

Do Option Markets Undo Restrictions on Short-Sales: Evidence from the 2008 Short Sale Ban



THE UNIVERSITY OF
MELBOURNE

FACULTY OF
ECONOMICS &
COMMERCE

Bruce D. Grundy
Bryan Lim
Patrick Verwijmeren



Timeline

- 1938: SEC institutes uptick rule
- 2007: SEC removes uptick rule on short sales
- 15 July 2008: SEC issues temporary ban on naked short sales of Fannie Mae, Freddie Mac and 17 other financial stocks
 - Expires mid-August
- 17 September 2008 (after market close): SEC issues permanent ban on naked short sales on all stocks



Timeline

- 18 September 2008 (after market close): SEC issues temporary ban on short sales of 979 financial stocks, provisionally ending 2 October 2008
- 21 September 2008: SEC specifies additional provisions on ban
- 2 October 2008: Ban extended to earlier of 17 October or 3 business days after Emergency Economic Stabilization Act is signed by President Bush (signed the next day)
- 8 October 2008: Ban ends at 11:59 PM



Uptick rule reinstatement

- March 2009: SEC seeks comments on proposals for reinstatement of variations of uptick rule
 - Example: suspend short selling for a period after an $x\%$ decline in share price



Options Market Maker exemptions from the Short Sale Restriction

– Initial (18 Sep)

- Options market makers granted 24 hour exemption, given that 19 Sep was the last trading day before index & equity options expired

– Revision (22 Sep)

- Options market makers exempt unless “the market maker knows that the customer’s or counterparty's transaction will result in the customer or counterparty establishing or increasing an economic net short position”



A rationale for banning short sales

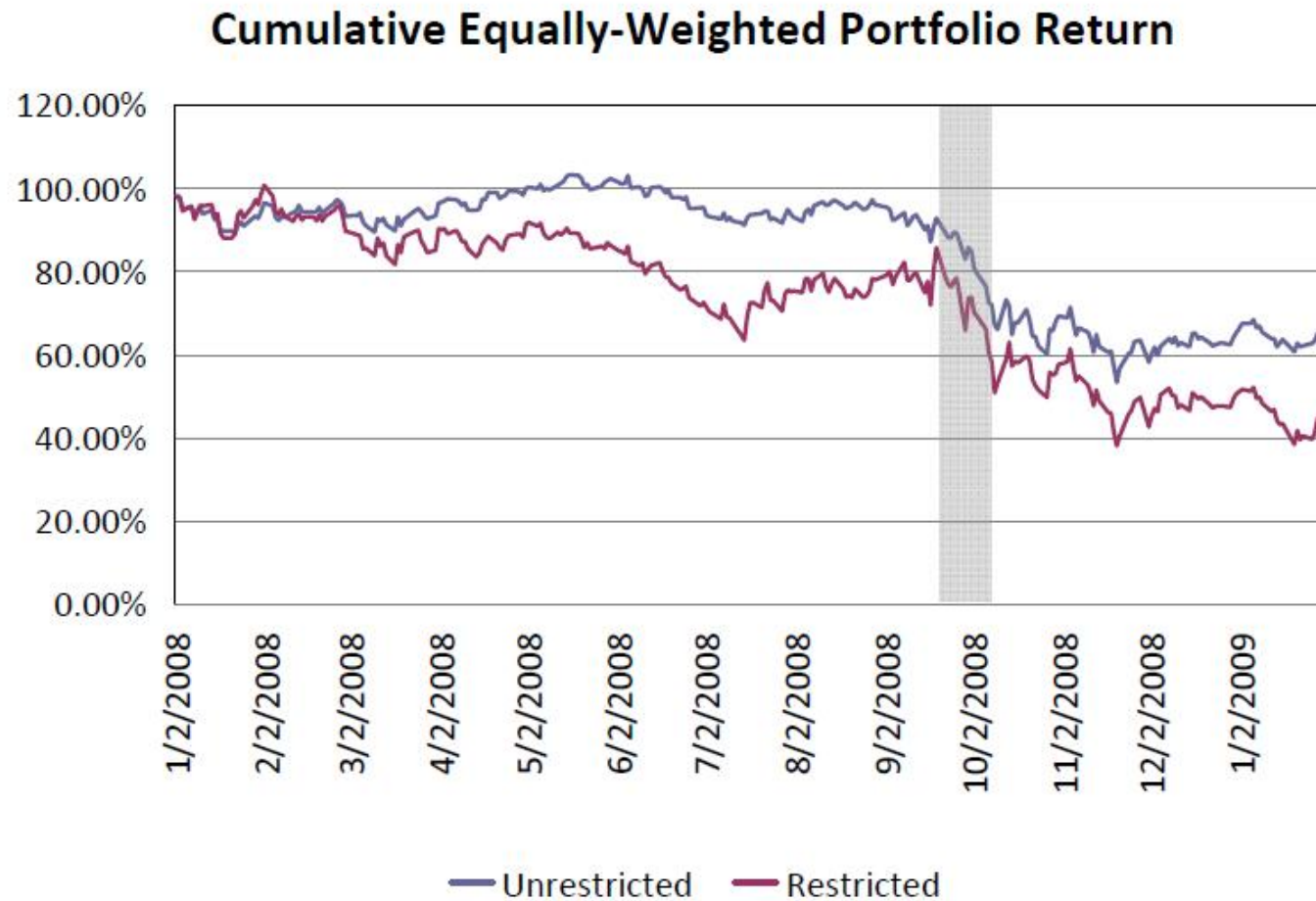
- Stop rumourtrage (SEC)
 - Would-be arbitrageurs can spread rumours about potentially distressed firms and profit from short positions if owners of shares then dump their holdings at depressed prices



Implications of restrictions on short sales

- Miller (1977): if short sales are restricted, prices will disproportionately reflect the most optimistic investors, biasing prices upward
- Diamond and Verrecchia (1987): in a RE world, short-sales constraints decrease the speed of price adjustment to information but do not bias the final price


Did the ban increase share prices?





Did the ban work?

- If the goal was to prevent stocks from decreasing in value: Maybe
- If the goal was to prevent arbitrageurs from short selling: Yes
 - Boehmer, Jones, and Zhang (2008): short-selling activity dramatically decreased for restricted stock during the ban

- 
- Theory: long positions in put options are substitutes for short positions in stocks (and vice versa)
 - Figlewski and Webb (1993): put options reduce the upward bias in prices associated with short sales constraints
 - If options market makers could sell puts and short sell the stock to hedge their own position, would-be short sellers could simply buy puts



Who might have sold short absent the ban?

- Informed traders who believe the stock is overvalued
- Uninformed traders who believe the stock is overvalued, at least temporarily
 - Includes would-be arbitrageurs trying to start a run on the stock

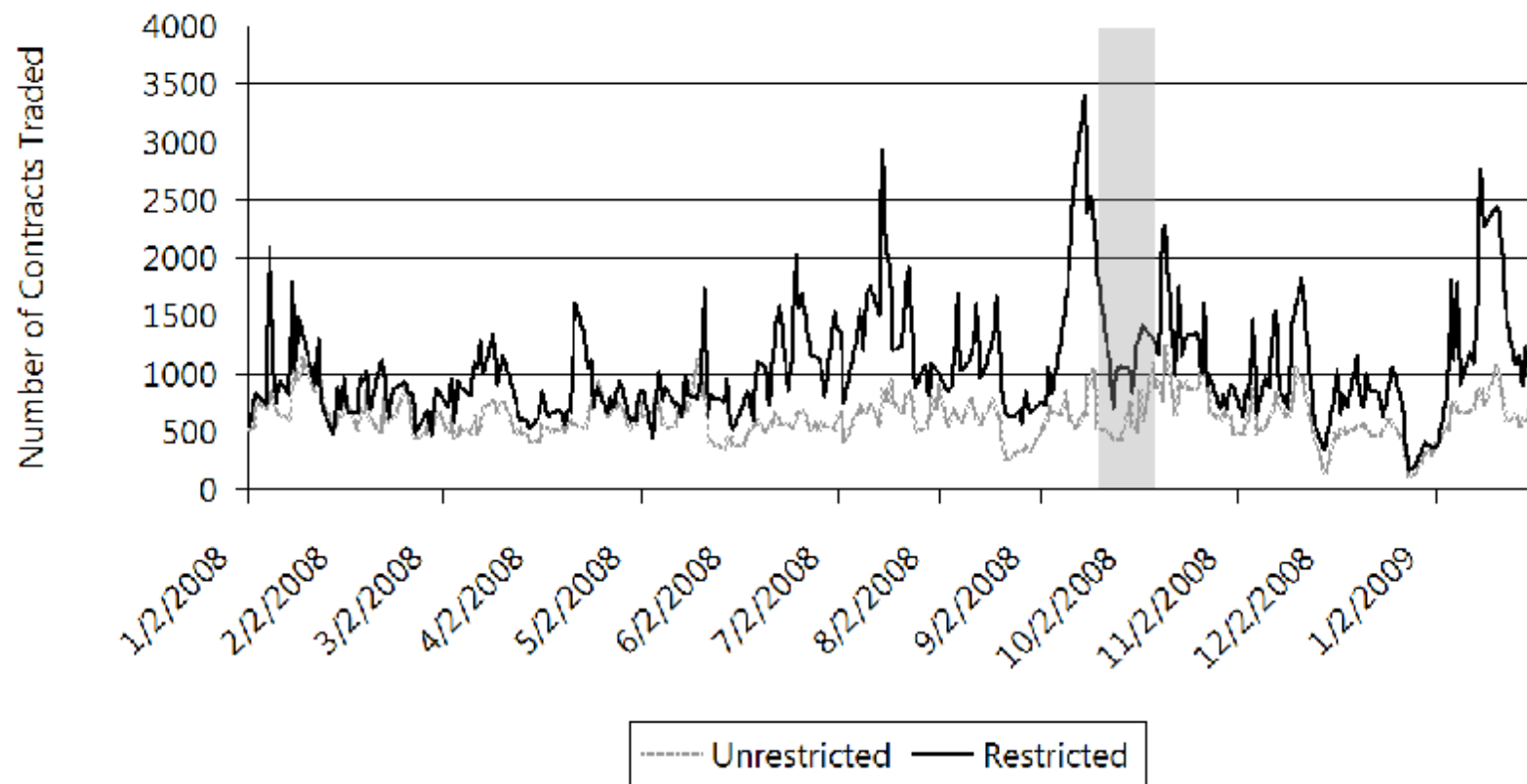


Would these traders switch to puts when the ban was in place?

- Informed investors: yes
- Arbitrageurs: yes provided they believe that the rumour alone, or a combination of the rumour and a reported increase in put volume, will have the same effect on share prices as the rumour and a reported increase in short sales

Total Put Option Volume

Average Put Option Volume per Stock





Our approach

- What effects did the short-sale ban have on the market for options, in terms of
 - Volumes?
 - Pricing?
- Did the ban cause options and equities markets to become decoupled?
 - In particular, did the ban have an effect on the incidence of put-call parity violations?



Hypothesis on pricing

- In theory, options spreads should increase during this short sales ban because
 - Greater information asymmetry
 - Increased monopoly/oligopoly power of market makers to write *hedged* puts (higher ask prices for puts)
 - and also to buy hedged calls (lower bid prices for calls)



Further reasons for an increase in spreads?

- Additional market factors at the time of the ban could also have increased spreads
 - Costs faced by market makers when borrowing stocks to short sell in order to hedge their written put positions may have increased if potential lenders become more concerned about potential default
 - Volatility as measured by VIX had increased, which would increase market maker's inventory cost of a position until it could be hedged or closed out.



Caveats

1. We are not able to study the effect of a short-sales ban holding everything else constant
 - Δ market conditions \rightarrow short-sales ban
 - Large year-to-date drop in the S&P 500
 - Large increase in CBOE Volatility Index (VIX)
 - This is almost always the case when short-sales constraints become binding



Caveats

2. How long could options market-makers hold their short stock positions?
 - SEC exemption was for “bona fide market making” by options market-makers
 - Similar exemption in Holland: “we [the Netherlands Authority for the Financial Markets] would not expect Market Makers to hold significant short positions, other than for brief periods.”



Data

- Daily options, stock and yield curve data from OptionMetrics
- Chicago Board Options Exchange Volatility Index (VIX)
- Sample consists of firms on S&P 500
- Exclude
 - Firms added to restricted list after 19 Sep
 - Firms with stock prices below \$5 on 19 Sep
- 71 Restricted, 396 Unrestricted = 467

Moneyiness

- Define “moneyiness” as the natural log of stock price divided by strike price: $\ln(S/K)$

	$\ln(S/K) < -0.1$	$-0.1 < \ln(S/K) < 0.1$	$\ln(S/K) > 0.1$
Puts	In-the-money	At-the-Money	Out-of-the-money
Calls	Out-of-the-money	At-the-Money	In-the-money

Daily Option Volume

- Tracking volume on a single option is not particularly informative

	Obs.	% Zero Vol
Puts	8,226,922	73.3%
Calls	8,227,073	67.3%



Option Volume per Stock

- Solution: aggregate total option volume per stock (OVS)
- OVS is a daily measure of the number of put (call) contracts traded on a stock on a given date
 - For example, the put OVS on 16 April 08 for 3M is the sum of all put option volume on that date written on ticker 'MMM'

Model

$$\begin{aligned} OVS = & a + b_1 stvol + b_2 stret + b_3 VIX + b_4 Restricted \\ & + b_5 Ban\ period + b_6 (Restricted \times Ban\ period) \\ & + b_7 Post\ Ban\ period + b_6 (Restricted \times Post\ Ban\ period) \end{aligned}$$

- *stvol* = daily traded volume of the stock (in millions)
- *stret* = daily return on the stock
- *VIX* = CBOE Volatility Index
- *Restricted* = 1 if the underlying stock is on the SEC list of restricted stocks
- *Ban period* = 1 if date is between 19/9 and 8/10

Summary Statistics

	Mean	Std. Dev.	Min	Max
Put Option Volume per Stock	4,455.0	14,308.0	0	1,062,962
Call Option Volume per Stock	5,440.8	20,632.6	0	2,815,869
Stock Volume (mil.)	7.19	13.41	0.089	1,224.1
Stock Return	-0.0014	0.043	-0.816	1.02
VIX	33.6	16.1	16.3	80.9

Option Volume per Stock – Results

* Indicates significance at the 1% level (** at the 5% level)

	Puts	Calls
(coefficients for control variables omitted)		
Restricted	1,786.9* (155.0)	-1,519.3* (163.0)
Ban period	-489.6* (159.5)	-530.4* (182.8)
Restricted x Ban period	-2,704.1* (823.7)	-426.3 (731.0)
Post Ban period	587.4* (196.4)	1,091.7* (273.4)
Restricted x Post Ban period	-1,283.7* (308.5)	-578.3** (250.4)
N	127,155	127,156
R ²	0.38	0.28

Option Volume per Stock – Results

	Puts	Calls
(coefficients for control variables omitted)		
Restricted	1,786.9*	-1,519.3*
	(155.0)	(163.0)
Ban period	-489.6*	-530.4*
	(159.5)	(182.8)
Restricted x Ban period	-2,704.1*	-426.3
	(823.7)	(731.0)
Post Ban period	587.4*	1,091.7*
	(196.4)	(273.4)
Restricted x Post Ban period	-1,283.7*	-578.3**
	(308.5)	(250.4)
N	127,155	127,156
R ²	0.38	0.28


Option Volume per Stock – Results

	Puts	Calls
(coefficients for control variables omitted)		
Restricted	1,786.9* (155.0)	-1,519.3* (163.0)
Ban period	-489.6* (159.5)	-530.4* (182.8)
Restricted x Ban period	-2,704.1* (823.7)	-426.3 (731.0)
Post Ban period	587.4* (196.4)	1,091.7* (273.4)
Restricted x Post Ban period	-1,283.7* (308.5)	-578.3** (250.4)
N	127,155	127,156
R ²	0.38	0.28



Why did call volumes decline during the ban period?

- Decreased demand for calls during ban period?



Why did put volumes decline during the ban period and decline more for restricted stocks

- Spreads (Prices) increased?
 - If spreads for puts on restricted stocks increased more than those on unrestricted stocks, we would expect a decline in put volume and a larger decline for restricted stocks



Δ Spreads \rightarrow Δ Volume?

- Decreased volume could be the result of unattractive pricing
- During the ban period, it is possible there was:
 - increased information asymmetry
 - increased costs of borrowing stocks
 - increased inventory risk
 - monopoly power

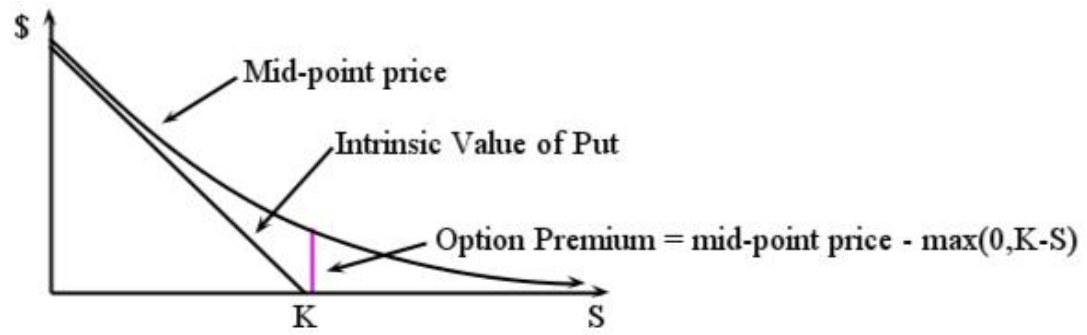
Adjusted Relative Spread

- Want to normalise spreads and examine whether they changed during ban period
- We define

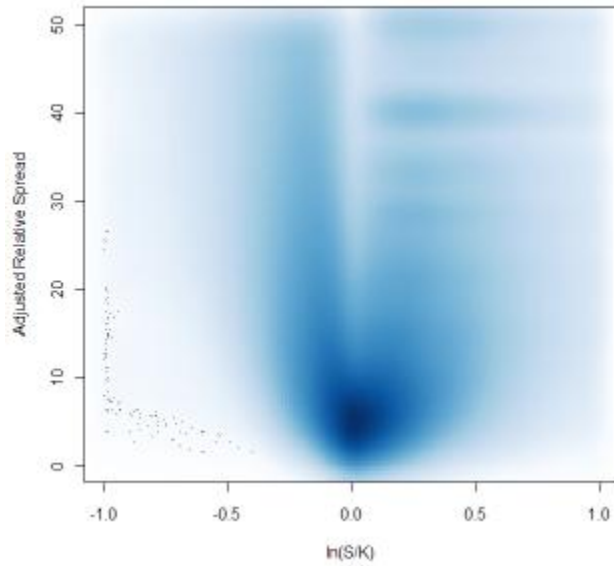
$$ARS_{i,t} = \frac{\text{Best Ask} - \text{Best Bid}}{\frac{\text{Best Ask} + \text{Best Bid}}{2} - \text{intrinsic value}} \cdot 100$$

where

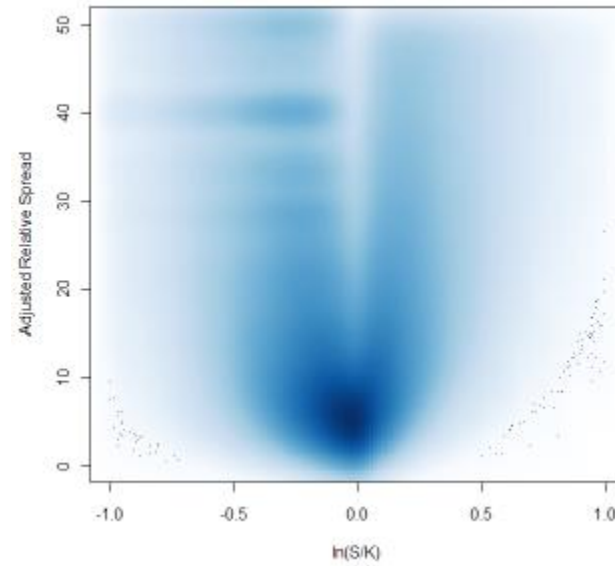
- Best Ask = lowest ask at close
- Best Bid = highest bid at close



Adjusted Relative Spread: Puts



Adjusted Relative Spread: Calls



Model

– Adjusted Relative Spread =

$$\alpha + \beta_1 | \ln(S/K) | + \beta_2 \times (1/\text{Time to maturity})$$

+ β_3 Restricted

+ β_4 Ban Period

+ β_5 Restricted x Ban Period

+ β_6 Post Ban Period

+ β_7 Restricted x Post Ban Period

Adjusted Relative Spreads – OLS

	Puts	Calls
(coefficients for control variables omitted)		
Restricted	0.43*	1.50*
	(0.0)	(0.0)
Ban Date	2.93*	2.51*
	(0.0)	(0.0)
Restricted x Ban Date	3.13*	1.59*
	(0.1)	(0.1)
Post Ban Date	-1.13*	-0.45*
	(0.0)	(0.0)
Restricted x Post Ban Date	-0.84*	-0.82*
	(0.1)	(0.0)
N	2,435,236	2,511,875
R ²	0.20	0.26

Adjusted Relative Spreads – OLS

	Puts	Calls
(coefficients for control variables omitted)		
Restricted	0.43*	1.50*
	(0.0)	(0.0)
Ban Date	2.93*	2.51*
	(0.0)	(0.0)
Restricted x Ban Date	3.13*	1.59*
	(0.1)	(0.1)
Post Ban Date	-1.13*	-0.45*
	(0.0)	(0.0)
Restricted x Post Ban Date	-0.84*	-0.82*
	(0.1)	(0.0)
N	8,425,884	8,426,037
R ²	2,435,236	2,511,875

Adjusted Relative Spreads – OLS Results

	Puts	Calls
(coefficients for control variables omitted)		
Restricted	0.43*	1.50*
	(0.0)	(0.0)
Ban Date	2.93*	2.51*
	(0.0)	(0.0)
Restricted x Ban Date	3.13*	1.59*
	(0.1)	(0.1)
Post Ban Date	-1.13*	-0.45*
	(0.0)	(0.0)
Restricted x Post Ban Date	-0.84*	-0.82*
	(0.1)	(0.0)
N	2,435,236	2,511,875
R ²	0.20	0.26

Ban Period Coefficients Summary

	Puts	Calls
Ban Period	OVS: ↓ ARS: ↑	OVS: ↓ ARS: ↑
Restricted Firm x Ban Period	OVS: ↓↓↓ ARS: ↑	OVS: ↓ ARS: ↑



Interpretation

- Spreads on puts increased during the ban period for both restricted and unrestricted stocks
 - Consistent with theory that borrowing costs /inventory costs/information asymmetry costs & market-maker monopoly power increased



Interpretation

- Spreads on calls increased during the ban period for both restricted and unrestricted stocks
 - Consistent with theory that inventory risk increased during ban period



Put-Call Parity

- During the ban period, was there a decoupling of the options and stock markets?
- Idea:
 - Look for violations in put-call parity



Put-Call Parity for American Options

- European option put-call parity bounds do not apply because of the possibility of the early exercise of puts prior to maturity and of calls on dividend-paying stocks prior to maturity
- One solution: impose particular option pricing models and compare theoretical and actual option prices
- Our solution: work with the put-call parity bounds

Put-Call Parity Bounds

– The (upper) bound is written as

$$P(S, t, K) + S \leq C(S, t, K) + K + PV(div)$$

– where

- P = price of the Put option
- S = price of the Stock
- C = price of the Call option
- K = strike price
- div = dividend payments until maturity



If bounds are violated

- Buy the relatively cheap package: call + $\$K$ of bonds + security which pays *div*
- Sell the relatively expensive package: put + stock
- Make money today off the difference in prices
- Make money tomorrow off the difference in payoffs

LOGIT: Probability of Violation

(coefficients for control variables omitted)

	Bound based on trading at mid-point prices	Bound based on buying at the ask and selling at the bid
Restricted firms	0.739* (0.016)	0.812* (0.024)
Ban period	0.610* (0.030)	0.269* (0.061)
Restricted firms*Ban period	0.193* (0.055)	0.034 (0.087)
Post Ban period	1.503* (0.032)	0.920* (0.058)
Restricted x Post Ban period	-0.356* (0.028)	-0.658* (0.047)
N	115,073	115,073
Pseudo R ²	14%	9%



Conclusions

- The short sale ban drove up the cost of trading in options
 - Trading activity decreased for both put options and call options during ban period.
- Violations of put-call parity based on mid-point prices become more frequent during the ban for restricted stock
- Options market combined with the market-maker exemption from the short-sales ban do not seem to have led to the effective circumvention of the short-sale ban