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A Study of Market-Wide Short-Selling Restrictions

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Abstract

This paper contributes empirical evidence to the on-going debate on short sales. Our examination of how market-wide short-sale restrictions affect aggregate market returns focuses on two main questions: What is the effect of short-sale restrictions on skewness, volatility, the probability of market crashes, and liquidity? What is the effect on the market expected return or cost of capital? We report new data on the history of short-selling and put option trading regulations and practices from 111 countries, and create a short-selling feasibility indicator for the analysis of stock market indices around the world. We find that when short-selling is possible, aggregate stock returns are less volatile and there is greater liquidity. When countries start to permit short-selling, aggregate stock price increases, implying lower a cost of capital. There is no evidence that short-sale restrictions affect either the level of skewness of returns or the probability of a market crash. Collectively, our empirical evidence suggests that allowing short-selling enhances market quality.

JEL classification code: G15, G12
Keywords: Short-sale constraints; Stock returns; Cost of capital; International finance

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Introduction

Selling a security one does not own has elicited long standing controversy. The debate among investors, traders, regulators, and various market participants on short-selling of securities that began as early as the 1600s continues today.[1] Even in the U.S. where short-selling has been allowed under some conditions since before the twentieth century, concerns about it were raised as recent as 2004.[2,3] Opponents of short-selling argue it disrupts orderly markets by causing panic selling, high volatility, and market crashes. Proponents claim short-selling facilitates information transfer, increases liquidity, and improves risk sharing in the economy. That fewer than half the exchanges around the world currently allow short sales underscores the lack of consensus among regulators on short sales. In the academic community, there is strong renewed interest in understanding the effects of short-selling. Lamont and Thaler (2003) and Lamont and Stein (2004) for example suggest that short-sale constraints by limiting arbitrage played a role in the year-2000 stock market bubble.

Theory suggests short-sale constraints have impacts on stock return means, volatility, skewness, as well as liquidity. Almost all available empirical studies examine the impact of short-sale constraints at the individual stock level, using different proxies for the constraints. The majority find that short-sale constraints impact stock return means and volatility. [4,5]

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[1] See http://www.prudentbear.com/press_room_short_selling_history.html for a review of the history of short-sale policy debates.

[2] The U.S. stock market started prohibiting short sales on a down tick in 1931. In 1932, brokers were required to obtain written authorization from their clients before lending shares. Short sales are allowed today when the current price is higher than the price of the previous trade (an uptick) or when the current price is unchanged from the previous trade but higher than the last trade at a different price (zero-plus tick).

[3] On June 23, 2004, the Securities and Exchange Commission voted to adopt new Regulation SHO under the Securities Exchange Act of 1934. Regulation SHO provides a new regulatory framework governing short-selling of securities.

[4] Most empirical studies of short-sale constraints focus on its relation to over pricing of individual stocks in the U.S stock market. These studies differ mainly in their measures of short-sale constraints. Arnold, Butler, Crack and Zhang (2004), Asquith, Pathak and Ritter (2004), Brent, Morse and Stice (1990), Dechow, Hutton, Meulbroek, and Sloan (2000), Figlewski (1981), Sefieddine and Wilhelm (1996), Senchack and Starks (1993), Woolridge and Dickinson (1994) employ short interest or the change of short interest as a proxy for the level of short-sale constraints. Figlewski and Webb (1993), and Danielson and Sorescu (2001) employ option introduction as proxy for a decline in short-sale constraints. Jones and Lamont (2002) use lending fees of stocks in the 'loan crowd' from 1926 through 1933. D'Avolio (2002) use loan supply and loan fees from an institutional lending intermediary as proxy for short-sale constraint. Most studies find that short-sale constraints are associated with stock overpricing, but a few do not.

[5] Some studies examine volatility. Except for Kraus and Rubin (2002) and Bollen (1998), most studies that examine the effect of option introduction (reduction in short sale constraints) on the volatility of the underlying stock find that the volatility of stock return is lower after the introduction of options (Conrad 1989; Skinner, 1989).

While these studies advance our understanding of how short-sale constraints impact individual stock returns and suggest that short-sale constraints have a non-negligible effect on stock returns, they provide little guidance as to how market-wide restrictions impact the aggregate market return or the overall quality of the market. The impact of market-wide restrictions on market returns can differ significantly from the impact of short-sale restrictions of individual stocks on their returns. For instance, there may be differential impact of short-sale constraints on the return distributions of different stocks. Because much of the firm-specific stock returns can be diversified away, the effect of short-sale constraints on individual stocks does not carry over to the aggregate market returns and has no impact on their expected returns. In contrast, the effect of market-wide restrictions may be systematic, and thus they impact market expected return.

Issues such as market-wide liquidity and the probability of a market crash need to be studied at the market level. Jones (2002) studies the change in liquidity around events that alter the level of short-sale constraints in the U.S. stock markets. He finds that the introduction of the requirement that brokers secure written authorization before lending a customer's shares in 1932 had a negative impact on liquidity, but the requirement that short sales be executed only on an up tick in 1938 had a positive effect on liquidity. Bris, Goetzmann and Zhu (2003) examine the effect of short-sale constraints on characteristics of the return distribution of individual stocks and how short-sale constraints affect market efficiency. They find markets are more efficient when short-selling is allowed.

We attempt to shed light on this issue by addressing two questions. First, what is the effect of short-sale constraints on skewness and volatility of returns, on the probability of a market crash, and on the liquidity of the overall stock market? The motivation for examining these characteristics comes from issues brought about by regulators and from the objective to asses the validity of our theories on the effects of short-sale constraints. Second, what is the effect on the market expected return or the cost of capital? Understanding how short-sale constraints affect the cost of capital is important because one major purpose of stock markets is to facilitate the raising of capital for firms.

We collect new data on the history of short-sale regulation and feasibility from 111 countries. We also collect data on the history of put option trading as Figlewski and Webb (1993) show that option trading ameliorate short-sale constraints. A bearish investor may emulate a short sale by buying a put option. We consider both the legality and feasibility of

short-selling or put option trading. We ask about feasibility because many countries do not have rules prohibiting short-selling, yet no short-selling takes place for lack of necessary institutions that facilitate stock borrowing across market participants. Conversely, some countries officially prohibit short-selling, yet short-selling takes place routinely via off-shore markets. We construct an indicator that determines whether short-selling is possible using information on the regulation and feasibility of both short-selling and put option trading. We use this indicator to analyze a subset of the 111 countries for which we have stock index data from December 1969 through December 2002. Our empirical analysis includes panel regression tests and event studies.

When short-selling is possible, we find less volatile aggregate returns. When short-selling is possible, there is greater liquidity, especially in down markets. We find no evidence that short-sale restrictions affect the skewness of returns or the probability of a market crash. As to the cost of capital, the event study analysis shows strong evidence that when stock markets first allow short-selling, the price of the market index increases. This suggests that investors require lower expected returns on stocks when short-selling is possible. Results from panel regressions also show evidence that the cost of capital is lower in exchanges where short-selling is possible.

This study makes three contributions to the existing literature. First, it reports new data on the feasibility of short-selling for a large number of countries. Second, it provides direct evidence that helps resolve the question of whether short-selling should be allowed. Collectively, our empirical findings lead us to conclude that allowing short sales enhances market quality. Finally, our findings show that market-wide short-selling restrictions affect market returns. It is significant that some of our findings on how market-wide short-selling restrictions affect the expected market return differ from what has been reported so far concerning the effects of short-selling constraints on individual stocks' expected returns.

The remainder of the paper is organized as follows. Section I develops hypotheses on the effect of short-selling restrictions on market returns and liquidity. Section II describes the data we collected on short-selling and put options trading. Section III describes the rest of the data used in our analysis. Section IV reports our findings on skewness and volatility of returns, market crashes, and liquidity. Section V reports our findings on the cost of capital. We conclude and discuss the implications of our findings in Section VI.

I. The effect of short-selling constraints and testable implications

This section presents some existing theories related to the effect of short-selling constraints and develops the hypotheses we later test.

A. Skewness

When short-selling is prohibited and investors have heterogeneous beliefs, private information of bullish investors is slowly fed into prices through stock trading as they are available, but the private information of informed traders who are bearish and do not own stocks are not incorporated into prices (see, for example, Miller, 1977; Harrison and Kreps, 1978). Subsequently, when market information is revealed through nature or public announcement, because negative news has not been disseminated, there are greater stock market price adjustments for bad news than good news. Even when the distribution of news is symmetric ex ante, the realized stock return distribution is more negatively skewed due to larger negative shocks when short-selling is not possible.

Hong and Stein (2003) propose a model to explain why large market declines can occur in the absence of news. Their model also produces negatively skewed returns when short-selling is not possible.

Hypothesis 1: Stock market returns are more negatively skewed in markets where short-selling is not possible.

B. Volatility

There is no widely accepted theory on how short-sale constraints affect the volatility of market returns. Kraus and Rubin (2002) derive a highly stylized model predicting the impact of index options introduction (a form of reduction in short-sale constraints) on the volatility of stock returns when there are short-sale constraints on the stocks. Their model predicts volatility may increase or decline, depending on the model parameter values. Lacking a reason to predict the direction of the effect on volatility, we examine Hypothesis 2.

Hypothesis 2: The volatility of the market return distribution differs in markets where short-selling is possible and where it is not.

C. Liquidity

Diamond and Verrecchia (1987) examine the effect of short-sale constraints on the adjustment speed of security prices. Their model predicts an increase in the bid-ask spread

and a decline in liquidity when short-selling is not possible. The decline in liquidity is due to diminished supply of stocks for sale because some investors who want to sell but do not already own stocks cannot take part in the market. In the Diamond-Verrecchia model, investors cannot short sell, but the market maker can in order to absorb buying demand from investors. When we match the Diamond-Verrecchia model to our empirical setting, we cast market makers as owning a large inventory of stock, so they can buy or sell from their inventory but not actually short sell. When we classify a market as not allowing short sales, in most markets an internal borrowing of securities within a financial institution may still be possible. Thus, we test Diamond-Verrecchia's predictions.

Hypothesis 3: There is less liquidity in markets where short-selling is not possible.

D. Expected return and the cost of capital

Short-selling restrictions affect expected market returns in two ways. First our empirical analysis demonstrates that when short-selling is possible market returns are less volatile and there is greater liquidity. Variance risk and liquidity are determinants of expected return. [6] Since country-specific variance risk is not completely diversifiable across countries in a less than fully integrated global financial market, investors should require a lower expected return when variance risk is lower and liquidity is greater, which is when short-selling is possible (see for example, Bekaert and Harvey, 1995).

Second, short-selling allows investors to better share risks from their different endowments; short-selling itself provides a more complete market. When investors can share their endowment risks in a more efficient manner, they require lower rate of return for their investments. This is also welfare improving (Ross, 1976). For these reasons we test Hypothesis 4.

Hypothesis 4: The cost of capital is lower in countries where short-selling is possible than where it is not.

E. Stock price change when short-selling prohibition is lifted

There are two opposing forces that affect price changes when short-selling prohibitions are lifted. The first is Miller (1977)'s *overpricing effect*. When short-selling is prohibited and investors have heterogeneous beliefs, only the valuation of the bullish investors and the

[6] There is ample empirical evidence that liquidity is a determinant of expected returns. For evidence on liquidity see Amihud and Mendelson (1986), Chordia, Roll, and Subrahmanyam (2000), Hasbrouck and Seppi (2001), Huberman and Halka (2000), and Pastor and Stambaugh (2003).

bearish investors who currently own the stock is registered in the stock price. Bearish investors who do not own the stock do not participate in the market, so their valuations are not registered in the stock price. Hence, on average stocks are over valued compared to the full-information prices, and stock prices decline when the short-selling prohibition is lifted.

On the other hand, if expected returns are lower when short-selling is allowed, stock prices should increase when short-selling prohibition is lifted, provided that expected future cash flows are constant during this transition period. Theoretically, either of these two effects could dominate. What happens to the stock prices when a short-selling prohibition is lifted is an empirical question.

Hypothesis 5: The aggregate market price changes when a short-selling prohibition is lifted.

II. Legality and feasibility of short-selling and put options trading

We collect data on the legality and the feasibility of short-selling and operation of put options trading in 111 stock markets around the world that have a websites and for which we could get contact information. To our knowledge, this is the largest set of such data available. Twenty-three of the countries are classified as developed markets, and 88 as emerging markets according to Morgan Stanley Capital International Inc.' classification. We surveyed these markets and derivatives exchanges if there were such a separate entity, during the second half of 2001 and during 2002.

Our survey letter asked whether the stock market allows short-selling and, if yes, what is the first date it was allowed. We also asked whether short-selling was feasible in practice, and, if yes, when was the first date it was feasible. We asked this second question because many countries do not ban short-selling, but at the same time no short-selling can actually take place because there are no enabling regulations and facilities. Then again, a country like Singapore officially prohibits short-selling, but it routinely takes place via off-shore markets. The actual feasibility of short-selling should have a stronger influence than simple legality on capital markets. We also asked whether put options were available for trading, and, if yes, as of what date. Wherever possible, we cross-checked answers against the 2000 edition of the *International Encyclopedia of the Stock Market*, the 2000 edition of the *Handbook of World Stock, Derivative and Commodity Exchanges*, and with various foreign national practitioners.

A. Short-selling

Table I reports on the legality and the feasibility of short sales. Most developed countries, except for Singapore, currently allow short sales. Many of these countries have always allowed them barring a few temporary moratoriums around the time of World War II. At the same time, many emerging countries have established laws or policies allowing short sales. The latest emerging country to officially allow short sales is Peru (2002). In 2002, 95 percent of developed countries allowed short sales, compared to 31 percent of emerging countries. Before 1990, the respective figures were 64 percent and 10 percent.

The actual feasibility of short-selling is difficult to measure. We rely on exchange officials, academicians, and industry connections to classify the countries in terms of feasibility of short-selling. Eighty six percent of developed countries report that short-selling is feasible in practice, but only 12 percent of emerging markets report that short-selling is feasible. Before 1990, the respective figures were 68 percent and 6 percent.

Figure 1 graphs the history of the legality and feasibility of short-selling and put option trading in the 20th century. It plots the time series of the number of countries in the world, the number of countries with stock markets, the number of countries that allow short-selling, and the number of countries where short-selling is feasible.[7]

It is apparent from Figure 1 that before the 1990s, while the number of countries with stock markets increased substantially, the number of countries allowing short-selling did not increase at the same rate; the ratio actually declined. Only after 1990 do we see a significant increase in the number of countries allowing short-selling. In countries that started allowing short-selling officially, policy did not necessarily translate into practice. In fact, we see a wider gap between the number of countries that officially allow short-selling and the number of countries where short-selling is feasible widened in the 1990s. Figure 1 shows a clear picture that policy markers have not reached a consensus on whether to permit and facilitate short-selling.

C. Put Options trading

Table II reports the legality and operation of put options trading. U.S. is the first country to

[7] The data for the number of countries in the world come from the 2002 CIA *World Factbook*. We obtained the date of incorporation of a stock market from the 2000 *Handbook of Stock, Derivative and Commodity Exchanges* or else the website of the country's stock exchange. Note that the number of countries with stock markets also includes countries whose stock markets were temporarily closed due to a crisis.

trade put options. In 2002, there was put options trading in 91 percent of developed countries and 19 percent of emerging countries. Before 1990, the respective figures were 55 percent and 1 percent.

Countries may have different policies on short-selling and put options trading. For example, in India, short-selling is uncommon, and it is prohibited to foreign investors. We have classified India as never allowing short-selling. Put options, however, were introduced in July 2001, after the Ketan Parekh scam. India's SEBI's (its SEC) wanted to encourage practices in line with the norms of developed markets and to provide a hedging tool for investors while at the same time discouraging speculators. Israel also does not allow short-selling but has put options trading. Other countries initiated put options trading before they started to allow short-selling. Chile is one example. The correlation between the existence of put options trading and short-selling is 0.34, which suggests that considering short-selling feasibility alone gives an incomplete account of the ability of investors to take positions that are effectively short positions.

We construct a binary variable that reflects the ability of investors to take short positions either through the existence of short-selling or put options trading, and employ it in the empirical analysis. We label this variable *SSPO feasibility*. For each country in each month, SSPO feasibility equals one if either short-selling or put options trading is possible. It equals zero otherwise.

III. Data

A. Stock market variables

Monthly equity indices are available from Datastream database for of 23 developed markets and 34 emerging markets. The data range from December 1969 through December 2002. These are value-weighted indices calculated with dividend reimbursement. We take the MSCI value-weighted world index as a proxy for the world market portfolio.[8]

[8] The MSCI World Index is an index of only developed countries. It begins in December 1969. In principle, the MSCI All-Country World Index, which includes more countries, might be a better choice, but in practice, because it is available only since December 1987, and has a 0.9968 correlation with the MSCI World Index, MSCI World Index is a better choice.

We compute monthly skewness as:

$$sk_{i,t} = \frac{n}{(n-1)(n-2)} \sum_{\tau=1}^{n} \left(\frac{r_{i,\tau,t} - \bar{r}_{i,t}}{\hat{\sigma}_{i,t}}\right)^3 , \tag{1}$$

where $\hat{\sigma}^2{}_{i,t} = \frac{1}{(n-1)} \sum_{\tau=1}^{n} (r_{i,\tau,t} - \bar{r}_{i,t})^2$.

$r_{i,\tau,t}$ is the daily return of day τ in month *t* of the index of country *i*, and $\bar{r}_{i,t}$ is the mean return of month *t*; *n* is the number of daily observations in month *t*.

We compute conditional variance of daily return as:

$$\hat{\sigma}^2_{i,t} = \frac{1}{(n-1)} \sum_{\tau=1}^{n} (r_{i,\tau,t} - \bar{r}_{i,t})^2 .$$

Following Bollerslev, Engle, and Wooldrige (1988), we also examine the conditional volatility of monthly returns using a multivariate ARCH model specified as:

$$\begin{aligned}
r_{i,t} &= c_1 + \varepsilon_{i,t} \\
r_{w,t} &= c_2 + \varepsilon_{w,t} \\
h_{i,t} &= b_1 + a_1\left(\frac{1}{2}\varepsilon^2_{i,t-1} + \frac{1}{3}\varepsilon^2_{i,t-2} + \frac{1}{6}\varepsilon^2_{i,t-3}\right) \\
h_{w,t} &= b_2 + a_2\left(\frac{1}{2}\varepsilon^2_{w,t-1} + \frac{1}{3}\varepsilon^2_{w,t-2} + \frac{1}{6}\varepsilon^2_{w,t-3}\right) \\
h_{i,w,t} &= b_3 + a_3\left(\frac{1}{2}\varepsilon_{i,t-1}\varepsilon_{w,t-1} + \frac{1}{3}\varepsilon_{i,t-2}\varepsilon_{w,t-2} + \frac{1}{6}\varepsilon_{i,t-3}\varepsilon_{w,t-3}\right) \\
\varepsilon_{i,t}, \varepsilon_{w,t} &\sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} h_{i,t} & h_{i,w,t} \\ h_{i,w,t} & h_{w,t} \end{bmatrix}\right),
\end{aligned} \tag{3}$$

where $r_{i,t}$ and $r_{w,t}$ is the dollar monthly return of the stock market index *i* and the world market index in month *t* ; $\varepsilon_{i,t-j}$ is the innovation in monthly return of the stock market index of country *i* in month *t-j* ; $h_{w,t}$ is the conditional variance of the monthly return of the stock market index of the world in month *t* ; $h_{i,t,}$ is the conditional variance of the monthly return of the stock market index of country *i* in month *t*. The conditional volatility of monthly returns is the square root of $h_{i,t}$.

We estimate the model in (3) using maximum likelihood. As in Engle, Lilien, and Robins (1987), the weights of the lagged residual vectors are taken to be 1/2, 1/3, and 1/6. The constants a_2 , b_2, and c_2 are constrained to be identical for every country-world pair..

We define a binary monthly crash variable to identify a month that the stock market drops more than two standard deviations. The standard deviation is the average of the previous three months. The variance $crash_{i,t}$ is defined as:

$crash_{i,t} = 1$, if $r_{i,t} < 2\sigma_{i,t}$

$crash_{i,t} = 0$, otherwise, where $\sigma_{i,t} = (\hat{\sigma}_{i,t-1} + \hat{\sigma}_{i,t-2} + \hat{\sigma}_{i,t-3})/3$.

We measure liquidity using turnover. *Turnover* is defined as the ratio of volume of dollar trade per month to dollar market capitalization at the end of the month.

Diamond and Verrecchia (1987) also predict that prohibiting short sales reduces liquidity more when stock prices decline than when they increase. We use asymmetric volume to capture this asymmetry in liquidity. Monthly asymmetric volume for country *i* is defined as:

$$VA_{i,t} = \frac{\dfrac{\sum_{\tau}^{n} Vol_{i,\tau,t} D_{i,\tau,t}}{\sum_{\tau}^{n} D_{i,\tau,t}} - \dfrac{\sum_{\tau}^{n} Vol_{i,\tau,t}(1 - D_{i,\tau,t})}{\sum_{\tau}^{n}(1 - D_{i,\tau,t})}}{\dfrac{\sum_{\tau}^{n} Vol_{i,\tau,t}}{n}}, \tag{4}$$

where $Vol_{i,\tau,t}$ is the daily dollar volume for day τ in month *t*, $D_{i,t}$ is a dummy variable that takes the value 1 if the return on day τ is positive and 0 if it is negative, and *n* is the number of daily observations in month *t*.

B. Control variables

Stulz (1999) points out that liberalization reduces the cost of equity through two routes. It reduces required return because risk-sharing improves, and because corporate governance improves. Bekaert and Harvey (2000) and Henry (2000) report that financial market liberalization reduces the cost of equity. They also show it affects liquidity, volatility, and potentially other variables of interest in our analysis. We control for the confounding effects of liberalization in all our regression tests. The indicator variable *liberalization* changes from zero to one in the month after the official liberalization. We use liberalization dates from Bekaert and Harvey (2000) and from Bae, Bailey and Mao (2003).

Chen, Hong, and Stein (2001) report that lagged return and lagged trend-adjusted turnover predict skewness. We include them as control variables in tests of skewness. Lagged trend-adjusted turnover is defined as in Chen, Hong, and Stein (2001).

Ferson and Harvey (1993) and Dumas and Solnik (1995) report returns of an index of a country may also vary with its exchange rate. In tests of expected returns, we control for exchange rate variation by including monthly foreign exchange rates from International Financial Statistics.

There may be other differences across countries that we do not explicitly model. To control for such differences, we use a country-fixed-effect dummy. We find the same results when we conduct the analyses without a country-fixed effect dummy but including additional control variables: GDP growth, shareholders' rights, exchange rate risk, and liquidity.

IV. Short-sale restrictions, market returns, and liquidity

In this section, we report the empirical test results of the relation between short-sale restrictions, skewness, volatility, market crash, and liquidity. All panel least square regressions include a country-specific dummy variable (not reported) in addition to the reported control variables. All reported regression estimates are corrected for country-specific heteroskedasticity and country-specific autocorrelation.

A. Short-sale restrictions and skewness,

To examine the relation between skewness and short-sale restrictions we estimate panel regressions of monthly skewness on SSPO feasibility controlling for liberalization, lagged return, lagged detrended turnover, and a time trend. Panel A of Table IV report these panel regression estimates.

For those countries that had a short-selling regime change which also have skewness data around the event date, we compare the average skewness pre- and post-event. We compare the average skewness over a two-year pre-event period and a two-year post-event period. We also test using a five-year pre- and post- event periods. Panel B of Table IV reports the pre- and post-event averages of skewness, their difference, and the p-value testing the hypothesis that there is no change in average skewness before and after short-selling feasibility changed. The test results in both Panels A and B indicate that short-selling restrictions have no impact on the skewness of the aggregate market return distribution.

B. Short-sale restrictions and volatility

Panel A of Table V reports coefficients of panel regressions of return variance on SSPO feasibility, controlling for liberalization, and time-trend. Excluding the time trend gives similar results. We report results of tests with conditional variance of daily returns and monthly returns from the ARCH model in equation (3). Except for the case of monthly variance of developed countries, the coefficient estimates of SSPO feasibility in all the other cases are negative and highly statistically significant. The coefficients are economically significant as well. The coefficient of SSPO feasibility in column 2 is -0.0024 which means that the standard deviation of monthly returns in countries that allow short-selling and those that do not differ by 0.05.

C. Short-sale restrictions and market crash

The variable *crash* equals one in months with a negative return of higher than 2 standard deviations, where the standard deviation of returns is the average of standard deviation returns during the previous three months. Table VI reports coefficient estimates of panel logit regressions of crash on SSPO feasibility, controlling for lagged volatility and liberalization. Results are similar for panel probit regressions. The results show that the feasibility of short-selling has no relation to the probability of a market crash.

D. Short-sale restrictions and liquidity

We use turnover as a proxy for liquidity. To mitigate the effect of outliers, which occur because the denominators are small in some countries, we take the natural logarithm of this ratio. Table VII reports panel regressions of turnover on SSPO feasibility, controlling for lagged absolute return, lagged volatility, liberalization, and a time trend. The coefficient estimates of SSPO feasibility are positive and highly significant in all regressions. The relation between turnover and SSPO feasibility is also economically significant. A coefficient of 0.3422 (column 3 of Table VII) translates into 15 percentage points higher turnover when short-selling is possible. These results support the prediction by Diamond and Verrecchia (1987) that there is reduced liquidity when short-selling is not possible.

Diamond and Verrecchia (1987) also predict less liquidity in a down market than in an up market when short-selling is not possible. That is, volume asymmetry (VA) should be lower when short-selling is possible than when it is not. Table VIII reports coefficients of

panel regressions of VA on SSPO feasibility, controlling for liberalization (columns 1, 3, and 5). The asymmetry in volume is negative and significant only in developed markets and not in emerging markets.

Regulators who oppose short-selling often argue that in a large market decline, speculative short-sellers will flock to the market, increase panic selling, increase down-market volume, and cause larger market decline than if speculative short-sellers were not present. This line of argument predicts that VA should be lower when short-selling is possible, but even more so when there is significant market decline or a market crash.

To examine the relation between VA, short-sale constraints, and market crash, we estimate a panel regression of volume asymmetry on SSPO feasibility, crash, and an interaction term SSPO feasibility × crash, controlling for liberalization. If opponents of short-selling are correct, then we should expect the interaction term to be negative. In other words, we expect the feasibility of short-selling to be associated with a more negative volume asymmetry when there is a crash. The coefficient estimates of this regression are in Columns 2, 4, and 6 of Table VIII. The coefficient of the interaction term is not significantly different from zero lending no support to this argument.

V. Short-sale constraints and the cost of capital

To examine the effect of short-sale constraints on the cost of capital, we employ an event study and panel regressions using two proxies for the cost of capital. An event study has the advantage that it directly measures the discrete equity price change that should occur if there is a change in the cost of equity and stock price caused by a change in short-selling rules. It is uninfluenced by other macroeconomic conditions outside the event window or by differences among countries. Henry (2000) uses the same method to study the effect of liberalization on the cost of equity.

A. Event study

Our analysis uses the actual date change in short-selling rules as the event date and not the announcement date for several reasons. First, the pessimist investors who did not trade due to short-selling restrictions can start trading only when the practice is implemented, so their effect on the level and on the volatility of the stock price occurs on the implementation date. Second, from a theoretical perspective, the expected return may increase or decline when

short-selling restrictions are lifted. The wild card is the effect on volatility, which may either increase or decline when short-selling is possible. Because of this uncertainty, investors may react to the news on the implementation date when this uncertainty is resolved.

Perhaps most important, when rules allowing short sales are first announced, in many cases it is uncertain whether it will be implemented at all or in a timely manner, and it would be uncertain as well whether the rule change will make short-selling feasible. Will the institutional infrastructure support short sales? How costly will it be to short? Will there be market makers willing to trade on a short position? These uncertainties are likely to keep investors from reacting to announcements of short sale rule changes even when they think they can predict the market reaction to a change in short-selling restrictions. As the implementation date nears, these uncertainties are resolved, so we should detect a gradual market reaction shortly before the implementation and at the implementation date. Conrad (1989) also finds change in short-sale constraints such as introduction of option trading affects price around the implementation date and not the announcement date.

We collected data on the specific dates an exchange started allowing short sales or put options trading for 31 events. We use the periods from -130 days to -30 days and from +30 days to +130 days to estimate the world market CAPM, which is used to calculate the excess abnormal returns during the event window. Returns are calculated using closing prices of each country index and the world market index.

Table IX presents the abnormal returns and the cumulative abnormal returns (CAR) from five days before the event date to five days after the event date. Columns 1 and 2 report abnormal excess returns and cumulative abnormal excess returns considering both short-selling rule change and put option introduction events. Columns 3 and 4 report CARs considering only short-selling rule change event. Columns 5 and 6 report CARs considering only put option trading change event. The CARs around the events that relax short-selling restrictions are mostly positive. In column 2, the CAR over the 11-day period for all events is 3.6%, which is economically significant. We test the statistical significance of this CAR using the methodology proposed by Brown and Warner (1985), and using a standard error estimated for the 11-day period. The t-statistic of 2.5 rejects the hypothesis that the CAR equals zero at the 5% significance level.

Figure 2 graphs the CARs for two calendar months (40 trading days) around the event date. The shaded area in the figure highlights the 20 trading days around the event.

The CARs are increasing in this shaded region and are quite flat outside. The CARs gradual increase starting approximately eight trading days before the event date, and continues to increase for the next ten trading days. This gradual increase in the market price prior to the implementation date is consistent with the idea that investors know about rule change from prior announcements, but are uncertain about actual implementation and the feasibility of short-selling until several days prior to the implementation date.

Evidence from our even study shows that relaxing short-selling restrictions results in a significant decline in the cost of capital. We have noted two forces driving the aggregate market price change when short-selling restrictions are lifted: Miller's overpricing effect, and the change in the market required rate of return due to lower variance risk, increased in liquidity, and improve risk-sharing in the economy. If the overpricing effect dominates, we should see market prices decline when short-selling restrictions are lifted. If the required expected return effect dominates, we should see market prices increase when short-selling restrictions are lifted. Our findings suggest that the latter effect is dominant at the aggregate market level.

At the firm level, some studies of U.S. stocks find reduce short-selling restrictions is associated with lower stock price or lower subsequently return (Jones and Lamont, 2001). Do our findings contradict evidence at the firm level? In a highly integrated market such as the U.S. stock market, the increase in firm-specific risks can be diversified away. Therefore, reduced variance and increased in liquidity which arise with reduced short-sale constraints at the firm level may not affect their expected stock returns. Miller's overpricing effect, however, affects individual stock prices as long as there are bearish investors who cannot short sell. Thus, it is likely that the overpricing effect dominates at the firm level; stock prices decline when short-selling constraints are reduced. Our findings do not contradict previous evidence at firm level, and they highlight the different effect of market-wide restrictions on the aggregate market return and the effect of firm-level constraints on firm returns.

The choice of an asset pricing model usually has little impact on an event study because the event window is narrow diminishing the impact of fundamental risk adjustment. Nonetheless, we carried out robustness checks by calculating excess abnormal returns in a number of ways: (1) as daily excess returns minus each country's own mean excess return, (2) as daily excess returns less daily excess world market index returns, and (3) as excess returns without risk adjustments. Our conclusions do not change.

B. Cross-country tests

We also examine the effect of short-selling restrictions on the cost of capital using panel regressions. A country's cost of capital is the required rate of return, which we measure using two approaches: (1) the cost of equity computed from country index returns after accounting for systematic risks, and (2) country credit ratings.

In the first test, we adopt the international asset pricing model proposed by Bekaert and Harvey (1995). This model allows a country to evolve from a developing segmented market, where risk is measured by the country's variance, to a country integrated with world equity markets, where risk is measured by the sensitivity of a country's equity returns to movements in the world market portfolio. The special case of complete integration, where the world factor is the only factor, is nested in this model. We estimate a simplified version of Bekaert and Harvey (1995)'s model in our computations of the risk-adjusted excess equity returns.

$$r_{i,t} - r_{f,t} = \alpha_0 + \phi_{i,t}\lambda_{\text{cov}} h_{i,w,t} + (1-\phi_{i,t})\lambda_{\text{var}} h_{i,t} + e_{i,t} \quad , \tag{5}$$

where $r_{i,t}$ is the dollar monthly return of the stock market index of country i in month t; $r_{f,t}$ is the monthly return of the one-month U.S. T-Bill in month t; α_0 is a constant that would be estimated; $\phi_{i,t}$ is a measure of the level of integration of country i in month t; λ_{cov} is the price of the covariance risk that would be estimated; $h_{i,w,t}$ is the conditional covariance of the monthly returns of the stock market index of country i with the monthly return of the world index in month t; λ_{var} is the price of own country variance risk that would be estimated. We restrict λ_{var} to be the same across all countries. $h_{i,t}$ is the conditional variance of returns of the stock market index of country i in month t; and $e_{i,t}$ is the residual error term.

We estimate equation (5) using non-linear least squares estimates. The results are presented in Panel A of Table X. The independent variables in model (5), conditional covariance $h_{i,w,t}$, and conditional variance $h_{i,t}$, are separately estimated pair-wise for each country i and the world from the multivariate ARCH model in equation (3).

The independent variable $\phi_{i,t}$ in model (5) measures the level of integration with the world market of country i in month t. It is computed as in Bekaert and Harvey (1997):

$$\phi_{i,t} = \frac{\exp\left(a_1 \left(\frac{\exp orts_{i,t} + imports_{i,t}}{gdp_{i,t}} \right) \right)}{1 + \exp\left(a_1 \left(\frac{\exp orts_{i,t} + imports_{i,t}}{gdp_{i,t}} \right) \right)} \quad . \tag{6}$$

$\phi_{i,t}$ is zero when a country is not integrated in the world market; it is one when a country is fully integrated.

Panel A of Table X reports the risk premium estimates for covariance risk and variance risk. Like Bekaert and Harvey (1997), we find that a country's expected return is determined by both the covariance risk and the country's own variance risk. Both risk premium estimates are positive. The residual from equation (5), which measures excess abnormal monthly returns, is used as the dependent variable in the panel regressions.

Panel B of Table X reports regressions of the residual term, $e_{i,t}$, on SSPO feasibility, controlling for liberalization, foreign exchange risk, and country-fixed effects. The coefficients estimates of SSPO existence in all regressions are negative, which indicates that the cost of capital is lower when short-selling is possible. However, the coefficients are not statistically significant at the 5% level.

A common difficulty in international finance is obtaining expected return from equity returns for a large number of countries due to limited equity data from 57 countries. Erb, Harvey, and Viskanta (1996) propose using the country credit rating from *Institutional Investor*'s semi annual survey of bankers as a proxy for expected return. From 75 to 100 bankers rate each country's credit worthiness on a scale of 0 to 100.

Erb, Harvey, and Viskanta (1996) show that the credit worthiness measure is a very good proxy for systematic risk in the equity markets. For countries for which equity indices are available, the log of country credit rating tracks the expected return of equity as well as or better than other available measures, particularly in segmented emerging economies. We thus use these country credit ratings as our second proxy for expected returns, allowing us to increase our data sample from 57 countries to 99 countries.

Table XI reports panel regressions of the log of country credit rating on SSPO feasibility, controlling for liberalization and country-fixed effects. The coefficient estimate for all-countries sample is 0.1031, and it is statistically significant at the 1% level. Exhibit 4 in Erb, Harvey, and Viskanta (1996) shows that an increase of one in the log of a country's

credit rating decreases the cost of equity by 10.47 percentage points. This implies that the cost of equity is lower by 1.07 (0.1031 × 10.4) percentage points per year when short-selling is possible.

The influence of short-sale restrictions appears stronger in emerging countries compared to developed countries; the magnitude of the coefficient of SSPO feasibility is higher and the p-value is lower for emerging countries.

VI. Discussions and concluding remarks

We have provided empirical evidence on the debate about the way market-wide short-selling restrictions affect aggregate market returns and on whether short-selling should be allowed. We focus on two important issues: the effect on skewness and volatility of the market return distribution, the probability of market crashes, and liquidity, and the effect on the cost of capital.

A particular contribution is that our research considers aggregate-market level evidence and uses data from a much broader range of countries than typically studied. We report regulation and feasibility of short sales and put options trading in 111 countries, and use a subset of this data to analyze the effect of short-selling restrictions. When short-selling is possible, aggregate stock returns are less volatile, and there is greater liquidity. When countries institute short-selling for the first time, aggregate stocks price increase, implying a lower cost of capital. There is no evidence that short-sale restrictions affect the level of skewness of returns or the probability of a market crash.

Our study has a number of implications. First, we examine how well current theory works for market-wide short-selling restrictions and market returns. We find short-selling restrictions have no effect on skewness of market returns as some theories predict. There is strong evidence, however, that volatility is lower when short-selling is possible although the theoretical predictions are ambiguous. Our finding on volatility is similar to some research findings at the firm-level that volatility declines with the introduction of options trading, which is an event that reduces short-selling constraints. Our findings on liquidity indicate reduced liquidity in the absence of short-selling.

Second, theory posits that there are two forces impacting expected returns due to short-selling restrictions. Our findings on expected return at the market level appear contrary

to many other empirical studies of short-sale constraints and expected return at the individual stock level. We conclude that while in many cases the overpricing effect may dominate at the individual stock level, the lower required expected return dominates at the market level. This suggests that short-sale constraints affect the market and individual stocks differently – a distinction not made explicit in the literature so far.

Finally, we find no evidence that short-selling disrupts orderly markets by causing panic selling, high volatility, or market crashes. The empirical evidence shows overall that allowing short sales enhances market quality.

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Table I: Legality and feasibility of short-selling

This table reports survey data on short-selling regulations and feasibility from 111 countries from immediately after WWII through 2002. The figures in Column 2 are the year short-selling became legal. The figures in Column 3 are the year when short-selling became feasible. Yes means short-selling has always been legal or feasible. No means short-selling has always been prohibited or not feasible. Details about short-selling rules and implementation in are in the last column.

Country	Legality	Feasibility	Details
Developed Markets			
Australia	Yes	Yes	
Austria	Yes	Yes	
Belgium	1935	1935	Regulations are not very explicit. Short-selling is allowed and widespread.
Canada	Yes	Yes	A temporary ban on short-selling was lifted in 10/40.
Denmark	Yes	Yes	The Copenhagen Stock Exchange's Rule Book does not carry any short-selling restrictions. There had never had such restrictions in Denmark.
Finland	1998	No	Tax laws (transfer) inhibits would-be short sellers.
France	Yes	Yes	
Germany	Yes	Yes	
Hong Kong	1994	1994	Short-selling wasvprohibited until 1/3/94. In 3/96 many restrictions were lifted (including tick rule abolished). On 9/7/98 more restrictions were placed (including tick rule). The number of designated securities for short-selling is revised on a quarterly basis.
Ireland	Yes	Yes	No restrictions.
Italy	Yes	Yes	
Japan	Yes	Yes	Short-selling is regulated by Article 162 of the Securities and Exchange Law. It is not restricted.
Luxembourg	1991	1991	Circular CSSF 91/75 allows short-selling.
Netherlands	Yes	Yes	
New Zealand	1992	No	Short-selling was allowed since 4/92 for approved securities with conditioned on liquidity. Since 7/00 all FASTER securities can be shorted. However, tax legislation is unfavorable to short-selling.
Norway	1992	1999	Short-selling was allowed in 1992. In 8/99-9/99 short selling rules and guidelines instituted making it feasible.
Portugal	Yes	Yes	
Singapore	No	Yes	Securities lending takes place outside of the Island. Short -selling is discouraged by regulators, however, it is widespread.
Spain	1992	No	Allowed in 1992, but not common.
Sweden	1993	1993	Allowed since 5/7/93.
Switzerland	Yes	Yes	The Swiss exchange has never issued any rules on short-selling. Nor did its predecessors, various local exchanges in Zurich, Geneva, Basel, etc. which were floor based and in operation until 95/96.
United Kingdom	Yes	Yes	
United States	Yes	Yes	The U.S. started prohibiting short sales on a down tick in 1931. In 1932, brokers were required to obtain written authorization from their clients before lending shares. Currently, short sales are allowed when the current price is higher than the price of the previous trade (an uptick) or when the current price is unchanged from the previous trade but higher than the last trade at a different price (zero-plus tick).

Country	Legality	Feasibility	Details
Emerging Markets			
Albania	No	No	
Argentina	1999	No	Short-selling is not common for stocks, but common for government bonds. Short-sellings may be held for up to 365 consecutive days. Mercado de Valores de Buenos Aires may suspend new short sales at any moment. The law allowing short-selling was inacted on 9/6/1999.
Armenia	Yes	No	Allowed but not feasible yet.
Azerbaijan	No	No	
Bahrain	No	No	
Bangladesh	No	No	
Barbados	No	No	
Bermuda	No	No	
Bolivia	No	No	
Botswana	No	No	
Brazil	1986	No	Legal since 6/9/86. CBLC (the exchange's clearing and settlement corporation) has a securities custody service called Securities Lending Program - BTC, which was implemented in 4/96. However, short-selling is very limited.
Bulgaria	No	No	
Chile	1999	2001	Bolsa de Santiago approved short selling, rules allowing short-selling on. Short-selling was exempt from capital gains taxation and was more feasible after 11/6/01.
China	No	No	
Colombia	No	No	
Costa Rica	No	No	
Croatia	No	No	
Cyprus	No	No	Considered a criminal offence.
Czech Republic	Yes	Yes	No regulation prohibiting short-selling. Short selling exists.
Ecuador	No	No	
Egypt	No	No	
El Salvador	No	No	
Estonia	Yes	No	No regulation restricting short-selling. But there is no regulation governing short-selling practice.
Fiji	1996	1996	Part VII item 46 (4) of 1996 act allows short-selling and establishes rules on short-selling practice.
Georgia	No	No	
Ghana	No	No	
Greece	2001	No	Short selling allowed in 5/31/01, but not widespread.
Guatemala	No	No	
Honduras	No	No	
Hungary	Yes	No	No regulation restricting short-selling. But there is no regulation governing short-selling practice.
Iceland	1986	No	Short-selling is uncommon. It is restricted for mutual funds.
India	Yes	No	Prohibited for foreign investors. No real existence.
Indonesia	No	No	Expected to be launched in 7/03.
Iran	No	No	
Israel	No	No	
Ivory coast	No	No	
Jamaica	No	No	
Jordan	No	No	
Kazakhstan	No	No	Kazakhstan

Country	Legality	Feasibility	Details
Emerging Markets			
Kenya	No	No	
Kuwait	No	No	
Kyrgystan	No	No	
Latvia	No	No	
Lebanon	No	No	Prohibited by article 182 of decree 7667 of 1995 (Beirut Bourse).
Lithuania	No	No	
Macedonia	No	No	
Malawi	Yes	No	Securities lending is allowed in the market but not yet feasible.
Malaysia	Allowed in 1995, prohibited in 1997	Started existing in 1996, stopped in 1997	Short-selling started on 9/30/96. The prohibition on 8/28/97 was a reaction to the Asian currency crisis.
Malta	No	No	Legislation is currently being drafted to allow securities lending.
Mauritius	No	No	
Mexico	Yes	Yes	
Moldova	No	No	
Mongolia	No	No	
Morocco	No	No	
Namibia	1992	No	Short-selling is allowed by article 24 of the Stock Exchange Control Act.
Nicaragua	No	No	
Nigeria	No	No	
Oman	No	No	
Pakistan	No	No	
Palestine	No	No	
Panama	No	No	
Paraguay	No	No	
Peru	2002	No	
Philippines	Prohibited in 1989, allowed in 1996	No	Short-selling was prohibited in 12/89. The revision of the rules in 1996 lifted the prohibition. In 1999 the Securities and Exchange Commission approved the proposed PSE Rules that would make short-selling more feasible. Its implementation is still pending the passage of the Senate Committee Report No. 115: Elimination of Imposition of DST on the secondary trading of financial Instruments.
Poland	2000	No	WSE has no rules on short-selling. Short-selling is regulated by a decree of counsel of ministers; short-selling was first allowed on 1/1/00.
Romania	No	No	
Russia	Yes	Yes	Always existed; Short-selling was explicitly regulated since 3/23/02.
Saudi Arabia	No	No	
Slovakia	No	No	
Slovenia	Yes	No	Short selling is not expressly allowed or prohibited at the moment, but changes in regulation regarding this matter are expected.
South Africa	Yes	Yes	

Country	Legality	Feasibility	Details
Emerging Markets			
South Korea	1996	No	Short-selling has been allowed since 9/96. But short-selling is prohibited to insiders and available on designated securities. Stocks ineligible for short-selling include stocks under surveillance and stocks designated as administrative issues.
Sri Lanka	No	No	
Sudan	No	No	
Swaziland	No	No	Prohibited since 3/99 when the Swaziland Stock Exchange was constituted.
Taiwan	1998	1998	Regulations allow short-selling since 9/4/98. But the shot-sale price must be higher or equal previous day's closing price.
Tanzania	No	No	
Thailand	1998	2001	10/98 rules and regulations placed. Short selling is feasible since 1/1/01.
Trinidad and Tobago	No	No	
Tunisia	No	No	
Turkey	1995	1995	4/3/95 Short selling allowed for stocks on ISE National 100.
Ukraine	No	No	
Uruguay	No	No	
Uzbekistan	Yes	No	The legislation does not prohibit short-selling But there is no regulatory framework that supports short-selling. Investors can lend/borrow securities directly via depositary houses only.
Venezuela	No	No	
Yugoslavia	No	No	
Zambia	No	No	
Zimbabwe	No	No	

Table II: Feasibility of put options trading

This table reports survey data on put options trading feasibility from 111 countries from immediately after WWII through 2002. The figures in Column 2 are the year put options trading became feasible. Yes means put options trading has always been feasible. No means put options trading has never been feasible. Details about short-selling rules and implementation in are in the last column.

Country	Feasibility	Details
Developed Markets		
Australia	1982	9/9/82.
Austria	1991	8/10/91.
Belgium	1992	Options on indices and stocks began trading on 6/12/92.
Canada	1975	Options started listing on the Montreal Exchange on 9/15/75. Started listing on the Toronto Exchange on 10/1/75.
Denmark	1990	European style put options on futures on the KFX share index started trading since 9/21/90. On 12/7/90 put options on individual Danish equities started trading. On 3/18/91 put options on government bonds started trading On 9/6/95. Put American options on the KFX index started trading in 2000.
Finland	1988	Options on the FOX index, which includes the 25 most traded stocks on the Helsinki Exchange, Started on 5/2/88.
France	1987	
Germany	1990	Started in 1/90 on individual stocks, and in August on the DAX index.
Hong Kong	1993	Index options started trading on 3/5/93. Stock options started trading on 9/8/95.
Ireland	No	
Italy	1995	Option contracts on the MIB 30 started trading on 11/15/95. Options on some of the most liquid individual stocks started trading on 2/19/96.
Japan	1989	TOPIX Index puts started trading in 10/20/89. Equity puts started trading in 7/97.
Luxembourg	No	
Netherlands	1978	Options on 3 listed stocks started in 4/78. Shortly after, options on 41 listed stocks started trading.
New Zealand	No	
Norway	1990	5/22/90.
Portugal	1999	Option contracts are traded on SEND - Electronic Derivatives Trading System.
Singapore	1993	Options market relaunched on 3/8/93 following an abortive attempt in 1980 which folded after 2 years.
Spain	1992	1/14/92.
Sweden	1987	The OM Stockholm/OMLX London exchange introduced options on Swedish stocks on 6/12/87.
Switzerland	1988	Options on individual equities were first listed on SOFFEX on 5/19/88.
United Kingdom	1984	5/3/84.
United States	1973	The CBOE first traded options on 4/26/73. There were 911 contracts traded on 16 stocks.

Country	Feasibility	Details
Emerging Markets		
Albania	No	
Argentina	1991	The rules were introduced in 1986, but the first transactions were in 7/3/91.
Armenia	No	
Azerbaijan	No	
Bahrain	No	
Bangladesh	No	
Barbados	No	
Bermuda	No	
Bolivia	No	
Botswana	No	
Brazil	1984	Stock options 12/18/84. Index options 7/96.
Bulgaria	No	
Chile	1994	Options began trading in 8/94.
China	No	
Colombia	No	
Costa Rica	No	
Croatia	No	
Cyprus	No	
Czech Republic	No	
Ecuador	No	
Egypt	No	
El Salvador	No	
Estonia	1996	Traded from spring 1996; no regulated option market with central counterparty.
Fiji	No	
Georgia	No	
Ghana	No	
Greece	2000	Put options on the FTSE/ASE-20 index started trading on 9/11/00.
Guatemala	No	
Honduras	No	
Hungary	2000	Options trading began at BSE on 2/18/00.
Iceland	No	
India	2001	Option trading introduced on 7/2/01, after the Ketan Parekh Scam.
Indonesia	2004	Started on 10/6/04 with 5 blue chip stocks.
Iran	No	
Israel	1993	8/1/93.
Ivory coast	No	
Jamaica	No	
Jordan	No	
Kazakhstan	No	
Kenya	No	
Kuwait	No	
Kyrgystan	No	
Latvia	No	
Lebanon	No	
Lithuania	No	
Macedonia	No	

Country	Feasibility	Details
Emerging Markets		
Malawi	No	
Malaysia	2000	12/1/00.
Malta	No	
Mauritius	No	
Mexico	Na	
Moldova	No	
Mongolia	No	
Morocco	No	
Namibia	No	
Nicaragua	No	
Nigeria	No	
Oman	No	
Pakistan	No	
Palestine	No	
Panama	No	
Paraguay	No	
Peru	No	
Philippines	No	
Poland	2000	Put warrants traded since 11/2/00.
Romania	No	
Russia	2001	FORTS has 2 put options on United Energy System and Gazprom that started trading in 9/19/01. Options have been trading on and off for 10 years unsuccessfully until the above date.
Saudi Arabia	No	
Slovakia	No	
Slovenia	No	
South Africa	1992	
South Korea	1997	Option on KOSPI 200 began trading on 7/7/97 and stock options for individual firms began trading on 1/28/02.
Sri Lanka	No	
Sudan	No	
Swaziland	No	
Taiwan	No	
Tanzania	No	
Thailand	No	
Trinidad and Tobago	No	
Tunisia	No	
Turkey	No	
Ukraine	No	
Uruguay	No	
Uzbekistan	1993	Small market.
Venezuela	No	
Yugoslavia	No	
Zambia	No	
Zimbabwe	No	

Table III: Summary statistics

Variable name	Mean	Standard deviation	Maximum	Minimum
Skewness	0.0662	0.7918	4.6471	-4.5862
Lagged detrended turnover	-0.0081	0.5298	16.5629	-12.6573
SSPO feasibility	0.4279	0.4948	1.0000	0.0000
Monthly Return	0.0076	0.0950	1.0229	-1.2114
Liberalization	0.5816	0.4933	1.0000	0.0000
Volatility	0.0009	0.0050	0.1995	0.0000
Turnover	0.0826	0.7494	26.0913	0.0000
Volume Asymmetry	0.0750	0.2519	1.8500	-2.4031
Crash	0.0364	0.1873	1.0000	0.0000
Credit rating	41.1858	25.5882	98.9000	3.6000

Table IV: Short-selling and conditional skewness

This table reports estimates from panel regressions of monthly skewness on SSPO feasibility, controlling for lagged return, lagged detrended turnover, liberalization, a time trend, and country-fixed-effects (not reported). The skewness measure is defined by equation (1) in the text. SSPO feasibility is a binary variable that equals one if either short-selling or put option trading is feasible in that country during that month. The indicator variable liberalization changes from zero to one in the month after the official liberalization date. Lagged return is the index return during the previous month. The variable lagged detrended turnover is the one month lag of the average over the previous six months of turnover after it is detrended. The detreding is done by subtracting from turnover the average of turnover during the previous eighteen months. All regressions are corrected for heteroskedasticity and country-specific autocorrelation. The p-value of each estimate is reported in parenthesis. We select countries with changes in short-selling or put option trading events. Panel B reports average skewness for these countries before and after the event month. The averages are taken for 2-year and 5-year windows. P-value that tests the hypothesis of no change is reported in parentheses.

Panel A: Regressions

Independent variables	All countries		Developed countries		Emerging countries	
Lagged detrended turnover	0.1536 (0.2151)		-0.8395 (0.1930)	-0.8375 (0.1999)	0.1774 (0.1379)	0.1773 (0.1388)
SSPO feasibility	0.0221 (0.4250)	0.0352 (0.2266)	-0.0149 (0.7123)	0.0068 (0.8748)	0.0556 (0.1464)	0.0552 (0.1723)
Lagged return	-0.6376 (0.0000)	-0.6410 (0.0000)	-0.6362 (0.0000)	-0.6434 (0.0000)	-0.6389 (0.0000)	-0.6388 (0.0000)
Liberalization	-0.0032 (0.8958)	0.0213 (0.4644)	-0.0085 (0.9007)	0.0268 (0.7164)	-0.0115 (0.6718)	-0.0131 (0.8403)
Time trend		-0.0016 (0.1492)		-0.0016 (0.1668)		0.0001 (0.9781)

Panel B: Pre- and post- event test

	Average skewness
2-year pre-event	0.1109
2-year post-event	0.1298
Change	0.019 (0.6267)
5-year pre-event	0.1291
5-year post-event	0.1389
Change	0.01 (0.8559)

Table V: Short-selling and conditional volatility

This table reports estimates from panel regressions of conditional volatility on SSPO feasibility, controlling for liberalization and a country-fixed-effects (not reported). Volatility of daily returns is the standard deviation of daily returns computed each month. Volatility of monthly returns is computed using the ARCH model given in Equation (3). SSPO feasibility is a binary variable that equals one if either short selling or put option trading is possible. The indicator variable liberalization changes from zero to one in the month after the official liberalization date. All regression coefficients are corrected for heteroskedasticity and country-specific autocorrelation. The p-value of each estimate is reported in parenthesis.

	All countries		Developed countries		Emerging countries	
Independent variables	Variance of Daily returns	Variance of monthly returns	Variance of Daily returns	Variance of monthly returns	Variance of Daily returns	Variance of monthly returns
SSPO feasibility	-0.0014	-0.0024	-0.0007	-0.0002	-0.0021	-0.0042
	(0.0000)	(0.0084)	(0.0351)	(0.7168)	(0.0000)	(0.0089)
Liberalization	-0.0004	-0.0009	0.0050	0.0009	-0.0015	-0.0029
	(0.0250)	(0.2241)	(0.0002)	(0.0106)	(0.0035)	(0.0792)
Time trend	0.0001	0.0001	0.0001	-0.0001	0.0001	0.0002
	(0.0000)	(0.1431)	(0.0151)	(0.1232)	(0.0024)	(0.0638)

Table VI: Short-selling and market crash

We counted as a crash observation, a month with a negative return larger than 2 standard deviations, where the standard deviation of returns is the average of standard deviation of returns during the previous three months. $crash_{i,t} = 0$, if $r_{i,t} < 2\sigma_{i,t}$ and $crash_{i,t} = 1$, otherwise. The average standard deviation $\sigma_{i,t} = (\hat{\sigma}_{i,t-1} + \hat{\sigma}_{i,t-2} + \hat{\sigma}_{i,t-3})/3$. This table reports estimates of panel logit regressions of crash on SSPO feasibility, controlling for liberalization, and country-fixed-effects (not reported). SSPO feasibility is a binary variable that equals one if either short-selling or put option trading is possible. The indicator variable liberalization changes from zero to one in the month after the official liberalization date, which was obtained from Bekaert and Harvey (2000). All regressions are corrected for heteroskedasticity and country-specific autocorrelation. The p-value of each estimate is reported in parenthesis.

	All countries	Developed countries	Emerging countries
SSPO feasibility	-0.0383	-0.0220	0.1240
	(0.7375)	(0.9201)	(0.4665)
Liberalization	-0.0196	-0.8302	0.3094
	(0.9314)	(0.0375)	(0.2375)

Table VII: Short-selling and liquidity

This table reports estimates from panel regressions of the logarithm of turnover on SSPO feasibility, controlling for lagged absolute return, lagged volatility, liberalization, a time trend, and country-fixed-effects (not reported). Turnover is defined as the natural logarithm of the ratio of volume of dollar trade per month to dollar market capitalization at the end of the month. SSPO feasibility is a binary variable that equals one if either short-selling or put option trading is possible. Lagged absolute return is the absolute value of index return during the previous month. Lagged volatility is the standard deviation of daily returns during the previous month. The indicator variable liberalization changes from zero to one in the month after the official liberalization date, which was obtained from Bekaert and Harvey (2000). All regressions are corrected for heteroskedasticity and country-specific autocorrelation. The p-value of each estimate is reported in parenthesis.

Independent variables	All countries			Developed countries			Emerging countries		
SSPO feasibility	0.5676	0.6557	0.3422	0.7345	0.9096	0.3232	0.3996	0.4282	0.3775
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0005)	(0.0000)	(0.0000)	(0.0000)
Lagged absolute return		0.8086	0.8311		-0.0238	0.4529		1.0850	1.0699
		(0.0002)	(0.0001)		(0.9586)	(0.2961)		(0.0000)	(0.0000)
Lagged volatility		3.1966	2.5813		5.1372	1.0598		3.2470	3.1215
		(0.0005)	(0.0027)		(0.1890)	(0.7676)		(0.0008)	(0.0010)
Liberalization	0.1291	0.0531	-0.5257	-0.1485	-0.1676	-1.1148	0.1913	0.1336	-0.0324
	(0.0155)	(0.2707)	(0.0000)	(0.5715)	(0.5195)	(0.0000)	(0.0004)	(0.0040)	(0.7163)
Time trend			0.0374			0.0429			0.0106
			(0.0000)			(0.0000)			(0.0246)

Table VIII: Short-selling and volume asymmetry

Monthly volume asymmetry for country *i* is defined as:

$$VA_{i,t} = \frac{\dfrac{\sum_{\tau}^{n} Vol_{i,\tau,t} D_{i,\tau,t}}{\sum_{\tau}^{n} D_{i,\tau,t}} - \dfrac{\sum_{\tau}^{n} Vol_{i,\tau,t}(1-D_{i,\tau,t})}{\sum_{\tau}^{n}(1-D_{i,\tau,t})}}{\dfrac{\sum_{\tau}^{n} Vol_{i,\tau,t}}{n}}$$

where $Vol_{i,\tau,t}$ is the daily dollar volume for day τ in month *t*, D_{τ} is a dummy variable that takes on value 1 if the return on day τ is positive and 0 if it is negative; and *n* is the number of daily observations in month *t*. This table reports estimates from panel regressions of volume asymmetry (*VA*) on SSPO feasibility, a crash variable, and an interaction term crash x SSPO feasibility, controlling for liberalization and country-fixed-effects (not reported). Crash is one for a month with a negative return larger than 2 standard deviations, where the standard deviation of returns is the average of standard deviation of returns during the previous three months. SSPO feasibility is a binary variable that equals one if either short-selling or put option trading is possible. The indicator variable liberalization changes from zero to one in the month after the official liberalization date, which was obtained from Bekaert and Harvey (2000). All regressions are corrected for heteroskedasticity and country-specific autocorrelation. The p-value of each estimate is reported in parenthesis.

Independent variables	All countries		Developed countries		Emerging countries	
SSPO feasibility	-0.0127	-0.0121	-0.0411	-0.0425	0.0127	0.0149
	(0.1751)	(0.1963)	(0.0018)	(0.0014)	(0.3366)	(0.2551)
Crash		-0.0733		-0.0951		-0.0689
		(0.0417)		(0.2004)		(0.0942)
SSPO feasibility × Crash		-0.0070		0.0279		-0.0436
		(0.8580)		(0.7138)		(0.4123)
Liberalization	-0.0034	-0.0033	0.0076	0.0079	-0.0108	-0.0110
	(0.7141)	(0.7212)	(0.7869)	(0.7802)	(0.2984)	(0.2877)

Table IX: Short-selling and cost of capital: an event study

We collected 31 specific dates when an exchange started allowing short selling or put option trading. We use the periods from -130 days to -30 days and from +30 days to +130 days to estimate the world market model, which is used to calculate the abnormal returns during the event window. This table reports abnormal returns and cumulative abnormal returns (CAR) from 5 days before the event date to 5 days after the event date. The last row provides the t-statistic associated with the 11-day CAR using the methodology proposed by Brown and Warner (1985).

	Short-selling & put options		Short-selling only		Put options only	
Event date	Abnormal return	CAR	Abnormal return	CAR	Abnormal return	CAR
-5	0.408	0.408	0.181	0.181	0.472	0.472
-4	0.773	1.181	-0.960	-0.779	1.268	1.74
-3	0.185	1.366	-0.439	-1.218	0.363	2.103
-2	0.322	1.688	1.142	-0.076	0.001	2.104
-1	0.254	1.942	-0.875	-0.951	0.576	2.68
0	0.295	2.237	2.269	1.318	-0.269	2.411
1	0.132	2.369	1.583	2.901	-0.282	2.129
2	0.364	2.733	0.543	3.444	0.314	2.443
3	0.709	3.442	1.771	5.215	0.405	2.848
4	0.183	3.625	1.553	6.768	-0.208	2.64
5	-0.001	3.624	1.259	8.027	-0.465	2.175
T-stats		2.506		3.090		1.281

Table X: Short-selling and cost of capital: using equity return as the cost of capital

Panel A reports the coefficient estimates of the following international asset pricing model:

$$r_{i,t} - r_{f,t} = \alpha_0 + \phi_{i,t}\lambda_{\text{cov}} h_{i,w,t} + (1+\phi_{i,t})\lambda_{\text{var}} h_{i,t} + e_{i,t},$$

where λ_{cov} the estimated price of the covariance risk with the world, and $\lambda_{\text{var}\,v}$ is the estimated price of own country variance risk. $r_{i,t} - r_{f,t}$ is the monthly equity return for each country minus the one month U.S. T-Bill return. The independent variable $h_{i,w,t}$ is the conditional covariance, and $h_{i,t}$, is the conditional variance obtained from the multivariate ARCH model in equation (3). The independent variable $\phi_{i,t}$ measures the level of integration of country *i* at time *t*, and is defined in equation (6). Panel B reports the coefficients from the estimate of the following model with country-fixed-effects (not reported):

$$e_{i,t} = \square_0 + \square_1 \, SSPO\ Feasibility_{i,t} + \square_2 \, Foreign\ Exchange\ Risk_{i,t} + \square_3 \, Liberalization_{i,t} + v_{i,t},$$

where $e_{i,t}$, is from the above asset pricing model. SSPO feasibility is a binary variable that equals one if either short-selling or put option trading is possible. Foreign exchange risk is estimated from the multivariate ARCH model in (3). The indicator variable liberalization changes from zero to one in the month after the official liberalization date, which was obtained from Bekaert and Harvey (2000).

Panel A: Estimates of the international asset pricing model

Dependent variable	Excess return of country
Some independent variables	
Covariance of country's equity return with world equity return multiplied by measure of the country's integration with the world	λ_{cov} = 5.0457 (0.0013)
Variance of the country's equity return multiplied by one minus measure of country's integration with the world	λ_{var} = 2.4667 (0.0727)

Panel B: Panel regression estimates

Dependent variable	Residual from risk adjustment model ($e_{i,t}$)		
Independent variables	All countries	Developed countries	Emerging countries
SSPO feasibility	-0.0017 (0.3997)	-0.0024 (0.3254)	-0.0036 (0.3673)
Foreign exchange risk, $h_{i,ifx,t}$	0.1585 (0.3479)	0.5461 (0.8077)	0.1233 (0.5657)
Liberalization	-0.0049 (0.0444)	0.0021 (0.6616)	-0.0061 (0.0810)

Table XI: Short-selling and cost of capital: using credit ratings as the cost of capital

The panel regressions with country-fixed effects are based on biannual data from 1979:2 through 2002:2. The dependent variable is credit rating, which represents the natural logarithm of a country credit rating. Country credit ratings are obtained from Institutional Investor's semi-annual survey of 75 to 100 bankers. Respondents rate each country on a scale of 0 to 100. SSPO feasibility is a binary variable that equals one if either short-selling or put option trading is possible. The indicator variable liberalization changes from zero to one in the month after the official liberalization date, which was obtained from Bekaert and Harvey (2000). P-values are in parentheses. We correct for country-specific heteroskedasticity and country-specific autocorrelation.

Dependent variable	Credit rating		
Independent variables	All countries	Developed countries	Emerging countries
SSPO feasibility	0.1031	0.0291	0.1659
	(0.0002)	(0.0695)	(0.0007)
Liberalization	0.0457	0.1753	0.0277
	(0.0640)	(0.0013)	(0.2991)

Figure 1. Short Selling Regulations & Put Options in the Twentieth Century

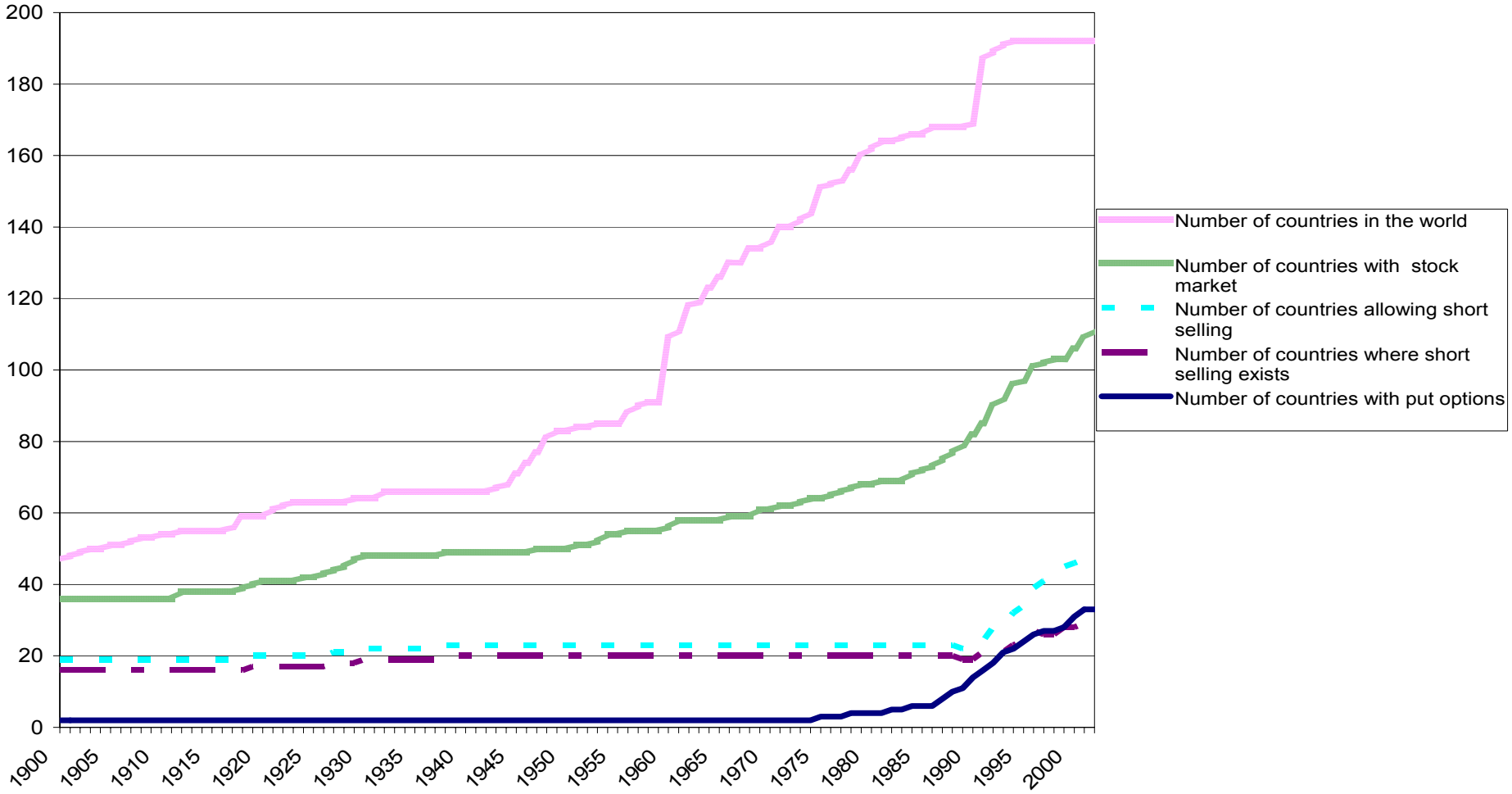
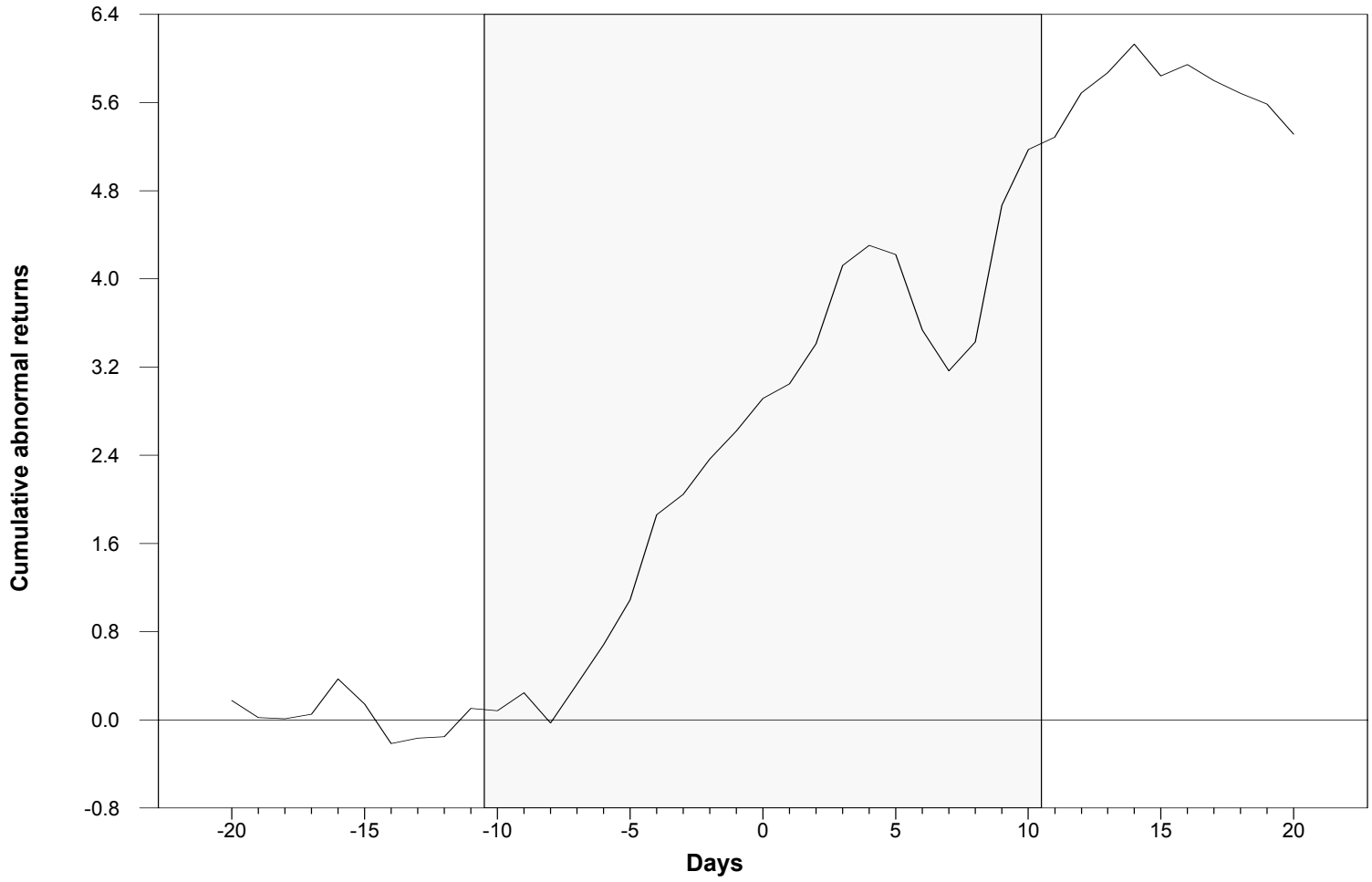


Figure 2: Cumulative abnormal return at the event date when countries first allow short-selling



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