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SHORT-SELLING BANS AND INSTITUTIONAL INVESTORS' HERDING BEHAVIOUR: EVIDENCE FROM THE GLOBAL FINANCIAL CRISIS

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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

The literature on short-selling restrictions focusses mainly on a ban's impact on market efficiency, liquidity and overpricing. Surprisingly, little is known about the effects of short-sale constraints on herd behaviour. Since institutional investors have come to dominate mature stock markets and rely extensively on short sales, constraining these traders may influence the asset pricing process. We investigate six stock markets that faced bans during the recent global financial crisis. Our empirical evidence shows that short-selling restrictions exhibit either no influence on herding formation or induce adverse herding. This implies a higher dispersion of returns around the market compared to rational asset pricing, which can be interpreted as an increase in uncertainty among stock market investors.

INTRODUCTION

The effects of short-sale restrictions on market efficiency, liquidity and overpricing have been studied extensively in finance literature. The global financial crisis has renewed interest about the consequences of short-selling bans. Regulators impose short-sale constraints to displace short sellers and, ostensibly, to prevent further declines in stock prices. Most notably, however, the literature is silent about short-sale constraints' effect on institutional investors' trading behaviour and, in particular, the possibility of generating herding behaviour. The present study aims to make a start in closing this gap.

Excluding short sellers constitutes market intervention, since, in spot markets, only investors owning stocks are able to express pessimistic beliefs about their underlying value. Short-sale bans may also affect the pricing process via institutional investors' trading because these investors dominate mature stock markets.[1] In addition, mainly institutional investors engage in short selling as an instrument to express their negative opinion on future stock values. The consequences of herding behaviour may show up in the pricing process through the distribution of individual, or a cross-section of, stock returns relative to the performance of the market as a whole. This paper investigates the impact of short-selling restrictions on institutional investors' herding behaviour in the United States, the United Kingdom, Germany, France, South Korea and Australia during the turmoil that afflicted financial markets in 2008-2009.

1 See, for example, Gonnard, Kim and Ynesta (2008). In the six countries examined, the financial assets of institutional investors grew very rapidly in the years leading up to the global financial crisis of 2008. By 2007, financial assets of institutional investors as a percent of GDP exceeded 200 percent in some cases (for example, 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 (around 90 percent of GDP). In what follows then, for simplicity, the evidence presented in this study will be referred to as largely pertaining to the behaviour of institutional investors.

The widely adopted approach proposed by Christie and Huang (1995) and Chang, Cheng and Khorana (2000) is used to test the conjecture that short-sale constraints affect institutional investors' herd behaviour. By following the literature and contrasting the findings for the stocks facing short-selling restrictions with those for a matched control sample, the effects of the crisis per se and the constraints can be disentangled. Given the short-lived nature of the bans to be examined, sample sizes are small. To overcome this drawback, test statistics are estimated using a bootstrapping methodology. Our empirical results do not support the notion that herding among institutional investors was an important phenomenon during the global financial crisis. For some markets, the evidence reveals no influence of short-sale constraints on herding behaviour. Interestingly, in other cases, returns on banned stocks show increased dispersion around the market, indicating so-called adverse or anti herding.

Unlike regular herd behaviour, adverse herding is a relatively unexplored phenomenon. In theoretical models, regular herding equilibria often arise from sequential decision problems (Scharfstein and Stein, 1990; Bikchandani, Hirshleifer and Welch, 1992; Avery and Zemsky, 1998; Hirshleifer and Teoh, 2003). For instance, financial analysts can be shown to have strong incentives to follow their colleagues if they aim at maximizing their future labour market reputation relative to each other (Graham, 1999). Effinger and Polborn (2001), however, introduce a model of competing agents facing incentives to go against the grain in order to appear as the only smart ones in the market. If this effect dominates, an agent will always oppose the action of his predecessor, thereby acting as a contrarian. Avery and Chevalier (1999) put forward a framework in which self-confidence built upon past successes leads managers to go against the market consensus.

Evidence for adverse herding among experts can be found for oil-price analysts (Pierdzioch, Rülke and Stadtmann, 2010) and even for Federal Open Market Committee members with respect to their inflation forecasts (Rülke and Tillmann, 2011). Addressing the case of stock market herding, Hwang and Salmon (2004) reveal a tendency of investors to reduce their herding or even to switch to adverse herd behaviour during periods of crisis, while regular herding is more likely to arise during calm times. Seeking a theoretical explanation for these findings, Hwang and Salmon (2009) address swings in herding behaviour related to time-variations in market sentiment. In particular, investors are prone to regular herding when they broadly agree about the stock market's future performance, while adverse herd formation is the consequence of a high level of divergence of opinion among market participants.

Our finding of adverse herding in stocks subject to a short-sale ban is likely to be a consequence of increased uncertainty among investors. It is well known in the literature that banning short selling may bias stock prices. Most research papers are supportive of overvaluation (see, for example, Seneca, 1967; Miller, 1977; Figlewski, 1981; Aitken et al., 1998; Desai et al., 2002; Asquith, Pathak and Ritter, 2005; and Boehme, Danielsen and Sorescu, 2006).[2] Bai, Chang and Wang (2006), however, show that if investors are allowed to be risk averse, restricting short sellers may result in both over- or undervaluation depending on the degree of asymmetric information in a given stock. Others predict or report no impact on the level of stock prices, but argue with reduced informational efficiency due to the constraints (see, for example, Diamond and Verrecchia, 1987; Bris, 2008). Hence, restricting short sellers causes uncertainty about stock prices, which, in turn, may reduce an investor's trust in the market consensus resulting in adverse herd behaviour.

The structure of the paper is as follows. The next section reviews the literature on the recent short-sale bans. The third section outlines the econometric methodology. The fourth section provides an overview of the institutional details and the timeline of the short-selling bans as well as of the data. The fifth section discusses the empirical results and the final section is the conclusion.

LITERATURE REVIEW

The debate on short selling has a long history.[3] Paralleling regulators' reaction to the global financial crisis, the academic literature on the impact of these constraints has received renewed attention. Some studies deal with Miller's (1977) overvaluation hypothesis. Miller (1977) argues that short-sale constraints, combined with the divergence of market participants' opinion, can lead to an upward bias in asset prices, as pessimists are unable to express their beliefs.

Analyzing the ban on naked shorts in selected financial stocks in the United States in July and August 2008, Boulton and Braga-Alves (2010) compare the behaviour of banned stocks with a matched control sample. Their results lend support to the notion that the ban led to a temporary inflation in stock prices. This effect is nearly reversed a couple of days after the expiration of the constraints. However, it is debatable whether the prohibition of all short sales in nearly 800 financial stocks in the United States in September and October 2008 had a similar effect. Making use of a factor-analytical out-of-sample approach, Harris, Namvar and Phillips (2009) advocate the view that, similar to the case of the first short-sale regime, this ban also artificially inflated stock prices, although their evidence

2 Harrison and Kreps (1978) also demonstrate that, under certain circumstances, even extreme overvaluation exceeding the valuation of the most optimistic investor may arise.

3 See Boehmer, Huszar and Jordan (2010) and Bris, Goetzmann and Zhu (2007) for literature reviews on short sales.

for a reversal of prices after the rule was abolished is less clear. By contrast, Boehmer, Jones and Zhang (2011) apply matching techniques to control for the effects of the crisis per se. They, however, conclude against the overvaluation hypothesis. A broad international perspective is given in Beber and Pagano (2013), who examine restrictions in 30 countries in 2008-2009. They are also unable to detect systematic overpricing.

The majority of papers, however, focus on the impact of short-sale constraints on market liquidity and efficiency. Analyzing the ban in the United States in July and August 2008, Bris (2008) and Boulton and Braga-Alves (2010) provide evidence supporting the notion that short-sale restrictions entail rising bid-ask spreads, lower trading volumes and reductions in pricing efficiency. Boehmer, Jones and Zhang (2011) show that the ban in September and October 2008 had a similar impact on US market quality. In addition to overvaluation, Beber and Pagano's (2013) international analysis also addresses this issue of market quality. Their findings support severe deteriorations to liquidity as well as slower price discovery. Stressing an argument put forward by Diamond and Verrecchia (1987), Kolasinski, Reed and Thornock (2012) analyze the efficiency of the remaining short sales during both US bans.[4] Consistent with the predictions in Diamond and Verrecchia (1987), higher costs and other obstacles to short selling drive out uninformed investors. This change in the mixture of investors, in turn, shows up in increased informational efficiency in the remaining shorts.

Autore, Billingsley and Kovacs (2011) examine the connection between liquidity and overpricing. In principle, the liquidity shock due to the ban should suppress stock prices that might offset the overvaluation effect (Amihud and Mendelson, 1986). The authors' evidence supports the notion that abnormal returns following the inception of the ban are lower the more intense the decline in liquidity for a given stock. Dealing with the United Kingdom's experience in 2008-2009 — an extended shorting regime that also covered derivatives — Marsh and Payne (2012) find the ban to be detrimental to order book liquidity and trading volume and to increased bid-ask spreads. Helmes, Henker and Henker (2011) report reduced trading activities and wider spreads for Australia.

The impact of the short-sale bans on markets for assets other than stocks has also been investigated. In most cases, derivatives trading is unaffected by short-selling constraints and might, in principle, be used by investors to circumvent the restrictions. In particular, single stock options and futures are considered substitutes for short sales (Danielsen and Sorescu, 2001; Danielsen, Van Ness and Warr, 2009). Grundy, Lim and Verwijmeren (2012) as well as Battalio and Schultz (2011) address this notion for the case of the United States in September and October 2008. Their evidence reveals that the substitutability between short sales and options and futures is relatively limited and that no large migration of short sellers to the derivatives market took place. In particular, the ban was associated with a dramatic increase in bid-ask spreads and reduced trading volumes for derivatives as well as substantial deviations between synthetic and real stock prices. Moreover, Choi, Getmansky and Tookes (2010) find the US ban in September and October 2008 inflicted serious damage on the market for convertible bonds.

4 The July-August ban left covered short sales unaffected while market makers and specialists were exempted when the Securities and Exchange Commission (SEC) prohibited all short sales in almost 800 financial stocks in September and October.

METHODOLOGY

Different approaches have been proposed to measure herding behaviour in stock markets. Analyses that deal with specific groups of investors, such as hedge fund managers, usually rely on a test statistic developed by Lakonishok, Shleifer and Vishny (1992). Using individual trade data, this measure compares the actual share of investors' buy-and-sell decisions to the expected value under the assumption of independent trading. However, this approach is not deemed useful for the purposes of this paper, since the analysis does not focus on a specific group of institutional investors. Hwang and Salmon (2004) put forward a model that allows for time-variations in herd formation. This measure rests on the cross-sectional dispersion of monthly betas. Of course, the durations of the short-selling bans under investigation are too short to generate time series of monthly beta estimates with a sufficient length (see the section Banned Stocks, Construction of Control Groups and Data). To shed light on the impact of the recent short-sale regimes on herd behaviour, this paper relies on the approach proposed by Christie and Huang (1995) and Chang, Cheng and Khorana (2000). Let N and T be the number of stocks and observations in the sample, respectively. In the first step, the following measure of dispersion of single stock returns around the market is calculated:

$$S_t = \frac{1}{N}\sum_{i=1}^{N}\left|r_{i,t} - r_{m,t}\right|, \tag{1}$$

where $r_{i,t}$ is the return of stock i and $r_{m,t}$ stands for the market return in period t, which is defined as a weighted average of single stock returns.[5] The weights are defined as the average relative market capitalizations during the ban period. The absolute cross-sectional deviation, (1),

5 Actually, Christie and Huang (1995) use the cross-sectional standard deviation and apply the absolute deviation, (1), only as a robustness check. The absolute deviation has prevailed in the literature, however, since it is much less sensitive to outliers.

measures the average deviation of single stock returns from the market return and, thus, provides insights into the extent to which market participants discriminate between individual stocks.[6]

Next, we estimate the following regression:

$$S_t = \gamma + \delta\,|r_{m,t}| + \zeta r_{m,t}^2 + \sum_{j=1}^{h} \varphi_j S_{t-j} + \epsilon_t. \qquad (2)$$

To account for autocorrelation, lagged values of S_t are included. The maximal lag length based on Schwert's (1989) criterion is selected and the number of lags is successively reduced until the coefficient of the last lag h is found to be statistically significant at the 10 percent level.

Chang, Cheng and Khorana (2000) highlight the notion that, when stocks are priced according to the capital asset pricing model (CAPM) developed by William Sharpe (1964) and John Lintner (1965), the absolute deviation (1) is linear in the absolute value of the expected market return, $E(|r_{m,t}|)$. Using the realized market return to proxy for the latter, rational asset pricing implies a significantly positive δ and a ζ (and all other parameters) equal to 0. By contrast, a value of ζ that significantly differs from 0 indicates a violation to the linearity implied by rational asset pricing.

For daily returns, this means that $Var(r_{m,t}) = E(r_{m,t}^2) - E(r_{m,t})^2 \approx E(r_{m,t}^2)$ holds, so that $r_{m,t}^2$ can be regarded as the market return variance. If, in periods of high volatility, institutional investors herd towards the market, this implies that the dispersion of returns around the market, S_t, becomes disproportionately low compared to the rational pricing model. This should show up as a negative coefficient for ζ. The other way around, adverse herding implies that strong market movements make investors resume more fundamental based pricing, as indicated by a positive value for ζ . Evidence supporting an impact of short-sale restrictions is found if ζ significantly differs between those stocks that are subject to the ban and the unrestricted stocks in the control group.

The main intention of regulators is to displace short sellers when the market is falling. To evaluate the effects of shorting constraints during different market phases, we differentiate between bullish and bearish markets, as in Chang, Cheng and Khorana (2000), by estimating regression (2) separately for positive and negative market returns. Additionally, for markets with a sufficiently high T (that is, all markets other than the United States, see the section Banned Stocks, Construction of Control Groups and Data), persistently rising and falling markets are taken into account by sorting S_t according to two consecutive market returns of the same sign.

The samples are of small to medium size. In addition, financial time series are almost always characterized by non-normalities. To overcome these issues, a bootstrap algorithm is applied to generate appropriate t-values for the parameters in (2). The bootstrap is based on the null hypothesis of rational asset pricing, which means that the data are generated according to the classical market model (that is, CAPM), namely:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \epsilon_{i,t}. \qquad (3)$$

The returns of the large cap stocks in the samples can be expected to display weak, if any, autocorrelation but strong cross-sectional dependence. To take this into account,

Chou (2004) is followed and the residuals in (3) for all stocks in a given test or control group are jointly resampled in order to reproduce cross-correlations among these stocks. In each case, 100,000 repetitions are performed to estimate critical values. In the case of rational asset pricing, the parameter of the squared market is expected to be 0 (Chang, Cheng and Khorana, 2000). For the constant and the coefficient on $|r_{m,t}|$, deviations from the distribution under rational asset pricing are reported. In what follows, significance refers to departures from the value implied by rational asset pricing.

A robustness check is performed with respect to the rational asset pricing model. For this purpose, the three-factor model proposed by Fama and French (1992) is used:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \eta_i SMB_t + \theta_i HML_t + \epsilon_{i,t}, \qquad (4)$$

where SMB_t stands for "small minus big" and accounts for the return difference between small and large capitalization firms. HML_t stands for "high minus low" and is designed to capture the relatively better performance of stocks with a high book-to-market ratio over those with a low one. We again bootstrap the critical values now based on specification (4).

As Chou (2004) uses this resampling scheme in an event study setting, testing whether it is also appropriate for equation (2) is carried out by estimating the rejection probability function. This is accomplished using simulated as well as real-world returns. For the latter, historical US returns are used.[7] Data is generated according to the following three processes: First, independent standard normally distributed pseudo-returns; second, realizations

6 Equation (1) and related measures have also been used outside of the literature on herding. For instance, the sharp increase in cross-sectional volatility during the peak of the dot.com bubble is the subject of Ankrim and Ding (2002). Solnik and Roulet (2000) use the dispersion of national stock markets around the world to measure the level of global stock market correlation for each period separately.

7 The returns of the 10 banned US stocks with the highest average market value over the period from 1999 to 2010.

drawn independently with replacement from the respective historical return series to reproduce the distribution of the single return series. These returns are independent and identically distributed (IID) but non-normal. Third, a process is used where the historical stock returns are jointly resampled to reproduce non-normalities and also cross-correlations between the stocks. Based on these three data-generating processes, the performance of the test can be studied, in the case of normally distributed returns as well as for returns that follow an IID non-normal distribution and, additionally, for the most realistic case, taking into account cross-correlation between returns.

Davidson and MacKinnon (2007) are relied on to efficiently estimate rejection probabilities.[8] In each case, rejection frequencies for 25 values of T based on 400,000 repetitions, respectively are estimated.

The asymptotic test performs well in the case of IID normal returns. A light over-rejection for small sample sizes rapidly disappears when increasing T. In contrast, the bootstrap test shows a slight under-rejection for low Ts, but outperforms the asymptotic test in terms of the maximal deviation and the sum of squared errors. The results of the asymptotic test deteriorate strongly when taking into account non-normalities. The test greatly over-rejects for most values of T. The bootstrap displays no systematic size distortions, if any at all. In the case of the cross-correlation in returns, we find the asymptotic test to be unusable in the sense of extreme over-rejections for all T. The bootstrap test still performs well: There is a tendency for a slight under-rejection with a maximal error below 0.5 percentage points.[9] We conclude that, in contrast to the asymptotic test, the bootstrap version is adequate to detect herding even in the case of small N and T.

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. These restrictions came into force on July 21. This ban was originally set to expire on July 29; however, on that day, the SEC issued an extension, which remained in place until August 12. Those first restrictions were only foreplay — on September 17, the SEC imposed a ban on naked shorting in all stocks that came into force at 12:00 a.m. the next day. Late on September 18, after the market closed, the regulators prohibited all short sales in nearly 800 financial stocks effective immediately.

On October 2, the regulators announced an extension of the ban for up to 30 days beyond September 17. The ban finally 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 our analysis as it provides only 14 observations, which are too few to enable calculation of the herding measure.

On September 18, 2008, the Financial Services Authority in the United Kingdom imposed the strongest version of the short-selling bans considered in this study. The ban came into force the next day, and prohibited the establishment of a net short position by whatever instrument (including derivatives, with an exemption for market makers and specialists) and affected 34 financial firms. The rule was in effect 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 was finally phased out on January 31, 2010. France followed the same time schedule as Germany. There, the Autorité des marchés financiers made short selling off limits in 15 financial institutions.

On September 30, 2008, the South Korean Financial Supervisory Service imposed a ban on all short sales in all South Korean stocks. This decision was justified on the grounds that “malignant rumors” circulated 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 is run for a sample ending August 2010.

On September 22, 2008, the Australian Securities and Investments Commission prohibited naked short sales for all firms listed at the Australian Securities Exchange 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 and Poor’s/Australian Securities Exchange (ASX) 200 plus five other stocks that are part of the Australian Prudential Regulation Authority-regulated business. This ban expired on May 24, 2009.

With a few exceptions (in the United States, the United Kingdom, Germany, France and Australia), the analysis

8 We refer to the algorithm denoted as $\widehat{RP}_A$ in chapter 4 of Davidson and MacKinnon (2007).

9 The corresponding plots are available upon request.

includes all banned stocks.[10] For South Korea, as explained below, analysis is limited to the financial stocks that belong to the KOSPI 100 index. The firms facing short-selling constraints included in this study are all large-cap and large mid-cap stocks.

This is regarded as an advantage for the identification of herding behaviour for the following reasons: First, there is ample evidence that small capitalization stocks in general tend to experience a higher level of herding towards the market compared to large company stocks (Lakonishok, Shleifer and Vishny 1992; Wermer, 1999; Bikhchandani and Sharma, 2001; Sias, 2004). Second, the closely related cross-autocorrelation puzzle states that stocks of companies with low market capitalization tend to lag large stocks and their own past returns (Lo and MacKinlay, 1990; Chang, McQueen and Pinegar 1999). Thus, the inclusion of small caps could bias the results such that herding-like behaviour is found that is more an inherent feature of the returns of stocks with low capitalization than a consequence of the constraints. For these reasons, analysis of the Korean short-selling ban is restricted as explained above.

For a given set of stocks and a given period, the return dynamics under short-sale constraints are compared with the unobservable hypothetical process when there are no restrictions on shorting. This requires resorting to an additional proxy. 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 affected by the ban, it is necessary to match the control groups mainly from a group of non-financial firms.[11] To build a reliable match on the available stocks, the matching variables have to be carefully selected. Unlike many other studies that base their matches solely on market capitalization and trading volume, this study also includes the market beta. This takes into account a particular feature of financial stocks since these stocks are known to have high betas that react more strongly to market movements than, for instance, utility stocks with comparable market capitalizations and trading volumes.

Similar to Boehmer, Jones and Zhang (2011), these variables are measured 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 matching partners should be chosen 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 matching variables is chosen for replacement.[12] As the beta, volume and capitalization strongly differ with respect to mean value and standard deviation, these variables are standardized by subtracting the mean and dividing by the standard deviation. This ensures that the selection of control stocks is driven equally by market sensitivity, trading volume and capitalization.[13]

The datasets consist of daily total returns, market capitalization and trading volume of the stocks subject to the ban as well as those in the respective index used for matching control groups. Potential matching partners are the stocks in 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 20 (France), the KOSPI 100 (South Korea) and the S&P/ASX 100 (Australia). Since we do not have enough stocks in our test and control groups to compute the HML (difference between value and growth stock, or High-Medium-Low) and SMB (difference between small- and large-cap stocks, or Small-Medium-Big) factor series based on quantiles (see equation (4)), appropriate indices are used. For HML, the difference between the returns of value and growth stocks, the country specific value and growth indices calculated by Morgan Stanley Capital International are used. To calculate SMB, the return difference between small and large capitalization stocks, the Dow Jones and the Dow Jones Small Cap Index (United States), the FTSE and the FTSE small (United Kingdom), the DAX and the SDAX (Germany), the CAC 40 and the CAC Small 90 (France), the KOSPI 50 and the KOSPI Small Cap Index (South Korea), and the S&P/ASX 100 and the FTSE ASFA Small Cap Index (Australia) are used. The index composition as it was the day before the start of the short-sale ban is used. The market returns used in (1)–(4) are calculated as capitalization-weighted averages of the respective test and control groups.

All time series are obtained from Thomson Reuters Datastream. The historical constituents of the indices were provided by S&P, the FTSE Group, the Deutsche Börse Group, NYSE Euronext and the Korea Exchange. Sample sizes are as follows: 347 (France), 343 (Germany), 317 (South Korea), 127 (Australia), 83 (United Kingdom)

10 In the United States, Merrill Lynch is not included as there is no longer sufficient data available. In Germany, the 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 are excluded, as the former was announced to be partly nationalized on September 29, 2008 and the latter was hardly traded during the ban period. In France, Dexia and Allianz are not included in the sample, as their quotations 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 had to be dropped from the sample due to missing data.

11 An exception is the July-August 2008 ban in the United States where a lot of financials appear in the control group.

12 Note that replacement is advisable to avoid the composition of the control groups being dependent on the order in which firms are matched to test groups.

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

and 17 (United States). The number of stocks in the test and control groups is given by 44 (Australia), 32 (United Kingdom), 18 (United States), 16 (South Korea), 12 (France), and 10 (Germany). Table 1 provides a summary of key features of the six short-selling regimes examined in the paper together with some descriptive statistics for the return indices of the stocks in the test and control groups.

Table 1: Overview about the Bans and Descriptive Statistics

	Ban Period	Type of Ban	Mean	SD	Ex. Kurtosis	*N*	*T*
United States							
Test Group	07/15/2008–08/12/2008	naked short sales	−0.817	3.642	−1.112	18	17
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	32	83
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	10	343
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	12	347
Control Group			0.038	2.299	6.053		
South Korea							
Test Group	06/01/2009–	all short sales	0.099	1.819	1.008	16	317
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	44	127
Control Group			0.185	2.968	2.490		

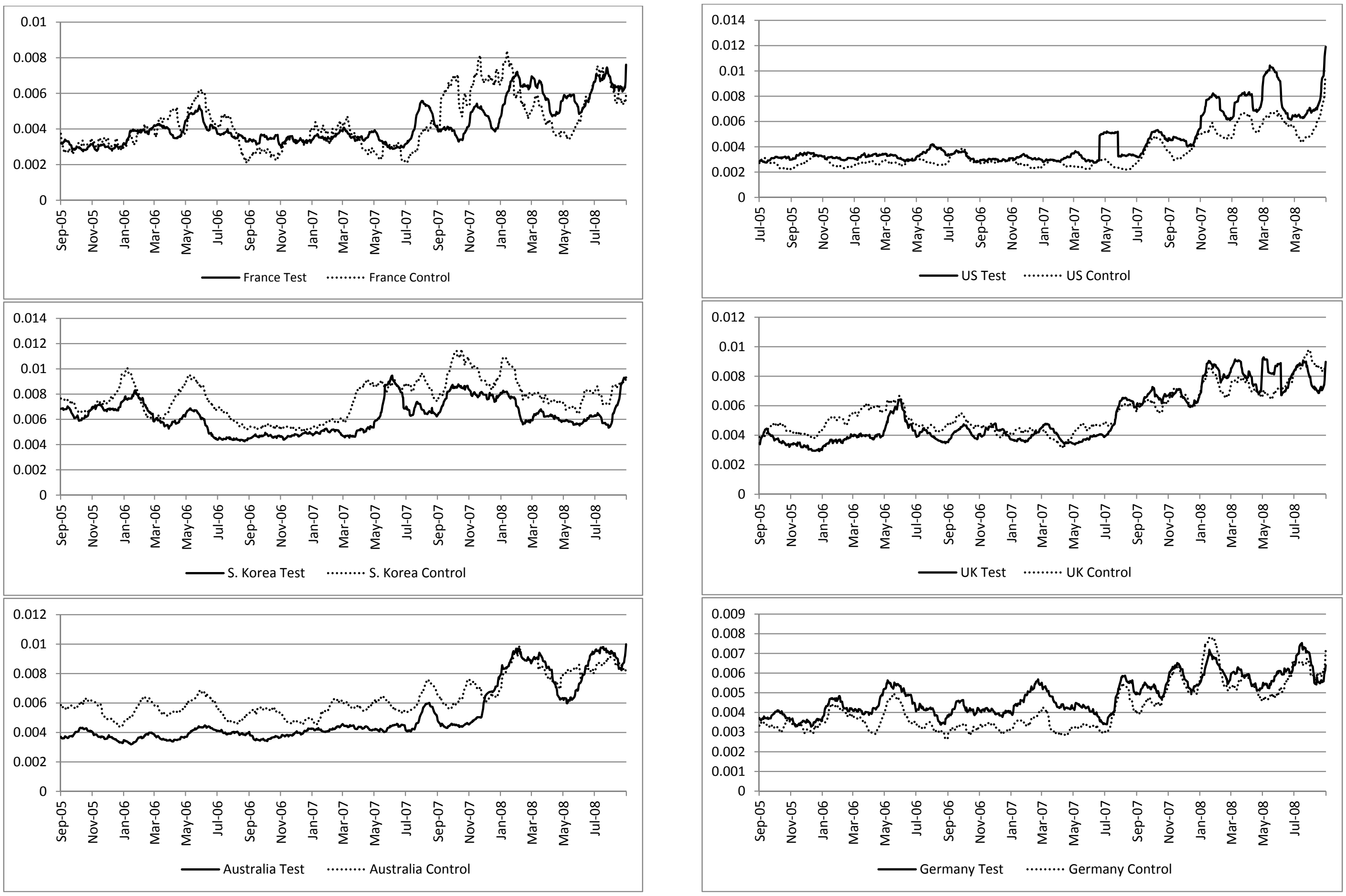
Notes: Mean, SD, and Ex. Kurtosis refer to the mean, standard deviation, and excess kurtosis of the respective market return during the ban period. *N* denotes the number of stocks included in the samples (which can be unequal to the number of stocks banned, see the section Banned Stocks, Construction of Control Groups and Data) while *T* is the number of observations for a given country. 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.

EMPIRICAL RESULTS

First of all, the stationarity and autocorrelation properties of the dispersion measure, S_t, are examined. Augmented Dickey-Fuller tests with both a linear and a changing trend, clearly reject a unit root in S_t in almost all cases. Autocorrelation is tested for using the Ljung-Box test and the significance of the autocorrelation coefficients for one up to 10 lags. Similar to Chang, Cheng and Khorana (2000), a strong serial correlation is found in S_t for all markets under consideration besides the United States.

The empirical approach taken in the study to measure the impact of short-sale constraints on institutional investors' herd formation is based on a control group of stocks carefully chosen to match the stocks to which the shorting ban applies. Therefore, checking for the quality of these control samples is important. To this end, the behaviour of the return dispersion between test and control stocks over a three-year period preceding the introduction of the bans is compared. Therefore, in Figure 1, 25-day moving averages of S_t are plotted. These graphs reveal that fluctuations in the cross-sectional dispersion of stock returns develop quite similarly for test and control groups in a given country.

Figure 1: 25-day Moving Averages of S_t for Six Countries



Notes: The figure displays 25-day moving averages of the dispersion measure, S_t, for the test and control groups for the United States, the United Kingdom, Germany, France, South Korea and Australia over a three-year period preceding the respective ban. For the sake of simplicity, S_t is calculated using an equal-weighted market index.

Estimation results for equation (2) are reported in Table 2. The R^2 strongly differs between markets as well as between test and control groups. This finding is also in line with Chang, Cheng and Khorana (2000). When looking at the parameter estimates, asterisks indicate significant deviations from rational asset pricing rather than from 0. During the US ban period, violations to the rational asset pricing model are not found with respect to the constant and δ, as can be seen from the statistically insignificant parameters estimates $\hat{\gamma}$ and $\hat{\delta}$. For the United Kingdom, only a few $\hat{\delta}$s and $\hat{\gamma}$s are observed that are significantly different from the distribution under the null. Conversely, for Germany and France and, to a lesser extent, for South Korea and Australia, the estimates for $\hat{\gamma}$ and $\hat{\delta}$ indicate violations to the rational asset pricing model.

Table 2: Herding Behaviour and Short-selling Bans: Empirical Estimates for Six Countries

	Test Group				Control Group			
	$\hat{\gamma}$	$\hat{\delta}$	$\hat{\zeta}$	R^2	$\hat{\gamma}$	$\hat{\delta}$	$\hat{\zeta}$	R^2
United States								
Overall	0.024	0.024	4.190	0.553	0.014	−0.114	8.330	0.340
l = 1 positive	0.015	0.480	−3.907	0.597	0.006	0.576	−2.413	0.394
l = 1 negative	0.033	−0.272	6.757	0.591	0.022	−1.159	28.750*	0.567
United Kingdom								
Overall	0.014	0.276*	1.321	0.762	0.019	0.147	0.701	0.543
l = 1 positive	0.013	0.107	2.841	0.862	0.019	0.293	0.355	0.686
l = 1 negative	0.016	0.193	2.253*	0.865	0.006	0.090	1.619	0.702
l = 2 positive	0.003**	0.592**	-0.716	0.884	0.032	0.075	1.127	0.498
l = 2 negative	0.020	0.048	3.583*	0.834	−0.006***	−0.046	1.867	0.702
Germany								
Overall	0.004**	0.133*	1.346***	0.695	0.003***	0.109	0.558	0.562
l = 1 positive	0.005	0.204**	1.052*	0.668	0.001***	0.265***	−0.407	0.670
l = 1 negative	0.002***	0.213**	−0.513	0.590	0.003***	−0.029	1.143	0.417
l = 2 positive	0.005***	0.172*	1.080**	0.780	0.002***	0.257***	−0.142	0.679
l = 2 negative	0.002***	0.154	0.182	0.602	0.004***	0.048	0.557	0.469
France								
Overall	0.004***	0.144	1.803***	0.734	0.003***	0.278***	−0.441	0.481
l = 1 positive	0.004***	0.245***	1.021**	0.778	0.004***	0.134	1.422	0.477
l = 1 negative	0.005**	−0.000	3.759***	0.720	0.002***	0.321**	0.187	0.528
l = 2 positive	0.005***	0.287***	0.884	0.755	0.004***	0.266**	0.025	0.489
l = 2 negative	0.005*	0.039	3.725***	0.746	0.002***	0.461***	−3.334**	0.546
South Korea								
Overall	0.003***	0.111**	−0.231	0.242	0.006***	0.198*	1.254	0.271
l = 1 positive	0.004***	0.161*	0.053	0.325	0.007	0.104	4.243	0.355
l = 1 negative	0.007	0.041	-0.403	0.144	0.006**	0.236	0.935	0.301
l = 2 positive	0.002***	0.254***	−2.025	0.404	0.009***	0.251*	0.190	0.257
l = 2 negative	0.006	0.011	0.244	0.146	0.012**	0.144	4.056	0.257
Australia								
Overall	0.011***	0.145	1.283	0.340	0.013	0.003	2.912	0.328
l = 1 positive	0.016	0.258	1.718	0.261	0.015**	0.019	3.525	0.450
l = 1 negative	0.021**	0.112	−0.775	0.102	0.010	−0.331**	8.166***	0.794
l = 2 positive	0.032	0.078	4.173	0.114	0.003***	0.329	−3.712	0.511
l = 2 negative	0.007	0.595*	−16.463*	0.561	0.005**	0.635	−5.334	0.462

Notes: l = 1, 2 refers to the length of consecutive market returns with the same sign. ***, **, and * denote statistical significance at the one percent, five percent and 10 percent level, respectively. These significance levels are based upon the bootstrap outlined in the Methodology section. Note that significance refers to significant differences from rational asset pricing.

Turning to the parameter that serves to capture herding formation, ζ , estimates reveal that institutional investors were, in general, not prone to herd behaviour during the global financial crisis. When looking at the stocks facing short-sale restrictions, there is not any support for this kind of behaviour in the United States and South Korea. Hence, in both stock markets, the banned stocks do not change with respect to institutional investors' herd formation. Australia is the only market where a weak tendency for herding in the constrained stocks is observed. By contrast, the estimates for ζ for the test groups in the United Kingdom, Germany and France indicate adverse herding; for all markets, the findings for the unrestricted stocks in the control groups overwhelmingly reveal neither herding nor adverse herding by institutional investors.

As a robustness check, the t-values are bootstrapped using the three-factor model represented by equation (4). The findings broadly support the results based on the baseline model. Moreover, as the selection of 0 as the threshold between the bull and bear market is to some extent arbitrary, the model was re-estimated using as a threshold the mean return of the respective samples during the ban. Previous findings are broadly confirmed.[14]

Adverse herding means that an increase in the absolute value of the market return leads to a disproportionately high increase in the dispersion of returns around the market comparedW to rational asset pricing. In the view of the authors, adverse herding indicates uncertainty in the market. This interpretation is supported by the empirical literature (see Hwang and Salmon, 2004, 2009). Theoretical models predict that adverse herding may arise due to increased self-confidence relative to other market participants (see Avery and Chevalier, 1999). Analogously, reduced trust in other investors' ability may show up as an increased dispersion of single stock returns. Additionally, the literature on short selling reports that displacing short sellers can lead to uncertainty about fundamental asset values.

To sum up, stock market performance during the global financial crisis was not driven by herding behaviour. In contrast, adverse herding intensified by short-selling constraints seems to be a phenomenon in some stock markets. This finding may be a consequence of increased uncertainty among investors.

CONCLUSION

The existing literature neglects potential effects of short-selling bans on herd behaviour, that is, on the dispersion of stock returns around market returns. As institutional investors dominate trading in mature stock markets, preventing them from selling short may have a significant impact on the asset pricing process. The aim of this paper is to fill this gap and, thus, evaluate the consequences of those regulatory measures. Dealing with bans on selected stocks in six countries during the recent financial crisis provides a natural experiment, permitting an evaluation of herd behaviour among stocks affected by short-sale constraints vis-à-vis the group of unbanned stocks.

In the United States, the United Kingdom, Germany, France, South Korea and Australia, regulators imposed shorting restrictions on selected financial stocks. This fact is exploited to match banned stocks against a control group of unrestricted stocks. For each test and control group, the herding measure proposed by Christie and Huang (1995) and Chang, Cheng and Khorana (2000) is calculated. To obtain insights into potentially asymmetric effects of short-sale constraints between bull and bear markets, specifications are estimated separately for rising and falling markets. Bootstrap techniques mean robust evidence can be produced from samples of small- and medium-size length. As shown by simulations, this procedure is appropriate for drawing reliable inferences.

The evidence reveals that institutional investors' herding in stock markets is not a prevalent phenomenon during the global financial crisis of 2008-2009. In some countries, displacing short sellers does not seem to affect the asset pricing process, whereas in other markets, the returns on banned stocks display a higher dispersion around the market compared to rational asset pricing models. This phenomenon is known as adverse herding and is likely to emerge in times of uncertainty and differences of opinion (see Hwang and Salmon, 2004, 2009). Additionally, it is well known that under short-sale constraints prices may deviate from fundamental values, thereby strengthening investors' uncertainty about these values. A robustness check confirms the results using the Fama and French (1992) three-factor model as the data-generating process instead of the classical market model to bootstrap the deviations from rational asset pricing.

An examination of the evidence leads to the conclusion that, all things considered, constraining short sales leads, in some cases, to greater uncertainty, which can produce adverse herding behaviour. Since the literature on short-selling bans also reports deteriorations in market quality, in particular rising bid-ask-spreads and lower trading volume, the weight of the empirical evidence further justifies the view that such bans have an adverse net effect on stock markets.

14 Detailed results are available upon request.

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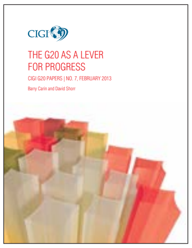
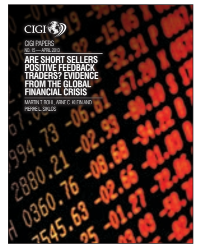


THE G20 AS A LEVER FOR PROGRESS

Barry Carin and David Shorr

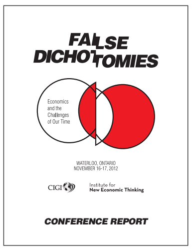
The failure of many observers to recognize the varied scale of the G20's efforts has made it harder for the G20 to gain credit for the valuable role it can play. This paper offers five recommendations for the G20 to present a clearer understanding of how it functions and what it has to offer.



ARE SHORT SELLERS POSITIVE FEEDBACK TRADERS? EVIDENCE FROM THE GLOBAL FINANCIAL CRISIS

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

During the recent global financial crisis, regulatory authorities in a number of countries imposed short-sale constraints aimed at preventing excessive stock market declines. The findings in this paper, however, suggest that short-selling bans do not contribute to enhancing financial stability.



FALSE DICHOTOMIES: ECONOMICS AND THE CHALLENGES OF OUR TIME

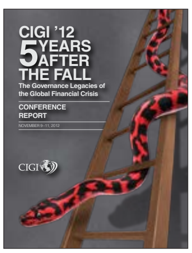
Kevin English

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.

EAST ASIAN STATES, THE ARCTIC COUNCIL AND INTERNATIONAL RELATIONS IN THE ARCTIC

James Manicom and P. Whitney Lackenbauer

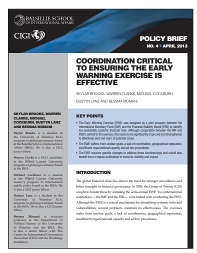
All three major East Asian states — China, Japan and South Korea — have bid for Artic Council membership and have active polar research programs, but their interest has met with concern in several quarters. This policy brief suggests that the Arctic Council's member states should welcome East Asian states as observers to enmesh them into "Arctic" ways of thinking.



FIVE YEARS AFTER THE FALL: THE GOVERNANCE LEGACIES OF THE GLOBAL FINANCIAL CRISIS

John Helliwell and CIGI Experts

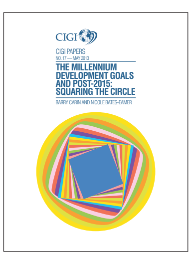
More than five years after the onset of the global financial crisis, the effects continue to be felt across a spectrum of issues. Five papers by CIGI experts form the core of this special report and provide insight and recommendations for building the governance arrangements required to deal with these enduring legacies, with an overview that sets the broader context in which the papers were presented and discussed at CIGI's annual conference.



COORDINATION CRITICAL TO ENSURING THE EARLY WARNING EXERCISE IS EFFECTIVE

Bessma Momani et al.

The need for stronger surveillance and better foresight in financial governance was made clear during the global financial crisis. The Group of Twenty initiated the early warning exercise, which is a critical mechanism for identifying systemic risks and vulnerabilities; however, several problems constrain its effectiveness.



THE MILLENNIUM DEVELOPMENT GOALS AND POST-2015: SQUARING THE CIRCLE

Barry Carin and Nicole Bates-Eamer

Based on a series of reports and discussions on the post-2015 development agenda that took place over the past two-and-a-half years, this paper reviews the history of the Millennium Development Goals (MDGs), describes the current context, lists the premises and starting points and provides a brief summary of the evolution of the project's view. The paper concludes with some observations on each of the 10 recommended goals.

POST-DOHA TRADE GOVERNANCE: ATLANTIC HEGEMONY OR WTO RESURGENCE?

Dan Herman

A free trade agreement between the United States and the European Union is finally moving closer to reality. While significant challenges remain, strong support in both markets has dramatically improved the likelihood of the deal's success, shaking the lull created by the demise of the Doha Development Round.

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