Internet Appendix

Short Selling Equity Exchange Traded Funds and its Effect on Stock Market Liquidity[*]

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IA-I ETFs sample construction

To construct our sample of ETFs we start with all the ETFs in the MSF database that (i) are categorized as "US ETF", (ii) have non-missing CUSIP identifiers (iii) have non-missing fund names and (iv) are available during our sample period (1 August 2008 to 31 October 2008). We drop ETFs from our sample with names containing any terms that refer to:

- an asset class other than equity (e.g., "bond", "currency", "commodity", "treasuries", "municipal", "T-Bill").

- non-U.S. investments (e.g., "global", "Emerging markets", "Japan", "Pacific").

- government assets (e.g., "Mississipi", "Oklhm").

- short or inverse investments (e.g., "Bear", "Inverse", "Short", "Ultrashort").

- mutual funds (e.g., "Mf", "MF").

- closed end funds.

We manually examine the sample to ensure that the samples contains no non-equity, non-U.S. or inverse ETFs. Next, we keep only the ETFs that have at least two short sales data points during the ban and non-ban period over our sample. Using the CUSIP identifiers, we merge with the CRSP database and then remove small funds with market capitalization on 18 September 2008 lower than $20 million. After applying these filters, we are left with an unbalanced panel of 198 ETFs.*

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*Our sample contains 12 purely financial ETFs (ETFs with terms like "bank", "insurance", "finance" or "broker-dealer" in their names).

Figure IA.1: Average buying pressure of S&P 500 non-banned stocks around the ban

The figure displays average signed daily buying pressure for the non-banned S&P 500 member stocks around the 2008 short-sale ban. The daily buying pressure measure for each stock is the dollar-volume-weighted sum of intraday buy trades, where trades are identified as buys using Lee and Ready (1991) algorithm, scaled by the daily dollar volume on each day. Large and small stocks are those with average market capitalization in July 2008 above and below the median of the S&P 500 stocks, respectively. The two vertical dotted lines indicate the short-sale ban period. The sample period is from 1 August 2008 to 31 October 2008.
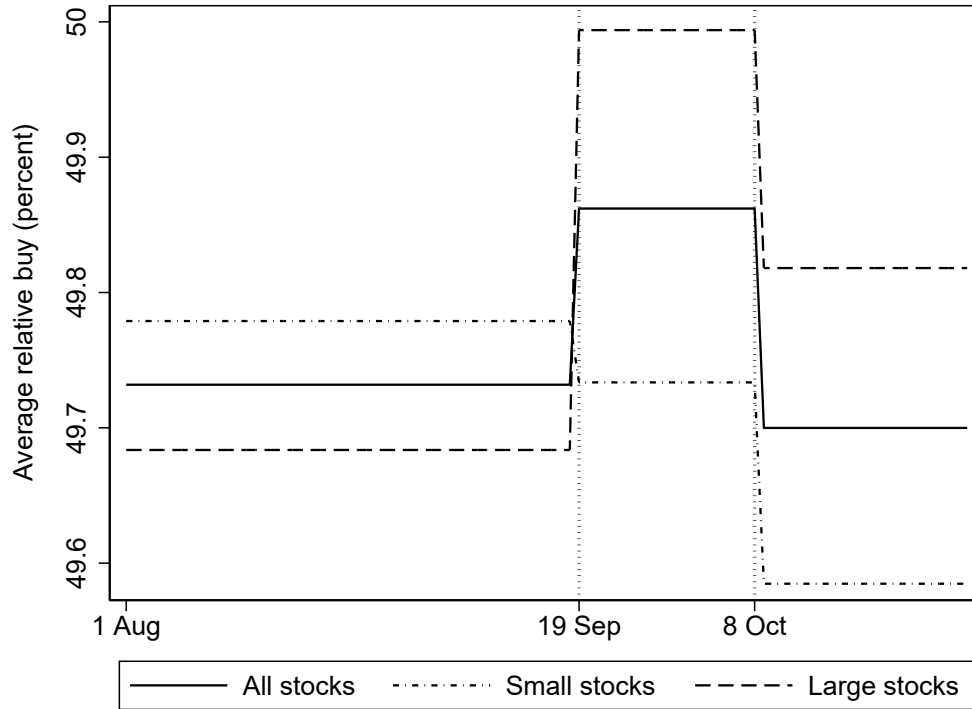
IA-II   Additional analysis of "create-to-lend" mechanism

In this section we examine the increase in SPY shares outstanding during the short-sale ban. We estimate linear regression of the following form:

$$\Delta \text{SHARES}_t = b_0 + b_1 \, \text{BAN}_t + b_2 \, \text{PREMIUM}_t + \epsilon_t, \tag{IA-2}$$

where ΔSHARES_t is the daily change in shares on day t measured in millions of shares. BAN_t is an indicator variable that takes the value one on the days of the 2008 short-sale ban, and zero otherwise. PREMIUM_t is the difference between SPY's closing price and its NAV, scaled by the NAV (expressed in percent). The SPY premium is, on average, zero and does not display any trends. However, it is not clear whether we should include the premium on day t or day $t-1$: does the premium observed at the end of the day stimulate share creation that same day, or the next day, or does it respond with a longer lag? To shed some more light on this question, we calculate a correlation between the daily changes in SPY shares outstanding and different lags of SPY premium. Figure IA.2, below, plots the correlations at different lags. We observe elevated correlations between changes in SPY shares and premium at time t and $t-1$. Both cases are theoretically reasonable, hence we consider both possibilities in the regression.

Figure IA.2: Cross-correlations between daily changes in SPY shares and SPY premium

This figure displays the correlation between the daily changes in SPY shares outstanding on day t, and the daily measure of SPY premium/discount for five days preceding and following t. The data are daily and the sample period is from 1 August 2008 to 31 October 2008.
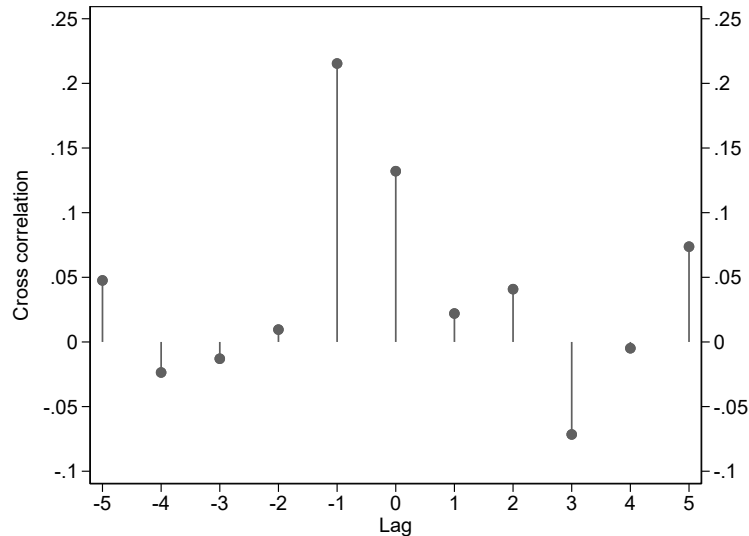
Table IA.1: The supply of SPY ETF and the short-sale ban

This table reports results of a regression of changes in SPY shares outstanding on the short-sale ban indicator and measures of premium. BAN is an indicator variable that takes the value one on the days of the 2008 short-sale ban. PREMIUM_t is the difference between SPY's closing price and its NAV, scaled by the NAV (expressed in percent). Newey and West (1987) standard errors with three lags are reported in parenthesis. The data are daily and the main sample period is from 1 August 2008 to 31 October 2008. *** indicates significance at 1 percent, ** - at 5 percent, * - at 10 percent.

	1 Δ SHARES	2 Δ SHARES	3 Δ SHARES	4 Δ SHARES	5 Δ SHARES
BAN	12.49**	12.44**	12.38**	12.97***	12.87***
	(5.56)	(5.51)	(5.20)	(4.74)	(4.82)
PREMIUM		3.00		5.13*	
		(4.76)		(2.69)	
PREMIUM_{t-1},			4.71		1.91
			(4.71)		(2.77)
Constant	0.44	0.59	0.67	0.13	0.11
	(1.48)	(1.56)	(1.50)	(0.22)	(0.22)
Observations	65	65	65	3,420	3,420
Adj. R^2	0.10	0.10	0.12	0.01	0.00
Sample	8/08−10/08	8/08−10/08	8/08−10/08	12/03−12/19	12/03−10/19

Our regression specification aims to formally test whether the short-sale ban was associated with significant growth in SPY shares outstanding. Table IA.1, above, presents our regression results. Confirming our visual intuition, the regression results show that the short-sale ban was associated with a statistically significant average increase in shares outstanding of 12.5 million shares per day (Column 1). Controlling for either day t or day $t-1$ premium does not change the result (Columns 2 and 3). The coefficients on both premium variables are positive, which is in line with theoretical prediction, but statistically insignificant (we have also considered changes in premium, but the results were also insignificant). The correct sign but lack of statistical significance of the regression coefficients of the premium variables suggests that statistical power could be a concern. We investigate this issue by expanding our sample of changes in SPY shares and SPY premium to the period 1 December 2003 (the first day NAV data becomes available) and 31 December 2019. We rerun the regression specifications of Columns 2 and 3 on the extended sample. Columns 4 and 5 present the results. We find that the coefficient on the ban indicator remains statistically significant, even with an extended sample. We also find that the coefficient on time t premium stays positive and becomes statistically significant (at the 10% level), suggesting that a larger premium is associated with a greater share creation and the lack of significance of SPY premium in our baseline specification can be partly attributed to statistical power.

IA-III   Stocks sample construction

To be included in the sample, stocks must meet all of the following criteria:

- Following Boehmer et al. (2013), we require stocks to have a share code of 10, 11 or 12 in the CRSP database. This requirement excludes closed-end funds, ETFs, REITs, warrants, preferred shares and American depositary receipts.

- We keep only the stocks that were traded on the three main stock exchanges - NYSE, NYSE MKT (AMEX in 2008) and NASDAQ.

- To clearly evaluate the effect of short sales restrictions, we exclude stocks that were included in the list of the banned stocks between September 23 and the end of the short sales ban or chose to exit the initial list.

- Similar to Grundy et al. (2012), we exclude securities that had missing information or no options traded in September, 2008 in OptionMetrics database. As most of the S&P 500 index stocks had options traded, we want to match them with similar non-S&P 500 stocks.

- We exclude Wachovia from our sample. The timing of the firm's difficulties - a large $8.9billion loss in the second quarter of 2008, a change in its CEO, a "silent run" on it and its acquisition by Wells Fargo - matches the period of our interest.

- Following Grundy et al. (2012), we exclude stocks with a price lower than $5 at the start of the ban because of their potentially lower liquidity.

References

Boehmer, E.; C. M. Jones; and X. Zhang. "Shackling short sellers: The 2008 shorting ban." *Review of Financial Studies*, 26, (2013), 1363–1400.

Grundy, B. D.; B. Lim; and P. Verwijmeren. "Do option markets undo restrictions on short sales? Evidence from the 2008 short-sale ban." *Journal of Financial Economics*, 106, (2012), 331 – 348.

Lee, C. M. and M. J. Ready. "Inferring trade direction from intraday data." *Journal of Finance*, 46, (1991), 733–746.

Newey, W. K. and K. D. West. "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." *Econometrica*, 55, (1987), 703–08.