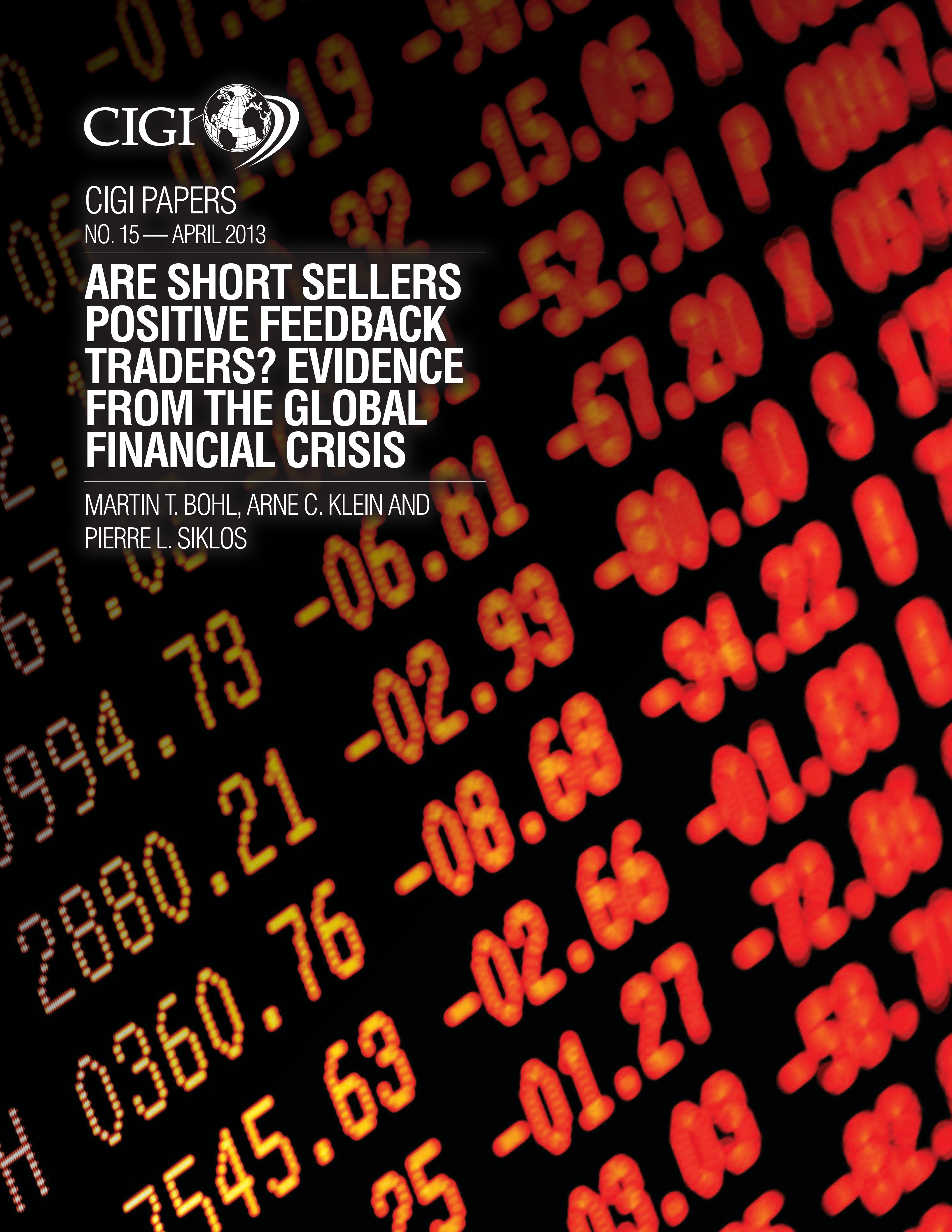

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MARTIN T. BOHL, ARNE C. KLEIN AND PIERRE L. SIKLOS

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ABOUT THE PROJECT

This publication emerges from a project called Essays in Financial Governance: Promoting Cooperation in Financial Regulation and Policies. The project is supported by a 2011-2012 CIGI Collaborative Research Award held by Martin T. Bohl, Badye Essid, Arne Christian Klein, Pierre L. Siklos and Patrick Stephan. In this project, researchers investigate empirically policy makers' reactions to an unfolding financial crisis and the negative externalities that emerge in the form of poorly functioning financial markets. At the macro level, the project investigates whether the bond and equity markets in the throes of a financial crisis can be linked to overall economic performance. Ultimately, the aim is to propose policy responses leading to improved financial governance.

EXECUTIVE SUMMARY

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 as behaving like 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 are examined. These provided a setting to analyze the impact of short-sale restrictions on feedback trading. The findings suggest that, in the majority of markets examined, restrictions of this kind amplify positive feedback trading during periods of high volatility and, hence, contribute to stock market downturns. On balance, therefore, short-selling bans do not contribute to enhancing financial stability.

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, the US Securities and Exchange Commission (SEC) declared that there was panic 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" (SEC, 2008). A potential rationalization for this kind of behaviour 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 (see: Sentana and Wadhwani, 1992; LeBaron, 1992; Koutmos, 1997; Kaminsky and Schmukler, 1999; Karolyi, 2002; Kaminsky, Lyons and Schmukler, 2004; and Salm and Schuppli, 2010). However, the literature is almost completely silent about the impact of short-sale constraints on institutional investors' feedback trading behaviour. This paper aims to fill this gap by investigating the short-selling regimes in the United States, the United Kingdom, Germany, France, South Korea and Australia during the recent global financial crisis. It contributes to the literature by providing evidence against the stabilizing effects of short-sale constraints, which may exacerbate positive feedback trading rather than mitigate it. Thus, banning short sellers may actually amplify market downturns rather than attenuate them.

Unlike the literature that reports *unconditional* autocorrelations (Beber and Pagano, 2013), this paper 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. Notably, the interaction between institutional investors' feedback trading and volatility is addressed.[1] This is of particular interest to regulators, as the bans were designed for times of market turmoil rather than for tranquil trading periods.

The debate on short selling is not new to academics (see: Boehmer, Huszar and Jordan, 2010; and Bris, Goetzmann and Zhu, 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 (see: Seneca, 1967; Figlewski, 1981; Senchack and Starks, 1993, Aitken et al., 1998, Desai et al., 2002; Asquith, Pathak and Ritter, 2005; and Boehme, Danielsen and Sorescu, 2006), although there are dissenters (see: Hurtado-Sanchez, 1978; Dickinson and Woolridge, 1994; and Husz´ar and Qian, 2011).

Direct evidence on short sellers' trading strategies is scarcer. Dechow et al. (2001) document short sellers' ability to exploit information from fundamental-to-price ratios to generate positive abnormal returns. Drawing on daily New York Stock Exchange (NYSE) order flow data, Boehmer, Jones and Zhang (2008) show that heavily shorted stocks significantly underperform relative to lightly shorted ones. Similar findings for the Nasdaq stocks are reported in Diether, Lee and Werner (2009). Blau et al. (2010) study short sellers' trading behaviour during periods of strong market movements. In particular, they examine the tendency of these investors to follow the crowd when the market is heating. Their results suggest that while short sellers act as contrarian investors on average, these investors are prone to herd behaviour during extreme up or down swings in the market.

Another 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, Morse and Stice, 1990). Boehmer and Wu's (2013) recent evidence lends credence to the notion that the ability to sell short significantly adds to the accuracy of stock prices. In particular, a higher short order flow tends to increase the informational efficiency of the pricing process.

Paralleling regulators' reaction to the global financial crisis, academic interest dealing with the impact of short-sale constraints has once again experienced a revival. Analyzing the ban in the United States 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, Namvar and Phillips (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, Huszar and Jordan (2011). Their results confirm deteriorations in market quality but cannot corroborate overvaluation. Based on the same ban period, Grundy, Lim and Verwijmeren (2012), 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 Kolasinski, Reed and Thornock (2013) supports Diamond and Verrecchia's (1987) prediction that negative effects on market quality are stronger for stocks with listed options.

Marsh and Payne (2012) report lower trading volumes and order book liquidity in the case of the United Kingdom. Focusing on Australia, Helmes, Henker and Henker (2011) document reduced trading activity and increased bid-ask spreads for stocks excluded from short selling. Considering restrictions in 30 countries, Beber and Pagano (2013) 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 (2013) paper comes closest to the study described in this paper. Their findings, however, only shed light on unconditional autocorrelations. Unconditional autocorrelations in single stock and portfolio returns is a well-known phenomenon (see, for example: Lo and MacKinlay, 1988; Conrad and Kaul, 1988; Lo and MacKinlay, 1990; Mech, 1993; Chang, McQueen and Pinegar, 1999; and Bris, 2008). Theoretical explanations for unconditional serial correlation focus on the speed of price discovery, nonsynchronous 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 behaviour can lead to autocorrelations that are conditional on volatility. Specifically, their model is able to explain the stylized fact that increased volatility is known to be accompanied by serial correlations, which are more negative and higher in absolute values than during periods of low volatility. A version of the Sentana and Wadhwani (1992) model is used to shed light on a short-sale ban's impact on institutional investors' feedback trading.

1 Measured in terms of trading volume or asset holdings, institutional investors have been playing a dominant role in mature stock markets for many years. By 2007, financial assets of institutional investors as a percent of GDP exceeded 200 percent in the case of the United States and the United Kingdom, and were well over 100 percent in the other countries considered in this study, with the exception of Korea, where the value is around 90 percent of GDP (Gonnard, Kim and Ynesta, 2008). Moreover, short sales are mainly used by institutional investors whereas individual investors play only a minor role. Consequently, this investigation of the impact of short-selling constraints amounts to an analysis of institutional investors' feedback trading behaviour.

Large parts of the literature on short-sale restrictions deal with overvaluation as suggested by Miller (1977), who argues that excluding pessimists from the market results in an upward bias in stock prices. In contrast, the present study deals with feedback trading behaviour, which may drive prices temporarily below their fundamental values. Like Miller (1977), this paper adopts the approach that the introduction of short-sale constraints leads to a change in the investor structure in the market. In the case of Miller (1977), the ratio of optimists is increased, whereas this paper examines a shift from classical mean-variance investors towards feedback traders.[2]

Focusing on bans that affect only selected financial stocks means the effects of the restrictions and the crisis per se can be disentangled by creating matched control groups from a sample of unbanned firms. This enables the contrast of changes in the extent of feedback trading in restricted stocks with those for unrestricted ones during the time period the ban is in place. The evidence suggests that autocorrelations in daily returns differ significantly between crisis and non-crisis periods on the one hand and between ban and non-ban periods on the other. First, as predicted by Sentana and Wadhwani (1992), autocorrelations become much stronger in absolute terms during the crisis. Second, and more important, there is evidence that, in the majority of countries, short-selling constraints further intensify institutional investors' positive feedback trading behaviour. The latter clearly contrasts with regulators' view that short-sale constraints may constitute a tool to stabilize stock markets during periods of turmoil.

The structure of the paper is as follows. In the next section, the timeline of the short-selling bans and the construction of control groups is sketched. The third section outlines the feedback trader model and further econometric methodology. The fourth section discusses the empirical results and the final section is the conclusion.

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, which came into force on July 21. On July 29, the day the ban was originally meant to expire, the SEC issued an extension, with the ban remaining in force until August 12.[3] These early restrictions were only foreplay — on September 17, the SEC imposed a ban on naked shorting in all stocks, which came into force at 12:00 a.m. the next day. Late on September 18, after the closing of the market session, regulators prohibited all short sales in nearly 800 financial stocks, effective immediately. On October 2, regulators announced an extension of the ban for up to 30 days beyond September 17. The ban expired at midnight on October 8, three days after the adoption of the so-called Troubled Asset Relief Program. This second US ban is not included in the analysis, since it lasted for only 14 days and does not provide a sufficient number of observations to consistently estimate changes in feedback trading.

On September 18, 2008, the Financial Services Authority (FSA) in the United Kingdom established the strongest version of the short-selling bans considered in this study, which came 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), it affected 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 Autorité des marchés financiers followed the same time schedule as in Germany, and placed limits to short selling in 15 financial institutions.

On September 30, 2008, the South Korean Financial Supervisory Commission imposed 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 June 2009. As this framework remained unchanged, the analysis for South Korea was run until the end of 2010.

On September 22, 2008, the Australian Securities & Investments Commission prohibited naked short sales for all firms listed at the Australian Securities Exchange (ASX)and established a reporting regime for covered short sales. In effect from November 19, 2008, this ban was lifted for all stocks, with the exception of financial stocks in the Standard & Poor's (S&P)/ASX 200 plus five other stocks that were part of businesses regulated by the Australian

2 We thank an anonymous referee for pointing out this distinction.

3 Normally, a short seller must borrow or expect to borrow the underlying security in question. Naked shorting implies that the seller does not obtain the security. Since not all bans considered here applied to naked shorting, it is doubtful that our results are influenced by this distinction.

Prudential Regulation Authority. This ban expired on May 24, 2009.

For the United States, the United Kingdom, Germany, France and Australia, most banned stocks can be included in the analysis.[4] For South Korea, the analysis is limited to the financial stocks in the KOSPI 100 due to liquidity concerns.

For a given set of stocks and a given period, the authors aim at comparing the return dynamics under short-sale constraints with an unobservable hypothetical process without restrictions on shorting. This requires the creation of a control group with similar characteristics. In order to do so, the matching techniques also employed by Boehmer, Jones and Zhang (2011) and Beber and Pagano (2013) are followed. In many of the countries included in this study, all or at least all important financial stocks are subject to the ban; therefore, it is necessary to match these control groups mainly from non-financial firms.[5]

The matching variables have to be carefully selected to build a reliable match on the stocks available. Following Boehmer, Jones and Zhang (2011), market capitalization and trading volume are used. Capitalization controls for firm size, while trading volume is included in order to rule out an influence of liquidity concerns on institutional investors' feedback trading. Furthermore, since the test groups consist of financial stocks, which are, in general, characterized by above-average exposure towards the market, the market beta calculated for the respective common market index is used as an additional matching variable.

Similar to Boehmer, Jones and Zhang (2011), mean values of these variables are calculated for the period from January 2008 until the introduction of the ban in the case of the United States, the United Kingdom, Germany, France and Australia. For South Korea, the period from September 2008 until the end of the ban on non-financial stocks on May 31, 2009 is used. The aim is to choose the matching partners such that they reflect, as closely as possible, the characteristics of the banned stocks. Therefore, Beber and Pagano (2013) are followed and the matching partner that minimizes the sum of squared differences in the mean values of the matching variables are selected with replacement. Note that replacement is advisable to prevent the composition of the control groups from being influenced by the order in which we match firms to our test groups. As the beta, volume and capitalization strongly differ with respect to mean value and standard deviation, standardized variables are used. This ensures that equal weights are assigned to each matching variable, in the sense that the selection of control stocks depends equally on market sensitivity, trading volume and capitalization.[6]

The 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 the index composition as it was the day before the introduction of the short-sale ban is used. The S&P 100 (United States), the FTSE 100 (United Kingdom), the DAX and MDAX (Germany), the CAC 40 and the French stocks in the Next CAC 100 (France), the KOSPI 100 (South Korea) and the S&P/ASX 100 (Australia) are used. To estimate the models described in the third section, value-weighted return indices from the stocks in the test and control groups are calculated using log returns. This avoids the necessity of estimating time series models from noisy single stock data.

To consistently and robustly estimate the feedback trader model, a relatively long sample period is preferred. However, fewer stocks in the test and control samples are available for calculating the return indices when the period extends to well before the ban. To cope with both aspects, the period from January 2003 until December 2010 is used.[7]

Thus, for each sample, there are eight years of daily data, which ought to be adequate to draw reliable conclusions.

All time series are obtained from Thomson Reuters Datastream. The historical constituents of the indices were provided by S&P's, the FTSE Group, the Deutsche Börse Group, NYSE Euronext and the Korea Exchange. The duration of short-sale constraints in days is: 402 (South Korea), 347 (France), 343 (Germany), 127 (Australia), 83 (United Kingdom) and 17 (United States). The number of stocks in the test and control groups are: 44 (Australia), 32 (United Kingdom), 18 (United States), 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.

4 In the United States, Merrill Lynch is not included as there is no longer sufficient data. In Germany, Hypo Real Estate is excluded from the analysis since it was nationalized and delisted during the ban. In the United Kingdom, Bradford & Bingley and Tawa were dropped, 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, Dexia and Allianz are not included in the sample, as their notations in Paris were delisted during the ban. Data is no longer available for Paris Re. In Australia, Macquarie DDR Trust and Challenger Financial Services Group are excluded because no data is available.

5 An exemption is the July/August 2008 ban in the United States, where the control group includes a lot of financials, for instance American International Group. In the United Kingdom, almost 20 percent of the control stocks are financials.

6 A list of the stocks in the test and control groups is available upon request.

7 This period is selected to ensure that for the countries with the smallest number of stocks, Germany and France, returns of at least nine stocks are available at every point in time.

Table 1: Overview about the Bans and Descriptive Statistics

	Ban Period	Type of Ban	Mean	SD	Ex. Kurtosis
United States					
Test Group	07/15/2008–08/12/2008	naked short sales	−0.817	3.642	−1.112
Control Group			0.222	3.116	−1.178
United Kingdom					
Test Group	09/19/2008–01/16/2009	all economic short positions	−0.435	4.686	3.364
Control Group			−0.048	5.150	0.499
Germany					
Test Group	09/22/2008–01/31/2010	naked short sales	0.020	3.278	4.420
Control Group			0.030	3.261	3.542
France					
Test Group	09/22/2008–01/31/2010	all short sales	0.010	3.332	2.556
Control Group			0.038	2.299	6.053
South Korea					
Test Group	06/01/2009–	all short sales	0.099	1.819	1.008
Control Group			0.195	1.521	0.375
Australia					
Test Group	11/19/2008–05/24/2009	naked short sales	0.133	2.136	0.423
Control Group			0.185	2.968	2.490

Notes: Mean, SD, and Ex. Kurtosis refer to the mean, standard deviation, and excess kurtosis of the respective market return during the ban period where the market return is expressed in percentage points. 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 it was lifted for non-financials.

METHODOLOGY

Relying on the previous work of Shiller (1984), De Long et al. (1990) and Cutler, Poterba and Summers (1991), Sentana and Wadhwani (1992) put forward a model based on the behaviour 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

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

where $E_{t-1}r_t$ denotes the expectation on the stock return in period t and $\bar{\alpha}$ the risk-free rate. μ_t is a positive function of the conditional variance σ_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 σ_t^2.

Feedback traders' relative holdings are determined in the following manner

$$F_t = \gamma r_{t-1}, \tag{2}$$

where γ 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 behaviour can be caused by stop-loss orders, portfolio insurance or trend chasing. In contrast, negative feedback trading, $\gamma < 0$, is in line with common "buy 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

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

Note that in the absence of feedback trading, $F_t = 0$, (3) collapses to the classical capital asset pricing model (see Merton, 1973) where stock returns do not display auto-correlation. 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, $\mu(\sigma_t^2) = \varsigma + \rho\sigma_t^2$, and assuming rational expectations, $r_t = E_{t-1}r_t + \epsilon_t$, leads to the following testable equation

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

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 σ_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. Nonsynchronous trading, as proposed by Lo and MacKinlay (1988, 1990), rests on the assumption that some stocks in a portfolio are traded at time t while others are traded at $t + 1$. If new information arrives in the market in period t, the first group of stocks will react to this news in t while the information is impounded into the prices of the second group only at time $t + 1$. Therefore, the returns of the overall portfolio will be serially correlated.

Mech's (1993) transaction cost approach recognizes that, due to market making, bid and ask prices differ. Intuitively, informed investors only trade if their estimate for the true stock value lies outside of the bounds defined by the bid and ask quotes, that is to say, higher (lower) than the ask (bid) price. When new information enters the market, affecting the fundamental values of the stocks in a portfolio, it may move investors' valuation for some of these securities outside of these bounds. However, the news may not be significant enough to move investors' assessment of the true stock value beyond the bid or ask price in the case of other stocks. For the second group of stocks, there may be no change until later on, when additional information arrives or simply because noise trading changes the bid and ask quotes. Similar to the nonsynchronous trading hypothesis, auto-correlated portfolio returns may be the consequence.

By contrast, the time-varying expected returns model proposed by Conrad and Kaul (1988) is a purely empirical approach that is not limited to portfolio return but also applies to single stocks. Conrad and Kaul (1988) assume that expected returns are driven by an autoregressive (AR)(1) or random walk process and use Kalman filter techniques to extract these returns. Although they are able to reject the random walk, the economic determinants behind such an AR(1) process remain unknown.

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, Richardson and Whitelaw (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 (see McQueen, Pinegar and Thorley, 1996 and 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 turn negative during times of high volatility.

To shed light on potential changes in feedback trading behaviour due to short-selling restrictions, (4) is extended in the following way

$$r_t = \alpha + \rho\sigma_t^2 - (\varphi_0 + \varphi_1\sigma_t^2 + \varphi_2 I_t^{SSR}\sigma_t^2)\, r_{t-1} + \epsilon_t. \tag{5}$$

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, σ_t^2, during periods of short-selling constraints. Thus, the parameters φ_1 and φ_2 are of particular importance where φ_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 when 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, the results for the banned stocks are contrasted against those in the unrestricted control groups. There are three possible parameter constellations. First, if the parameter φ_2 does not differ between the stocks in the test and control groups, short-sale constraints do not affect feedback trading. Second, if the test group's parameter, φ_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 sell 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 φ_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 feed back trading, that is, $\varphi_1 > 0$, a destabilizing effect 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.

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

$$\sigma_t^2 = \omega + \beta_0 \epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2, \qquad (6)$$

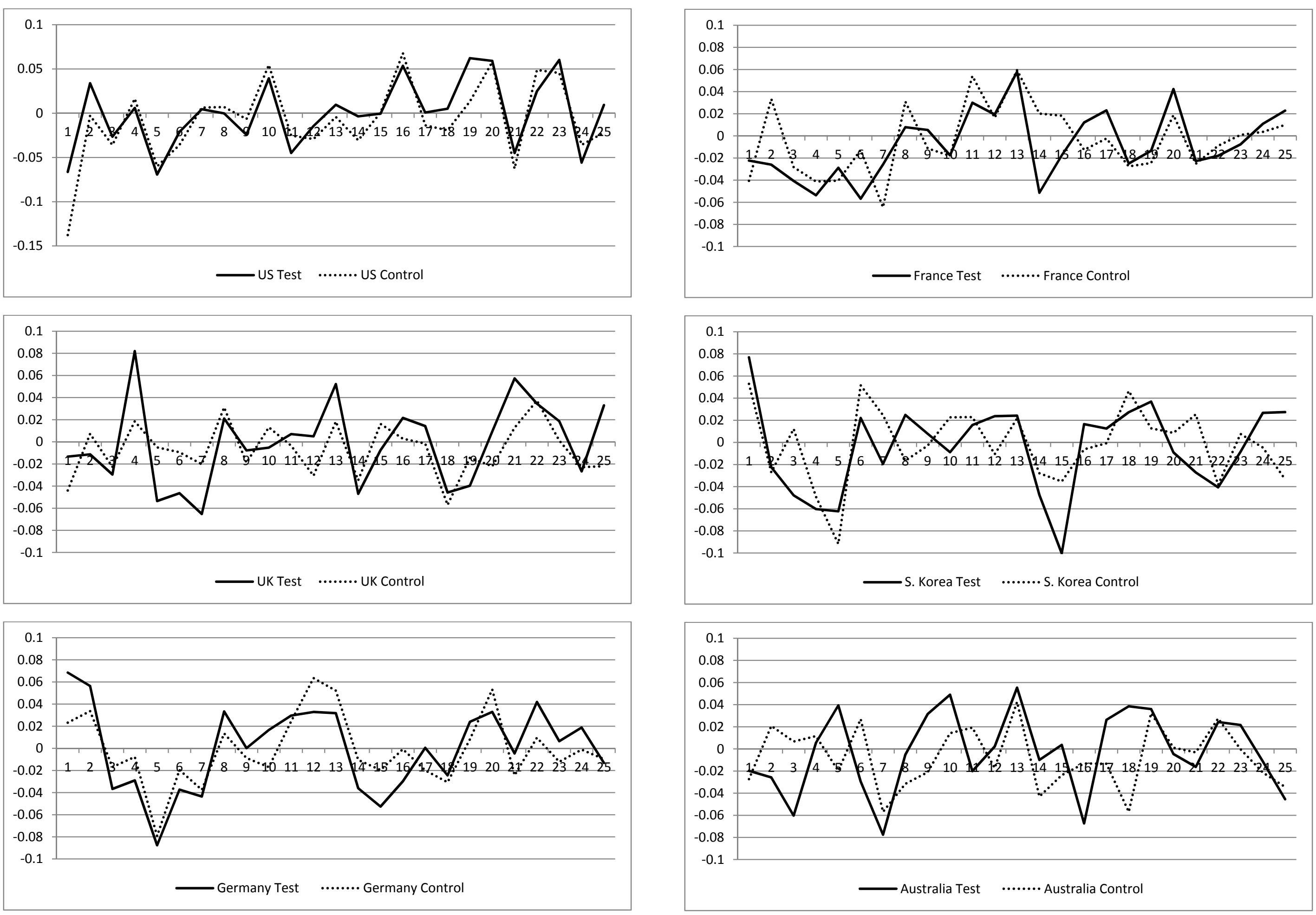
where the parameter restrictions $\omega, \beta_0, \beta_1 > 0$ and $\beta_0 + \beta_1 < 1$ apply. Finally, t-tests are performed on the significance of differences in $\hat{\varphi}_2$ between test and control groups. To check for robustness, the feedback trader model is re-estimated (5) using the T-GARCH specification proposed by Glosten, Jagannathan and Runkle (1993). The models are estimated by quasi maximum likelihood, with standard errors corrected as proposed by Bollerslev and Wooldridge (1992).

EMPIRICAL RESULTS

The empirical approach to measuring the influence short-sale constraints exert on feedback trading relies on matched control samples. Therefore, assessing the quality of these matches is important. Since autocorrelated stock returns are being dealt with, the autocorrelation functions for up to 25 lags for the test and control groups in a given country are compared, where the period when the ban is in effect is excluded. The results, displayed in Figure 1, show that the serial dependence in returns is relatively similar among test and control stocks. In addition to the visual comparison, the correlation between the autocorrelation functions of the test and control groups for a given country is also considered. In the case of Australia, there is a moderate correlation of 0.273.

For all other markets, however, the correlation coefficients lie between 0.593 (United Kingdom) and 0.850 (United States).

Figure 1: Autocorrelation Functions for Six Countries



Notes: Autocorrelation functions with 25 lags for daily value-weighted return indices for the test and control groups for the United States, the United Kingdom, Germany, France, South Korea and Australia.

Table 2 provides average values for market capitalizations, trading volumes and market betas, that is, the three matching variables for each test and control group, to verify the absence of a systematic bias in the matched samples. In most cases, the values for all three variables match relatively closely between the test and control groups. The market capitalization is, on average, two percent higher for the control stocks while their trading volume is about 6.5 percent lower. The sensitivity towards the market is, on average, five percent lower for the control groups. Hence, these relatively small differences suggest that our control stocks are not subject to any significant systematic bias.

Table 2: Matching Statistics

	Market Capitalization	Trading Volume	β
United States			
Test Group	81895	675438	1.949
Control Group	62490	671904	1.747
United Kingdom			
Test Group	9275	6304323	1.140
Control Group	12331	7102369	1.102
Germany			
Test Group	16630	1218	1.139
Control Group	15319	1056	1.066
France			
Test Group	28666	120472	1.241
Control Group	22143	77008	1.087
South Korea			
Test Group	4414913	52424645	1.225
Control Group	4476268	51265244	1.228
Australia			
Test Group	8907	45516	1.063
Control Group	11691	45682	1.082

Notes: Average values for market capitalizations, trading volumes and market betas for test and control groups over the nine months preceding the respective ban. Trading volume is expressed in thousand units of home currency, while market capitalization refers to a million units of home currency.

The parameter estimates for the baseline model given in (5) and (6) are reported in Table 3. 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 one percent level.

Table 3: GARCH Estimation Results for the Feedback Trader Model

	$\hat{\alpha}$	$\hat{\rho}$	$\hat{\varphi}_0$	$\hat{\varphi}_1$	$\hat{\varphi}_2$	$\hat{\omega}$	$\hat{\beta}_0$	$\hat{\beta}_1$	t-test
United States									
Test Group	0.053***	0.007***	0.027***	0.002	0.001	0.006***	0.055***	0.944***	0.622
Control Group	0.000	0.024***	0.011***	0.010***	0.000	0.009***	0.072***	0.923***	
United Kingdom									
Test Group	0.032***	0.005***	−0.035***	0.002***	0.005***	0.005*	0.096***	0.901***	6.588***
Control Group	0.058**	0.017**	0.022***	0.009***	−0.004**	0.003*	0.067***	0.933***	
Germany									
Test Group	0.040***	0.021***	−0.052***	0.002**	0.002***	0.043***	0.111***	0.874***	2.712***
Control Group	0.000***	0.004***	0.003***	0.007***	−0.000	0.002***	0.100***	0.883***	
France									
Test Group	0.046***	−0.006***	−0.011***	0.001***	0.002***	0.0152***	0.109***	0.891***	−0.259
Control Group	0.003	0.020	0.049***	−0.001	0.003	0.022***	0.092***	0.901***	
South Korea									

	$\hat{\alpha}$	$\hat{\rho}$	$\hat{\varphi}_0$	$\hat{\varphi}_1$	$\hat{\varphi}_2$	$\hat{\omega}$	$\hat{\beta}_0$	$\hat{\beta}_1$	t-test
Test Group	0.055***	0.000	−0.010***	0.007***	0.002***	0.042***	0.104***	0.891***	3.509***
Control Group	0.051***	0.025***	−0.056***	0.005*	−0.001	0.043***	0.068***	0.919***	
Australia									
Test Group	0.029***	0.014**	−0.004***	0.003	0.013***	0.002***	0.116***	0.857***	4.389***
Control Group	0.005***	0.012***	−0.011***	0.002*	0.001	0.006***	0.081***	0.919***	

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 modelled by $\sigma_t^2 = \omega + \beta_0\epsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$. When assuming positive feedback trading, i.e., $\varphi_1 > 0$, a destabilizing effect 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. t-test indicates the t-value for the test of the significance in differences in $\hat{\varphi}_2$. ***, **, and * denote statistical significance at the one percent, five percent and 10 percent level, respectively.

Recall that this parameter is designed to capture the impact of the explanations for unconditional feedback trading discussed in the section on methodology. Lo and MacKinlay's (1988, 1990) nonsynchronous trading hypothesis is unlikely to be relevant in this case, since the test and control groups consist of large cap stocks, which are heavily traded each day. Similarly, time-varying expected returns are relatively unlikely to be the root cause of unconditional return autocorrelations since Conrad and Kaul (1988) demonstrate that the explanatory power of this hypothesis is inversely related to firm size. For the portfolio formed from the stocks with the largest size, their model explains only one percent of the variation in returns. Therefore, the observed unconditional serial correlations might be a consequence of transaction costs as proposed by Mech (1993).

The estimates for the parameter capturing the interaction between conditional variance and autocorrelation, $\hat{\varphi}_1$, is found to be significant and positive for nine out of 12 samples indicating positive feedback trading. Now attention is turned to $\hat{\varphi}_2$, the estimates for the parameter capturing changes in feedback trading during the period when short selling is constrained. For all test groups, except the United States, 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, insignificant parameters $\hat{\varphi}_2$ are observed in the majority of cases, except for the United Kingdom, where a negative and significant estimate is reported. t-tests on the significance in differences suggest that for the United Kingdom, Germany, South Korea and Australia, $\hat{\varphi}_2$ is significantly higher for the stocks facing short-sale restrictions than for the unbanned ones. In all four cases, this result holds at the one percent level. Thus, in these stock markets, displacing short sellers leads to more pronounced feedback trading.

Interestingly, there are markets where an amplification of positive feedback trading as a consequence of both banning only naked shorts (Germany and Australia) and banning all shorts but leaving derivative trading unaffected (South Korea) is observed. However, the effect is the strongest in the United Kingdom, where regulators imposed an insurmountable hurdle for pessimists not owning a stock, that is, a prohibition to establish any kind of economic short position including derivatives. The finding of intensified positive feedback trading among different kinds of institutional short-sale regimes can be interpreted as a kind of robustness check. However, a significant impact of short-selling restrictions on institutional investors' feedback trading is not found in the case of the United States and France.

The United States differs to some extent from the other markets under consideration, since there are liquid and advanced derivative markets, which may provide investors with substitutes for short sales. Empirical evidence, however, does not lend much support to the substitutability hypothesis. Dealing with the case of the US short-sale regime in September and October 2008, Battalio and Schultz (2011) provide evidence favouring the notion that single stock options constitute only a partial substitute for short sales. In particular, they show that banning short sales leads to a dramatic increase in trading costs in terms of wider bid-ask spreads. As a result, the use of these derivatives becomes unattractive to pessimists. Grundy, Lim and Verwijmeren (2012) show that short sellers do not switch to single stock futures, either.

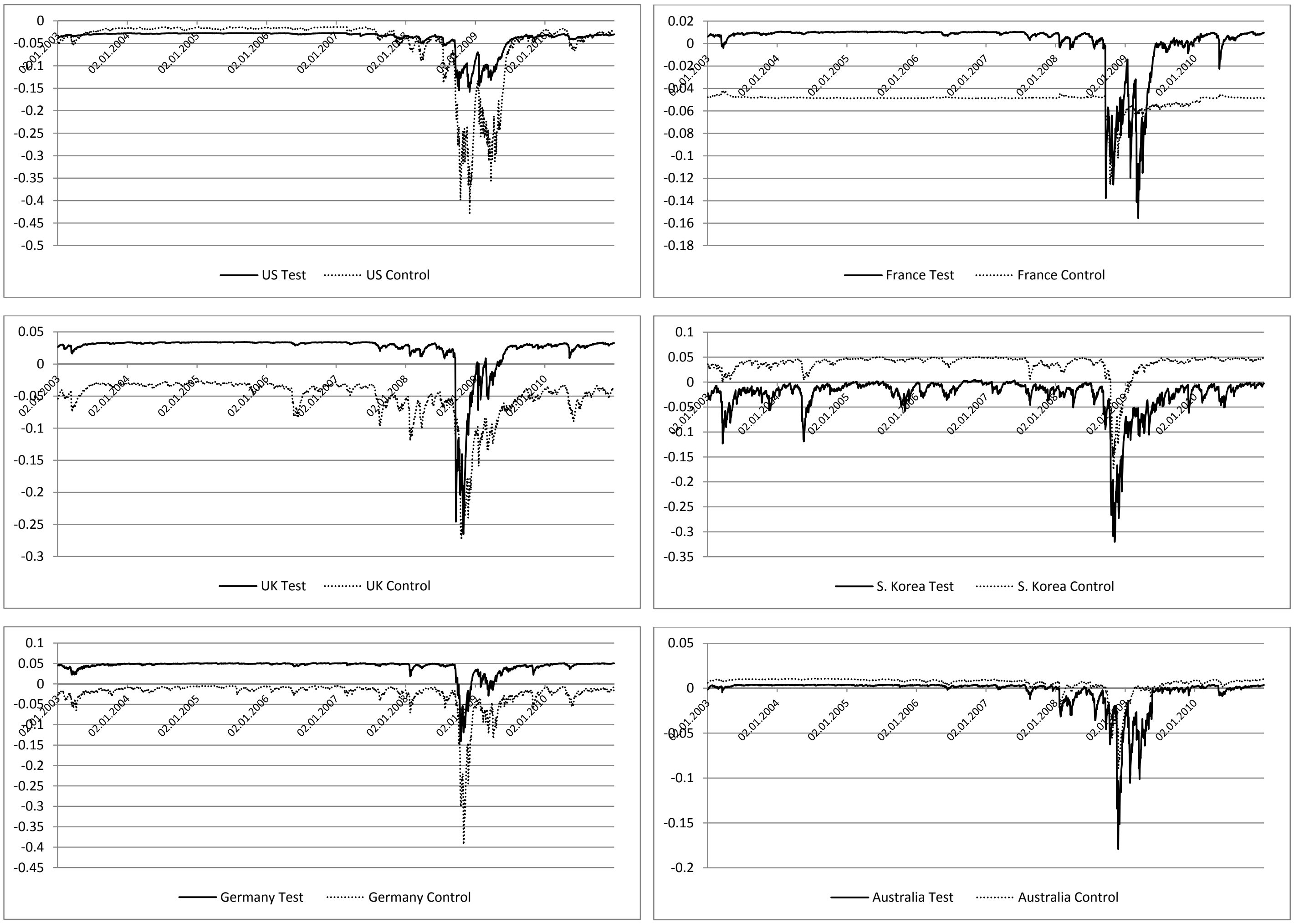
At first glance, the finding that banning short sales makes investors more prone to positive feedback trading contrasts with the tendency of short sellers to follow the crowd on trading days when the absolute value of the market returns exceeds a certain limit as reported in Blau et al. (2010). However, the authors only investigate US stock market data over the sample period January 2005 to December 2006.[8] This period was characterized by tranquil stock trading and economic expansion while dealing with a period of an extraordinarily severe crisis and market uncertainty. The literature claims behavioural effects like feedback trading and herding to be closely related to investors' sentiment (see Shiller, 1984; Lee, Shleifer and Thaler, 1991; Devenow and Welch, 1996), which, in turn, is time-varying (see Lee, Jiang and Indro, 2002; Baker and Wurgler, 2006). Therefore, it seems unlikely that institutional investors' behaviour could be expected to be

8 Consequently, their sample does not contain extended periods of market downturn. In particular, their data set only contains 12 days of extreme negative returns

similar between tranquil periods and times of financial crisis.

Conditional return autocorrelation coefficients, $-(\hat{\varphi}_0 + \hat{\varphi}_1\sigma_t^2 + \hat{\varphi}_2 I_t^{SSR}\sigma_t^2$, are plotted in Figure 2. 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 (see, for example, Sentana and Wadhwani, 1992; LeBaron, 1992; Koutmos, 1997; Kaminsky and Schmukler, 1999; Karolyi, 2002; Kaminsky, Lyons and Schmukler 2004; and Salm and Schuppli, 2010).

Figure 2: Conditional Correlations for Six Countries



Notes: Conditional correlation coefficients for the test and control groups for the United States, the United Kingdom, Germany, France, South Korea and Australia based on the specification given in (5) and (6).

It is well known that the volatility process of financial returns often exhibit asymmetries. As outlined above, these effects can be studied using the Glosten, Jagannathan and Runkle (1993 T-GARCH model. Table 4 shows the results. This robustness check broadly confirms the main results, as the significance in differences in $\hat{\varphi}_2$ remains unchanged.

Table 4: T-GARCH Estimation Results for the Feedback Trader Model

	$\hat{\alpha}$	$\hat{\rho}$	$\hat{\varphi}_0$	$\hat{\varphi}_1$	$\hat{\varphi}_2$	$\hat{\omega}$	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	t-test
United States										
Test Group	0.059***	0.000	−0.029***	0.003***	0.002***	0.007***	0.005***	0.959***	0.060***	0.916
Control Group	0.031***	0.008***	0.028***	0.003	−0.000	0.009***	0.059***	0.886***	0.089***	
United Kingdom										
Test Group	0.033***	0.001***	−0.024v	0.002**	0.000	0.006***	0.0987***	0.899***	0.004***	5.321***
Control Group	0.059***	0.008***	−0.010***	0.007***	−0.003***	0.010***	0.097***	0.876***	0.053***	
Germany										
Test Group	0.024***	0.003**	−0.004***	−0.001***	0.003***	0.032***	0.009***	0.922***	0.104***	4.214***
Control Group	0.000	0.004***	0.003***	0.007***	−0.000	0.002***	0.100***	0.883***	0.010***	
France										
Test Group	0.026***	−0.003**	−0.002	0.006***	−0.007	0.014	0.115***	0.881***	0.007	−0.686
Control Group	0.000	0.023***	0.030***	0.000	0.002	0.034***	0.026***	0.898***	0.111***	
South Korea										
Test Group	0.063***	0.000	0.000	0.007***	0.002***	0.042***	0.095***	0.912***	−0.019***	1.743*
Control Group	0.040***	0.022***	-0.035***	0.007***	−0.002	0.005***	0.069***	0.920***	−0.002***	
Australia										
Test Group	0.040***	0.002	-0.024*	−0.002	0.021**	0.007***	0.014***	0.926***	0.110***	2.326***
Control Group	0.001***	0.005***	-0.000	0.003***	−0.001	0.011***	0.060***	0.911***	0.054***	

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 modelled by $\sigma_t^2 = \omega + \beta_0\epsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2 + \beta_2 I_t^{\epsilon_{t-1}<0}\epsilon_{t-1}^2$ with $I_t^{\epsilon_{t-1}<0}$ being equal to 1 if the lagged error, ϵ_{t-1}, is negative and equal to zero otherwise. When assuming positive feedback trading, i.e., $\varphi_1 > 0$, a destabilizing effect 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 one percent, five percent and 10 percent level, respectively. β_2 refers to the asymmetry parameter in the Glosten, Jagannathan and Runkle (1993) T-GARCH model. t-test indicates the t-value for the test of the significance in differences in $\hat{\varphi}_2$.

To sum up, the 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.

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, enabling evaluations of 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 six countries during the recent global financial crisis provide a natural experiment to compare banned stocks to assimilable unbanned stocks with respect to feedback trading behaviour.

In the United States, the United Kingdom, Germany, France, South Korea and Australia, regulators imposed short-selling regimes of different severities 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, the feedback trader model proposed by Sentana and Wadhwani (1992) is estimated, augmented by dummy variables to capture changes in the degree of feedback trading behaviour under short-selling constraints. To check for robustness, the model was re-estimated including asymmetric effects in the variance equation as proposed by Glosten, Jagannathan and Runkle (1993).

The 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 view, 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.

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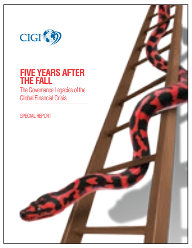

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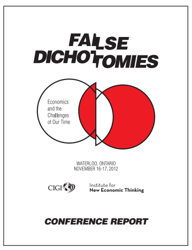
Pierre Siklos

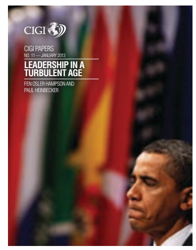
Five years after the onset of the global financial crisis, policy makers seemingly continue to believe that the severity of any crisis-led downturn can be divorced from its source. Credibility in new international regulatory frameworks must begin at home with a determination for monetary policies to work together.



FALSE DICHOTOMIES: ECONOMICS AND THE CHALLENGES OF OUR TIME

Kevin English

This report following a CIGI-INET conference held in November 2012 focusses on how economists should work with other areas of study, such as history, law, psychology and political economy, to enrich research and provide more well-rounded answers to the questions facing the economic community today.



LEADERSHIP IN A TURBULENT AGE

Fen Osler Hampson and Paul Heinbecker

Sound economic policies, which are in short supply in most key nations of the world, are fundamental to national security and international leadership. The United States must work alongside others — and accept that others will sometimes work together without it — to deal with a wide range of persistent and emerging global problems and issues.

THE SHORT VIEW: THE GLOBAL CONJUNCTURE AND THE NEED FOR COOPERATION

James A. Haley

Successfully addressing both short- and medium-term policy challenges requires policy horizons much longer than the myopic orientation adopted by too many, this paper argues, and it will take global economic leadership to secure the cooperation that is needed to strike a judicious balancing of adjustment burdens.

SUSTAINABLE DEVELOPMENT AND FINANCING CRITICAL GLOBAL PUBLIC GOODS

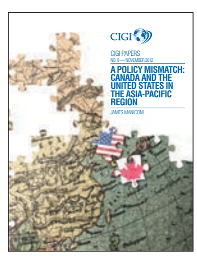
Barry Carin

The idea of a "Green Super Fund" can be framed as a positive sum game, with a win-win-win allocation that would garner widespread global support and ultimately be accepted by all the major players.

STRENGTHENING INTERNATIONAL FINANCIAL INSTITUTIONS TO PROMOTE EFFECTIVE INTERNATIONAL COOPERATION

Thomas A. Bernes

The current global financial crisis resulted from the failure of major economies and global institutions to address emerging fault lines in global financial markets and global institutions. No single country has the ability or resources to fix things on its own — a near-unprecedented degree of collective action is required.



A POLICY MISMATCH: CANADA AND THE UNITED STATES IN THE ASIA-PACIFIC REGION

James Manicom

The United States and Canada, two of the world's closest allies, have reinvigorated their diplomatic and military postures toward the Asia-Pacific region. On balance, however, Canada may not be an ideal Pacific partner for the United States.

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