls occur when brokerages force investors to liquidate their positions. Investors who are confident in the rising price of a stock may buy shares on borrowed funds, called “buying on margin,” using the value of the shares themselves as collateral. When prices decline, so does the value of the collateral and at some point brokerages issue “margin calls,” requiring shares to be sold even though the owners would prefer not to. Panics occur when investors, fearing further losses, sell their shares. The executors of a bear raid profit from the price decline by buying back the shares they borrowed—“covering” their short positions—at the lower market price.

In the aftermath of the 1929 market crash, Congress created the Security and Exchange Commission (SEC). Recognizing the dangers of short selling, Congress specifically required

the SEC to regulate short selling [5]. The regulation that was instituted in 1938, the uptick rule, states that borrowed shares may only be sold on an “uptick”—at a price that is higher than the immediately preceding price. The rule was designed to limit the intentional or unintentional impact of short selling in driving prices down, and specifically to prevent bear raids. The uptick rule was repealed in July, 2007 by the SEC on the basis of arguments that markets were transparent and no longer needed the protection of the uptick rule [6]. SEC claims that the uptick rule had no significant effect on market stability, even in absence of specific manipulation, have been refuted [7–9]. Our results implying a bear raid in November 2007 contradict the assertion of market transparency.

Our evidence points to a bear raid on the large financial services company Citigroup. On November 1, 2007, Citigroup’s stock experienced an unusual increase in trading volume and decrease in price. To analyze this event, we studied financial industry short trading data (see Appendix A), which reveal the total number of borrowed shares (short interest) at the end of each trading day. Using these data, we show that the increase in trading volume on November 1 coincides with an increase in borrowed shares. Six days later, a comparable number of short positions were closed during a single trading day. News events to which these events might normally be attributed cannot account for the difference between trading in borrowed shares and trading by owners of shares. The magnitude and coincidence of short activity is evidence of a concerted effort to drive down Citigroup’s stock price and achieve a profit, i.e., a bear raid.

## II. CITIGROUP ON NOVEMBER 1 AND 7, 2007

On November 1, 2007, Citigroup experienced large spikes in short selling and trading volume. The number of borrowed shares—short interest—increased by approximately 130 million shares to 3.8 times the 3-month moving average. The total trading volume jumped from 73 million shares on the previous day to 171 million shares, 3.7 times the 3-month moving average. The ratio of the increase in short positions to volume was 0.77. This is the fraction of the total trading that day that may be attributed to short positions held until market closing. The total value of shares borrowed on November 1 was approximately \$6.07 billion. Adjusted for the dividend issued on November 1, 2007, Citigroup stock closed on November 1 down \$2.85 from the previous day, a drop of 6.9%.

The number of positions closed on November 7, 202 million, was 53% larger than the number opened on November 1. The short interest before the increase on November 1 and after November 7 are virtually identical, the larger decrease corresponding to an additional increase in short interest between these dates. The mirror image one-day anomalies in short interest change suggest that the two are linked. We can conservatively estimate the total gain from short selling by multiplying the number of short positions opened on November 1 by the difference between the closing price on November 1 and closing price on November 7 (\$4.82), which yields an estimated gain for the short sellers of \$640 million.

The total decrease in short interest on November 7 exceeds the total trading volume on that day, 121 million, by 82 million shares. This indicates that the reported decrease in borrowed shares is not fully accounted for by recorded trading on the markets. The difference may result from off-market transfers, which may be advantageous to short sellers in not causing the price to increase. Alternatively, despite the usual coincidence of borrowing and selling, this may be due to shares that were borrowed and returned without being sold short. Further investigation of transaction data is necessary to explain the difference in returned shares and trading volume.

Figure 1 shows daily stock price, volume, and short sale data for Citigroup over a two-year period starting January 1, 2007. Short sale data includes short interest—the number of shares borrowed at the end of each day—and the daily change in short interest. During much of 2007-2009, the daily change in short interest did not exceed a small fraction of the total trading volume. The largest single-day increase in short interest occurred on November 1 and is marked with arrows in Figure 1. Figure 2 shows an enlarged view of the period around that date.

In Appendix B we analyze quantitatively the probability of the events on November 1 and November 7. Often probabilities are estimated using normal (Gaussian) distributions that underestimate the probability of extreme events (“black swans”) that are better represented by long-tailed distributions [11, 12]. We directly fitted the long tails of the distributions and estimated the probability of the events based upon these tails to be  $p = 2 \cdot 10^{-5}$  and  $8 \cdot 10^{-9}$ , respectively. Given 250 trading days in a typical year, it would take on average 200 years and 500 thousand years, respectively, to witness such events. Moreover, the probability of these two events occurring 6 days apart is  $p = 1 \cdot 10^{-12}$ , corresponding to 4 billion years, comparable to the age of the Earth. Figure 3 shows that these events are outside the general

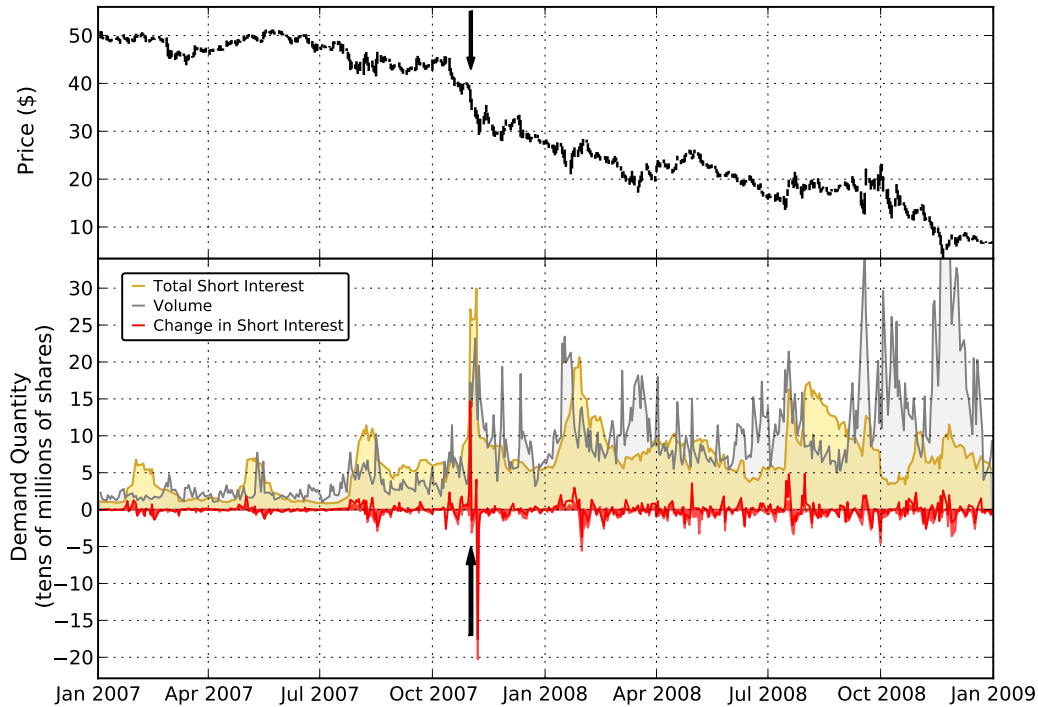


FIG. 1: Market activity for Citigroup over a two-year period starting January 1, 2007. Top panel shows vertical bars for the daily high and low stock price. Lower panel shows total short interest (yellow), trading volume (gray), and daily change in short interest (red). Arrows indicate November 1, 2007 [10].

behavior of the market. We emphasize that our estimates of the probabilities of these events reflects the higher probabilities of extreme events in long-tailed distributions.

Changes in investor behavior are often explained in terms of specific news items, without which it is expected that prices have no reason to change significantly [13, 14]. The press attributed the drop of Citigroup’s stock price on November 1 to an analyst’s report that morning [15, 16]. This report, by an analyst of the Canadian Imperial Bank of Commerce (CIBC), downgraded Citigroup to “sector underperform” [17]. Any such news-based explanations of investor behavior on November 1 (similarly for November 7) would not account for the difference in behavior between short sellers and other investors. Under the assumptions of standard [14] capital asset pricing models, all investors act to maximize expected future wealth [18], and should therefore respond similarly to news. Furthermore, it has been shown empirically that the ratio of short sales to total volume remains nearly constant, even around



FIG. 2: Market activity for Citigroup over a five-month period starting on August 15, 2007. Top panel shows bars for daily high and low stock price (adjusted for dividends). Lower panel shows daily change in short interest (red bars), total short interest (yellow lines), and trading volume (gray bars). Arrows indicate November 1, 2007 [10].

news events [19]. In the literature, analysis of the residual small differences in the behavior of short and long investors has been interpreted to indicate that short sellers have an informational advantage or that short sellers are able to anticipate lower future returns [19–23], rather than cause them. Still, these studies do not show that large differences in trading generally occur between short and long sellers. Thus, the existence of such a difference is indicative of specific trader action.

Our evidence points to a bear raid during a period of financial stress [24, 25] to which the Federal Reserve Bank responded in August 2007 by announcing that they would be “providing liquidity to facilitate the orderly function of markets” because “institutions may experience unusual funding needs because of dislocations in money and credit markets” [26]. Shortly afterwards, the Dow Jones Industrial Average achieved its historical peak—14,167 points on October 9—three weeks prior to November 1, the date our evidence suggests a bear

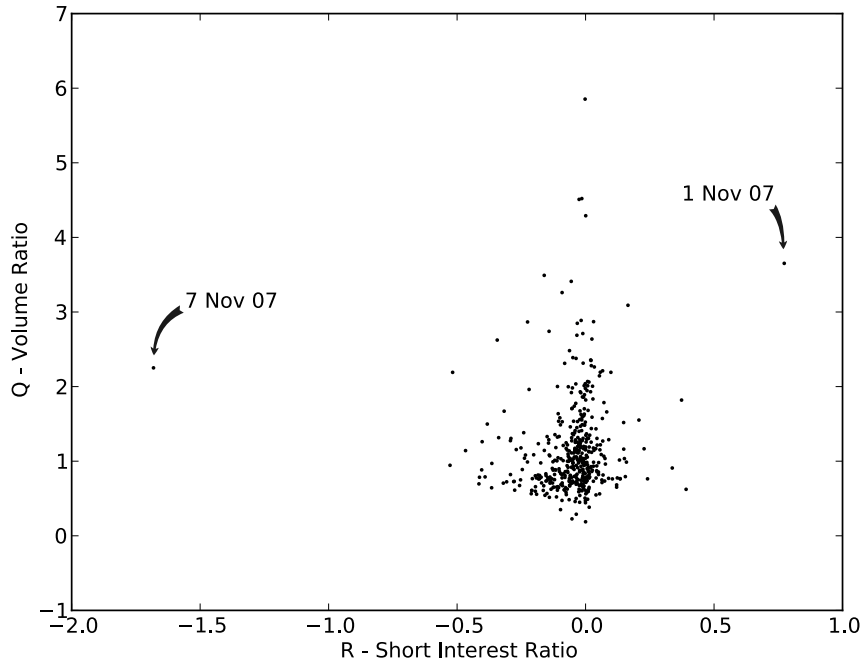


FIG. 3: Scatter plot of the daily volume of trading divided by the three month prior average (volume ratio), and the increase in number of borrowed shares divided by the volume (short interest change ratio), for Citigroup over a two-year period starting January 1, 2007. Arrows indicate Citigroup on 1 November 2007 and 7 November 2007. These two points are well outside of the behavior of daily events even during the period of the financial crisis in late 2007 and throughout 2008. The two measures are described in Appendix A.

raid occurred. Bear raids may have long-term price impact if decision makers infer investor confidence from price movements and act on that basis [27, 28]. Citigroup CEO Charles Prince’s resignation on November 4 after an emergency board meeting [29] may reflect such an effect. The months after November 1 saw the beginning of the stock market turmoil of 2008-2009 as well as many significant events of the financial crisis, such as the purchase of Bear Stearns by JP Morgan Chase in March 2008 and the bankruptcy of Lehman Brothers in September 2008.

### III. CONCLUSIONS AND POLICY IMPLICATIONS

The 2007–2011 financial crisis resulted in widespread economic damage and introduced questions about both our understanding of economic markets and about the practical need for regulations that ensure market stability. The Financial Crisis Inquiry Commission

(FCIC) reported that over 26 million Americans were unemployed or underemployed in early 2011, and that nearly \$11 trillion in household wealth evaporated. Moreover, the FCIC concluded that the crisis was avoidable and was caused in part by “widespread failures in financial regulation and supervision [that] proved devastating to the stability of the nation’s financial markets” [30]. Regulatory changes that preceded the financial crisis include the June 2007 repeal of the uptick rule, which was implemented in 1938 to increase market stability and inhibit manipulation [5–8, 31].

Within the resulting deregulated environment, it is still widely believed that the crisis was caused by mortgage-related financial instruments and credit conditions, and that individual traders did not play a role [32–35]. Our analysis demonstrates that manipulation may have played a key role. Methods for detecting manipulation and its effects are necessary to both inform and enforce policy.

When the SEC repealed the uptick rule on July 6, 2007, one of its main claims was that the market was transparent, and that such regulations were not needed to prevent market manipulation [6]. Our results suggest that, not long after the uptick rule was repealed, a bear raid may have occurred and remained undetected and unprosecuted. Our analysis reinforces claims that lax regulation was an integral part of the financial crisis [30].

In response to requests for reinstatement of the uptick rule after the financial crash, the SEC underwent extended deliberations and finally implemented an alternative uptick rule, which allows a stock to fall by 10% in a single day before limitations on short selling apply [36]. This weaker rule would not have affected trading of Citigroup on November 1, 2007, as its minimum price was just 9% lower than the close on October 31. Subsequent day declines until November 7 were also smaller than 10%.

The existence of a major market manipulation should motivate changes in market models, analysis, regulation and enforcement. In particular we conclude that:

- Large traders may have a significant influence on the market. Scientific analysis and models should recognize the role of large traders and consider both past events and potential future events they may cause. For example, market time series analysis that does not specifically consider the effect of manipulation may be unable to discover it, because manipulation events may not manifest in averages and distributions that are usually considered.



- Improved access to data can enable the detection of market manipulation. This would foster transparency in the markets, which has been lauded but not realized. Regulatory agencies should mandate the increased availability of relevant data for the detection of manipulation. If these data cannot be made available in real-time or for public use, they may be provided with time delays or only for scientific use. Data of importance include not only the opening of short positions but also their closing, as aggregate short sale activity cannot be determined when only opening trade data are available. These data should be made available at the transaction level.
- Current legislation, which focuses on retroactive penalties, is ineffective due to the discrepancy between the timescale of enforcement response and that of market manipulation. Severe failures in the financial system may include cascading global market crises and numerous takeovers and bankruptcies, making the disentanglement of individual events difficult if not impossible. Regulatory agencies should adopt preventive measures such as the uptick rule, which would be more effective than punitive ones. The uptick rule was designed to minimally restrict trader's actions while simultaneously providing underlying stability for the financial system and inhibiting particular forms of manipulation, including bear raids.
- The limitations of our data prevent definitive conclusions about individual events or their attribution to individual investors. Enforcement agencies should perform investigations into specific candidate events, including the candidate event we identified on November 1, 2007.
- Until effective regulations and enforcement are in place, market price changes may not reflect economic news. They may reflect market manipulation.

The complexity of financial markets and their rapid dynamics suggest that data analysis and market models are increasingly necessary for guiding decisions about setting market regulations and their enforcement [37–39]. Independent of the role it may play in financial crises, understanding market manipulation may be important for characterizing market dynamics. Recent decades have seen significant advances in financial market theory, including the mean-variance portfolio theory [40], the capital asset pricing model [18], arbitrage pricing theory [41], and the theory of interest rates [42]. However, the financial crisis and anoma-

lous events such as “flash crashes” [43] demonstrate limitations in existing approaches. More recent efforts seek to explain market phenomena via methods such as agent-based modeling [44–49] and analysis of the long-tailed distributions of price fluctuations [11, 50–53]. While these methods have been successful in describing some aspects of market behavior, they generally do not consider the impact of individual traders who have the ability to significantly impact the market [54–60]. Current approaches, whether analytical or statistical, may not reveal isolated—or even frequent—instances of trader influence.

Among the possible forms of individual trader influence, intentional actions—including manipulation—are of particular relevance, as they undermine the role of markets in setting prices so as to reflect economic value. Market manipulation is illegal under Section 10 of the Securities Exchange Commission Act of 1934 [5]. Some forms of manipulation are well documented, including indirect price manipulation through the generation of false news [61]. Direct price manipulation through market transactions is also commonly thought to occur [1, 2, 54], but methods for its detection that are based on statistical analysis [62, 63] are limited by their inability to independently account for news events and other anomalies. No direct evidence of recent price manipulation has been presented based upon these methods.

The timing of the event we identified raises questions about the potential role it may have played in the financial crisis. Understanding the wider impact of such an event requires that we consider the vulnerability of the overall market.

Whereas a highly stable system is not vulnerable to any but the largest impacts, a vulnerable system can be destabilized by much smaller shocks [64, 65]. This is a general aspect of the behavior of complex interdependent systems, not just of financial markets. Specific events can have large effects if the underlying physical, biological or social system is vulnerable. For example, while mass extinctions have been shown to coincide with meteor strikes [66], underlying vulnerabilities are thought to contribute to the severity of extinction events [67]. Similarly, market manipulation during a period of instability and high interconnectedness, such as before the financial crisis [24, 25, 68], may exacerbate or even trigger a collapse. The financial system can be expected to exhibit this general property of complex systems, in which the coincidence of underlying vulnerability and extreme events can trigger crises.

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## Appendix A: Methodology: Data and Event Detection

It is generally difficult to characterize the investments of individual traders, especially for short positions. Unlike those who own large stakes in companies, those with large short positions are not required to report their holdings [69]. Short interest data is publicly available by ticker symbol at two-week intervals for a rolling 12-month period [70]. This time resolution is too low to detect the bear raid candidate we will describe, and does not include historical data for the period of the financial crisis. The recent availability of off-market transaction systems that enable large volume transactions, such as crossing networks [71, 72], makes it difficult, if not impossible, to trace intentional large short sale transactions using market data. A short sale transaction between cohorts on a crossing network may allow one trader to execute a short sale while the other trader accumulates a long position. This long position can then be sold on the open market without leaving a signature of its short sale origins.

Our study is based on industry data on daily securities lending. While this data does not identify the individuals borrowing the shares, the time resolution proved sufficient to provide evidence of a bear raid.

We obtained price and volume data from Thomson Reuters Datastream. Short interest data was obtained from Data Explorers and included a daily record of the value and quantity of loaned securities as reported by brokerages. These included separate time series for the total number of borrowed securities (total demand quantity) and for daily incremental changes in the number of borrowed shares. Daily incremental changes were approximately given by day-to-day differences in total demand quantity, with small corrections arising from the addition and removal of reporting organizations from the data set. The reconstruction of short selling data from security lending data is an inexact process, because borrowed securities may be used for purposes other than short selling, including tax arbitrage, dividend arbitrage, and merger arbitrage. Furthermore, reported data may be incomplete, because not all lenders supply data to industry data providers. Nevertheless, because short selling is the predominant reason for securities lending, securities lending is a reasonable proxy for short selling [73, 74]. We also were able to eliminate the possibility of the most likely alternative explanation to a bear raid, dividend arbitrage, as described in Appendix C.

The signature of a successful bear raid is an anomalous spike in the number of shares

of a company’s stock that are sold short, followed by a price decline, then a corresponding large spike in the number of positions that are covered—a decrease in the number of short positions. A sufficiently large increase in short selling would also increase the total volume of trades, so we monitored also the total daily trading volume.

We searched data for several prominent companies to identify candidate events, and calculated two ratios,  $R$  and  $Q$ , for each trading day.  $R$  is the ratio of the change in short interest to daily volume,

$$R(t) = \frac{\Delta S(t)}{V(t)}, \quad (1)$$

where  $\Delta S(t) = S(t) - S(t-1)$  is the change in short interest,  $V$  is trading volume, and  $t$  is the date. A large absolute value of  $R$  indicates that a high proportion of trading is accounted for by securities lending activity—that the volume of borrowed shares was a substantial fraction of the total volume, and that short sales might have affected the stock price. A high positive value indicates that shares were borrowed, and a high negative value indicates short covering. Note that if a large number of short positions were opened and closed on the same day (i.e. an intraday bear raid), it would not be revealed by daily short interest data. We cannot exclude the possibility of intraday bear raids occurring during this period.

$Q$  is the ratio of the trading volume to the three month moving average,

$$Q(t) = \frac{V(t)}{\bar{V}(t)}, \quad (2)$$

where  $\bar{V}$  is the prior 3-month (63 trading day) moving average of volume. A value of  $Q$  substantially greater than one indicates an anomalously high trading volume. The event we analyzed was identified by a high absolute value of  $R$  and high value of  $Q$ , indicating that the increase in borrowed shares was large in comparison to trading activity, and that total trading activity increased dramatically.

## **Appendix B: $R$ and $Q$ distributions**

In this appendix we present our analysis of the distributions of  $R$  (the ratio of the change in short interest to daily volume, see Eq. 1) and  $Q$  (the ratio of the trading volume to the three month moving average, see Eq. 2) for Citigroup, from January 2007 through December 2008. The analysis allows us to obtain a probabilistic estimate of the inherent likelihood of

$R$  and  $Q$  values for each day, and in particular for the events on November 1 and 7, 2007.

The positive and negative tail cumulative distributions for Citigroup for  $R$  are plotted in Fig. 4. The two sides of the distribution behave differently: while the positive tail follows a power law distribution (top panel), the negative tail is well described by a Laplacian distribution (bottom panel). The distribution for  $Q$ , shown in Fig. 5, has a power law tail. November 1 and 7, 2007 are omitted in the plots, but this does not affect the fitted distributions. From the fitted distributions we extracted the expected probabilities of the two events.

### Appendix C: Tests and Technical Notes

We have tested a number of alternative explanations of the data:

- Is it possible that the borrowed shares were used to receive a dividend payment, i.e. dividend arbitrage?

Sometimes borrowing shares provides benefits of dividends to the borrower rather than to the owner. In such cases the borrower may not necessarily sell the shares short, which precludes a bear raid.

The date on which shares were borrowed, November 1, was an “ex-dividend” date, i.e. a date on which ownership determines dividend payments. In order for borrowers to receive the benefit of dividends they are required to hold the shares at the prior day’s closing. Thus, there was no dividend paid to shares borrowed on November 1.

- Is it possible that the reported dates for borrowed shares is delayed so that the actual date of borrowing is a different date than what is reported (for example, could it be reported on the date of settlement three days after a market transaction)?

We verified the agreement of reported borrowing and short selling date by looking at the period of the short sale ban starting in September 2008. The dates of the start and stop of borrowing coincide with the dates that they should for the ban, which shows that there is no delay in reporting.

- Does commercial market transaction data corroborate the short selling?

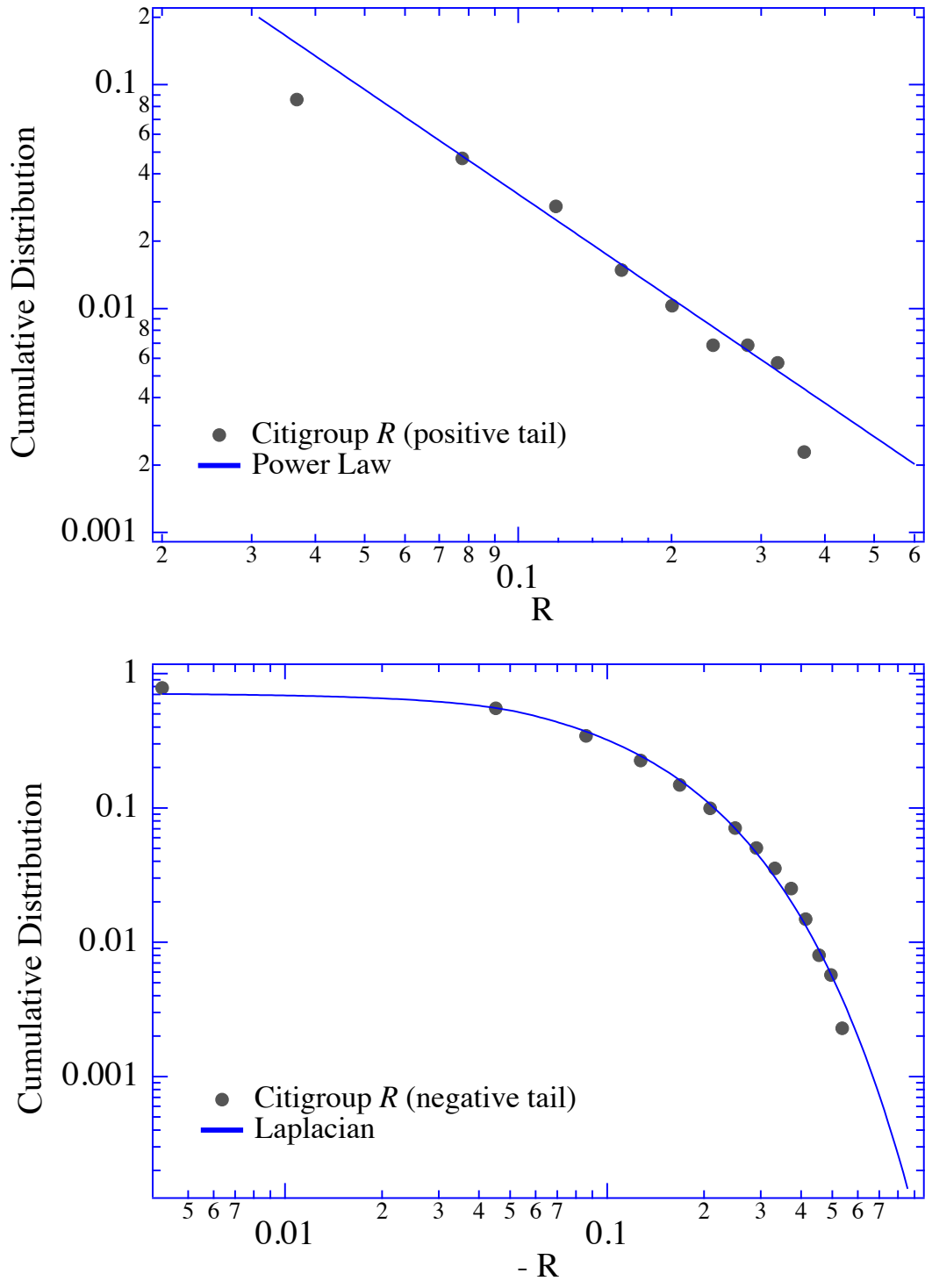


FIG. 4: **Citigroup  $R$  distribution** - Cumulative distribution functions (CDF) of the short interest change ratio for Citigroup, for 2007 and 2008. *Top panel:* Positive tail of the distribution, blue line is the best fit power law ( $CDF(R) \sim R^\alpha$ , with  $\alpha = -1.35$ ). *Bottom panel:* Negative tail of the distribution, blue line is the best fit Laplacian distribution ( $CDF(R) \sim 1 + \text{sign}(R - \beta)(1 - \exp(-|R - \beta|/\gamma))$ ), with  $\beta = 0.11$  and  $\gamma = 0.048$ ).

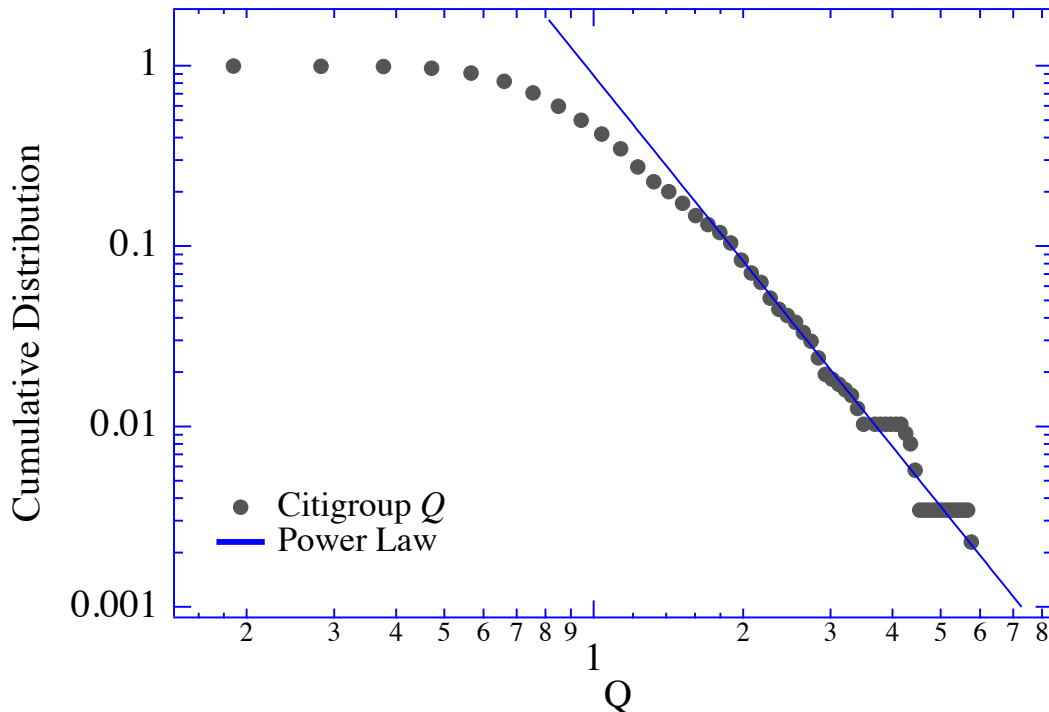


FIG. 5: **Citigroup  $Q$  distribution** - Cumulative distribution function (CDF) of the volume ratio for Citigroup for 2007 and 2008. Blue line is the best fit power law ( $CDF(Q) \sim Q^\alpha$ , with  $\alpha = -3.34$ ).

We have studied commercially available NYSE short selling data [75] from these dates, and found it to be unreliable because the transactions reported are inconsistent with reported trade and quote data [76] at the transaction level. Despite dialog with the NYSE staff we have not received an explanation of the inconsistency. For the present analysis, the inconsistency inhibits our efforts to use this data to cross-validate the results in this report. More generally, it raises questions about the reliability of market provided short sale data.

- Is it possible that the analyst report downgrading Citigroup that morning was released in collusion with the bear raid?

We have no specific evidence, but such collusion would be consistent with strategies used by those who manipulate stocks [1, 2, 54, 61].

- Is it possible that those who engaged in the bear raid also used trading in options to increase their profits by buying put or selling call options?

Our estimate of the profits made on the bear raid are conservative.

- Is it possible that the large block trades on November 1 and 7 represented trading based upon information that was not yet available to the public on November 1?

Our evidence suggests that a single individual or group of individuals traded a large volume of borrowed shares on November 1 and November 7. If this represented potentially illegal insider trading, the traders would have avoided attracting attention. Neither the large trading volume nor the abrupt price drop on November 1 at the opening of the market appear to be consistent with a low-profile trading approach. The rapid price drop is also inconsistent with the expected behavior of insider traders, which is to maximize profits by selling gradually to avoid affecting prices until the negative news becomes public. Both the large volume of trading and the rapid drop are consistent with trading intended to affect prices, i.e. a bear raid. While the intentions of traders can only be determined from a more detailed inquiry once those traders are identified, the available information strongly supports a bear raid over the possibility of insider trading per se. It is possible that traders with insider information chose to help matters along by performing a bear raid at the same time as they were trading on insider information.

#### **Addendum: Additional Tests and Technical Notes**

Following the release of this paper, we were contacted by the NYSE with additional information about the NYSE short selling transaction data [75] described in Appendix C. The new information enabled us to reconcile the short sale and trade data [76] by aggregating and shifting the times of multiple transfers to correspond with market transactions. There are residual issues with a small minority of transactions that are being resolved, but these issues appear to be irrelevant to conclusions about the volume of trading.

The additional information enables us to identify with some confidence the reported short sale volume on the NYSE on November 1 and other dates. The short sale volume is not unusual as a proportion of total volume, constituting about one quarter of the total volume on this market. NYSE transactions constituted 30% of the total market volume on November 1, 2007. This limits the volume of reported short selling on the markets, and diminishes the



likelihood that the reported increase in borrowed shares was directly reflected in reported short sales.

Absent an alternative interpretation, if shares were sold in a way that concealed their origin as borrowed shares the data sets would be consistent. One method to achieve this, using “short to buy” transactions, was reported in Senate investigations of the Pequot Capital hedge fund in 2009 [77]. In this approach a single trader moves shares from one account to another, creating a short position in one and a long position in the other. Since there is no change in beneficial ownership, such transactions may be reported in a way that is not consistent with standard reporting requirements, resulting in share borrowing without a market record. Long positions created this way may be sold on any market without being identified as short sales, even though in doing so a net short position is created.

This method appears to have been developed to hide short selling at a time when the uptick rule was in effect. Short to buy transactions require a close relationship with a broker dealer. The necessary access to market trading systems, called “sponsored” or “direct market” access, needed to perform the short to buy transaction is not available to most traders but constitutes a significant fraction of reported trading [78, 79]. Only recently, beginning in 2011, were brokers required to apply standard regulations to transactions of traders using sponsored access [80, 81]. Previously, non-compulsory self-regulation was in effect [82]. In the absence of oversight, market data may not properly record the volume of short selling.

An explanation in these terms for the events in November of 2007 is also consistent with the observation that there was a larger volume of returned shares on November 7 than the trading volume. In the “short to buy” scenario, residual positions can be closed through “back office” transactions and may never be recorded on the market.

The new information we received implies that the sale of borrowed shares reflected in the increase in borrowed shares on November 1 and the corresponding decrease on November 7 may have been done in a way that would not have been prevented by the uptick rule. A more detailed inquiry into the means by which such selling could have been done is beyond the current work.

We thank Steven Poser and Wayne Jett for helpful discussions.

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