Short-sale constraints and efficiency of the spot–futures dynamics

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ABSTRACT

This paper studies the spot and futures cross-market efficiency implications of the regulatory short-selling constraints imposed during the 2008–2009 financial crisis. We find that the equilibrium position for the basis during the ban period is below that normally seen, with the spot price higher relative to the futures price. This suggests that holding the spot was more valuable than holding the futures during the ban period. Further, we find that the speed of adjustment has slowed down and in some cases become statistically insignificant, suggesting that arbitrage is less effective during the ban period. The results presented here have implications for regulators and traders regarding the efficiency of these markets during a short-sale ban.

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1. Introduction

During the financial crisis in 2008–2009, regulatory bodies across the major world stock markets imposed emergency bans on short-selling activities. Regulators viewed short-selling as one of the main speculative activities that could drive prices down, causing a potential crash in the market. Concerns around financial market stability led the Securities and Exchange Commission (SEC) to be the first to initiate an emergency order on 21st July 2008 to temporarily ban naked short-selling and imposed mandatory pre-borrowing in 19 US financial stocks. Then later following the collapse of Lehman Brothers on 15th September 2008, a sense of panic over a systemic market crash induced regulators in several countries to impose short-selling restrictions on stocks traded on their national exchanges (see Gruenewald, Wagner, & Weber, 2010 for details on the restrictions). Most of the European regulators, along with the US and Canada, imposed restrictions on particular financial sector stocks. Asian and Australian regulators, however, imposed restrictions on all stocks.

Recent studies document several implications of the short-selling ban in equity markets. Beber and Pagano (2010) examine the impact of the regulatory restrictions in 30 countries and find that the bans were detrimental for stock market liquidity, especially for stocks with small market capitalization, high volatility and no listed options.

They also find that the ban had slowed down price discovery and contributed to poor stock price performance. Boehmer, Jones, and Zhang (2009) find that the bans induced around a 65% drop in the shorting activities and the banned stocks suffered severe degradation in market quality, as measured by spreads, price impacts, and intraday volatility. Similar conclusions are documented by Gurliacci, Jeria, and Sofianos (2008), Kolasinksi, Reed, and Thornock (2009), and Frino, Lecce, and Lepone (2011), among others. Autore, Billingsley, and Kovacs (2011) find that an unintentional consequence of the ban has been a dramatic reduction in the liquidity of the banned stocks. The paper also finds that the bans have led to stock overvaluation, validating Miller's (1977) overvaluation theory.

Such short-selling regulatory restrictions in the equity markets can also have an impact on markets that derive from them, such as the equity options market. Battalio and Schultz (2011) examine the short-sale ban impact on equity options and find a dramatic increase in the trading costs for options on banned stocks, making it difficult for the investors to use options to hedge. They further find the synthetically created share prices from options for banned stocks to be significantly lower than actual share prices during the ban period, attributed to increased hedging costs. Similarly, an increase in spreads for options on banned stocks, a decrease in trading activity, and an increase in violations of put-call parity during the ban period are documented by Cakici, Goswami, and Tan (2010), and Grundy, Lim, and Verwijmeren (2010).

This paper is the first to examine the impact of the recent short-sale ban on the relationship between the spot and futures markets. The dynamic relationship between the spot and futures prices is

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well-established in the literature. The two asset prices are bound together by the cost of carry model where the basis (price difference between log-futures and log-spot) follows a non-linear equilibrium correction mechanism. Due to market irregularities such as transaction costs, deviations from the equilibrium point create non-arbitrage upper and lower boundaries within which there are no profitable arbitrage activities. Since the short-selling restrictions are applied only to stocks and not to futures, one might expect the equilibrium non-arbitrage relationship between the two assets to be altered. Previous studies such as Pope and Yadav (1994) find significant futures underpricing (relative to the spot) when short-sale constraints are binding. Fung and Draper (1999), Jiang, Fung, and Cheng (2001), among others, find that short-sale restrictions weaken the mean reversion adjustment process and alter mainly the lower non-arbitrage boundary level due to higher costs in holding the spot position.

In this paper, we investigate the changes in the futures basis due to the 2008 regulatory short-selling restrictions imposed in the equity markets. To understand the cross-market implications of the regulatory ban, we first examine the dynamics of the basis for changes in distributional characteristics. Second, we test for changes in the speed of mean reversion of the basis. Third, we examine if the ban has induced a change in the equilibrium position, and finally we test for changes in the non-arbitrage boundaries that might be altered if market participants react differently during the ban period. For example, given a short-sale ban on spots, traders may wish to hold spot in greater quantities than prior to the ban. Recent studies have not examined the effect of the 2008 short-selling bans on the futures market and hence this paper fills a noticeable gap in the literature. Further, since policy makers are still interested in knowing the cross-market implications of the ban, this paper provides valuable information about the effect of the ban on the efficiency of the futures market.

The results show that the basis has fallen during the ban period. This means that holding the stock has become relatively more valuable than holding the futures. We find that the introduction of the ban has led to a decrease in the equilibrium position of the basis. This is true not only for the attractor point but also for the non-arbitrage bands around equilibrium. We also find that the speed of mean reversion has changed, typically becoming slower but not always (or has become insignificant due to increased variance as coefficients are still large but the standard errors have also increased). The results presented here are important not only to academics, but also to market practitioners and regulators. Our results present evidence that the regulatory ban has affected the efficient functioning of the futures markets and also implicitly examines the behaviour of traders and how they respond to the ban.

The reminder of this paper is organised as follows. Section 2 provides the theoretical underpinnings that explain the relationship between the spot and futures markets and discusses the methodologies used in examining the spot–futures dynamics. Section 3 discusses the dataset considered. Section 4 reports the empirical results that discuss the cross-market implications of the short-sale ban. Section 5 concludes.

2. Short sale constraints and spot–futures dynamics

The feedback relationship between the spot and futures markets is widely documented in several studies. Kawaller, Koch, and Koch (1987), Stoll and Whaley (1990), Chan (1992), and Brooks, Rew, and Ritson (2001), among others, show that futures prices lead the spot prices and act as a vehicle of price discovery. This is reflected through the fact that holding a futures position involves very little capital and is perhaps aloof from several market inefficiencies such as transaction costs. Also, the presence of several market frictions might cause one market to react faster than the other, causing the lead–lag relationship.

Short-sale constraints in the spot market can influence this lead–lag relation since negative information can affect the futures market but cannot be reflected in the spot market through potential short-selling activities. Diamond and Verrecchia (1987) show that if the short-sale constraints are binding then the futures should lead the spot much more when the markets are falling (under bad news) than when the markets are rising. Further, when the futures are underpriced and short-sale constraints are binding, arbitrageurs are unable to correct the mispricing by holding a long hedge position (long futures and short stock). This suggests that futures will remain underpriced when markets are falling. Puttonen (1993) and Jiang et al. (2001) empirically test these predictions and find evidence that short-sale restrictions reduce the speed of adjustment in the stock market, thereby inherently weakening the contemporaneous relation between the spot and the futures market. Pope and Yadav (1994) find that short-sale constraints lead to significant futures underpricing among the FTSE 100 index futures relative to the cash index. Thus, under periods of the short-sale ban we can expect the lag length between the futures and spot to widen, with slower mean reversion to their long-run equilibrium point.

The two markets are tied together through a no-arbitrage relationship given by the cost of carry model

$$F_t = S_t e^{(r-d)(T-t)} \tag{1}$$

where F_t and S_t are the spot and futures prices quoted at time t, r is the continuously compounded risk-free rate, d is the continuously compounded dividend yield and T is the maturity date of the futures contract. This relationship was first advocated by MacKinlay and Ramaswamy (1988) and Stoll and Whaley (1990). Taking natural logs, Eq. (1) can be written in terms of the basis, which is the price differential between log-futures (f_t) and log-spot (s_t)

$$x_t \equiv f_t - s_t = (r-d)(T-t). \tag{2}$$

The basis x_t provides a link between the two markets and is also referred to as the error correction term. A non-zero basis term (ignoring the right-hand side of Eq. (2)) therefore represents the presence of arbitrage opportunities. That is, if the futures price is too high relative to the spot ($x_t > 0$) then arbitrageurs will buy spot and sell futures. In contrast, if the spot price is too high ($x_t < 0$) then arbitrageurs will (short) sell spot and buy futures. Both actions will ensure reversion to equilibrium ($x_t = 0$). Furthermore, as can be seen from this simple description, the short-selling ban would have a more direct effect on one side of the arbitrage relationship. Assuming, a linear adjustment

Table 1
Summary of the data. This table lists the number of banned and unbanned stocks considered for the nine European countries. Coverage is the number of banned stocks in the sample as a percentage of the total stocks that were banned by the regulators. The short-selling ban period was ongoing in some countries at the end of the sample period considered in this paper (31st August 2010). In such cases, the end date is specified as 'ongoing' in the table below.

	Ban period		Number of banned firms			Number of unbanned firms
	Start date	End date	Banned list	Total banned	Coverage	
Austria	27/10/2008	30/09/2010	4	4	100.00	11
Belgium	22/09/2008	Ongoing	2	4	50.00	8
France	22/09/2008	Ongoing	9	15	60.00	29
Germany	20/09/2008	31/01/2010	5	11	45.45	22
Netherlands	22/09/2008	01/06/2009	3	9	33.33	20
Portugal	22/09/2008	Ongoing	8	8	100.00	9
Spain	24/09/2008	Ongoing	6	15	40.00	23
Switzerland	19/09/2008	Ongoing	6	7	85.71	27
UK	19/09/2008	16/01/2009	9	30	30.00	18
Total			52	103	50.49	167