Are Short Sellers Positive Feedback Traders?
Evidence from the Global Financial Crisis*

Martin T. Bohl†, Arne C. Klein‡ and
Pierre L. Siklos§

October 17, 2011

Abstract

Short sellers are routinely blamed for destabilizing stock markets by exacerbating deviations from fundamental values. In response, regulators periodically impose short sale constraints aimed at preventing excessive stock market declines. One explanation is that policy makers regard short sellers behaving as positive feedback traders. Relying on the theoretical model put forward by Sentana and Wadhwani (1992) which stresses the conditional nature of returns’ persistence, bans on selected financial stocks in six countries during the 2008/2009 global financial crisis provide us with a setting to analyze the effect of short sale restrictions on feedback trading. To date, empirical evidence only deals with unconditional correlation of returns. Our findings suggests that in the majority of markets the restrictions amplify positive feedback trading and, hence, contribute to stock market downturns.

JEL Classification: G10, G12, G14, G15, G18
Keywords: Short Selling Ban, Short Sales, Feedback Trading, Financial Crisis.

*We are indebted to Christian A. Salm for helpful comments and suggestions. The authors would like to thank the participants of the International Finance and Banking Society Conference (Rome), in particular Giovanni Walter Puopolo. The third author would like to thank the Centre for International Governance Innovation (CIGI) for financial support.

†Corresponding author, Department of Economics, Westphalian Wilhelminian University of Münster, Am Stadtgraben 9, D-48143 Münster, Germany, fax: +49 251 83 22846, phone: +49 251 83 25005, email: martin.bohl@wiwi.uni-muenster.de

‡Department of Economics, Westphalian Wilhelminian University of Münster, Am Stadtgraben 9, D-48143 Münster, Germany, phone: +49 251 83 22989, email: arne.klein@wiwi.uni-muenster.de.

§Department of Economics, Wilfrid Laurier University and Viessmann European Research Centre, 75 University Avenue, Waterloo, ON, Canada N2L 3C5, email: psiklos@wlu.ca
1 Introduction

During the recent global financial crisis in 2008/2009, regulators, politicians and high-profile media coverage blamed short sellers for amplifying stock market downturns. In this spirit, regulatory authorities around the world imposed bans on short sales with the hope of stabilizing stock markets thereby preventing excessive price declines. For instance, in the announcement of the July/August 2008 ban on naked shorts (SEC (2008)), the US Securities and Exchange Commission (SEC) declared that there was panic selling “which may be further exacerbated by naked short selling. As a result, the prices of securities may artificially and unnecessarily decline well below the price level that would have resulted from the normal price discovery process.” A potential rationalization for this kind of behavior is to view short sellers as akin to positive feedback traders who amplify deviations from fundamental values.

Feedback trading is a well known phenomenon during times of financial turmoil (Sentana and Wadhwani (1992), LeBaron (1992), Koutmos (1997), Kaminsky and Schmukler (1999), Karolyi (2002), Kaminsky et al. (2004), Salm and Schuppli (2010)). However, the literature is silent about the impact of short sale constraints on institutional investors’ feedback trading behavior. The present paper aims to fill this gap by investigating the short selling regimes in the US, the UK, Germany, France, South Korea and Australia during the recent global financial crisis. We contribute to the literature by providing evidence against the stabilizing effects of short sale constraints as they may exacerbate positive feedback trading rather than mitigate it. However, unlike the literature which reports unconditional autocorrelations (Beber and Pagano (2011)), ours is the first to highlight the conditional nature of return persistence stemming from feedback trading, a point emphasized by Sentana and Wadhwani’s (1992) seminal article. This allows us to draw conclusions about institutional investors trading behavior.\footnote{Measured in terms of trading volume or asset holdings, institutional investors have played a dominant role in mature stock markets for many years. By 2007, financial assets of institutional investors as a percent of GDP exceeded 200% in case of the US and the UK and were well over 100% in the other countries considered in this study with the exception of Korea where the value lied around 90% of GDP (Gonnard et al. (2008)). Moreover, mainly institutional investors use short sales whereas individual investors play only a minor role. Consequently, our investigation of short selling constraints’ impact is an analysis of institutional investors’ feedback trading behavior.}
The debate on short selling is not new to academics (see Boehmer et al. (2010) and Bris et al. (2007) for reviews). Empirical research on short sellers’ investment strategies focuses on their ability to identify overvalued stocks. There is widespread evidence supporting the view that high short interest predicts negative subsequent returns (Seneca (1967), Figlewski (1981), Senchack and Starks (1993), Aitken et al. (1998), Desai et al. (2002), Asquith et al. (2005), Boehme et al. (2006)) although there are dissenters (Hurtado-Sanchez (1978), Dickinson and Woolridge (1994), Huszár and Qian (2011)). Direct evidence on short sellers’ trading strategies is more scarce. Dechow et al. (2001) document short sellers’ ability to exploit information from fundamental-to-price ratios to generate positive abnormal returns. Drawing on daily NYSE order flow data, Boehmer et al. (2008) show that heavily shorted stocks significantly underperform compared with lightly shorted ones. Similar findings for the Nasdaq stocks are reported in Diether et al. (2009). A third perspective argues that short sales may be due to arbitrage, hedging or tax related trades and, thus, this type of activity does not necessarily contain information about future performance (Brent et al. (1990)).

Paralleling regulators’ reaction to the global financial crisis, academic interest on the impact of short sale constraints has been revived once again. Analyzing the ban in the US in July and August 2008, Bris (2008) and Boulton and Braga-Alves (2010) report evidence of negative effects on market liquidity, such as rising bid-ask spreads, lower trading volume and reductions in pricing efficiency. Additionally, the results of Harris et al. (2009) and Boulton and Braga-Alves (2010) lend further support to Miller’s (1977) overvaluation hypothesis. The US short selling regime in September and October 2008 is the subject of Boehmer et al. (2009). Their results confirm deteriorations in market quality but cannot corroborate overvaluation. Based on the same ban period, Grundy et al. (2009) as well as Battalio and Schultz (2011) provide evidence stressing the thesis that options represent a substitute to short sales. Evidence for both US short sale regimes given in Kolanski et al. (2010) supports Diamond and Verrecchia’s (1987) prediction that the negative effects on market quality are stronger for stocks with listed options.

Dealing with the case of the UK, Marsh and Payne (2010) report lower trading
volumes and order book liquidity. Focusing on Australia, Helmes et al. (2010) document reduced trading activity and increased bid-ask spreads for stocks excluded from short selling. Considering restrictions in 30 countries, Beber and Pagano (2011) add to the evidence that short sale constraints entail reductions in market liquidity. In addition, they analyze the residuals of market model regressions reporting increased autocorrelation for banned stocks.

Beber and Pagano’s (2011) paper comes closest to our study. However, their findings only shed light on unconditional autocorrelations. Unconditional autocorrelations in single stock and portfolio returns is a well known phenomenon (e.g., Lo and MacKinlay (1988), Conrad and Kaul (1988), Lo and MacKinlay (1990), Mech (1993), Chang et al. (1999), Bris (2008)). Theoretical explanations for unconditional serial correlation focus on the speed of price discovery, non-synchronous trading, transaction costs and market microstructure issues but do not deal with institutional investors’ trading patterns. By contrast, Sentana and Wadhwani (1992) show that feedback trading behavior can lead to autocorrelations that are conditional on volatility. Specifically, their model is able to explain the stylized facts that increased volatility is known to be accompanied by serial correlation that is more negative and higher in absolute value than during periods of low volatility. We make use of a version of the Sentana and Wadhwani (1992) model to shed light on a short sale ban’s impact on institutional investors’ feedback trading.

Focusing on bans that affect only selected financial stocks, we are able to disentangle the effects of the restrictions and the crisis per se by creating matched control groups from a sample of unbanned firms. This enables us to contrast changes in the extent of feedback trading in restricted stocks with those for unrestricted ones during the time span the ban is in place. In contrast to regulators’ view, we find evidence that, in the majority of countries, short selling constraints intensify positive feedback trading.

The structure of the paper is as follows. In section 2, we sketch the timeline of the short selling bans and the construction of control groups. Section 3 outlines the feedback trader model and further econometric methodology. Section 4 discusses the empirical results. Section 5 concludes.
2 Banned Stocks, Construction of Control Groups and Data

In many countries, short selling bans were part of the first regulatory changes intended as countermeasures against falling stock market prices during the financial crisis of 2008/2009. On July 15, 2008, the SEC announced an emergency order banning naked short selling in the stocks of 19 large financial firms coming into force on July 21. This ban was originally meant to expire on July 29 but on this day the SEC issued an extension of it remaining in force until August 12. Those first restrictions were only foreplay, as on September 17 the SEC imposed a ban on naked shorting in all stocks coming into force 12:00 am the next day. Late on September 18, after the closing of the market session, the regulators prohibited all short sales in nearly 800 financial stocks being effective immediately. On October 2, the regulators announced an extension of the ban for up to 30 days beyond September 17. Finally, the ban expired at midnight October 8, 3 days after the adoption of the so called Troubled Asset Relief Program. We do not include this second US ban in our analysis as it lasts for only 14 days not providing us with a sufficient number of observations to consistently estimate changes in feedback trading.

In the UK, on September 18, 2008, the Financial Services Authority established the strongest version of the short selling bans considered in this study, coming into force the next day: A prohibition to create a net short position using any instrument (including derivatives with an exemption for market makers and specialists) affecting 34 financial firms. The rule was limited until January 16, 2009 and expired on schedule.

The German Bundesanstalt für Finanzdienstleistungsaufsicht preferred a relatively long leash for short sellers, only forbidding naked short sales in 11 large financial firms. Announced on September 19, and established the next trading day, the ban was extended three times in 2008 and 2009 and finally phased out on January 31, 2010. In France, the same time schedule as in Germany was followed. There, the Autorité des Marchés Financiers placed off limits to short selling in 15 financial institutions.

On September 30, 2008, the South Korean Financial Supervisory Commission im-
posed a ban on all short sales in all South Korean stocks, which was justified on the grounds of 'malignant rumors' in the market. On May 20, 2009 it was announced that the ban would be lifted for non-financial stocks effective from June 2009. As this framework remained unchanged, we run our analysis for South Korea until the end of 2010.

On September 22, 2008, the Australian Securities & Investment Commission prohibited naked short sales for all firms listed at the Australian Securities Exchange and established a reporting regime for covered short sales. With effect from November 19, 2008 this ban was lifted for all stocks, with the exception of financial stocks in the S&P/ASX 200 plus 5 other stocks that were part of the Australian Prudential Regulation Authority regulated business. This ban expired on May 24, 2009.

With a few exceptions, in the US, the UK, Germany, France and Australia we include all banned stocks in our analysis.\(^2\) In South Korea, we limit our analysis to the financial stocks in the KOSPI 100 due to liquidity concerns.

For a given set of stocks and a given period, we aim to compare the return dynamics under short sale constraints with an unobservable hypothetical process without restrictions on shorting. This requires us to develop a proxy for the latter. In order to do so, we rely on matching techniques to construct control groups with similar market characteristics. As in most of the countries included in this study, all or at least all important financial stocks are subject to the ban, it is necessary to match the control groups mainly from non-financial firms.\(^3\) Therefore, to build a reliable match on the stocks available, the matching variables have to be carefully selected. Unlike many other studies that base their matches solely on market capitalization and trading volume, we additionally include the market beta. This takes into account a particular feature of financial stocks since these stocks are known to have high betas reacting

\(^2\)In the US, we do not include Merrill Lynch as there is no longer any sufficient data. In Germany, we exclude the Hypo Real Estate from our analysis since it was nationalized and delisted during the ban. In the UK, we exclude Bradford & Bingley and Tawa, as the first was announced to be partly nationalized on September 29, 2008 and the second was hardly traded during the ban period. In France, we do not include Dexia and Allianz in our sample, as their notations in Paris were delisted during the ban. For Paris Re, data is not available anymore. In Australia, we have to drop Macquarie DDR Trust and Challenger Financial Services Group as there is no data available.

\(^3\)An exemption is the July/August 2008 ban in the US where the control group includes a lot of financials.
much stronger to market movements than, for instance, utility stocks with comparable market capitalizations and trading volumes.

Similar to Boehmer et al. (2009), these variables are measured from January 2008 until the introduction of the ban in the case of the US, the UK, Germany, France and Australia. For South Korea, we use the period from September 2008 until the end of the ban on non-financial stocks on May 31, 2009. We aim to choose the matching partners such that they reflect as closely as possible the characteristics of the banned stocks. Therefore, for each banned stock, we choose with replacement the matching partner that minimizes the sum of squared differences in the matching variables. As the beta, volume and capitalization strongly differ with respect to mean value and standard deviation, we use standardized variables. This ensures that we assign equal weights on each matching variable in the sense that the selection of control stocks depends equally on market sensitivity, trading volume and capitalization.

Our datasets consist of daily total returns, market capitalizations and trading volumes of the stocks subject to the ban as well as those in the indices used for matching control groups, where we use the index composition as it was the day before the introduction of the short sale ban. We use the S&P 100 (US), the FTSE 100 (UK), the DAX and MDAX (Germany), the CAC40 and the French stocks in the Next CAC 100 (France), the KOSPI 100 (South Korea) and the S&P/ASX 100 (Australia). To estimate the models described in Section 3, we calculate value weighted return indices from the stocks in the test and control groups using log returns. This avoids to estimate time series models from noisy single stock data.

To consistently and robustly estimate the feedback trader model, we prefer a relatively long sample period. However, the longer we go back before the ban the fewer stocks in our test and control samples are available for calculating the return indices. To cope with both aspects, we use the period from January 2003 until December 2010. Thus, for each sample, we have 8 years of daily data to draw reliable conclusions.

---

4 Note that replacement is advisable to avoid the composition of the control groups depending on the order in which we match firms to our test groups.
5 A list of the stocks in our test and control groups is available upon request.
6 We select this period to ensure that for the countries with the smallest number of stocks, Germany and France, at least returns of 9 stocks are available at every point in time.
All time series are obtained from Thomson Reuters Datastream. The historical constituents of the indices were provided by Standard & Poor’s, the FTSE Group, the Deutsche Börse Group, NYSE Euronext and the Korea Exchange. Short sale constraints last for 402 (South Korea), 347 (France), 343 (Germany), 127 (Australia), 83 (UK) and 17 (US) days. The number of stocks in the test and control groups is given by 44 (Australia), 32 (UK), 18 (US), 16 (South Korea), 12 (France) and 10 (Germany). Table 1 provides a summary of the time schedules and key features of the six short selling regimes together with some descriptive statistics for the return indices of the stocks in the test and control groups.

3 Methodology

Relying on the previous work of Shiller (1984), De Long et al. (1990) and Curtler et al. (1991), Sentana and Wadhwani (1992) put forward a model based on the behavior of two heterogeneous groups of investors, namely fundamentalists and feedback traders. The first group, also called smart money traders, makes its investment decisions within a rational mean-variance framework. In particular, its relative stock holding is given by

$$S_t = \frac{E_{t-1}r_t - \bar{\alpha}}{\mu_t}, \quad (1)$$

where $E_{t-1}r_t$ denotes the expectation on the stock return in period $t$ and $\bar{\alpha}$ the risk free rate. $\mu_t$ is a positive function of the conditional variance $\sigma_t^2$, $\mu_t = \mu(\sigma_t^2)$, and accounts for a risk premium in the spirit of capital asset pricing type models. Thus, fundamentalists’ demand increases with the expected excess return $E_{t-1}r_t - \bar{\alpha}$ and decreases with $\sigma_t^2$.

Feedback traders’ relative holdings are determined in the following manner

$$F_t = \gamma r_{t-1}, \quad (2)$$

where $\gamma$ captures the type and degree of feedback trading. The case of $\gamma > 0$ refers
to positive feedback trading. This means buying after price increases and selling after price declines. Such a behavior can be caused by stop loss orders, portfolio insurance or trend chasing. In contrast, negative feedback trading, $\gamma < 0$, is in line with common 'by low-sell high' strategies.

Market clearing requires that all stocks are held so that $S_t + F_t = 1$. Together with (1) and (2) this implies

$$E_{t-1}r_t - \bar{\alpha} = \mu \left( \sigma_t^2 \right) - \gamma \mu \left( \sigma_t^2 \right) r_{t-1}. \quad (3)$$

Note that in the absence of feedback trading, $F_t = 0$, (3) collapses to the classical capital asset pricing model (Merton (1973)) where stock returns do not display autocorrelation. By contrast, the presence of feedback traders, $F_t \neq 0$, implies first order serial correlation in stock returns. Relying on a linearized formulation for the risk premium, $\mu \left( \sigma_t^2 \right) = \varsigma + \rho \sigma_t^2$, and assuming rational expectations, $r_t = E_{t-1}r_t + \epsilon_t$, leads to the following testable equation

$$r_t = \alpha + \rho \sigma_t^2 - \left( \varphi_0 + \varphi_1 \sigma_t^2 \right) r_{t-1} + \epsilon_t, \quad (4)$$

where $\alpha = \bar{\alpha} + \varsigma$, $\varphi_0 = \gamma \varsigma$ and $\varphi_1 = \gamma \rho$. Given a positive risk-return relationship, $\rho > 0$, positive feedback trading, $\gamma > 0$, induces negative conditional autocorrelations in stock returns as $\varphi_1 = \gamma \rho > 0$. This effect increases with conditional variance $\sigma_t^2$. By contrast, negative feedback trading, $\gamma < 0$, leads to positive conditional autocorrelations as $\varphi_1 = \gamma \rho < 0$.

By means of the term $\varphi_0 r_{t-1}$, (4) is able to capture unconditional autocorrelations in stock returns different from 0 induced by feedback trading. However, feedback trading is not the only theoretical rationale for autocorrelations in daily stock index returns. The most common alternative explanations are nonsynchronous trading, transaction costs and time-varying expected returns. Empirical evidence, however, suggests that the observed autocorrelations are too large to trace back to these explanations. For instance, the results of Mech (1993) and Boudoukh et al. (1994) lend little support to Lo and MacKinlay’s (1988, 1990) nonsynchronous trading hypothesis. Similarly, the transaction costs model put forward by Mech (1993), and the time-varying expected
returns proposed by Conrad and Kaul (1988), fail to explain a large portion of the serial correlation in index returns (McQueen et al. (1996), Ogden (1997)). Moreover, it should be stressed that the hypotheses outlined above refer to unconditional autocorrelations and, hence, are unable to explain the empirical observation that return autocorrelations turns negative during times of high volatility.

To shed light on potential changes in feedback trading behavior due to short selling restrictions, we extend (4) in the following way

$$r_t = \alpha + \rho \sigma_t^2 - (\varphi_0 + \varphi_1 \sigma_t^2 + \varphi_2 I_t^{SSR} \sigma_t^2) r_{t-1} + \epsilon_t.$$ 

(5)

The dummy variable $I_t^{SSR}$ is equal to 1 if short sale restrictions are in place and 0 otherwise. In the present paper, positive feedback trading is the focus of interest because it may amplify stock market downturns and deviations from fundamental values in times of high conditional variance, $\sigma_t^2$, during periods of short selling constraints. Thus, the parameters $\varphi_1$ and $\varphi_2$ are of particular importance where $\varphi_2$ accounts for potential changes in the extent of feedback trading when the ban is in place. Given positive feedback trading, so that $\varphi_1 > 0$, a parameter $\varphi_2 = 0$ indicates unchanged positive feedback trading during the period the constraints are in effect. Intensified positive feedback trading is found in the case where $\varphi_2 > 0$ since the coefficient on $\sigma_t^2 r_{t-1}$ rises to $\varphi_1 + \varphi_2$ as long as the restrictions are in force. By contrast, finding that $\varphi_2 < 0$ is evidence for a moderation of positive feedback trading during the ban.

One might argue that changes in positive feedback trading patterns might be explained by financial turmoil rather than by the short selling constraints per se. Therefore, to disentangle the effects of the short selling ban and the crisis, we contrast our results for the banned stocks against those in the unrestricted control groups. There are 3 possible parameter constellations. First, if the parameter $\varphi_2$ does not differ between the stocks in the test and control group, short sale constraints do not affect feedback trading. Second, if the test group’s parameter, $\varphi_2^{Test}$, is greater than the one found for the group of unrestricted stocks, $\varphi_2^{Control}$, the ban amplifies positive feedback trading. If this is the case, a disproportionately high share of positive feedback traders in the market sells after past price declines irrespective of fundamental values exacerbating financial distress. This would be evidence for the destabilizing effects of short sale
constraints during stock market turmoil. Third, a value for $\varphi_2$ being lower for banned stocks compared to unconstrained ones indicates a dampening effect on positive feedback strategies and, thus, supports regulators’ point of view that short selling bans stabilize stock markets during crises. Concisely stated, when assuming positive feedback trading, i.e., $\varphi_1 > 0$, a destabilizing effects is found if $\varphi^{Test}_2 - \varphi^{Control}_2$ is positive, whereas a negative difference is in line with a stabilizing impact of the constraints.

To take into account volatility clustering and ARCH effects, (5) is jointly estimated with Bollerslev’s (1987) GARCH(1, 1) approach

$$\sigma^2_t = \omega + \beta_0 \epsilon^2_{t-1} + \beta_1 \sigma^2_{t-1},$$

(6)

where the parameter restrictions $\omega, \beta_0, \beta_1 > 0$ and $\beta_0 + \beta_1 < 1$ apply. Last, we perform t-tests on the significance in differences in $\hat{\varphi}_2$ between test and control groups. To check for robustness, we reestimate the feedback trader model (5) using the T-GARCH specification proposed by Glosten et al. (1993). The models are estimated by Quasi Maximum Likelihood correcting the standard errors as proposed by Bollerslev and Wooldridge (1992).

4 Empirical Results

The parameter estimates for the baseline model given in (5) and (6) are reported in Table 2. As with most daily financial time series, strong ARCH effects and volatility clustering, measured by $\hat{\beta}_0$ and $\hat{\beta}_1$, are present. The stationarity conditions for the parameters of the conditional variance equation are met in all cases. Turning to the mean equation, all stock return indices display unconditional autocorrelations different from 0 as all $\hat{\varphi}_0$ parameters are statistically significant at the 1% level. We find the estimates for the parameter capturing the interaction between conditional variance and autocorrelation, $\hat{\varphi}_1$, to be significant and positive for 9 out of 12 samples indicating positive feedback trading.

[Insert Table 2 about here]
Now we turn to $\hat{\phi}_2$, the estimates for the parameter capturing changes in feedback trading during the period when short selling is constrained. For all test groups, except the US, the estimates are positive and significant indicating higher conditional autocorrelation and, thus, increased positive feedback trading when the constraints are in place. For the control groups, we observe in the majority of cases insignificant parameters $\hat{\phi}_2$ other than for the UK, where a negative and significant estimate is reported. t-tests on the significance in differences suggest that for the UK, Germany, South Korea and Australia, $\hat{\phi}_2$ is significantly higher for the stocks facing short sale restrictions than for the unbanned ones. In all 4 cases, this result holds at the 1% level. Thus, in these stock markets, displacing short sellers leads to more pronounced feedback trading.

Conditional return autocorrelation coefficients, $-\left(\hat{\phi}_0 + \hat{\phi}_1 \sigma_t^2 + \hat{\phi}_2 I_{SSR} \sigma_t^2\right)$, are plotted in Figure 1. For all samples, these coefficients decline sharply during the global financial crisis of 2008/2009. This finding is in line with the phenomenon of intensified positive feedback trading during periods of financial turmoil reported in a large body of empirical literature (e.g., Sentana and Wadhwani (1992), LeBaron (1992), Koutmos (1997), Kaminsky and Schmukler (1999), Karolyi (2002), Kaminsky et al. (2004), Salm and Schuppli (2010)).

[Insert Figure 1 about here]

It is well known that the volatility process of financial returns often exhibits asymmetries. As outlined above, these effects can be studied using the Glosten et al. (1993) T-GARCH model. Table 3 shows the results. This robustness check broadly confirms our main results as the significance in differences in $\hat{\phi}_2$ remains unchanged.

[Insert Table 3 about here]

To sum up, our evidence suggests that, in the majority of markets under consideration, short selling bans amplify positive feedback trading. Thus, contrary to regulators’ expectations, these constraints do not stabilize stock markets in times of financial distress but can actually lead to additional selling during market downturns.
5 Conclusion

In the recent financial crisis, politicians, regulators and high-profile media coverage blamed short sellers for exacerbating stock market downturns. Institutional short sellers adhering to positive feedback trading strategies are a potential justification for this allegation. The extant literature underscores the negative effects of short sale constraints on informational efficiency and liquidity but is silent about their impact on positive feedback trading during financial crises. The aim of this paper is to fill this gap. Insights into this topic are of great interest to stock market regulators to evaluate the efficiency of short sale constraints in keeping prices closer to their fundamental values. Positive feedback trading can amplify stock market downturns in times of financial turmoil. Given that short sellers follow positive feedback trading strategies, regulatory measures intended to displace them can be a powerful tool to stabilize stock markets. Bans on selected stocks in 6 countries during the recent global financial crisis provide us with a natural experiment to compare banned stocks to assimilable unbanned stocks with respect to feedback trading behavior.

In the US, the UK, Germany, France, South Korea and Australia, regulators imposed short selling regimes of different severity affecting only financial or even only selected financial stocks. Comparing the group of restricted stocks to carefully matched control groups of unrestricted stocks allows us to discriminate between effects of the financial crisis and the ban. For each test and control group, we estimate the feedback trader model proposed by Sentana and Wadhwani (1992) augmented by dummy variables to capture changes in the degree of feedback trading behavior under short selling constraints. To check for robustness, we reestimated the model including asymmetric effects in the variance equation as proposed by Glosten et al. (1993).

Our evidence does not support the view that short sellers adhere to positive feedback strategies that may amplify stock market downturns and drive prices away from fundamental values. Conversely, in the majority of markets considered in this paper, displacing these investors is associated with intensified positive feedback trading. Thus, short sale constraints actually play a destabilizing role and may amplify market crashes.
It is well known in the literature that short sale constraints create uncertainty about fundamental asset values as negative information can only be exploited with delay. In our perception, this lack of reliability of fundamental based pricing renders it more attractive to use positive feedback trading strategies. All things considered, together with plenty of studies reporting a deterioration in pricing efficiency and market quality under short sale constraints such as rising bid-ask-spreads, our findings suggest that the bans have a negative net effect.
References


Figure 1: Conditional Correlations for Six Countries

- US Test vs. US Control
- UK Test vs. UK Control
- Germany Test vs. Germany Control
Figure 1: Conditional Correlations for Six Countries (continued)
Table 1: Overview about the Bans and Descriptive Statistics

<table>
<thead>
<tr>
<th>Country</th>
<th>Ban Period</th>
<th>Type of ban</th>
<th>Mean</th>
<th>SD</th>
<th>Ex. Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>07/15/2008 – 08/12/2008</td>
<td>naked short sales</td>
<td>-0.817</td>
<td>3.642</td>
<td>-1.112</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td>0.222</td>
<td>3.116</td>
<td>-1.178</td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>09/19/2008 – 01/16/2009</td>
<td>all economic short positions</td>
<td>-0.435</td>
<td>4.686</td>
<td>3.364</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td>-0.048</td>
<td>5.150</td>
<td>0.499</td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>09/22/2008 – 01/31/2010</td>
<td>naked short sales</td>
<td>0.020</td>
<td>3.278</td>
<td>4.420</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td>0.030</td>
<td>3.261</td>
<td>3.542</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>09/22/2008 – 01/31/2010</td>
<td>all short sales</td>
<td>0.010</td>
<td>3.332</td>
<td>2.556</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td>0.038</td>
<td>2.299</td>
<td>6.053</td>
</tr>
<tr>
<td><strong>S. Korea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>06/01/2009 –</td>
<td>all short sales</td>
<td>0.099</td>
<td>1.819</td>
<td>1.008</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td>0.195</td>
<td>1.521</td>
<td>0.375</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>11/19/2008 – 05/24/2009</td>
<td>naked short sales</td>
<td>0.133</td>
<td>2.136</td>
<td>0.423</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td>0.185</td>
<td>2.968</td>
<td>2.490</td>
</tr>
</tbody>
</table>

Notes: Mean, SD and Ex. Kurtosis refer to the mean, standard deviation and excess kurtosis of the respective market return during the ban period. In South Korea, the ban started on September 30, 2008 but with effect from June 2009 the ban was lifted for non-financials. In Australia, the ban started on September 22, 2008 but with effect from November 19, 2008 the ban was lifted for non-financials.
Table 2: GARCH Estimation Results for the Feedback Trader Model

<table>
<thead>
<tr>
<th></th>
<th>( \hat{\alpha} )</th>
<th>( \hat{\rho} )</th>
<th>( \hat{\varphi}_0 )</th>
<th>( \hat{\varphi}_1 )</th>
<th>( \hat{\varphi}_2 )</th>
<th>( \hat{\omega} )</th>
<th>( \hat{\beta}_0 )</th>
<th>( \hat{\beta}_1 )</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.053***</td>
<td>0.007***</td>
<td>0.027***</td>
<td>0.002</td>
<td>0.001</td>
<td>0.006***</td>
<td>0.055***</td>
<td>0.944***</td>
<td>0.622</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.000</td>
<td>0.024***</td>
<td>0.011***</td>
<td>0.010***</td>
<td>0.000</td>
<td>0.009***</td>
<td>0.072***</td>
<td>0.923***</td>
<td></td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.032***</td>
<td>0.005***</td>
<td>-0.035***</td>
<td>0.002**</td>
<td>0.005**</td>
<td>0.005*</td>
<td>0.096***</td>
<td>0.901***</td>
<td>6.588***</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.058**</td>
<td>0.017**</td>
<td>0.022***</td>
<td>0.009***</td>
<td>-0.004**</td>
<td>0.003*</td>
<td>0.067***</td>
<td>0.933***</td>
<td></td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.040***</td>
<td>0.021***</td>
<td>-0.052***</td>
<td>0.002**</td>
<td>0.002**</td>
<td>0.043***</td>
<td>0.111***</td>
<td>0.874***</td>
<td>2.712***</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.000***</td>
<td>0.004***</td>
<td>0.003***</td>
<td>0.007***</td>
<td>-0.000</td>
<td>0.002**</td>
<td>0.100***</td>
<td>0.883***</td>
<td></td>
</tr>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.046***</td>
<td>-0.006***</td>
<td>-0.011***</td>
<td>0.001**</td>
<td>0.002**</td>
<td>0.0152***</td>
<td>0.109***</td>
<td>0.891***</td>
<td>-0.259</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.003</td>
<td>0.020</td>
<td>0.049***</td>
<td>-0.001</td>
<td>0.003</td>
<td>0.022***</td>
<td>0.092***</td>
<td>0.901***</td>
<td></td>
</tr>
<tr>
<td><strong>South Korea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.055***</td>
<td>0.000</td>
<td>-0.010***</td>
<td>0.007***</td>
<td>0.002**</td>
<td>0.042***</td>
<td>0.104***</td>
<td>0.891***</td>
<td>3.509***</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.051***</td>
<td>0.025***</td>
<td>-0.056***</td>
<td>0.005*</td>
<td>-0.001</td>
<td>0.043***</td>
<td>0.068***</td>
<td>0.919***</td>
<td></td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.029***</td>
<td>0.014**</td>
<td>-0.004***</td>
<td>0.003</td>
<td>0.013***</td>
<td>0.002**</td>
<td>0.116***</td>
<td>0.857***</td>
<td>4.389***</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.005***</td>
<td>0.012***</td>
<td>-0.011***</td>
<td>0.002*</td>
<td>0.001</td>
<td>0.006***</td>
<td>0.081***</td>
<td>0.919***</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The estimates are based on the following mean equation, \( r_t = \alpha + \rho \sigma_t^2 - (\varphi_0 + \varphi_1 \sigma_t^2 + \varphi_2 \sigma_t^{I_{SSR}^2} ) r_{t-1} + \epsilon_t \) where the conditional variance is modeled by \( \sigma_t^2 = \omega + \beta_0 \sigma_{t-1}^2 + \beta_1 \sigma_{t-1}^4 \). When assuming positive feedback trading, i.e., \( \varphi_1 > 0 \), a destabilizing effects is found if \( \varphi_2^{Test} - \varphi_2^{Control} \) is positive, whereas a negative difference is in line with a stabilizing impact of the constraints. *** ** and * denote statistical significance at the 1%, 5% and 10% level, respectively. t-test indicates the t-value for the test of the significance in differences in \( \varphi_2 \).
Table 3: T-GARCH Estimation Results for the Feedback Trader Model

<table>
<thead>
<tr>
<th></th>
<th>( \hat{\alpha} )</th>
<th>( \hat{\rho} )</th>
<th>( \hat{\varphi}_0 )</th>
<th>( \hat{\varphi}_1 )</th>
<th>( \hat{\varphi}_2 )</th>
<th>( \hat{\omega} )</th>
<th>( \hat{\beta}_0 )</th>
<th>( \hat{\beta}_1 )</th>
<th>( \hat{\beta}_2 )</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.059***</td>
<td>0.000</td>
<td>-0.029***</td>
<td>0.003***</td>
<td>0.002***</td>
<td>0.007***</td>
<td>0.005***</td>
<td>0.959***</td>
<td>0.060***</td>
<td>0.916</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.031***</td>
<td>0.008***</td>
<td>0.028***</td>
<td>0.003</td>
<td>-0.000</td>
<td>0.009***</td>
<td>0.059***</td>
<td>0.886***</td>
<td>0.089***</td>
<td></td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.033***</td>
<td>0.001***</td>
<td>-0.024***</td>
<td>0.002</td>
<td>0.000</td>
<td>0.006***</td>
<td>0.0987***</td>
<td>0.899***</td>
<td>0.004***</td>
<td>5.321</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.059***</td>
<td>0.008***</td>
<td>-0.010***</td>
<td>0.007***</td>
<td>-0.003***</td>
<td>0.010***</td>
<td>0.097***</td>
<td>0.876***</td>
<td>0.053***</td>
<td></td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.024***</td>
<td>0.003**</td>
<td>-0.004***</td>
<td>-0.001***</td>
<td>0.003***</td>
<td>0.032***</td>
<td>0.009***</td>
<td>0.922***</td>
<td>0.104***</td>
<td>4.214</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.000</td>
<td>0.004***</td>
<td>0.003***</td>
<td>0.007***</td>
<td>-0.000</td>
<td>0.002***</td>
<td>0.100***</td>
<td>0.883***</td>
<td>0.010***</td>
<td></td>
</tr>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.026***</td>
<td>-0.003**</td>
<td>-0.002</td>
<td>0.006***</td>
<td>-0.007</td>
<td>0.014</td>
<td>0.115***</td>
<td>0.881***</td>
<td>0.007</td>
<td>-0.686</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.000</td>
<td>0.023***</td>
<td>0.030***</td>
<td>0.000</td>
<td>0.002</td>
<td>0.034***</td>
<td>0.026***</td>
<td>0.898***</td>
<td>0.111***</td>
<td></td>
</tr>
<tr>
<td><strong>South Korea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.063***</td>
<td>0.000</td>
<td>0.000</td>
<td>0.007***</td>
<td>0.002***</td>
<td>0.042***</td>
<td>0.095***</td>
<td>0.912***</td>
<td>-0.019***</td>
<td>1.743</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.040***</td>
<td>0.022***</td>
<td>-0.035***</td>
<td>0.007***</td>
<td>-0.002</td>
<td>0.005***</td>
<td>0.069***</td>
<td>0.926***</td>
<td>-0.002***</td>
<td></td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Group</td>
<td>0.040***</td>
<td>0.002</td>
<td>-0.024*</td>
<td>-0.002</td>
<td>0.021**</td>
<td>0.007***</td>
<td>0.014***</td>
<td>0.926***</td>
<td>0.110***</td>
<td>2.326</td>
</tr>
<tr>
<td>Control Group</td>
<td>0.001***</td>
<td>0.005***</td>
<td>-0.000</td>
<td>0.003***</td>
<td>-0.001</td>
<td>0.011***</td>
<td>0.060***</td>
<td>0.911***</td>
<td>0.054***</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The estimates are based on the following mean equation, \( r_t = \alpha + \rho \sigma_t^2 - (\varphi_0 + \varphi_1 \sigma_t^2 + \varphi_2 I_t^{SSR} \sigma_t^2) r_{t-1} + \epsilon_t \) where the conditional variance is modeled by \( \sigma_t^2 = \omega + \beta_0 \epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \beta_2 I_{t-1}^{<0} \epsilon_{t-1}^2 \) with \( I_{t-1}^{<0} \) being equal to 1 if the lagged error, \( \epsilon_{t-1} \), is negative and equal to zero otherwise. When assuming positive feedback trading, i.e., \( \varphi_1 > 0 \), a destabilizing effects is found if \( \varphi_2^{Test} - \varphi_2^{Control} \) is positive, whereas a negative difference is in line with a stabilizing impact of the constraints. \( *** \), \( ** \) and \( * \) denote statistical significance at the 1\%, 5\% and 10\% level, respectively. \( \beta_2 \) refers to the asymetry parameter in the Glosten et al. (1993) T-GARCH model. t-test indicates the t-value for the test of the significance in differences in \( \varphi_2 \).