Efficiency and the Bear: Short Sales and Markets around the World*

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May 2005

Abstract: We analyze cross-sectional and time series information from forty-six equity markets around the world, to consider whether short sales restrictions affect the efficiency of the market, and the distributional characteristics of returns to individual stocks and market indices. We construct two measures of price efficiency that quantify the asymmetric response of individual stock returns to negative vs. positive information, and find some evidence that prices incorporate information faster in countries where short sales are allowed and practiced. This evidence is consistent with more efficient price discovery at the individual security level. A common conjecture by regulators is that short sales restrictions can reduce the relative severity of a market panic. We test this conjecture by examining the skewness of market returns. We find strong evidence that in markets where short selling is either prohibited or not practiced, market returns display significantly less negative skewness. However, at the individual stock level, short sales restrictions appear to make no difference.

* We thank Gerard Goetz, Xi Luo, and Carolina Velosa for excellent research assistance, and Frank Fabozzi and Gustavo Rodríguez (NYSE), for considerable help in obtaining the data. We are grateful to seminar audiences at the University of Alberta, London Business School, Rutgers, Cornell's Johnson School, Emory University, University of Virginia-Darden, University of Illinois at Urbana-Champaign, the Tenth Annual Fortis/Georgia Tech International Finance Conference, the 2004 Advisory Board Conference at Boston College, the 14th Financial Economics and Accounting Conference at Indiana University, The College of William and Mary Frank Batten Young Scholar Conference, the 2003 EFA Meetings in Glasgow, the 2004 AFA Meetings in San Diego, and especially to Alex Butler, John Y. Campbell, Charles Jones, Frank de Jong, Owen Lamont, Christian Lundblad, Bernard Yeung, an anonymous referee, and Robert Stambaugh (the editor), for helpful comments and suggestions.

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In February of 1609, a group of well-connected Dutch businessmen, led by one of the original subscribers to the Dutch East India Company, Isaac Le Maire, formed a secret association, a "Groote Companie," to short the shares in the East India Company in anticipation of the incorporation of a rival French-chartered trading firm. Le Maire and his colleagues sold shares forward in a "blanco" transaction promising future delivery in one or two years. Over the next twelve months, their profits mounted, as East India Company shares dropped by 12%, angering shareholders who inevitably learned of their plan. In January of 1610, a year after the formation of the "Groote Companie" and only eight years after the official founding of the Amsterdam Exchange, the first regulation against short selling was enacted. Share prices rebounded, a rival French company was not formed and Isaac Le Maire never succeeded in disentangling himself from the litigation that ensued.[1]

At various times over the next four hundred years, short–sellers have been blamed for stock market declines, and market participants have called for regulation against short sales.[2] However, despite centuries of disagreement between speculators and regulators on the topic, no one really knows whether short sales constraints are a good or a bad thing. As the above example indicates, short sales restrictions are nearly as old as organized exchanges, and yet

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[1] This account is taken from Montias, John Michael, 1989, *Vermeer and His Milieu*, Princeton Press, Princeton, p. 20. The original study of the Le Maire affair may be found in J. G. van Dillen, 1930, "Isaac Le Maire en de handle in action der Oost-Indische Companie," *Economisch-historisch Jaarboek* 16:46, 107-111. For a discussion on the legal and ethical view of short-selling in late Sixteenth Century Holland, see De Marchi and Harrison (1994).

[2] For an excellent review of the history of short sales restrictions, see "A Short History of the Bear," by Edward Chancellor, October 29, 2001, copyright David W. Tice and Co, http://www.prudentbear.com/press_room_short_selling_history.html.

there is little empirical evidence on whether they prevent or facilitate market crashes, or whether they hinder or help rational price discovery.

In this paper, we use cross-sectional and time series information from forty-six equity markets from around the world to examine the question of whether short sales restrictions affect the efficiency of the market and the distributional characteristics of individual as well as market returns. We obtain information regarding the history and current practice of short sales restrictions from market regulators, investment banks, and institutional investors specializing in short sales. This dataset allows us to characterize each country in terms of the legality, as well as the practice, of short selling for the period 1990–2001.

Because the existence of short sales regulation is highly correlated with the development of financial markets, our challenge is to identify the true effects of such regulation on measures of efficiency and market stability that are not driven by other country-specific characteristics. Moreover, in our sample there are only five countries that have changed their regulation over the sample period; hence identification in the time-series dimension is problematic. However, we exploit the fact that even in countries where short sales are prohibited, dual-listed stocks are shortable in another market. One of the most significant institutional changes in international investing in the last decade has been the growth of the depository receipt market in the U.S. and Europe. Once restricted to a very few bell-weather securities from a handful of non-U.S. exchanges, ADRs, GDRs, and Global Issues now allow domestic investors to achieve considerable exposure to the world equity markets without leaving the comfort of the U.S. or the U.K. regulatory environment. A major factor in this domestic environment, of course, is the ability to short.[3] Therefore, we are able to identify, even within countries where short sales are

[3] In the case of global offerings, dual-listed stocks can be shorted in the U.S. and the U.K. like any other stock. Regarding ADRs and GDRs, selling them can be difficult because of liquidity reasons, unless the security is widely

not allowed or not practiced, a subsample of stocks that can be shorted because they are listed both in the domestic market and in either the U.S. or the U.K. By using the fact that some stocks in a given country are dual-listed, while others are not, we are able to isolate the effect of short sales regulation on equity prices, while controlling for major country effects. Our analysis is based on a test of the differences in behavior of non-shortable stocks (only domestic) vs. shortable stocks (dual-listed) in countries where short sales are restricted, controlling for differences between domestic stocks and dual-listed stocks in countries where short sales are allowed and practiced.

In this paper, we rely on two measures of market efficiency. The first is a downside-minus-upside R-squared measure of the relative co-movement of individual stock returns with the market, depending on the sign of the market return. It is calculated by first estimating two market model regressions of individual stock returns: one on negative market returns and one on positive market returns (downside R-squared and upside R-squared respectively), and then calculating the difference in R-squared coefficients. In the presence of short-selling restrictions, we hypothesize that there is less idiosyncratic risk incorporated into prices conditional on negative information, and therefore the downside-minus-upside R-squared should be lower when short sales are allowed in a country, relative to a situation where short sales are either

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held by institutions. In the U.S., on the other hand, the 1934 Securities Exchange Act exempts ADR short positions from the up-tick rule under §10a-1 (e)(8), which applies to companies that are listed on a foreign exchange:

> *"(e) The provisions of paragraphs (a) and (b) of this section (and of any exchange rule adopted in accordance with paragraph (a) of this section) shall not apply to:*
>
> *(8) Any sale of a security registered on, or admitted to unlisted trading privileges on, a national securities exchange effected for a special international arbitrage account for the bona fide purpose of profiting from a current difference between the price of such security on a securities market not within or subject to the jurisdiction of the United States and on a securities market subject to the jurisdiction of the United States; provided the seller at the time of such sale knows or, by virtue of information currently received, has reasonable grounds to believe that an offer enabling him to cover such sale is then available to him in such foreign securities market and intends to accept such offer immediately."*

prohibited, or not practiced. Our second measure is based on the difference in cross-autocorrelation between signed-market returns and individual stock returns, with a one-week lag. Diamond and Verrecchia (1987) predict that when short sales are restricted individual stock returns adjust slowly to common factor information, conditioning on a negative market return. We also compute the difference in downside-minus-upside cross-autocorrelation, to control for common factors that determine cross-autocorrelation anyway.

In countries where short selling is feasible and practiced, we find a marginally but significantly lower downside-minus-upside R-squared, and a marginally but significantly lower downside-minus-upside cross-autocorrelation, controlling for a host of other factors. This evidence is weakly consistent with short selling facilitating more efficient price discovery at the individual security level.

A common conjecture by regulators is that short sales restrictions can reduce the severity of price declines. This view is articulated by one of the regulators whom we contacted to obtain data for our sample. In his words: "*forbidding short selling prevents big market swings since the market size is limited*." We test this conjecture by examining the skewness of market returns, as well as the frequency of extreme negative returns. We find strong evidence that the lifting of short sales restrictions is associated with increased negative skewness in market returns. However, there is not a significant impact of short sales on the frequency of crashes—at least realized crashes. Put together, these two results imply that, when sorting is feasible, extreme returns become not more frequent, but certainly more negative.

Our analysis in this paper sheds light on the costs and benefits of short sales regulation at the individual security level as well. On the one hand, our data somehow support the view that short selling facilitates efficient price discovery—at least to the extent that efficiency is captured empirically by the lack of synchronous movement in weekly returns. On the other hand, short

selling may also potentially facilitate severe price declines in the market, at least as defined in terms of negative skewness. Despite the relationship between short sales constraints and skewness at the market level, we find little compelling evidence that short sales constraints prevent or mitigate severe price declines at the individual stock level.

We separately study the five countries in our sample that changed their short sales regulation and practice during the sample period—Hong Kong, Norway, Sweden, Malaysia, and Thailand—using an event-study methodology. Even though restricting the sample to only five countries implies a drastic reduction in degrees of freedom, using these countries obviates the need for most controls. We find significant increases in efficiency—at least for one of our measures—and a marginal increase in the negative skewness of market returns, once short sales are allowed and practiced in these countries.

Figure 1 summarizes our findings regarding the skewness of the market and the synchronicity of stock returns. We plot the downside-minus-upside cross correlation against market skewness, depending on whether countries allow and commonly practice short sales or not. Furthermore, we exclude from the figure dual-listed stocks in countries where short sales are not allowed or not practiced. In this figure we do not control for a number of factors that potentially influence synchronicity and skewness, however the raw data is somewhat instructive. Countries in which short sales are practiced display modestly less cross-autocorrelation difference, and more negative skewness.

[Insert Figure 1 here]

Hong Kong, Malaysia, Norway, Sweden, and Thailand appear twice in the figure. This is because they lifted short sales constraints in the period of our study. For example, short sales restrictions for Hong Kong were eliminated in 1996. Before that date, the downside-minus-

upside cross-autocorrelation was -0.18%, and the market skewness was –0.02. In the period since 1996, the downside-minus-upside cross-autocorrelation declined to -0.35%, and the market skewness decreased to -0.06. Hong Kong's positional shift in the figure represents the common pattern among the countries that relaxed short sales constraints.[4] The international evidence shown in Figure 1 at least suggests that short sales might play an important role in efficiency and the magnitude of market crashes. In the remainder of this paper, we investigate these potential relationships in econometric detail.

The paper is organized as follows. In the next section we review the current literature on short sales and discuss our contributions in the context of related research. In Section II we summarize the range of short sales regulations and practices in markets around the world. In Section III we describe the classification of stocks within a country into domestic and dual-listed. In Section IV we analyze the relationship between short sales and foreign listing. Section V reports the results of our tests of relative pricing efficiency. Section VI reports the statistical characteristics of market and security returns associated with short sales and tests for differences in skewness conditional upon restrictions. In Section VII we separately analyze the five countries which have changed their regulation over the sample period. In Section VIII we graphically analyze the distribution of stock returns. In Section IX we consider the effect of put options as an alternative mechanism to short sales, and Section X concludes. The Appendix contains an econometric model that illustrates the relationship between a delayed response to information and our measures of market efficiency.

[4] Section VII in the paper shows in cross-sectional regressions that the difference in skewness and cross-autocorrelation before and after the change in regulation is significantly different from zero.

I. Literature Review

Short sales play an important role in asset pricing models and the theory of portfolio choice. Most neo-classical models in finance (c.f. Ross, 1976) rely upon the ability of market participants to take off-setting positions in close economic substitutes in order to enforce the law of one price. Considerable research in the last decade has explored the effects of short sales and frictions in an asset market. For example, Luttmer (1993), Chen (1995, 2001), He and Modest (1997), Hansen and Jagannathan (1997), Jouini and Kallal (2001), Duffie, Garleanu and Pedersen (2002) all address the effect of market frictions and seek to characterize the magnitude of mispricing that may obtain. Diamond and Verrecchia (1987) explore the effects of short sales constraints on the speed of price-adjustment to private information. Building on their model, more recent theoretical work (Abrew and Brunnermeier 2001, 2002; Scheinkman and Xiong 2003), shows that short sales constraints can be the direct cause to—or at least a necessary condition for—bubbles and excessive volatility. This is indeed contrary to regulators' belief that short sales constraints can stabilize the market.

Hong and Stein (2003) develop a heterogeneous agent model linking short sales constraints to market crashes. In their model, if some investors are constrained from selling short, their accumulated unrevealed negative information will not be manifest until the market begins to drop, which further aggravates market declines and leads to a crash. They motivate the model with the observation that the U.S. market displays negative skewness.

Most of the research cited above suggests that short sales constraints have an adverse effect on efficiency—the only question is how much. An interesting exception is the argument of Allen and Gale (1991) who point out that the potential for financial innovation renders short selling a destabilizing influence in the economy. This is potentially interesting in light of our findings that short sales tend to be allowed in major markets where financial innovations

occur—particularly with respect to capital structure and new security development—and that these markets also tend to display relatively higher negative skewness in returns. Bernardo and Welch (2004) develop a model describing how the fear of financial crisis, instead of a real liquidity shock, is the true cause of financial crises. One implication of their model is that putting constraints that hinder some market participants from front-running other investors can effectively prevent financial crisis from happening, supporting the finding of Allen and Gale (1991) that short sales can potentially destabilize the economy.

Empirical evidence on short selling largely supports the theoretical view that constraining it hinders price discovery. Jones and Lamont (2002) use early 20th Century U.S data to show that stocks which are expensive to short have high valuations and low subsequent returns. Their finding is consistent with the hypothesis that difficult-to-short stocks are over-priced. Using data on DotComs, Ofek and Richardson (2003) show that short sales constraints, in the form of stock option lock–ups, have considerable and persistent negative impact on subsequent stock returns, also supporting the argument that stock prices do not fully incorporate information under short sales constraints. Geczy, Musto, and Reed (2002) use a comprehensive dataset of short sales, and find that short sales restrictions have a mixed impact on the profitability of well–known arbitrage strategies.

There is also a vast empirical literature that tests the predictions by Diamond and Verrecchia (1987), who argue that short sales constraints impair the diffusion of positive and negative information differently. Asquith and Meulbroek (1995), Aitken et al. (1998), and Danielsen and Sorescu (2001) all find that the introduction of short sales, in the form of either changes in the short interest, short sales regulation, or options, is associated with negative future returns. This indicates that negative information is incorporated slowly into prices when shorting is constrained. In addition, Reed (2003) finds that stocks for which short-selling is

particularly costly have larger price reactions to earnings announcements, especially negative earnings announcements. These studies emphasize the short-sale constraints' asymmetric impact on market efficiency: not only does the overall price efficiency is reduced by short sales constraints; such an effect is stronger when there is negative information.

Short selling requires the ability to borrow securities. As we will discuss in this study, securities borrowing and lending can directly determine the costs of short selling and hence should be considered in conjunction with short sales constraints. In our empirical analysis, we classify countries into categories according to whether short selling is practiced. Although short selling is allowed in some countries, securities borrowing and lending is so limited that short sales are not really feasible. D'Avolio (2002) provides empirical evidence about securities borrowing and lending in U.S. stock markets that demonstrates considerable cross-sectional variation in the feasibility of maintaining short positions, depending on the divergence of market opinion.

Short selling is an important tool used by speculators to exploit over-priced securities. Bekaert and Harvey (2000) explore the importance of speculators in emerging market efficiency. They find that the cost of capital, an indicator of market efficiency, decreases after a capital market liberalization. They stress the importance of a regulatory change to a country's openness to speculators—this would naturally extend to short sales restrictions and thus our work fits naturally into the literature on the globalization of capital markets.

There are a few key empirical studies that seek to understand the impact of short sales regulations on return distributions using international data. Aitken et al. (1998) offer evidence from the Australian Stock Exchange suggesting that short sales trades reflect significant bad news about companies. Biais et al. (1999) find that the spot market in the Paris Bourse, which is subject to leverage and short sales constraints, reflects good news significantly faster than bad

news. Poitras (2002) concludes that rights issues trade below the arbitrage boundary because of short sales restrictions on the Stock Exchange of Singapore (SES). Li and Fleisher (2002), using Chinese stock market data, find that the dispersion of domestic analysts' forecasts is negatively correlated to stock returns in the A-share market, where short sales restrictions are binding, and not significantly related to the return of B-shares where short sales restrictions are not binding. Studying the impact of short sales constraints in an international setting avoids potential country specific factors and generalizes the findings on short sales regulations.[5]

In sum, most theory and empirical evidence from the U.S. and from a few non-U.S. markets suggest that short sales constraints are an impediment to price discovery—particularly when the news is bad. Some theories argue that limiting short sales may be necessary under certain conditions to achieve equilibrium, however thus far there is no empirical test of the contrary proposition. No study has used the power of cross-sectional differences in regulations across countries to test short sales effects.[6]

II. Short Sales Restrictions around the World

Our main data source for short sales regulation and practice is information provided by investment banks. The Morgan Stanley Dean Witter Global Network Management Division (GNM) has compiled information regarding short sales regulation, impediments and practices from their global network of sub-custodian banks for 59 countries, and they made a summary of

[5] It is also worth mentioning that options and other derivatives can sometimes be an important way to convey negative information. In Section IX we analyze the interaction of derivatives markets and short sales, and provide a list of theoretical and empirical references.

[6] One exception is Charoenrook and Daouk (2004), who analyze the effect of short sales on skewness and the cost of capital.

this research available to us. We obtained similar information from the International Securities Lending Division at Goldman Sachs (ISL). The ISL complements the information from GNM in two important aspects. It provides detailed information on the tax effects of short positions, the settlement cycle of short sales, and the registration requirements for shorting in 46 countries. There are some countries for which the GNM and ISL data indicates that short selling is not practiced despite the fact that a widely used guide, the *Worldwide Directory of Securities Lending and Repo* (WDSLP), lists institutional investors involved in short sales in those countries. In these cases, we contacted the listed institutions to understand the discrepancy. In most cases we found they were not active in short sales, or else they were mostly focused on securities lending. An exception is Singapore where it appears that, even though short selling is not formally allowed, it is widely practiced, although short sales are typically executed off-exchange between depository agents. We obtained additional information on securities trading, settlement and tax laws from the International Securities Services Association (ISSA) Handbook, however ISSA only provides current information on these issues.

In addition to information provided by investment banks, industry publications and market participants, we contacted the equivalent of the Securities and Exchange Commissions of the 59 countries in the GNM dataset to learn what we could from them about regulation and practice. Information from market regulators was particularly useful in allowing us to track the history of short sales regulations for each country over the last fifteen years. With their help we are able to examine some key regulatory regime shifts in our empirical analysis. We found in general that the information provided by practitioners was more detailed than the information from regulators, although it should not be surprising that Goldman Sachs and Morgan Stanley Dean Witter know more about market practice than regulators themselves. For instance, in one case, regulators told us that short selling was not practiced in their market, while ISL indicated

that most of the short–selling transactions for that market take place offshore—outside the purview of the regulatory agency. What regulators may lack in specific knowledge about market practice they typically make up for in interest in the current project. Many of the regulatory agencies we contacted expressed a strong desire to learn the results of our study, because the question of the efficacy of short sales restrictions continues to be an issue of interest.

Our information about short sales regulations and practice is summarized in Table 1. Out of the 59 countries in the GNM dataset, we exclude the countries for which we could not find individual firm stock price data. This leaves a sample of 46 countries. In 35 of them, short selling is currently allowed, at least as of December 2001, the final date of our sample period. In 10 of these 46, short sales were prohibited for the entire sample period of January, 1990 to December, 2001. In 13 of the 35 countries where short sales are currently allowed, restrictions existed in 1990 but were lifted at some point within the sample period. These countries are: Argentina, Chile, Finland, Hong Kong, Hungary, Malaysia, New Zealand, Norway, Philippines, Poland, Spain, Sweden, and Thailand. In three cases—Malaysia, Hong Kong, and Thailand—restrictions on short selling were removed and later re-enacted gradually.[7]

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[7] In Malaysia, the Securities Commission issued in December 1995 the Guidelines on Securities Borrowing and Lending, and the Securities Industry Act of 1993 was amended to allow short sales. The regulatory changes came into force on March 7, 1996, and allowed the local exchange—the Kuala Lumpur Stock Exchange—to enact short–selling rules. With that, regulated short selling commenced on September 30, 1996. However, in August 28, 1997, and in the onset of the Asian financial crises, these activities were suspended as interim measures to prevent excessive volatility in the markets. In February, 2001 the Securities Commission launched a plan—the Capital Market Masterplan—that recommended the re-introduction of short selling and securities lending activities.

In Hong Kong, short selling was prohibited before January 3, 1994. The SEHK then allowed 17 out of the 33 constituent stocks of the Hang Seng Index (HSI) to be sold short subject to several restrictions. These restrictions were lifted on March 25, 1996 at the same time that 113 of the firms listed on the exchange, including all the constituent stocks of the index, were allowed to be sold short.

There is clearly a difference between what the law allows and what is common practice. Although short selling is currently legal in most countries, it is only practiced in 25. In some countries, tax rules make shorting very difficult. In Chile for instance, although short selling and securities lending have been possible since 1999, they are rarely used because lending is considered an immediate, taxable sale. Given that there is no sale price, the relevant price is the highest price of the stock on the day it is lent; if it is higher than the purchase price, capital gains tax will apply. In Turkey, stock lending is treated as a normal transaction by the tax authorities, and as such it is liable to capital gains tax where applicable. In Finland, transfer laws also place a serious burden on this activity. In Philippines and Turkey short selling is allowed, but the rules are not yet clearly defined. In Thailand, evidence of the practice is murky. Regulators in that country believe that short selling is not practiced because the market for borrowing stock is very narrow, especially on the supply side, due to the absence of a futures market.

[Insert Table 1 here]

There are some other features of short–selling practices throughout the world that are relevant for our purposes. In some markets only the largest and most liquid stocks may be shorted. Until 1996, Hong Kong only allowed short sales in securities specifically designated by the Hong Kong Exchanges and Clearing Ltd. A similar rule currently operates in Greece. More objective criteria are found in Poland, where any security with a market capitalization of at least

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In Thailand, the Securities Exchange Commission first enforced short–sales regulations on July, 1997, suspending them because of the currency crises. Beginning on January 1, 1998, short sales were allowed again in the Thai capital market, through financial institutions licensed to operate securities borrowing and lending (SBL) business. The practice of short selling has increased gradually: in 1999 there were only three securities companies licensed to operate SBL. Although ISL and GND characterize Thailand as a country where short sales are a common practice, market regulators were aware of only one transaction since 1997, apart from "mistaken" transactions done by brokers.

250 million zlotys qualifies. We adopt the convention of classifying Hong Kong as a country where short selling is allowed only after 1996, even though it was allowed for a subset of stocks beginning in 1994. For Poland and Greece, GNM reports that short selling is not practiced.

We also regard short selling as allowed and practiced in a country even if some investors are prohibited from entering into these transactions. In Sweden, for example, traders can go short without having borrowed the shares in advance,[8] while individual investors must borrow the shares before they go short. In Greece prior to 2001, short selling was only available to the members of the Athens Derivatives Exchange. Some countries only impose short sales restrictions on foreign investors. In Brazil, for instance, a short seller must have a domestic legal representative. Taiwan is a special case in our sample. In Taiwan, foreign and institutional investors are prohibited from shorting, and individuals can only short upon special authorization by the Ministry of Finance. Besides, the up-tick rule is enforced. Therefore we classify Taiwan as a country where short sales are allowed, but not practiced.[9] It is fair to say that for every country in our sample, there exists a constellation of laws, regulations, institutional norms, variation in practice and fine print governing the ability to take and maintain a short position in a stock. Our challenge in this paper has been to categorize them in economically meaningful ways.

Although the actual practice of short selling depends upon laws, regulation, frictions and costs in markets, we are initially forced to reduce the complexities to a single dimension for purposes of analysis. We classify countries in our sample into four groups, depending on whether short selling is legal and practiced. This classification of course misses the nuances of

[8] They must borrow the stock before the end of the day, however.

expenses and risks that potentially characterize differences in short selling across international markets. In the next section we describe how we further classify stocks within a country into shortable and non-shortable, even in the case where short sales are not allowed or not practiced.

We therefore end up with four groups of countries. In the first group we have the countries where short selling became legal some time before 1990, and where short selling is currently practiced. This group includes: Australia, Austria, Belgium, Canada, Czech Republic, [10] Denmark, France, Germany, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, Portugal, Singapore, South Africa, Switzerland, the U.K., and the U.S. The second group consists of countries in which short sales were prohibited as of December, 2001. These are: China, Colombia, Greece, Indonesia, Pakistan, Peru, South Korea, Venezuela, and Zimbabwe. The third group is comprised of countries in which short selling is allowed but rarely practiced: Argentina, Brazil, Chile, Finland, Hungary, Israel, New Zealand, the Philippines, Poland, Spain, [11] Taiwan, and Turkey. Finally, the remaining five countries—Hong Kong, Norway, Sweden, Malaysia, and Thailand—comprise a group for which short sales regulation and practice changed sometime between January, 1990 and December, 2001.

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[9] We have re-estimated our regressions including Taiwan as a country where short sales are allowed and practiced. There is no qualitative change in our results.

[10] The Prague Stock Exchange was established on November 1992, and the automated trading system started operations in January 1993. We include the Czech Republic in the group of countries where short selling is allowed and practiced, although we only have data on Czech firms since 1993.

[11] Chile made short selling legal only in 2000, but there is no current practice. Spain legalized short selling in 1992, but only securities lending facilities are common among institutions, as a way of facilitating hedging strategies.

III. Equity Market Data and Sources

The international return, volume and issue data for the 46 markets in our study come from Datastream and Worldscope, and our U.S. data come from CRSP. Prices and returns are measured in local currency. We construct value-weighted market indices for each country in the sample. It is important to note that the number of firms per country varies across years, and thus the volatility of the market index might vary with time as a consequence, since there are typically fewer constituent firms in the indices for some countries in the earlier years of the sample.[12] For this reason we estimate a year-fixed effects model in most of our statistical analysis.

We obtain accounting data from Worldscope for non-U.S. firms, and Compustat for U.S. firms. We also obtain country information from the Economist Intelligence Unit database and from the World Bank. In particular, we characterize each country in our sample by its geographical size, the GDP per capita, and the variance of GDP growth. Finally, we construct an index of good government following Mørck, Yeung, and Yu (2000) (MYY), as the sum of indices of corruption, risk of government repudiation of contracts, and risk of expropriation of private property in La Porta et al. (1997).

IV. Foreign Listing and Short Selling

The classification of countries into two categories is not perfect. Even when short sales are either not allowed or not practiced, some stocks in a country can still be shorted. A good

example is Nokia, which represents about 2/3 of the total market capitalization of the Helsinki Stock Exchange (HEX) in 2001. As per our own data, Finland is a country where short sales are not practiced. However, Nokia has been listed on the New York Stock Exchange since July 1, 1994. These Nokia depository receipts can be shorted, although only in the U.S.[13] Thus, taking into account shares that list abroad, the percentage of the Finnish market that is shortable is 70.29% on average between 1999 and 2001 (see Table 2). Hence, these shortable components of national exchanges must be considered when examining the effects of short sales restrictions on markets.

We compile data on non-U.S. companies that list in NYSE, NASDAQ and the LSE. We obtain data on U.S. listings directly from the NYSE.[14] Data for the London Stock Exchange comes from the Exchange's website. We obtain the date of the first listing of each foreign firm in these markets via direct listing (IPO), ADRs (in the U.S.) and GDRs (in the U.K.). We also obtain from Datastream stock market information about all firms listed in the 46 countries in our database. Bris, Goetzmann, and Zhu (2004) show – using the same dataset – that without taking foreign listings into consideration, the percentage of the world market capitalization that is shortable varies between 89.35% in 1994 and 94.15% in 1999. When foreign listings are included, they show that up to 96.29% of the world market is shortable as of 2002. The numbers are very similar even when they exclude the U.S. markets from the calculations.

[Insert Table 2 here]

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[12] Datastream has an acceptable coverage only after 1995.

[13] Indeed, there are five Finnish companies in our database that list in the U.S.: Nokia (direct listing in NYSE since 7/1/94), Metso Corporation (direct listing in NYSE since 7/1/99), Stora Enso Oyj (ADR in NYSE since 9/1/00), UPM-Kymmeny (ADR in NYSE since 6/29/99), and Instrumentarium Corporation (ADR in Nasdaq since 8/18/83).

[14] We thank Gustavo Rodríguez from the NYSE for providing us with these data.

In Table 2 we specifically consider the countries where short sales are not allowed or not practiced, but where there are firms that list in a U.S. or U.K. market. The table illustrates the changing importance of cross-listings through time. The aggregate percentage of shortable capitalization via depository receipts for all short-sales-restricted countries shows a moderate but significant increase from 28% in the early period 1990-1993 to 36% in 1999-2001. However in some countries the shortable capitalization is considerable: in Argentina, Finland, and South Korea, more than 50% of the market is shortable via cross-border listings in 1999-2001. In Argentina, the percentage of the market capitalization that is shortable increases from 3% in 1990-1993, to 50% in 1999-2001.

Our final sample of countries and regulations includes 46 markets. Within each market, we classify stocks into two groups, depending on whether the stocks are dual-listed or not. In countries where short sales are not allowed or not practiced, the dual-listed stocks constitute a group of stocks that are actually shortable. By analyzing the differences between domestic (stocks without a foreign listing) and dual-listed stocks in the domestic market, and by comparing these differences with the control sample of stocks in countries where short sales are allowed and practiced, we are able to identify the effect of short-selling restrictions on the variables of interest.

For simplicity, in the remainder of the paper we call *dual-listed stocks* the group of stocks within a country that list abroad. Obviously these are always shortable stocks, and we analyze the price behavior of these stocks in the domestic market. That is, the relevant price that we study is the price of the dual-listed stock in the domestic market.[15] We compute value-weighted market returns for each subgroup of stocks within a country and year. Therefore there

are two market returns in each country,[16] if there are dual-listed stocks. We call countries without a foreign listing *domestic stocks*. These are shortable only in countries where short sales are allowed. Table 3 shows the descriptive statistics of the variables we use, for each of the four groups of stocks in the sample. In the cross-sectional regressions below, we only use groups of firms where the number of observations is at least five firms.

[Insert Table 3 here]

V. Short sales Restrictions and the Efficiency of Stock Prices

A. Measures of Price Efficiency

The first question in our analysis is whether short sales restrictions play a role in efficient price discovery. The key implication of Diamond and Verrecchia (1987) is that short sales constraints impede the market's ability to rapidly impound value-relevant information. As the voluminous literature on the efficient market theory suggests, there is no universal test for relative market efficiency, although event studies and filter rules have a long history of application. An important recent contribution to the literature on market efficiency is MYY's observation that more efficient markets can be expected to have more idiosyncratic risk, since the ratio of firm-specific information to market-level information is likely to be higher in informational environments that allow market participants to acquire information and act quickly and inexpensively upon it. MYY examine international differences in the degree of co-movement in

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[15] In cases where the dual-listed stock is also a dual-class stock in the domestic market, we consider only the share class with cash-flow rights, irrespective of which class is dual-listed.

[16] Our results do not change if we estimate our regressions using the overall market index (one index per country, not two).

stock prices across countries around the world, and find that the ratio of idiosyncratic risk in relatively developed markets is higher than in markets that are commonly viewed as less developed—particularly emerging markets.

In contrast to MYY, we intend to exploit the potential asymmetry in price adjustment under short sales constraints. The MYY measure looks at the efficiency of price moves in both directions. However, if only price adjustment to bad news is constrained, we expect idiosyncratic risk to be smaller when market returns are negative, and in particular, in regimes where short sales are either prohibited or not practiced. Although the cross-sectional difference in the market efficiency measure can partly be ascribed to differences in country characteristics—market liberalization, increases in market integration—such characteristics should not be able to explain why the market efficiency difference is bigger for negative market returns than for positive returns. Such a separate measure of market efficiency provides opportunities to test the proposition in Diamond and Verrecchia (1987) that short sales constraints hinder efficiency especially for negative information.

The MYY measures compute the amount of private information incorporated into prices, but not the timing of the price adjustment. Recent work by Hou and Moskowitz (2004) suggests that efficiency can be modeled as a delay in price adjustment. We too measure the speed of individual stock prices adjustment to market movements by calculating the cross-autocorrelation between the lagged market return and individual stock returns. In the presence of short sales restrictions, Diamond and Verrecchia (1987) predict that prices will adjust slowly to negative market news. Hong, Lim, and Stein (2000) cannot empirically reject the hypothesis that short sales constraints explain the differential reaction of stocks to bad versus good news. They recognize that, in their setting, it is difficult to quantify the magnitude of short sales constraints. Because we have a rich sample of countries with and without restrictions, the difference

between downside (negative market return) and upside (positive market return) cross-autocorrelations depending on these prohibitions provides more direct evidence that short sales constraints slow downside price discovery.

B. Computation

B.1. R-squared

MYY compute the R^2 for regressions of the form:

$$r_{ijt} = \alpha_{ij} + \beta_i^M \times r_{mjt} + \beta_i^W \times r_{wt} + \varepsilon_{ijt} \quad (1)$$

That is, they regress weekly stock returns on the value-weighted market return, and a value-weighted world index for every firm i and in every year (where week t belongs to year T). This approach is similar to Hou and Moskowitz (2004), who estimate regression (1) with different lags on the market return. We calculate two separate measures of individual security co-movement. Let r_{mt}^+ equal the market return when it is either positive or zero, and let r_{mt}^- equal the market return when it is negative. Following MYY, for each country in our sample, for every year T, and for domestic and dual-listed stocks, we calculate the R-squared in the following two modified regressions:

$$r_{ijt} = \alpha_{ij} + \beta_i^M \times r_{mjt}^+ + \beta_i^W \times r_{wt} + \varepsilon_{ijt} \quad (2)$$

$$r_{ijt} = \alpha_{ij} + \beta_i^M \times r_{mjt}^- + \beta_i^W \times r_{wt} + \varepsilon_{ijt} \quad (3)$$

We compute the corresponding R-squared coefficients, R_{ijTD}^{2+} and R_{ijTD}^{2-} respectively. We use weekly data for every week t in year T. The subscript D indicates whether the R-squared

is calculated for either domestic or dual-listed stocks within a country. The market return is value-weighted, using data on market capitalization from Datastream and Worldscope. We then average the R^2s for each country j and for every year T and group D, as in MYY:

$$R^{2+}_{jTD} = \frac{\sum_i R^{2+}_{ijTD} \times SST_{ijTD}}{\sum_i SST_{ijTD}} \qquad R^{2-}_{jTD} = \frac{\sum_i R^{2-}_{ijTD} \times SST_{ijTD}}{\sum_i SST_{ijTD}} \tag{4}$$

where SST is the sum of squares in the corresponding regression.

We measure asymmetries by computing the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$. Note that all confounding factors that affect both the upside and the downside fraction of idiosyncratic risk are taken care of in the downside-minus-upside R-squared. Finally, and for comparison with MYY, we also compute the total R-squared R^2_{jTD} from individual stock regressions like (1).

If short sales impede the incorporation of negative information into prices, the downside R-squared should decrease more when short sales are allowed and practiced in a country. We propose a simple econometric model in the Appendix that shows formally how this can happen. In the model, individual stock returns are determined by a factor model, where the only factor is the market. When short sales are restricted, stock returns respond immediately to positive market information, but they incorporate the current market news only partly if the market return is negative. Therefore, the observed market return also incorporates both current and past market news, if they are negative. A regression of individual stock returns on the observed market returns, conditional on the sign of the market return, yields a higher downside R-squared the slower market news are incorporated into individual stock prices. The model also shows that

the upside R-squared is affected as well by short sales restrictions. Therefore, the difference R^{2Diff}_{jTD} drops when short sales are allowed.

In Table 3 we report that the average total R-squared is 19.38% when short sales are not practiced, and 12.87% when short sales are allowed (the difference is statistically significant at the 1% level), for domestic stocks. This is consistent with the level of idiosyncratic risk being lower when shorting is prohibited. However, such effect may depend on some country-specific factors. In general the downside R-squared is larger than the upside R-squared, which is consistent with Hong, Lim, and Stein (2000). We also find significant declines in the upside and downside R-squared coefficients (from 12.73% and 14.57% to 9.09% and 11.26% respectively, both significant at the 1% level), for domestic stocks. Results are similar, although weaker, for dual-listed stocks. The downside-minus-upside R-squared significantly drops when short sales are allowed in domestic stocks, which is inconsistent with the market being more efficient when shorting is possible. However, this does not take into account either the differences across countries or time effects. There is no significant change in the downside-minus-upside R-squared in dual-listed stocks.

B.2. Cross-autocorrelation

As an alternative measure of price efficiency, we compute cross-autocorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate:

$$\rho^{+}_{jTD} = \frac{\sum_{i} \rho^{+}_{ijTD}}{N_{jTD}}, \qquad \rho^{-}_{jTD} = \frac{\sum_{i} \rho^{-}_{ijTD}}{N_{jTD}}, \qquad \rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD} \tag{5}$$

The cross-autocorrelations are equivalent to estimating regression coefficients of individual stock returns on lagged market returns, as in Hou and Moskowitz (2004). They compare the R-squared of a regression of returns on lagged market returns, with the R-squared of a regression of returns on the contemporaneous market return. The larger the difference, the larger the price delay. The cross-autocorrelation coefficient is an alternative way of standardizing the same measure. Moreover, Hou and Moskowitz (2004) argue that the price delay is best measured on a weekly basis, as we do: there is little variation at the monthly level and too much noise at the daily level. Such a measure of price delay has additional explanatory power for cross-sectional returns over traditional factors.

In Table 3 we report the total (that is, irrespective of the sign of the market return), downside, upside, and difference in cross-autocorrelation classified by the short sales regime, for domestic and dual-listed stocks. The total cross-autocorrelation is smaller when short sales are allowed (from 3.66% to 2.69% on average, a significant difference at the 10% level), and is significantly lower in dual-listed stocks. This result is consistent with the hypothesis that price discovery is faster in dual-listed stocks (Foerster and Karolyi, 1999), and when a market friction is removed (Hou and Moskowitz, 2004). Consistent with intuition, the cross-autocorrelation is larger on the downside than in the upside. The downside cross-autocorrelation is smaller in domestic stocks when short sales are allowed (significant difference at the 5% level), while there is no significant change in the upside cross-autocorrelation. Although the downside-minus-upside cross-autocorrelation declines (from 1.61% to 1.34%), such decline is not significantly different from zero. Regarding dual-listed stocks, we do not find any significant pattern.

C. Multivariate Tests

C.1. R-squared

MYY find that developing economies display significantly higher levels of co-movement than more developed ones. In particular, they find that co-movement is explained in the cross-section by the GDP per capita. They provide several hypotheses why this can happen, and show that, when interacted with an index of good government, the significance of the GDP per capita disappears.

One potentially important explanation for such a pattern is that smaller countries have less-diversified stock markets. To address this issue, MYY use country-level and industry-level Herfindahl indices. The former captures the cross-industry concentration based upon sales, the latter captures the average within-industry concentration based upon sales. To see how this might work, consider some extreme examples: Finland and Norway vs. the U.S. In Finland, Nokia represents more than 50% of the market capitalization of the Helsinki Stock Exchange. In terms of domestic sales, the telecommunications giant accounts for 5% of the total sales in the country, and 19.6% of the sales in its industry. Indeed, Telecom Equipment accounted for 22.82% of the total sales of Finnish companies.

The country-Herfindahl index for Finland is 12.28. This is not dramatically higher than the median of 11.02 for all the countries in the sample. The industry-Herfindahl index for Finland is 8.29 (compared to a median 7.11 for the whole sample). This means that, even though the telecom industry is highly concentrated, the other industries are not. In contrast, Norway has a country-Herfindahl measure of 73, and an industry-Herfindahl measure of 17.82. In this case it is driven by the natural resources industries that represent the bulk of the industrial production

in Norway. For the U.S., the country-Herfindahl measure is 4.45 in 2001, and the industry-Herfindahl measure is 2.25%. Thus, Norway has a low cross-sectional dispersion in firm returns due to its industrial structure, not necessarily because of relative market efficiency, and the Herfindahl indices appear to be a useful control.

Liquidity also determines the ability to short a stock. As trading gets cheaper, it is more profitable to invest in the acquisition of fundamental information about individual stocks. Because obtaining measures of liquidity for emerging markets is difficult, we use the simple method described in Bekaert, Harvey and Lundblad (2003) that measure liquidity as the percentage of returns in a country that are zero. We then compute the frequency of zero returns for each group of stocks (domestic and ADR) within each country, and for each year.

In our analysis, we replicate as closely as possible the estimation and control variables used in MYY, adding a short sales indicator variable. We construct indices of industry concentration (by industry and country, as described in their paper), indices of earnings co-movement,[17] and calculate the number of listed firms in each country and year. The short sales indicator is a dummy variable that equals one whenever short selling is allowed and practiced in a given country and year, and zero otherwise. If a country changed its regulation in a given year, we eliminate that observation from the sample. We additionally construct two ADR dummies. ADR0 equals 1 if the observation corresponds to dual-listed stocks in countries where short sales are not allowed or not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to dual-listed stocks in countries where short sales are allowed and practiced, zero otherwise. Because dual-listed stocks in countries where short sales are prohibited are shortable, we expect ADR0 to display a significant coefficient. Because dual-listed stocks in countries

[17] Since we replicate the procedure in MYY, we do not provide details on how these variables are computed.

where short sales are practiced are not different from domestic stocks in terms of the possibility of being shorted, we expect the coefficient of ADR1 to be insignificant. Finally, because listing abroad has different implications in countries where short sales are prohibited/not practiced, relative to countries where short sales are allowed and practiced, we expect the coefficients of ADR0 and ADR1 to be statistically different. Figure 2 summarizes the interpretation of our dummy variables under the null hypothesis that short sales restrictions reduce market efficiency.

[Insert Figure 2 here]

Our final panel with complete data includes 668 observations. The earnings co-movement index is available for only a subset of countries. When we use it, the number of observations is reduced to 375. We estimate the model with year–fixed effects and country–fixed effects when possible. We control for several country–and–year specific factors, such as the GDP per capita, the country and industry Herfindahl indices, and the earnings co-movement index. We additionally control for time–invariant variables, like the geographical size of the country, the variance in GDP growth, and the good government index. In these cases, we estimate the regressions with country-random effects. As in MYY, the dependent variable is transformed into a continuous variable over the range $[-\infty,+\infty]$.[18] We report the results of the estimation in Table 4. Standard errors are adjusted for heteroskedasticity.

[Insert Table 4 here]

The first four regressions in Table 4 confirm the MYY findings. Countries with higher GDP per capita display lower stock price synchronicity. A one standard deviation in GDP per

capita (in logs) is associated with a reduction of 0.31 standard deviations in the total R-squared (based on model I).[19] The GDP per capita is significant in only one specification. As in all the next tables, we provide a test of equality of the coefficients of the ADR dummies. We do not find any differential effect of the ADR dummies on the overall R-squared.

In all specifications but the last one, in which we control for earnings co-movement and hence we have fewer observations, we find that lifting short sales restrictions is associated with an increase in the idiosyncratic portion of stock returns. That is, the description of legal regimes in Section II shows that, in general, more developed markets allow short selling while developing markets restrict it. However, the short–selling indicator remains significant when we allow for both year– and country–fixed effects. This is possible because we have inter-temporal changes in short sales practices for some countries in our sample. In addition, we have cross-sectional variation within each country and year because, for the countries where short sales are not allowed or not practiced, we have a subsample of stocks in each year that is shortable (dual-listed stocks). Moreover, the short sales indicator is significant after controlling for differences in the GDP per capita across countries, and the number of listed firms.

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[18] The transformed R-squared is calculated as $R^{2*} = \log\frac{R^2}{1-R^2}$. Therefore the downside-minus-upside R-squared varies between -∞ and +∞ as well. Results in cross-sectional regressions are similar if we do not apply the transformation.

[19] To calculate the economic significance, we multiply the corresponding coefficient times the standard deviation of the corresponding variable, and divide by the standard deviation of the dependent variable. In the case of the GDP per capita, $-0.31 = -0.146 \times 1.674 \div 0.781$.

In terms of economic significance, short-selling restrictions are associated with a reduction in market co-movement of 0.39 standard deviations (model I in first panel).[20] In other words, the idiosyncratic risk of the average stock increases by 0.39 standard deviations. We find that more liquid markets tend to co-move more. This counterintuitive result is consistent with Dimson and Marsh (1983) who show that betas for illiquid stocks are underestimated when lagged relationships are not accounted for. Finally, and as in MYY, the number of stocks is significantly related to the total R-squared, since as the number of stocks tends to one, the R-squared should mathematically tend to one as well. Unlike MYY, we find no relationship between the good government index and the total R-squared.

Even though the cross-sectional and time-series variation in our sample allows us to identify the effects of short sales restrictions, they can still proxy for other non-observable, country-specific characteristics. The decomposition of R-squared into upside and downside market movements allows us to control for those unobservable factors. In the last two panels of Table 4 we identify a significant decline in both the downside and the upside R-squared coefficients when short sales are allowed and practiced. This is consistent with an overall increase in idiosyncratic risk when shorting prohibitions are removed. We do not find a significant incremental effect of dual-listed stocks in countries where short sales are prohibited, while in general the two R-squared coefficients are larger for dual-listed stocks in countries where short sales are allowed. This evidence is consistent with Foerster and Karolyi (1999), who show that dual-listed stocks suffer an order flow migration from the domestic market to the foreign market. Therefore we should expect domestic returns of dual-listed stocks to be less efficient.

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[20] To calculate the economic significance of a dummy variable, we do not multiply by its standard deviation.

The effect of short sales on the downside R-squared is larger in magnitude than for the upside R-squared. Short sales are associated with a decline of 0.35 standard deviations of the downside R-squared, and 0.30 standard deviations of the upside R-squared. Consistent with Diamond and Verrecchia (1987), we find a positive relationship between the difference downside-minus-upside R-squared and short sales restrictions. Without short sales restrictions the difference in R-squared is 0.19 standard deviations lower (based on model I). The short sales dummy is significant in all models but one.

The effect of short sales on the difference between the downside and the upside R-squared is statistically significant only at the 10% level. Allowing short sales reduces the difference by 9.5%. Therefore, shorting increases efficiency, but the evidence based on R-squared is not too strong.

Dual listing is associated with a reduction in the downside-minus-upside R-squared of 0.34 and 0.24 standard deviations in countries where short sales are prohibited and allowed, respectively. However, the coefficient of ADR1 is not significantly different from zero, and the coefficients of ADR0 and ADR1 are significantly different at the 5% significance level. More liquid markets are associated with less difference between downside and upside R-squared, which is consistent with more liquid markets being more efficient.

C.2. Cross-autocorrelations

In Table 5 we report results of the panel regression estimation.[21] The first panel shows results for the total cross-autocorrelation; the second panel reports the results for the downside-minus-upside cross-autocorrelation; and the last two panels report the results for the downside and upside cross-autocorrelation, respectively.

[Insert Table 5 here]

The speed of price adjustment measured by the total cross-autocorrelation is not significantly related to short-selling restrictions (first panel). We find that the weekly cross-autocorrelation is negatively related (and hence the speed of price adjustment is positively related): (i) to a foreign listing, and irrespective of short sales restrictions, (ii) to liquidity, (iii) economic development, and (iv) the country's Herfindahl index.

When we split the cross-autocorrelation depending on the sign of the market return, we find that short sales are associated with a reduction in the downside cross-autocorrelation. Allowing short sales reduces the downside cross-autocorrelation by 0.81 standard deviations, which is an economically significant effect (from model I). Similarly, dual-listed stocks in countries where short sales are not allowed or not practiced display downside cross-autocorrelations which are 0.65 standard deviations lower than similar, domestic stocks. In countries where short sales are allowed, foreign listing reduces downside cross-autocorrelation by 0.49 standard deviations.

The downside-minus-upside cross-autocorrelation is also significantly related to short sales restrictions. When short sales are allowed and practiced, the difference in cross-

[21] We transformed the correlations so they take values between -∞ and +∞, as $\rho^* = \log\frac{\rho+1}{1-\rho}$. Therefore the downside-minus-upside cross-autocorrelation varies between -∞ and +∞ as well. Results in cross-sectional regressions are similar if we do not apply the transformation.

autocorrelations is 0.59 standard deviations lower.[22] The coefficient is significant at the 10% level only. Taken together, these results provide evidence that short sales constraints make downside price discovery slower, but this evidence is weak at best. Again, ADR0 is statistically and economically significant, and the effect of foreign listing is statistically different in countries where short sales are prohibited compared to countries where they are allowed and practiced.

In sum, our multivariate analyses provide some evidence in favor of Diamond and Verrecchia (1987). Markets where short sales are allowed are more efficient because bad news appears to be more rapidly impounded into prices.

VI. Short sales Restrictions and the Distribution of Stock Returns

In this section we examine the distribution of stock returns conditional upon short sales restrictions. We compute statistics for three different series for each country and group. First we construct weekly stock returns for each firm in our sample with at least 100 daily observations available in a given year. We also construct time series' of weekly returns for the corresponding market indices. Finally, we run, for every year and each firm, regressions specified in equation (3), and save the residuals from the regression as abnormal firm returns. In a market with many systematic shocks, firms' raw returns may primarily reflect systematic shocks and thus the residual may be of interest. Because equity returns are distributed approximately log-normal, we

[22] The coefficient of the short sales dummy ranges from 8% to 9% in the four regressions we specify. The average cross-autocorrelation difference in Table 3 is 1.47%, which seems to suggest that the effect of short sales is large in magnitude. The reason for such a large coefficient is the country effects (whether fixed or random). As an illustration, the average coefficient for the country dummies in model (I) is 0.177 for the group of countries where short sales are not feasible, and -0.21 for the group of countries where sorting is allowed and practiced (a difference of 38%). These averages exclude the countries that have changed regulation during the period.

transform the three groups of returns into their logarithmic representation, and compute the skewness of the distributions. We additionally compute the frequency of extreme returns.

We find some evidence that supports regulators' view that short–selling constraints help prevent financial panics, at least for market returns. There is a strong negative relationship between market skewness and the ability to short. However the distribution of individual stock returns in our sample is insignificantly related to short sales restrictions. There is also an insignificant relationship between the frequency of extreme negative returns and short–selling restrictions.

A. Skewness

Hong and Stein (2003) develop a model in which investors possess different information about the value of a stock. Investors with negative information cannot always use it due to short sales constraints. They would be willing to sell the stock to high–valuation investors, but they do not necessarily own it. The Hong and Stein (2003) model provides a rationale for why stock returns display negative skewness. Their paper predicts that elevated trading volume should be associated with increased negative skewness. Indeed, in the accompanying empirical study, Chen et al. (2002) test the proposition that abnormal turnover is a predictor of negative skewness. They find consistent evidence on a sample of NYSE and AMEX stocks for the period July, 1962 to December, 1998: at the firm level, changes in turnover predict future negative skewness.

A reasonable implication of the Hong and Stein model is that whenever short–selling restrictions are absent, skewness should become *more* negative. The econometric model in the Appendix also shows that, when short sales are prohibited, market skewness is positive, and that skewness decreases when individual stock returns incorporate market information faster. Our

objective in this section is to test this proposition. Table 3 reports univariate results on our three measures of skewness. For domestic stocks, market skewness is positive and larger in the presence of short sales restrictions (0.085 vs. -0.058, significantly different at the 1% level). Individual stock returns skewness is also larger when short sales are prohibited (the difference is significant at the 10% level). Similar patterns characterize skewness in dual-listed stocks.

Given that skewness is almost certainly affected by country– and time–specific effects, we perform a panel regression analysis that controls for these factors. In addition to the country-specific controls, we follow Chen et al. (2001), who find that the de-trended turnover and past market returns are predictors of skewness. We construct the average de-trended turnover for the countries in our sample as follows. We first calculate the de-trended volume by firm, by subtracting the previous-year volume from the current volume.[23] We then calculate the sum of de-trended volumes for all firms in a given country, group of stocks, and year, and divide by the total number of shares outstanding for all the firms in the country-group with available data on volume.[24]

Results from the estimation are in Table 6. We find that short sales restrictions are associated with less negative skewness at the market level. Economically, allowing short sales reduces skewness by 0.30 standard deviations (based on model I). Liquidity is positively and

[23] Note that we lose one year of observations for every firm.

[24] We try an alternative specification that consists of calculating the market turnover first, and then de-trending it. This methodology, similar to Chen et al. (2001), provides qualitatively similar results.

significantly related to skewness. The other controls, including the GDP per capita and the good government index, are insignificant.[25]

[Insert Table 6 here]

The coefficient of the short sales dummy is significant at the one percent level in one specification, and at the five percent level in the other two. This result raises the question of whether we are capturing a reverse causality between skewness and shorting restrictions. We do not have a direct way to rule this out directly here. However, in Section VII we study the five countries that have experienced changes in regulation. We show that in the years before shorting restrictions are lifted, market skewness does not change. Besides, the frequency of negative extreme returns declines before short sales are permitted. Therefore, countries do not relax shorting prohibitions after a period of positive returns. It is still possible that countries ban shorting after a crash. However, in our sample we have only one case where shorting was allowed and after prohibited—Malaysia in 1997.

Moreover, for markets in which short selling is either prohibited or not practiced, there is no evidence that returns display significantly less negative skewness at the individual stock level. Therefore, at the market level, where the welfare effects are greatest and where regulators expect short sales to reduce crashes, it makes a difference whether short sales are allowed and practiced, once we control for macroeconomic factors.

Table 6 is as interesting for what it does not say. We do not find evidence consistent with the theoretical model in Hong and Stein (2003), who theorize that differences of opinion, proxied by the lagged de-trended turnover, should predict more negative skewness. In the last

[25] Bae, Lim, and Wei (2003) find that positive skewness is most profound in stock markets with poor corporate governance. Our results do not support this view, although theirs are based on a cross-section of countries, and not

models in Table 6 (models IV in each panel) we regress the three different measures of skewness on our controls, only for the countries where short sales are not allowed or not practiced. We have 225 observations. The coefficient of the de-trended turnover is not significant. Only for individual stock abnormal returns we find that lagged market returns help predict skewness. However, the coefficient is the opposite of what Hong and Stein (2003) predict.

B. Crashes

Arguably the most important rationale for short sales restrictions is that short selling is responsible for recent market crashes in the world financial market—particularly the 1987 market crash and the 1997 Asian crises. Our objective in this section is to evaluate the empirical evidence for such a view.

The main difficulty in estimating the probability and severity of a market crash conditional upon the existence of short sales restrictions is the Peso problem: we only have data on realized crashes. One alternative is to measure the extent of market drops during crisis events depending upon the existence of short–selling restrictions. However, this would not answer the question of whether crashes are more likely in the presence of short–sellers. If we believe market regulators, short selling may not trigger a crash, but simply make it more severe.

We therefore calculate the number of days in our sample period in which stock returns are below two standard deviations from their previous year average. We divide this number by the total number of trading days, and then compute the frequency of extreme returns. Under the assumption that returns are log-normally distributed, the percentage should equal 2.3%.

[Insert Table 7 here]

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on a panel.

In Table 7 we regress the frequency of extreme results on a set of explanatory variables. Short sales restrictions are insignificantly associated with more frequent extreme negative returns. The evidence from this table suggests that the probability of extreme negative returns is not likely to be a function of short sales practices in countries, but rather determined by other non–specified, country–specific factors. We do find significant differences between dual-listed stocks depending on short sales restrictions: extreme returns are less likely in dual-listed stocks in countries where shorting is allowed, relative to dual-listed stocks in countries where shorting is prohibited (significant difference at the 5% level). Besides, dual-listed stocks display less extreme returns than domestic stocks, in countries where short sales are prohibited.

To summarize—we find strong evidence that market returns become more negatively skewed after sorting becomes feasible; but we also find that negative extreme returns do not become more frequent. That is, shorting is associated not to more frequent negative extreme returns, but certainly to extreme returns that become more negative.

VII. Event Study: Countries with Regulatory Changes

To shed some light on the relationship between short sales constraints and extreme returns, and in order to eliminate a number of the potential cross-sectional differences that might explain the results thus far, in this section we restrict our attention to the sub-set of countries that changed regulations over the period 1990–2001. Essentially this should allow a good hedonic control, country by country, at least under the assumption that the regulatory change is not triggered by shifts in other characteristics. Moreover, this strategy obviates the needs for most controls. These countries are: Hong Kong, Malaysia, Norway, Sweden, and Thailand. In the case of Hong

Kong, Norway, Sweden, and Thailand, short sales restrictions were removed in a specific year (not the same calendar year for each country). In Malaysia—as we detail in section II—short selling was allowed only for the period 1995–1997, and was then prohibited again in August 1997 at the onset of the Asian financial crises. For Malaysia, we only consider the period January 1990-August 1997.[26]

[Insert Table 8 here]

Table 8 reports the frequency of extreme events and the market skewness for the five countries, around the year in which short sales become effective, as well as the R-squared and cross-autocorrelation measures. We further classify stocks into dual-listed and domestic, and calculate the average within each group by year-to-event.

For the average domestic stock, there is a clear decline in R-squared, which is consistent with Campbell, Lettau, Malkiel, and Xu (2001), and shows an overall increase in idiosyncratic risk. Such decline happens for both the downside and the upside R-squared. Figure 3 display the time series of the downside R-squared by country, and shows that the decline is not driven by a particular country. The downside R-squared is consistently larger than the upside R-squared, and their difference declines over time around the change of the short sales regulation. Such pattern is not so clear when looking at cross-autocorrelations: the total cross-autocorrelation declines, but the downside-minus-upside difference does not.

[Insert Figure 3 here]

[26] Because we want to have as many observations as possible after short sales are allowed, we include in our event study the first eight months of 1997. This means that market skewness and extreme negative return calculations include one month of the Malaysian currency crises (the Thai Baht was devalued in July 1997).

The frequency of extreme returns drops from 13.34% in year -7 to 4.80% in year +7. However in Sweden, the frequency of extreme results is higher after 1992 than in 1991, when short–selling restrictions are lifted. Moreover, in Norway the effect of short sales is a reduction of the percentage of extreme returns one year after the law change, but a dramatic increase in years +3 and +4 (see Figure 3). We obtain similar results for market skewness. It therefore seems that the effect of short sales on crashes may be somewhat country–specific, and the univariate results do not provide conclusive results.

[Insert Table 9 here]

In Table 9 we provide statistical evidence on the changes in market efficiency and the probability of crashes. We divide observations into two groups—when short sales are prohibited and when short sales are allowed—and compute differences in means and medians for the same variables. We use firm-year-level data for R-squared coefficients, cross-autocorrelations, and the frequency of extreme negative returns (around 15,000 observations in total) and we use country-year-level data for market skewness (77 observations in total). The sample of dual-listed stocks is small, so statistical inferences are difficult. However, for the sample of domestic stocks, we find declines in the downside-minus-upside R-squared (from 5.80% to 3.03% on average, significantly different at the 1% level), and in the downside-minus-upside cross-autocorrelation (from 0.03% to -0.20%, insignificantly different). We also find a significant decline in the frequency of extreme negative returns (from 7.73% to 6.20%). There are no significant changes in the market skewness.

[Insert Table 10 here]

Finally, in Table 10 we run panel regressions with country- and year-fixed effects.[27] Observations are country-year averages for all variables. Consistent with Table 9, we find a decline in the downside-minus-upside cross-autocorrelation, which is both statistically and economically significant: a regulatory change to allow short sales reduced the downside-minus-upside cross-autocorrelation by 0.80 standard deviations. Results for R-squared are not significant, which shows that the reduction in R-squared identified before maybe a pure time effect unrelated with changes in regulation.

The event study also provides evidence in favor of regulators' claims that short sales make crashes more likely. After short sales are allowed in the five countries with regulatory changes, we find that the distribution of domestic stocks is more negatively skewed, and that the frequency of extreme negative returns increases. This contradicts our own earlier univariate results, which do not take secular effects into account. In terms of economic significance, removing short sales restrictions reduces the market skewness 1.38 standard deviations, and increases the frequency of extreme market returns 0.77 standard deviations. Whether stocks are dual listed or not in countries where short sales are prohibited, does not seem to make a difference. However, this result must be taken with caution since there are only five country-year observations where ADR0 equals one.

VIII. Kernel Estimation of Return Distributions

[27] We do not control for time-invariant variables like the size of the country or the quality of government index. They are not significant in random-effect regressions, and they do not change the qualitative effect of the other variables.

Thus far, we have looked at various statistics of conditional distributions. It is also instructive to look at the return densities themselves. We perform a kernel estimation of a density function of stock returns with and without short sales constraints that fits the distribution of returns.[28] The advantage of the kernel estimation is that we do not need to constrain the distribution to be normal, or even symmetric.

[Insert Figure 4 here]

We estimate the kernel density for the market returns, both for the total sample and for the sub-sample of countries with regulatory changes, depending on whether short sales are allowed or not, and depending on whether stocks are dual-listed or not. Figure 4 plots the histograms of returns, as well as the densities, depending on the existence of short–selling restrictions. Confirming the results in Table 3, Figure 4 shows that (i) the distribution of returns is more leptokurtotic when short sales are allowed and practiced; and (ii) the distribution of

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[28] The general form of the kernel density estimator is:

$$\hat{f}_\lambda(x) = \frac{1}{n_\lambda} \sum_{i=1}^{n} N\left(\frac{x - x_i}{\lambda} \right)$$

where N(·) is the kernel function, that we specify to be standard normal, λ is the bandwidth parameter, n is the sample size, and xi is the ith observation. The kernel density minimizes the mean integrated squared error ηλ:

$$\eta_\lambda = \int_x \left\{ E\left(\hat{f}_\lambda(x) - f(x) \right)^2 \right\} dx + \int_x Var\left(\hat{f}_\lambda(x) \right) dx$$

where λ is the one that minimizes the estimated mean integrated square error:

$$\hat{\eta}_\lambda = \frac{1}{4} \lambda^4 \left(\int_t t^2 N(t) dt \right)^2 \int_x \left(f''(x) \right)^2 dx + \frac{1}{n\lambda} \int_t \left(N(t) \right)^2 dt$$

We additionally consider values for λ=0.5 and λ=1.

returns is not symmetric. Focusing on the subsample of domestic stocks, there is an apparent difference in skewness between stocks in countries where short sales are allowed and practiced, and countries where short sales are prohibited, at least in countries where regulation has changed in the period 1990-2001. This is consistent with our results in Section VIII.

IX. Short sales Constraints and the Existence of Derivatives Market

Although we have focused the paper on the effect of short sales constraints, it is well known that a short position can be replicated using derivatives.[29] Therefore, if there are countries with short sales constraints, which also allow the trading of put options, this may be relevant to our analysis. In this section we analyze the effect of derivatives on our measures of market efficiency and on the distribution of stock returns when short sales are restricted.

One important issue is that short sales constraints may inhibit efficient option price discovery. Klemkosky and Resnick (1979), investigate the relationship between short sales restrictions and put-call parity.[30] They find that approximately 55% of all put-call parity violations are due to short sales restrictions. Ofek, Richardson, and Whitelaw (2004) find similar results when they incorporate the effect of the early exercise premium of American options. Lamont and Thaler (2003) argue that irrational investors may not use the options

[29] Figlewski (1989, 1993) finds that there is significantly higher average level of short interest exhibited by optionable stocks and option prices are related to short interest. This suggests that options facilitate short selling and also facilitate information diffusion.

[30] See also Danielsen and Sorescu (1999).

market,[31] and therefore violations of put-call parity may signal irrational mispricing of the underlying stock. Cao, Chen, and Griffin (2004), on the other hand, find evidence that considerable price discovery takes place in the options market. Mayhew and Mihov (2004) examine the issue of whether options markets substitute for the ability to sell short. They argue that, in the presence of short sales restrictions, introducing options should make it easier for investors to take synthetic short positions, and therefore there should be a negative market reaction to the introduction of a new option contract. However, they fail to find such an impact in their empirical tests. Thus, the evidence on the role of options in efficient price discovery is mixed, and the question of whether options facilitate downside price discovery when short sales are restricted remains an open empirical question.

In this section we examine the effects of having derivatives markets on our measures of efficiency, skewness and market crashes, when short sales are not allowed or not practiced. Charoenrook and Daouk (2004) survey 111 countries and collect information on the ability to short and the ability to write puts. They use this to study conditional skewness. We combine their data into ours, and find that, out of the 46 countries we consider, there are 11 countries which had, during at least one year, well-functioning put option markets but where short sales were not allowed or not practiced.[32] These cases account for 53 country-year observations out of a total of 535 observations.

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[31] Indeed Lamont and Stein (2004) find that, in the presence of shorting constraints, investors do not substitute options for short positions.

[32] The markets where put options are available but short sales are not are: Brazil in 1990-2001, Chile in 1995-1999, Spain in 1993-2001, Finland in 1990-2001, Greece in 2001, Hong Kong in 1994-1995, Israel in 1994-2001, South Korea in 1998-2001, Norway in 1991-1995, Poland in 2001, and Sweden in 1990.

We construct a dummy variable that equals 1 when put options are feasible, but short sales are not, and re-estimate our previous regressions.[33] In Table 11 we report a summary of our results. We regress the downside-minus-upside R-squared coefficient and cross-autocorrelation, market skewness, and the frequency of extreme negative returns, on all of our time-variant control variables—so we can estimate the regressions with country-fixed effects. We also run two sets of regressions, one with the entire sample, and another one with the countries that experience changes in regulation over the sample period, as described in the previous section.

[Insert Table 11 here]

We do not find the effect of put options to be significant in the presence of short selling restrictions. None of our variables—with the exception of the downside-minus-upside R-squared in the restricted sample—can be significantly explained by put options alone. The significance of the short sales dummy is preserved, if anything with a lower economic significance. Interestingly, controlling for short sales, put options are associated with a reduction rather than an increase in market efficiency, based on R-squared differences in the subsample of five countries: the coefficient of the put-option dummy is positive and significant at the 5% level, which is essentially driven by Norway and, to a lesser extent, by Sweden and Hong Kong. This means that put options alone reduce our R-squared measure of market efficiency by about one standard deviation, and it is consistent with Lamont and Thaler (2003), and Mayhew and Mihov (2004).

[33] Note that, when short sales are allowed, it is irrelevant whether derivatives trading is possible or not for investors to trade on negative information, since put options can be replicated with a bond and a short position on stocks. That is why we do not consider the opposite case of countries where short sales are permitted, but put option trading is not.

X. Conclusions

Restrictions on short selling of shares are nearly as old as stock markets themselves. Critics often view short sales as immoral—the exploitation of others' misfortune and an exacerbating factor in periods of market crisis. As recently as the Asian currency crisis of 1997, short–sellers were blamed by politicians and journalists for helping to destroy the "Asian Miracle." In the current environment with the growth of hedge funds, concerns about the danger of allowing speculation frequently surface. There is at least some common suspicion that short selling can exacerbate market crashes. Most academic researchers, however, make a strong theoretical case for allowing short sales in markets. Their case is based upon the notion that markets exist to facilitate the efficient pricing of assets, and that restricting short sales reduces market efficiency. Recent empirical evidence by researchers provides some support for the hypothesis that difficulty in short selling is associated with security mispricing. In this paper, we survey short–selling regulations and practices for major stock markets around the world. We find empirical evidence in support of the academic view. We use a sample of countries with time-series as well as cross-sectional differences in short sales practice. Within countries where short sales are not allowed or not practiced, we additionally consider the subsample of stocks that list in either the U.S. or the U.K., and which are therefore shortable. Using market efficiency measures based on asymmetries in individual stock responses to market returns, we find a negative association between short sales restrictions and the diffusion of negative information into prices. Our analysis of the statistical characteristics of markets, specifically the skewness of log returns, provides some interesting support for the commonly held regulatory view that short sales restrictions are associated with less negative skewness in market returns.

References

Abreu, D., Brunnermeier, M.K., 2001, Bubbles and crashes, *Econometrica*, forthcoming

Abreu, D., Brunnermeier, M.K., 2002, Synchronization risk and delayed arbitrage, *Journal of Financial Economics* 66, 341-360

Aitken, Michael, Alex, Frino, Michael S. McCorry, and Peter L. Swan, 1998, "Short Sales Are Almost Instantaneously Bad News: Evidence from the Australian Stock Exchange," *Journal of Finance*, 2205-2223

Allen, Franklin, and Douglas Gale, 1991, "Arbitrage, Short Sales, and Financial Innovation," 1991, *Econometrica* 59(4), 1041-1068

Asquith, P., and Meulbroek, L., 1995, An empirical investigation of short interest, working paper, Harvard Business School

Bae, Kee-Hong, Chan-Woo Lim, and K.C. John Wei, 2003, "Corporate Governance and Conditional Skewness in the World's Stock Markets," working paper.

Bekaert, Geert, and Campbell R. Harvey, 2000, "Foreign Speculators and Emerging Equity Markets," *Journal of Finance*, 565-613

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2003, "Liquidity and Expected Returns: Lessons from Emerging Markets," working paper.

Bernardo, Antonio, and Ivo Welch, 2004, "Liquidity and Financial Market Runs," *Quarterly Journal of Economics* 119, 135-158.

Biais, Bruno, Christophe Bisiere, and Jean-Paul Decamps, 1999, "Short sales constraints, Liquidity and Price Discovery: An Empirical Analysis on the Paris Bourse," *European Financial Management* 5(3), 395-409

Bris, Arturo, William N. Goetzmann, and Ning Zhu 2004, "Short Sales in Global Perspective," in Frank Fabozzi, ed., The Theory and Practice of Short-Selling, Wiley, forthcoming.

Campbell, John Y., Martin Lettau, Burton G. Malkiel and Yexiao Xu , 2001, "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk," *Journal of Finance* 56(1), 1-43

Cao, Charles Q., Zhiwu Chen, and John M. Griffin, 2004, "Informational Content of Option Volume Prior to Takeovers," *Journal of Business*, forthcoming.

Charoenrook, Anchada, and Hazem Daouk, 2004, "The World Price of Short Selling", working paper.

Chen, Joseph, Harrison Hong, and Jeremy C. Stein, 2001, "Forecasting Crashes: Trading Volume, Past Returns, and Conditional Skewness in Stock Prices," *Journal of Financial Economics 61(3)*, 345-381.

Chen, Zhiwu, 1995, "Financial Innovation and Arbitrage Pricing in Frictional Economies," *Journal of Economic Theory*, 65(1), February, 117-135.

Chen, Zhiwu, 2001, "Viable Costs and Equilibrium Prices in Frictional Securities Markets," *Annals o Economics and Finance*, 2(2), 297-323.

D'Avolio, Gene, 2002, "The Market for Borrowing Stock," *Journal of Financial Economics*, 66(2), pages 271-306.

Danielsen, B., Sorescu, S., 2001, "Why do option introductions depress stock prices? A study of diminishing short sales constraints," *Journal of Financial and Quantitative Analysis* 36, 451-484

De Marchi, Neil and Paul Harrison, 1994, "'Trading in the Wind' with Guile: The Troublesome Matter of the Short Selling of Shares in Seventeenth Century Holland," *History of Political Economy* Supplement, 26(0), pages 47-65.

DeLong, J.B., Shleifer, A., Summers, L.H., Waldmann, R.J., 1990, "Noise trader risk in financial markets," *Journal of Political Economy* 98, 703-738.

Diamond, Douglas W., and Robert E. Verrecchia, 1987, "Constraints on Short–selling and Asset Price Adjustment to Private Information," *Journal of Financial Economics 18(2)* June, 277-311

Dillen, J.G. van, 1930, "Isaac Le Maire en de Handle in Action der Oost-Indische Companie," *Economisch-historisch Jaarboek.*

Dimson, Elroy, and Paul Marsh, 1983, "The Stability of U.K. Risk Measures and the Problem of Thin Trading," *Journal of Finance* 38, 753-783.

Duffie, Darrell, Nicholae Garleanu, and Lasse Heje Pedersen, 2002, "Securities Lending, Shorting and Pricing," *Journal of Financial Economics* 66(2), pages 307-339.

Duffie, Darrell., 1996, "Special repo rates," *Journal of Finance* 51, 493-526

Erzo G. J. Luttmer, 1996, "Assessing Specification Errors in Stochastic Discount Factor Models," *Econometrica* 64(6), 1439-1467.

Figlewski S., Webb, G.P., 1993, "Options, Short Sales, and Market Completeness," *Journal of Finance* 48, 761-777

Figlewski S., 1989, "Option Arbitrage in Imperfect Markets," *Journal of Finance* 44, 1289-1311

Foerster and Karolyi, 1999, "The Effects of Market Segmentation and Investor Recognition on Asset Prices: Evidence from Foreign Stocks Listing in the U.S.," *Journal of Finance* 54, 981-1014.

Geczy, Christopher C., David K. Musto, and Adam V. Reed, 2002, "Stocks Are Special Too: An Analysis of the Equity Lending Market," *Journal of Financial Economics* 66, 241-269.

Hansen, Lars Peter, and Ravi Jagannathan, 1997, "Assessing Specification Errors in Stochastic Discount Factor Model," *Journal of Finance*, 52(2) June, 557-590.

He, Hua, and David Modest, 1995, "Market Frictions and Consumption-based Asset Pricing," *Journal of Political Economy*, 103(1), 94-117.

Hong, Harrison, Terence Lim, and Jeremy C. Stein, 2000, "Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies," *Journal of Finance* 55, 265-295.

Hong, Harrison and Jeremy C. Stein, 2003, "Differences of Opinion, Short sales Constraints and Market Crashes," *Review of Financial Studies* 16, 487-525.

Hou, Kewei, and Tobias J. Moskowitz, 2004, "Market Frictions, Price Delay, and the Cross-Section of Expected Returns," *Review of Financial Studies*, forthcoming.

International Securities Services Association Handbook, 2002.

Jegadeesh Naramsimhan and Sheridan Titman, 1995, "Overreaction, Delayed Reaction and Contrarian Profits," *Review of Financial Studies* 8, 973-993.

Jouini, E and H, Kallal ,2001, "Efficient Trading Strategies in the Presence of Market Frictions," *Review of Financial Studies* 14(2), 343-369

Jones, Charles and Owen Lamont, 2002, "Short sales Constraints and Stock Returns," *Journal of Financial Economics*, 66(2), 207-239.

Klemkosky Robert C., and Bruce G. Resnick, 1979, "Put-Call Parity and Market Efficiency," *Journal of Finance* 34, 1141-1155.

La Porta R., Lopez-de-Silanes, Shleifer, A., Vishny, R.W., 1997, "Law and Finance," *Journal of Political Economy* 106, 1112-1155.

Lamont, Owen, and Jeremy C. Stein, 2004, "Aggregate Short Interest and Market Valuations," *American Economic Review* 94, 29-32

Lamont, Owen, and Richard H. Thaler, 2003, "Can the Market Add and Substract? Mispricing in Tech Stock Carve-outs", *Journal of Political Economy* 21, 227-268.

Li, Lianfa, and Belton M. Fleisher, 2002, "Heterogeneous Expectations and Stock Prices in Segmented Markets: Application to Chinese Firms," working paper, Ohio State University.

Lo, Andrew W., and A. Craig MacKinlay , 1990, "An econometric analysis of nonsynchronous trading," Journal of Econometrics 45, 181-211.

Mayhew, Stewart, and Vassil Mihov, 2004, "Short sales Constraints, Overvaluation, and the Introduction of Options", working paper.

Montias, John Michael, 1989, *Vermeer and His Milieu*, Princeton Press, Princeton, NJ.

Mørck, Randall, Bernard Yeung, and Wayne Yu, 2000, "The Information Content of Stock Markets: Why do Emerging Markets Have Synchronous Stock Price Movement," *Journal of Financial Economics*, 58(1), pages 215-260.

Ofek, Eli, and Matthew Richardson, 2003, "DotCom Mania: The Rise and Fall of Internet Stock Prices," *Journal of Finance* 58, 1113-1137.

Ofek, Eli, Matthew Richardson, and Robert F. Whitelaw, 2004, "Limited Arbitrage and Short Sales Restrictions: Evidence from the Options Markets", *Journal of Financial Economics*, forthcoming.

Poitras, Geoffrey, 2002, "Short sales restrictions, Dilution and the Pricing of Rights Issues on the Singapore Stock Exchange, " *Pacific Basin Finance Journal* 10(2), 141-62.

Reed, Adam, 2003, "Costly short-selling and stock price adjustment to earnings announcement," working paper, University of North Carolina.

Ross, Stephen A., 1976, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory* 13, 341-360.

Scheinkman, Jose, and Wei Xiong, 2003, "Overconfidence and Speculative Bubbles," *Journal of Political Economy* 111, 2003, 1183-1219

Untermyer, Samuel, 1915, "Speculation on Stock Exchanges and Public Regulations of the Exchanges," *American Economic Review* 5(1), 24-68.

World Directory of Securities Lending and Repo, *International Securities Finance Magazine*.

Country	When was short selling allowed	When was securities lending allowed	Whether Short Selling is Practiced	Comments
Argentina	Allowed in 1999	Allowed in 1991	No	Equity lending is rare and occurs only between brokers. Short-selling cannot last more than 360 days in a row. Only allowed for 16 stocks.
Australia	Before 1990	Before 1990	Yes	Securities can be borrowed from ASX and counter party. Cash and non-cash collateral are accepted at 105-110% of the underlying value of the loan securities. Collateral is marked-to-market daily.
Austria	Before 1990	Before 1990	Yes	
Belgium	Before 1990	Before 1990	Yes	There is no organized market for stock lending and borrowing. A law on securities lending was passed in March 1999 but still pending. There is no official regulation on short selling stocks.
Brazil	Before 1990	Before 1990	No	CBLC has been authorized to maintain a securities lending program. Under CVM Instruction No. 249, only entities which offer settlement, registration, and custody services in the Brazilian market are authorized to provide securities lending services. Accordingly, foreign investors are not authorized to engage in directed/discretionary lending activities that are outside the CBLC program.
Canada	Before 1990	Before 1990	Yes	The market for securities lending is large (40+ billion dollar business)and well developed.
Chile	Allowed in 1999	Allowed in 1999	No	Short-selling cannot last more than 360 days in a row. The entity (including individuals) who is lending the stocks maintains the beneficial ownership, except the right to vote.
China	Not allowed	Not allowed	No	
Colombia	Not allowed	Not allowed	No	Securities lending is not authorized.
Czech Republic	Before 1990	Before 1990	Yes	There is no regulations on short selling since Prague Stock Exchange (PSE) was opened in 1993. It is possible to sell securities only if absent securities are bought or borrowed before the settlement date.
Denmark	Before 1990	Before 1990	Yes	No regulatory barriers inhibiting securities lending.
Finland	Allowed in 1998	Before 1990	No	The transfer tax laws place a serious burden on the activity.
France	Before 1990	Before 1990	Yes	Securities lending is permitted by law in 1987 and 1988. All establishments (domestic and foreign) are eligible for short-selling as long as they are recognized as counter parties.
Germany	Before 1990	Before 1990	Yes	A securities lending facility was created in 1989 to improve market liquidity.
Greece	Not allowed	Not allowed	No	Securities lending and borrowing have been legalized by the Greek Parliament but the operational framework has yet to be established.
Hong Kong	Allowed in 1996	Before 1990	Yes	Short selling is allowed for 33 stocks in 1994, and then to a wide range of stocks in 1996.
Hungary	Allowed in 1996	Allowed in 1996	No	The 1996 Act CXI does not prohibit short sales. However, the volume is very limited
Indonesia	Not allowed	Allowed in 1996	No	No guidelines have been provided by BAPEPAM, The Indonesian Regulatory Authority for the Indonesian Capital Market.
Ireland	Before 1990	Before 1990	Yes	Securities lending volume is still limited.
Israel	Before 1990	Before 1990	No	The TASE does not offer a securities lending program to its members. TASE rules indicate that the securities account of a TASE member at clearing house may not enter into a short position intentionally.
Italy	Before 1990	Before 1990	Yes	
Japan	Before 1990	Before 1990	Yes	Allowed for stocks listed on the first section of the exchanges.
Luxembourg	Before 1990	Before 1990	Yes	
Malaysia	Allowed in 1995, Prohibited again in 1997	Allowed in 1995, Prohibited again in 1997	Yes	Short seling and securities lending were suspended during the regional financial crisis of 1997. With the economic recovery, improvements in reporting requirements, prudential controls and the cessation of trading of KLSE-listed securities offshore, short selling and securities lending are expected to be restored restored.
Mexico	Before 1990	Before 1990	Yes	The system is generally used as a safeguard against failing to deliver rather than securities lending as a product. Foreign investors are eligible to participate in securities lending through a local broker. Margin is 150%.
Netherlands	Before 1990	Before 1990	Yes	There is a central lending facility at the ASE.
New Zealand	Allowed in 1992	Not allowed	No	Tax regulations prevents onshore securities lending from taking off.

Country	When was short selling allowed	When was securities lending allowed	Whether Short Selling is Practiced	Comments
Norway	Allowed in 1992	Allowed in 1996	Yes	Securities lending is still in the early stages of development and tax implications are being discussed at the Ministry of Finance.
Pakistan	Not allowed	Not allowed	No	There are no regulations that restrict foreign investors from lending or borrowing securities. Short selling is not allowed.
Peru	Not allowed	Not allowed	No	Off shore lending is prohibited. Lima Stock Exchange is considering allowing new activities such as securities lending, short selling and new repo trades in the future.
Philippines	Allowed in 1998	Allowed in 1998	No	Although the SEC has approved the rules on SBL and short selling, the rules are not yet clearly defined in the market.
Poland	Allowed in 2000	Before 1990	No	Neither the full legal nor operational framework have been established.
Portugal	Before 1990	Before 1990	Yes	Securities lending is allowed and practiced. BVLP charges 10 b.p. annualized over the initial value (maximum days for calculation is 45) for this service.
Singapore	Not allowed	Before 1990	Yes	Onshore lending is limited while offshore lending is active.
South Africa	Before 1990	Before 1990	Yes	Short selling is always allowed in JSE.
South Korea	Not allowed	Before 1990	No	Securities lending and borrowing has not been active to date.
Spain	Allowed in 1992	Allowed in 1992	No	Securities lending and short selling is available since 1992. Since July 1994, SCLV has acted as principal for the lending pool formed by the daily bids from the clearing members. The load must be reported to the SCLV within two working days of the sale date.
Sweden	Allowed in 1991	Allowed in 1991	Yes	Widely practiced.
Switzerland	Before 1990	Before 1990	Yes	Securities lending is legal in Switzerland and there are no restrictions on who may borrow or lend. There is no central lending facility and no stamp duties apply to securities lending.
Taiwan	Before 1990	Before 1990	No	Qualified Foreign Institutional Investors (QFIIs) are prohibited from borrowing securities on-shore and can only lend securities on-shore to brokers to cover their fails. Margin trades and short selling are not allowed for institutional investors. Besides, dealers cannot buy at daily up-limit and sell at daily down-limit. In contrast, major shareholders of listed companies are required to file to the securities authority before they sell their holdings. Individual investors who meet certain qualifications of age, actual trading records and financial integrity can apply for margin accounts, which can be opened with eligible brokers or securities finance companies. The securities eligible for margin trading are common stocks and beneficiary certificates meeting the standards Governing Margin Purchase and Short Sale of Securities. Since the Asian financial crisis the authorities in Taiwan have been prohibiting investors from short selling when share is trading below previous day's close. .
Thailand	Allowed in 1997	Allowed in 1999	Yes	Short selling is very limited after being allowed in 1999.
Turkey	Before 1990	Allowed in 1996	No	Securities lending is not widely practiced.
United Kingdom	Before 1990	Before 1990	Yes	Short selling is active in UK.
United States	Before 1990	Before 1990	Yes	
Venezuela	Not allowed	Not allowed	No	Securities lending is not specifically prohibited or provided for under current regulations. Free transfers of securities between different beneficial owners cannot be done without executing a trade on the exchange. Off-shore lending is generally not practiced.
Zimbabwe	Not allowed	Not allowed	No	

Table 1. Short Selling Restrictions Around the World

For each country in the sample, the table describes the date where short selling was allowed if this happened on or after 1990. Otherwise countries are classified as 'Allowed Before 1990', or 'Not Allowed'. Securities Lending refers to the ability of an investor to borrow securities from another party. Short Selling refers to the ability of an investor to sell a borrowed security to a third party. Short Selling is practiced when there are indications from market participants, market regulators, or institutions within a country, that short selling is a common practice. Data is obtained from the Global Network Management Division at Morgan Stanley Dean Witter, the International Securities Lending at Goldman Sachs, the corresponding market regulators, the International Securities Services Association Handbook, and practitioners listed in the *Worldwide Directory of Securities Lending and Repo.*

		1990-1993	1994-1998	1999-2001
All Countries	**Shortable**	**$158,923**	**$933,524**	**$1,991,153**
	Non-Shortable	**$407,657**	**$2,812,947**	**$3,573,801**
	Ratio	**28.05%**	**24.92%**	**35.78%**
Argentina	Shortable	$810	$102,431	$62,115
	Non-Shortable	$22,995	$154,631	$61,188
	Ratio	3.40%	39.85%	50.38%
Brazil	Shortable	NA	$2,385	$41,217
	Non-Shortable	NA	$168,610	$565,240
	Ratio		1.40%	6.80%
Chile	Shortable	NA	$8,303	$892
	Non-Shortable	NA	$3,576	$37
	Ratio		69.90%	96.01%
China	Shortable	NA	$8,303	$892
	Non-Shortable	NA	$628,297	$1,435,108
	Ratio		1.30%	0.06%
Colombia	Shortable	NA	$14,220	$582
	Non-Shortable	NA	$68,272	$20,787
	Ratio		17.24%	2.72%
Finland	Shortable	$253	$82,214	$571,223
	Non-Shortable	$53,510	$224,591	$241,469
	Ratio	0.47%	26.80%	70.29%
Greece	Shortable	NA	$1,361	$51,348
	Non-Shortable	NA	$48,946	$238,443
	Ratio		2.71%	17.72%
Hungary	Shortable	NA	$2,296	$2,343
	Non-Shortable	NA	$26,582	$43,094
	Ratio		7.95%	5.16%
Indonesia	Shortable	NA	NA	$66,660
	Non-Shortable	NA	NA	$316,465
	Ratio			17.40%
Israel	Shortable	$2,110	$24,733	$34,194
	Non-Shortable	$18,923	$91,540	$102,163
	Ratio	10.03%	21.27%	25.08%
New Zealand	Shortable	$10,176	$46,808	$21,588
	Non-Shortable	$20,497	$112,522	$60,186
	Ratio	33.18%	29.38%	26.40%
Peru	Shortable	NA	$4,113	$2,373
	Non-Shortable	NA	$29,743	$20,307
	Ratio		12.15%	10.46%
Philippines	Shortable	NA	$18,807	$9,737
	Non-Shortable	NA	$230,701	$84,146
	Ratio		7.54%	10.37%
Poland	Shortable	NA	$985	$34,243
	Non-Shortable	NA	$8,612	$50,643
	Ratio		10.26%	40.34%
South Korea	Shortable	NA	$209,350	$329,457
	Non-Shortable	NA	$313,001	$271,694
	Ratio		40.08%	54.80%
Spain	Shortable	$145,574	$375,643	$562,408
	Non-Shortable	$291,732	$665,280	$646,334
	Ratio	33.29%	36.09%	46.53%
Taiwan	Shortable	NA	$39,015	$199,381
	Non-Shortable	NA	$600,307	$663,270
	Ratio		6.10%	23.11%
Turkey	Shortable	NA	$859	$1,393
	Non-Shortable	NA	$66,035	$188,332
	Ratio		1.28%	0.73%

Table 2. World Market Capitalization and Short-Sales Restrictions. Countries where Short Sales are Not Allowed / Not Practiced

This table classifies the World Market capitalization into shortable and non-shortable, for countries where short sales are not allowed / not practiced. Market Capitalization is in US$ millions. To calculate the numbers in these columns we have taken into account firms in countries where short sales are not allowed / not practiced, that list in markets where short sales are allowed and practiced, in particular the U.S. (NYSE and Nasdaq) and the U.K. (LSE). Pakistan, Venezuela, and Zimbabwe are not included in the table because we do not have data available on dual-listed firms from these countries.

Domestic Stocks

	R-Squared	Upside R-Squared	Downside R-Squared	Difference Downside minus Upside	Cross-Autocorrelation	Upside Autocorrelation	Cross-Downside Cross-Autocorrelation	Difference Downside minus Upside	Frequency of Extreme Negative Returns	Market Skewness	Mean Skewness of Individual Stock Returns	Mean Skewness of Individual Residual Returns	Market Turnover (Detrended)	Market Return
Short Sales Not Allowed / Not Practiced														
Number of Observations	258	258	258	258	258	258	256	256	259	258	258	258	257	259
Mean	19.38%	12.73%	14.57%	1.84%	3.66%	2.89%	4.51%	1.61%	8.58%	0.0854	0.1142	0.0517	0.0922	12.41%
Median	16.99%	11.33%	12.14%	1.17%	3.48%	3.06%	4.92%	1.79%	6.17%	0.1201	0.0863	0.0307	-0.2008	9.90%
Short Sales Allowed And Practiced														
Number of Observations	277	277	277	277	277	277	276	276	277	277	277	277	273	277
Mean	12.87%	9.09%	11.26%	2.17%	2.69%	2.03%	3.36%	1.34%	6.00%	-0.0585	0.0472	0.0357	0.1196	12.16%
Median	9.74%	7.28%	8.88%	2.08%	2.49%	2.04%	3.10%	1.11%	4.93%	-0.0479	0.0561	0.0435	-0.0768	9.78%
Difference (p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0053)	(0.0854)	(0.9690)	(0.0496)	(0.6012)	(0.0001)	(0.0041)	(0.0976)	(0.8058)	(0.5522)	(0.6486)
Whole Sample														
Number of Observations	535	535	535	535	535	535	532	532	536	535	535	535	530	536
Mean	16.01%	10.85%	12.85%	2.01%	3.16%	2.44%	3.91%	1.47%	7.25%	0.0109	0.0795	0.0434	0.1063	12.28%
Median	13.35%	9.07%	10.56%	1.73%	2.94%	2.44%	3.92%	1.38%	5.41%	0.0152	0.0672	0.0394	-0.1526	9.84%

Dual-listed Stocks

Short Sales Not Allowed / Not Practiced														
Number of Observations	113	113	113	113	161	161	160	160	161	160	160	160	154	161
Mean	39.75%	31.44%	31.76%	0.32%	2.86%	3.51%	2.24%	1.30%	7.95%	0.0271	0.0387	-0.0343	-0.2488	8.63%
Median	39.03%	28.28%	27.04%	0.26%	2.34%	3.65%	2.93%	1.71%	2.55%	0.0857	0.0886	-0.0129	-0.4071	5.30%
Short Sales Allowed And Practiced														
Number of Observations	186	186	186	186	216	216	216	216	216	228	216	216	185	228
Mean	30.75%	22.29%	24.10%	1.81%	1.91%	3.02%	0.79%	2.23%	6.31%	-0.0313	-0.0037	0.0168	-0.1097	11.15%
Median	27.34%	19.08%	19.95%	2.26%	1.87%	3.14%	0.41%	3.07%	2.68%	-0.0505	0.0163	0.0078	-0.3943	11.40%
Difference (p-value)	(0.0000)	(0.0001)	(0.0000)	(0.2124)	(0.6953)	(0.1759)	(0.5505)	(0.2211)	(0.0678)	(0.0077)	(0.0255)	(0.8757)	(0.2061)	(0.4639)
Whole Sample														
Number of Observations	299	299	299	299	377	377	376	376	377	388	376	376	339	389
Mean	34.15%	25.74%	26.99%	1.25%	2.31%	3.23%	1.41%	1.83%	7.01%	-0.0072	0.0144	-0.0049	-0.1729	10.11%
Median	32.08%	21.52%	22.46%	1.44%	2.00%	3.27%	1.05%	2.28%	2.68%	0.0118	0.0443	0.0023	-0.4047	8.34%
Short-Sales Not Allowed / Not Practiced: Difference Dual-listed Stocks -Domestic Stocks	(0.0000)	(0.0000)	(0.0000)	(0.2126)	(0.0000)	(0.0000)	(0.2645)	(0.7718)	(0.0000)	(0.9953)	(0.8233)	(0.4396)	(0.0000)	(0.5287)
Short-Sales Allowed and Practiced: Difference Dual-listed Stocks -Domestic Stocks	(0.0000)	(0.0000)	(0.0000)	(0.0217)	(0.0000)	(0.1207)	(0.5401)	(0.0908)	(0.0000)	(0.8793)	(0.1053)	(0.6273)	(0.0036)	(0.8330)
Whole Sample: Difference Dual-listed Stocks - Domestic stocks	(0.0310)	(0.7332)	(0.5321)	(0.5946)	(0.0000)	(0.0001)	(0.2723)	(0.6398)	(0.0000)	(0.9493)	(0.2474)	(0.4253)	(0.0000)	(0.9046)
Whole Sample: Difference Short Sales Allowed-Prohibited	(0.0000)	(0.0000)	(0.0000)	(0.0077)	(0.0000)	(0.0000)	(0.0000)	(0.1119)	(0.0530)	(0.0001)	(0.0048)	(0.9273)	(0.3159)	(0.4357)

Table 3. Descriptive Statistics

Mean and Median values of the variables used in the paper, classified by Domestic / Dual-listed stocks, as well as by Short-Sales Regulation. For each country in our sample, for every year T, and for Domestic and Dual-Listed Stocks, we calculate the R-squared in two modified market regressions of individual stock returns on the domestic market index, and the world market index, where we use only either positive or negative market returns. We then compute the corresponding R-squared coefficients, R^{2+}_{ijTD} and R^{2-}_{ijTD} and average the R^2s for each country j and for every year T and group D. We also compute the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$, as well as the R-Squared in a standard market regression (irrespective of the sign of the market return). Market Skewness is the skewness of log(1+r), where r denotes market returns. We calculate skewness for each country and year. We compute cross-autocorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, where r^{+}_{mt} equals the market return when it is either positive or zero, and r^{-}_{mt} equals the market return when it is negative for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate $\rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD}$. To compute the frequency of extreme returns, for each firm and year, we calculate the mean and standard deviation of returns, and calculate the number of days where the return is below the average return, minus two standard deviations. We aggregate this number by group, country and year, and divide by the total number of firm-days in the year with available stock price information. The sample includes firms from 46 countries with stock price information available from Datastream and CRSP. All variables are defined in the paper. Test of differences are non-parametric Kruskal-Wallis tests. P-values are in parentheses.

	Mean	St. Dev	R-Squared - Overall				R-Squared Difference Downside Minus Upside				Downside R-Squared				Upside R-Squared			
			(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Short Sales Allowed and Practiced	0.598	0.491	-0.306***	-0.247***	-0.177*	-0.152	-0.095*	-0.106*	-0.125*	-0.092	-0.224***	-0.165**	-0.178*	-0.174	-0.188**	-0.141*	-0.093	-0.118
			[3.64]	[2.78]	[1.72]	[1.29]	[1.86]	[1.84]	[1.96]	[0.84]	[3.05]	[2.06]	[1.93]	[1.50]	[2.57]	[1.78]	[0.96]	[1.27]
ADR0	0.057	0.232	0.11	0.18	0.117	0.296	-0.165*	-0.159*	-0.12	-0.087	-0.125	-0.188*	-0.141	-0.125	-0.06	-0.011	-0.042	0.400**
			[0.93]	[1.50]	[0.77]	[1.27]	[1.80]	[1.72]	[1.06]	[0.43]	[1.16]	[1.70]	[0.99]	[0.55]	[0.54]	[0.10]	[0.29]	[2.34]
ADR1	0.168	0.374	0.185	0.275**	0.183	0.214	-0.121	-0.109	-0.002	-0.065	0.279**	0.360***	0.266*	-0.028	0.184	0.252**	0.202	0.448**
			[1.45]	[2.08]	[1.13]	[0.71]	[1.15]	[1.00]	[0.01]	[0.24]	[2.38]	[2.95]	[1.78]	[0.10]	[1.51]	[2.02]	[1.28]	[1.98]
Days with Zero Return (%)	4.605	1.674	-0.313***	-0.325***	-0.326***	-0.272***	-0.082***	-0.084***	-0.075**	0.034	-0.170***	-0.180***	-0.168***	-0.173***	-0.272***	-0.280***	-0.247***	-0.179***
			[10.26]	[10.53]	[8.94]	[4.87]	[3.06]	[3.08]	[2.34]	[0.60]	[5.92]	[6.17]	[4.88]	[3.12]	[9.01]	[9.18]	[6.79]	[3.62]
Log (Number of Stocks)	-0.943	1.004	-0.120***	-0.096***	-0.117***	-0.092	0.019	0.022	0.046*	0.016	-0.122***	-0.101***	-0.123***	-0.123**	-0.086***	-0.069**	-0.091**	0.006
			[3.93]	[3.01]	[2.75]	[1.52]	[1.06]	[1.13]	[1.73]	[0.32]	[4.58]	[3.55]	[3.19]	[2.10]	[3.22]	[2.48]	[2.25]	[0.15]
Log (GDP per capita)	4.605	1.674		-0.146**	-0.116	-0.084		-0.016	0.012	0.023		-0.117*	-0.116	-0.083		-0.085	-0.085	-0.178**
				[2.03]	[0.94]	[0.50]		[0.42]	[0.20]	[0.26]		[1.90]	[1.17]	[0.56]		[1.47]	[0.83]	[2.37]
Country Herfindahl Index	0.121	0.171			0.655	0.196			0.007	0.123			0.673*	0.21			0.608	0.265
					[1.40]	[0.39]			[0.03]	[0.39]			[1.72]	[0.47]			[1.49]	[1.02]
Industry Herfindahl Index	0.206	0.227			-0.521	-0.132			0.27	0.132			-0.751**	-0.332			-0.357	-0.097
					[1.12]	[0.27]			[1.36]	[0.48]			[1.96]	[0.76]			[0.90]	[0.45]
Good Government Index	24.199	4.601			0.004	0.005			-0.013	-0.009			0.001	0.002			0	0.002
					[0.98]	[1.12]			[1.33]	[1.11]			[0.17]	[0.41]			[0.09]	[0.20]
Log (Country Size)	12.668	2.071			-0.033	-0.051			-0.001	-0.006			-0.029	-0.036			-0.015	-0.056***
					[0.91]	[1.07]			[0.06]	[0.24]			[0.98]	[0.86]			[0.49]	[2.77]
Earnings Comovement Index	0.330	1.007				-0.053				0.019				-0.05				-0.036
						[0.69]				[0.44]				[0.74]				[1.08]
Variance in GDP growth	0.001	0.001				83.376				27.236				39.837				28.965
						[1.03]				[0.56]				[0.55]				[0.75]
Mean of Dependent Variable			-1.701	-1.701	-1.701	-1.701	0.189	0.189	0.189	0.189	-1.943	-1.943	-1.943	-1.943	-2.133	-2.133	-2.133	-2.133
St. Dev. Of Dependent Variable			0.781	0.781	0.781	0.781	0.489	0.489	0.489	0.489	0.632	0.632	0.632	0.632	0.631	0.631	0.631	0.631
Observations			668	667	564	375	668	667	564	375	668	667	564	375	668	667	564	375
Number of Countries			46	46	39	25	46	46	39	25	46	46	39	25	46	46	39	25
Test ADR0 =ADR1 (p-value)			(0.3900)	(0.2800)	(0.4500)	(0.2200)	(0.0290)	(0.0260)	(0.0270)	(0.4400)	(0.0680)	(0.0390)	(0.2800)	(0.6800)	(0.5900)	(0.9600)	(0.7200)	(0.1200)
R-squared within			0.58	0.57	0.59	0.65	0.13	0.13	0.16	0.2	0.47	0.47	0.49	0.53	0.4	0.4	0.43	0.46
R-squared between			0.48	0.51	0.47	0.41	0.09	0.1	0.17	0.03	0.39	0.42	0.49	0.39	0.44	0.49	0.46	0.63
R-squared total			0.52	0.54	0.53	0.57	0.12	0.12	0.16	0.17	0.44	0.45	0.49	0.48	0.42	0.43	0.45	0.51
Year Fixed Effect			YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Fixed Effect			YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO
Country Random Effect			NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4. R-Squared

For each country in our sample, for every year T, and for Domestic and Dual-Listed Stocks, we calculate the R-squared in two modified market regressions of individual stock returns on the domestic market index, and the world market index, where we use only either positive or negative market returns. We then compute the corresponding R-squared coefficients, R^{2+}_{ijTD} and R^{2-}_{ijTD} and average the R^2s for each country j and for every year T and group D. We also compute the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$, as well as the R-Squared in a standard market regressions of individual stock returns on the domestic market index (irrespective of its sign), and the world market index. We transform the R-squared coefficients using the transformation $R^{2*} = \log\frac{R^2}{1-R^2}$.

The percent of zero returns is the average number of days when a stock has a zero return, divided by the number of days in the year with available return data, averaged across stocks in a given group, country, and year. The number of firms is the number of firms with available stock price data in Datastream, in each country and year. Country Herfindahl index is calculated as the sum of the market shares (squared) of every firm in each country and year, relative to the corresponding country's total sales. Industry Herfindahl index is calculated as the sum of the market shares (squared) of every industry in each country and year, relative to the corresponding country's total sales. The size of the country is the extension of a country in square kilometers, from www.yahoo.com. The earnings comovement index is calculated as in Mørck et al. (2000). The Good Government index is the sum of the Risk of Expropriation, Corruption, and Repudiation of Contract indices from La Porta et al. (1997). The Short Selling variable is a dummy variable that equals one when short selling is allowed and practiced in a given country and year, zero otherwise. ADR0 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are not allowed / not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are allowed and practiced, zero otherwise. The sample includes firms from 46 countries with stock price information available from Datastream. Macroeconomic variables are from the Economist Intelligence Unit database. Standard errors are robust. The absolute value of the t-statistic is in brackets.

	Mean	St. Dev	Cross-Autocorrelation Overall				Cross-Autocorrelation Downside minus Upside				Downside Cross-Autocorrelation				Upside Cross-Autocorrelation			
			(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Short Sales Allowed and Practiced	0.598	0.491	-0.047	-0.014	-0.067	-0.024	-0.093*	-0.085*	-0.091*	-0.08	-0.104***	-0.086**	-0.079**	-0.054	-0.011	-0.001	0.012	0.025
			[0.82]	[0.25]	[1.16]	[0.38]	[1.84]	[1.65]	[1.68]	[1.34]	[2.87]	[2.35]	[2.07]	[1.41]	[0.30]	[0.02]	[0.32]	[0.63]
ADR0	0.057	0.232	-0.149**	-0.071	-0.057	-0.139	-0.206**	-0.095	-0.037	-0.046	-0.084**	-0.059	-0.064	-0.143**	-0.05	-0.015	0.03	0.064
			[2.49]	[1.10]	[0.79]	[1.23]	[2.03]	[1.45]	[0.70]	[0.82]	[2.30]	[1.48]	[1.38]	[2.06]	[1.33]	[0.37]	[0.66]	[0.97]
ADR1	0.168	0.374	-0.133**	-0.052	-0.037	-0.137	0.038	0.047	0.085	0.165*	-0.063*	-0.027	0.005	0.015	-0.098***	-0.071*	-0.079*	-0.150**
			[2.34]	[0.84]	[0.53]	[1.35]	[0.76]	[0.86]	[1.32]	[1.80]	[1.74]	[0.68]	[0.11]	[0.26]	[2.79]	[1.85]	[1.72]	[2.40]
Days with Zero Return (%)	4.605	1.674	0.035**	0.044***	0.071***	0.058**	-0.006	-0.005	-0.002	-0.01	-0.011	-0.007	-0.005	-0.019	-0.005	-0.001	-0.003	-0.009
			[2.55]	[3.18]	[4.45]	[2.42]	[0.46]	[0.41]	[0.14]	[0.47]	[1.26]	[0.75]	[0.48]	[1.32]	[0.61]	[0.17]	[0.28]	[0.57]
Log (Number of Stocks)	-0.943	1.004	-0.036**	-0.019	-0.026	-0.045*	0.009	0.011	0.021	0.041*	-0.009	-0.001	0.008	0.017	-0.017*	-0.012	-0.013	-0.024
			[2.32]	[1.16]	[1.42]	[1.81]	[0.66]	[0.77]	[1.28]	[1.86]	[0.92]	[0.13]	[0.67]	[1.17]	[1.81]	[1.16]	[1.11]	[1.63]
Log (GDP per capita)	4.605	1.674		-0.184***	-0.193***	-0.255***		-0.037	-0.09	-0.112		-0.095***	-0.126***	-0.145***		-0.059*	-0.035	-0.033
				[3.37]	[3.02]	[3.14]		[0.75]	[1.51]	[1.46]		[2.75]	[3.00]	[2.92]		[1.70]	[0.83]	[0.63]
Country Herfindahl Index	0.121	0.171			-1.542***	-0.962			0.752	0.488			0.950***	1.163***			0.203	0.675
					[3.13]	[1.40]			[1.63]	[0.75]			[2.95]	[2.76]			[0.61]	[1.52]
Industry Herfindahl Index	0.206	0.227			1.587***	0.905			-0.796*	-0.461			-1.039***	-1.180***			-0.248	-0.719
					[3.10]	[1.28]			[1.65]	[0.69]			[3.10]	[2.72]			[0.72]	[1.57]
Good Government Index	24.199	4.601			0.059***	0.080***			0.024	0.027			0.034***	0.038**			0.01	0.011
					[3.05]	[3.29]			[1.33]	[1.15]			[2.69]	[2.54]			[0.76]	[0.73]
Log (Country Size)	12.668	2.071			0.077***	0.102***			0.028	0.03			0.058***	0.061***			0.029**	0.031*
					[3.54]	[3.75]			[1.40]	[1.16]			[4.05]	[3.65]			[2.00]	[1.77]
Earnings Comovement Index	0.330	1.007				0.028**				0.038***				0.024***				-0.014
						[2.04]				[2.85]				[2.77]				[1.55]
Variance in GDP growth	0.001	0.001				0.0121				0.0101				0.0543				0.0433
						[0.00]				[0.00]				[0.04]				[0.00]
Mean of Dependent Variable			0.011	0.011	0.011	0.011	0.033	0.033	0.033	0.033	0.071	0.071	0.071	0.071	0.038	0.038	0.038	0.038
St. Dev. Of Dependent Variable			0.183	0.183	0.183	0.183	0.156	0.156	0.156	0.156	0.128	0.128	0.128	0.128	0.126	0.126	0.126	0.126
Observations			604	602	440	335	602	600	441	336	603	601	442	336	605	603	441	336
Number of Countries			46	46	39	25	46	46	39	25	46	46	39	25	46	46	39	25
Test ADR0 =ADR1 (p-value)			(0.4000)	(0.6600)	(0.2600)	(0.7900)	(0.0160)	(0.0200)	(0.0260)	(0.0670)	(0.9500)	(0.8100)	(0.6000)	(0.0960)	(0.0600)	(0.1200)	(0.2800)	(0.9200)
R-squared within			0.11	0.11	0.11	0.09	0.06	0.06	0.08	0.09	0.19	0.19	0.22	0.12	0.14	0.14	0.16	0.13
R-squared between			0.36	0.33	0.28	0.31	0.04	0	0.03	0.04	0.68	0.71	0.68	0.63	0.23	0.31	0.13	0.05
R-squared total			0.1	0.12	0.12	0.11	0.06	0.06	0.08	0.08	0.2	0.2	0.23	0.16	0.14	0.15	0.16	0.12
Year Fixed Effect			YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Fixed Effect			YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO
Country Random Effect			NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Cross-Autocorrelations

We compute cross-autccorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, where r^{+}_{mt} equals the market return when it is either positive or zero, and r^{-}_{mt} equals the market return when it is negative for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate $\rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD}$. We also compute the correlation between individual stock returns, and the lagged market return (irrespective of its sign). We transform the correlations so they take values from -∞ to +∞, as $\rho^{*} = \log\frac{\rho+1}{1-\rho}$. The percent of zero returns is the average number of days when a stock has a zero return, divided by the number of days in the year with available return data, averaged across stocks in a given group, country, and year. The number of firms is the number of firms with available stock price data in Datastream, in each country and year. Country Herfindahl index is calculated as the sum of the market shares (squared) of every firm in each country and year, relative to the corresponding country's total sales. Industry Herfindahl index is calculated as the sum of the market shares (squared) of every industry in each country and year, relative to the corresponding country's total sales. The size of the country is the extension of a country in square kilometers, from www.yahoo.com. The earnings comovement index is calculated as in Mørck et al. (2000). The Good Government index is the sum of the Risk of Expropriation, Corruption, and Repudiation of Contract indices from La Porta et al. (1997). The Short Selling variable is a dummy variable that equals one when short selling is allowed and practiced in a given country and year, zero otherwise. ADR0 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are not allowed / not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are allowed and practiced, zero otherwise. The sample includes firms from 47 countries with stock price information available from Datastream. Macroeconomic variables are from the Economist Intelligence Unit database. Standard errors are robust. The absolute value of the t-statistic is in brackets.

	Mean	Std.Dev	Dependent Variable: Skewness of Market Indices				Dependent Variable: Skewness of Individual Stock Abnormal Return				Dependent Variable: Skewness of Individual Stock Raw Return			
			(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Short Sales Allowed and Practiced	0.598	0.491	-0.185***	-0.158**	-0.160**		-0.049	-0.02	0		0.011	0.02	0.022	
			[3.01]	[2.26]	[2.17]		[0.95]	[0.37]	[0.01]		[0.28]	[0.45]	[0.54]	
ADR0	0.057	0.232	0.204	0.086	0.078	0.01	0.087	0.048	0.011	0.054	0.076	-0.007	0.028	0.098
			[1.56]	[0.60]	[0.51]	[0.05]	[0.79]	[0.42]	[0.08]	[0.46]	[0.92]	[0.08]	[0.33]	[0.98]
ADR1	0.168	0.374	0.275**	0.187	0.189		-0.021	-0.039	-0.059		-0.01	-0.035	-0.04	
			[2.23]	[1.43]	[1.27]		[0.20]	[0.37]	[0.44]		[0.13]	[0.42]	[0.48]	
Days with Zero Return (%)	4.605	1.674	0.116***	0.115***	0.109***	0.168***	0.006	-0.002	0.004	0.015	-0.036*	-0.039*	-0.025	-0.051**
			[3.34]	[3.17]	[2.67]	[3.59]	[0.22]	[0.05]	[0.12]	[0.49]	[1.68]	[1.71]	[1.12]	[1.99]
Log (Number of Stocks)	-0.943	1.004	0.018	-0.006	-0.003	-0.05	0.012	0.012	0	0.007	0.019	0.013	0.009	0.038
			[0.69]	[0.19]	[0.10]	[1.11]	[0.55]	[0.52]	[0.02]	[0.25]	[1.13]	[0.67]	[0.48]	[1.56]
Detrended Turnover (lagged)	-0.067	0.922	0.025	0.022	0.018	0	0.019	0.017	0.021	-0.015	0.021	0.02	0.019	0.01
			[0.95]	[0.83]	[0.66]	[0.00]	[0.86]	[0.73]	[0.90]	[0.57]	[1.30]	[1.28]	[1.14]	[0.46]
Market Return (lagged)	0.110	0.330	-0.07	-0.081	-0.087	0.027	0.084	0.105	0.111	0.163**	0.079*	0.084*	0.124***	0.066
			[0.94]	[1.06]	[1.07]	[0.27]	[1.35]	[1.63]	[1.61]	[2.49]	[1.77]	[1.88]	[2.64]	[1.20]
Log (GDP per capita)	9.481	0.730		-0.012	0.06	0.041		-0.021	-0.031	-0.019		0.029	-0.06	-0.012
				[0.26]	[0.63]	[0.72]		[0.58]	[0.36]	[0.52]		[0.96]	[1.19]	[0.40]
Country Herfindahl Index	0.121	0.171		-0.407*	-0.426	-0.218		-0.032	-0.058	-0.267		0.283**	0.431***	0.048
				[1.82]	[1.48]	[0.37]		[0.18]	[0.22]	[0.70]		[2.04]	[2.76]	[0.15]
Industry Herfindahl Index	0.206	0.227		-0.027	0.01	-0.343		-0.121	-0.088	-0.029		-0.222**	-0.363***	-0.081
				[0.17]	[0.04]	[0.68]		[0.97]	[0.41]	[0.09]		[2.08]	[3.08]	[0.30]
Good Government Index	24.199	4.601			-0.013				0.003				0.018**	
					[0.87]				[0.23]				[2.27]	
Log (Country Size)	12.668	2.071			0.01				0.001				-0.014	
					[0.63]				[0.05]				[1.58]	
Mean of Dependent Variable			-0.001	-0.001	-0.001	0.063	0.113	0.113	0.113	0.085	0.062	0.062	0.062	0.019
St. Dev. Of Dependent Variable			0.606	0.606	0.606	0.718	0.447	0.447	0.447	0.633	0.385	0.385	0.385	0.578
Observations			540	526	495	225	540	526	495	225	540	526	495	225
Number of Countries			45	45	39	24	45	45	39	24	45	45	39	24
Test ADR0 =ADR1 (p-value)			(0.1000)	(0.1100)	(0.1000)		(0.6500)	(0.6200)	(0.6300)		(0.3000)	(0.6300)	(0.3500)	
R-squared within			0.17	0.17	0.16	0.23	0.11	0.11	0.11	0.24	0.12	0.13	0.13	0.13
R-squared between			0.32	0.33	0.35	0.36	0.14	0.23	0.12	0.17	0.03	0.1	0.17	0.29
R-squared total			0.18	0.19	0.18	0.25	0.12	0.12	0.11	0.24	0.12	0.14	0.17	0.17
Year Fixed Effect			YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Fixed Effect			YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES
Country Random Effect			NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. Skewness and Short-Selling Restrictions

The dependent variable is the skewness of log(1+r), where r denotes stock returns in each country and year. The skewness of raw returns is calculated as the skewness of the total sample of weekly stock returns (in logs) in each country and year. The skewness of abnormal returns is the skewness of log(1+u), where u is the residual of a regression of weekly stock returns on the market index, for each firm in every country and year. The skewness of the market return is the skewness of the value-weighted market index return, in each country and year. The percent of zero returns is the average number of days when a stock has a zero return, divided by the number of days in the year with available return data, averaged across stocks in a given group, country, and year. The number of firms is the number of firms with available stock price data in Datastream, in each country and year. Country Herfindahl index is calculated as the sum of the market shares (squared) of every firm in each country and year, relative to the corresponding country's total sales. Industry Herfindahl index is calculated as the sum of the market shares (squared) of every industry in each country and year, relative to the corresponding country's total sales. The size of the country is the extension of a country in square kilometers, from www.yahoo.com. The Good Government index is the sum of the Risk of Expropriation, Corruption, and Repudiation of Contract indices from La Porta et al. (1997). The Short Selling variable is a dummy variable that equals one when short selling is allowed and practiced in a given country and year, zero otherwise. ADR0 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are not allowed / not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are allowed and practiced. We construct the average de-trended turnover for the countries in our sample as follows. We first calculate the de-trended volume by firm, by subtracting the previous-year volume from the current volume. We then calculate the sum of de-trended volumes for all firms in a given country, group of stocks, and year, and divide by the total number of shares outstanding for all the firms in the country-group with available data on volume. The sample includes firms from 46 countries with stock price information available from Datastream. Macroeconomic variables are from the Economist Intelligence Unit database. Standard errors are robust. The absolute value of the t-statistic is in brackets.

	Mean	Std.Dev	(I)	(II)	(III)	(IV)
Short Sales Allowed and Practiced	0.598	0.491	0.001	0.11	0.021	-0.07
			[0.01]	[1.18]	[0.24]	[0.67]
ADR0	0.057	0.232	-0.813***	-0.718***	-0.304*	-0.619**
			[5.39]	[4.65]	[1.81]	[2.41]
ADR1	0.168	0.374	-1.171***	-1.097***	-0.649***	-0.569***
			[8.67]	[8.09]	[4.26]	[2.98]
Log (Days with Zero Return)	4.605	1.674	-0.381***	-0.400***	-0.356***	-0.241***
			[9.91]	[10.33]	[8.42]	[4.08]
Log (Number of Stocks)	4.605	1.674	-0.132***	-0.104***	0.010	0.00
			[4.41]	[3.35]	[0.26]	[0.06]
Log (GDP per capita)	9.481	0.730		-0.166***	-0.131*	-0.08
				[2.68]	[1.74]	[0.82]
Good Government Index	24.199	4.601			0.021*	0.02
					[1.90]	[1.44]
Country Herfindahl Index	0.121	0.171			0.307	0.514*
					[0.92]	[1.78]
Industry Herfindahl Index	0.206	0.227			-0.013	-0.06
					[0.05]	[0.27]
Log (Country Size)	12.668	2.071			0.041**	0.052**
					[1.97]	[2.51]
Earnings Comovement Index	0.330	1.007				0.101***
						[2.84]
Variance in GDP growth	0.001	0.001				7.606
						[0.18]
Mean of Dependent Variable			-2.913	-2.913	-2.913	-2.913
St. Dev. Of Dependent Variable			0.682	0.682	0.682	0.682
Observations			668	667	564	375
Number of Countries			46	46	39	25
Test ADR0 =ADR1 (p-value)			(0.0100)	(0.0100)	(0.0100)	(0.8000)
R-squared within			0.28	0.28	0.25	0.22
R-squared between			0.33	0.41	0.12	0.29
R-squared total			0.27	0.29	0.21	0.25
Year Fixed Effect			Yes		Yes	
Country Fixed Effect			Yes		No	
Country Random Effect			No		Yes	

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7. Frequency of Extreme Negative Returns and Short-Selling Restrictions

The dependent variable is the per year number of trading days where the market return is lower than the average market return minus two standard deviations, divided by the total number of trading days. The endogenous variable is mapped on the set of real numbers, with the transformation log(x/(1-x)). The mean and standard deviation of the market return is calculated over the same country and the previous year. The percent of zero returns is the average number of days when a stock has a zero return, divided by the number of days in the year with available return data, averaged across stocks in a given group, country, and year. The number of firms is the number of firms with available stock price data in Datastream, in each country and year. Country Herfindahl index is calculated as the sum of the market shares (squared) of every firm in each country and year, relative to the corresponding country's total sales. Industry Herfindahl index is calculated as the sum of the market shares (squared) of every industry in each country and year, relative to the corresponding country's total sales. The size of the country is the extension of a country in square kilometers, from www.yahoo.com. The earnings comovement index is calculated as in Mørck et al. (2000). The Good Government index is the sum of the Risk of Expropriation, Corruption, and Repudiation of Contract indices from La Porta et al. (1997). The Short Selling variable is a dummy variable that equals one when short selling is allowed and practiced in a given country and year, zero otherwise. ADR0 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are not allowed / not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are allowed and practiced, zero otherwise. The sample includes firms from 46 countries with stock price information available from Datastream. Macroeconomic variables are from the Economist Intelligence Unit database. Standard errors are robust. The absolute value of the t-statistic is in brackets.

Domestic Stocks

Year to Law Change	R-Squared				Cross-Autocorrelation				Probability of Extreme Negative Return	Market Skewness
	Total	Downside	Upside	Difference	Total	Downside	Upside	Difference		
-7	36.00%	45.05%	26.95%	18.10%	4.59%	8.07%	1.11%	6.96%	13.34%	-0.450
-6	26.07%	33.60%	18.49%	15.11%	4.75%	5.34%	4.16%	1.18%	9.23%	-0.131
-5	19.38%	22.14%	16.62%	5.52%	2.81%	2.09%	3.53%	-1.45%	9.64%	-0.139
-4	20.68%	25.43%	15.99%	9.44%	3.44%	4.77%	2.12%	2.65%	8.68%	-0.297
-3	10.85%	10.29%	11.39%	-1.10%	3.53%	2.76%	4.30%	-1.54%	8.02%	0.200
-2	15.97%	19.04%	12.96%	6.08%	3.17%	4.38%	1.97%	2.41%	6.19%	-0.060
-1	16.26%	18.04%	14.49%	3.54%	2.43%	0.85%	4.00%	-3.15%	6.04%	0.121
0	14.38%	12.42%	16.34%	-3.92%	1.93%	0.84%	3.02%	-2.18%	5.34%	0.253
1	12.44%	13.17%	11.72%	1.45%	2.29%	1.75%	2.82%	-1.07%	6.52%	-0.006
2	14.90%	16.84%	12.97%	3.88%	4.99%	7.72%	2.27%	5.45%	5.31%	-0.235
3	14.28%	13.84%	14.72%	-0.87%	1.69%	0.94%	2.45%	-1.50%	5.24%	-0.052
4	12.31%	14.85%	9.80%	5.04%	-0.03%	-0.56%	0.50%	-1.06%	6.71%	-0.229
5	9.94%	12.71%	7.18%	5.53%	0.61%	-1.47%	2.68%	-4.15%	8.66%	-0.322
6	11.77%	13.59%	9.93%	3.66%	0.89%	2.86%	-1.07%	3.93%	9.56%	-0.187
7	13.76%	15.17%	12.35%	2.82%	4.35%	6.28%	2.42%	3.85%	4.80%	0.501
8	6.89%	8.92%	4.91%	4.01%	1.03%	1.10%	0.96%	0.15%	5.99%	-0.431
9	9.52%	11.20%	7.85%	3.35%	-0.17%	0.67%	-1.01%	1.68%	5.09%	-0.157
10	9.69%	11.52%	7.87%	3.66%	1.13%	-1.04%	3.30%	-4.34%	3.50%	-0.125

Dual-listed Stocks

Year to Law Change	R-Squared				Cross-Autocorrelation				Probability of Extreme Negative Return	Market Skewness
	Total	Downside	Upside	Difference	Total	Downside	Upside	Difference		
-7	.	.	.	.	.	.	.	.	.	.
-6	.	.	.	.	.	.	.	.	.	.
-5	.	.	.	.	.	.	.	.	.	.
-4	.	.	.	.	.	.	.	.	.	.
-3	.	.	.	.	.	.	.	.	.	.
-2	68.65%	53.03%	99.90%	-46.87%	11.10%	-1.97%	24.16%	-26.13%	51.70%	-0.328
-1	61.22%	53.73%	68.71%	-14.98%	7.55%	12.14%	2.96%	9.18%	2.17%	-0.066
0	52.12%	53.43%	50.82%	2.61%	13.46%	21.81%	5.12%	16.69%	30.76%	0.399
1	39.77%	41.48%	37.78%	3.71%	3.72%	1.51%	5.94%	-4.43%	21.67%	0.518
2	33.92%	30.11%	37.72%	-7.61%	4.54%	6.73%	2.35%	4.38%	2.96%	0.372
3	32.96%	38.07%	28.99%	9.08%	-1.15%	-2.29%	-0.01%	-2.28%	21.46%	-0.118
4	30.83%	36.40%	25.26%	11.14%	2.50%	-0.73%	5.72%	-6.45%	7.07%	-0.159
5	30.49%	29.69%	31.29%	-1.60%	2.13%	-4.42%	8.69%	-13.12%	10.42%	-0.299
6	56.69%	53.75%	59.62%	-5.87%	3.14%	2.99%	3.30%	-0.31%	2.55%	0.271
7	63.98%	63.44%	64.53%	-1.08%	3.03%	-5.04%	11.10%	-16.14%	2.17%	0.163
8	60.27%	65.06%	55.47%	9.60%	1.33%	13.12%	-10.45%	23.58%	24.81%	0.188
9	55.34%	46.03%	64.65%	-18.62%	1.94%	1.34%	2.53%	-1.20%	10.61%	0.012
10	51.21%	52.38%	50.04%	2.34%	1.32%	-7.34%	9.97%	-17.31%	1.72%	0.021

Table 8. Event Study. Time-series of the main variables, for countries with regulatory changes, around the time of the law change

R-Squared, Cross-autoorrelation, Probability of Extreme Market Returns, and Market Skewness, for the five countries with regulatory changes between 1990 and 2001–Hong Kong, Norway, Sweden, Malaysia, and Thailand. The sample includes firms from these countries with stock price information available from Datastream. for each country in our sample, for every year T, and for Domestic and Dual-Listed Stocks, we calculate the R-squared in two modified market regressions of individual stock returns on the domestic market index, and the world market index, where we use only either positive or negative market returns. We then compute the corresponding R-squared coefficients, R^{2+}_{ijTD} and R^{2-}_{ijTD} and average the R^2s for each country j and for every year T and group D, as in MYY. We also compute the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$, as well as the R-Squared of a standard market model regression (irrespective of the sign of the market return). We compute cross-autocorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, where r^{+}_{mt} equals the market return when it is either positive or zero, and r^{-}_{mt} equals the market return when it is negative for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate $\rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD}$.

Market Skewness is the skewness of log(1+r), where r denotes market returns. We calculate skewness for each country and year. To compute the frequency of extreme returns, for each firm and year, we calculate the mean and standard deviation of returns, and calculate the number of days where the return is below the average return, minus two standard deviation. We aggregate this number by country and year, and divide by the total number of firm-days in the year with available stock price information. The table shows averages of all these variables, where countries are grouped by years to law change.

Domestic Stocks

		R-Squared				Cross-Autocorrelation				Probability of Extreme Negative Return	Market Skewness
		Total	Downside	Upside	Difference	Total	Downside	Upside	Difference		
When Short Sales are Prohibited	Number of Firms (Markets)	6,023	5,939	5,983	5,921	6,074	6,060	6,063	6,049	6,166	21
	Mean	25.13% ***	20.51% ***	14.76% ***	5.80% ***	3.21% ***	3.23% ***	3.19% ***	0.03%	7.73% ***	-5.02%
	Median	19.89%	13.94%	8.27%	2.75%	3.23%	3.26%	3.30%	-0.08%	2.68%	7.31%
When Short Sales are Allowed	Number of Firms (Markets)	9,628	9,517	9,561	9,470	9,692	9,673	9,665	9,646	10,796	31
	Mean	17.42% ***	13.82% ***	10.88% ***	3.03% ***	1.93% ***	1.83% ***	2.04% ***	-0.20%	6.20% ***	-12.97%
	Median	11.50%	8.87%	5.04%	1.46%	1.82%	1.88%	1.64%	0.16%	2.68%	-2.55%
	Difference (p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.7489)	(0.0020)	(0.2672)
Total	Number of Firms (Markets)	15,651	15,456	15,544	15,391	15,766	15,733	15,728	15,695	16,962	52
	Mean	20.39% ***	16.39% ***	12.37% ***	-4.10% ***	2.42% ***	2.37% ***	2.49% ***	-0.11%	6.75% ***	-9.76%
	Median	14.39%	10.40%	6.16%	-1.85%	2.32%	2.40%	2.25%	0.05%	2.68%	2.77%

Dual-listed Stocks

		R-Squared				Cross-Autocorrelation				Probability of Extreme Negative Return	Market Skewness
		Total	Downside	Upside	Difference	Total	Downside	Upside	Difference		
When Short Sales are Prohibited	Number of Firms (Markets)	4	4	3	3	6	6	6	6	6	4
	Mean	65.97% *	53.38%	79.11% **	-25.73%	9.32% ***	8.56% *	5.09%	3.48%	26.94%	-19.70%
	Median	65.84%	53.56%	99.26%	-0.61%	8.99%	6.33%	2.71%	3.62%	2.49%	-7.35%
When Short Sales are Allowed	Number of Firms (Markets)	57	54	55	53	61	61	61	61	61	20
	Mean	43.63% ***	39.41% ***	38.18% ***	-0.57%	2.17% **	4.01% ***	0.32%	3.69%	11.82% ***	8.09%
	Median	24.60%	22.72%	19.08%	-0.27%	3.87%	4.85%	-0.26%	5.72%	2.30%	4.78%
	Difference (p-value)	(0.3821)	(0.6453)	(0.0603)	(0.5727)	(0.0266)	(0.3340)	(0.3680)	(0.9475)	(0.7574)	(0.6421)
Total	Number of Firms (Markets)	61	58	58	56	67	67	67	67	67	24
	Mean	44.64% ***	40.37% ***	40.29% ***	-1.09%	2.81% ***	4.87% ***	0.75%	4.12%	13.17% ***	3.46%
	Median	24.91%	22.72%	19.76%	-0.44%	4.30%	4.85%	1.00%	5.72%	2.30%	4.78%

Short Sales Prohibited, Difference Domestic - ADR (p-value)	(0.1413)	(0.2186)	(0.0053)	(0.1829)	(0.0356)	(0.1600)	(0.7377)	(0.5721)	(0.6353)	(0.6565)
Short Sales Allowed Difference Domestic - ADR (p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0317)	(0.4433)	(0.0168)	(0.0994)	(0.0020)	(0.9756)	(0.1479)
Whole Sample, Difference Domestic-Dual-listed Stocks (p-value)	(0.0000)	(0.0000)	(0.0000)	(0.6459)	(0.3634)	(0.0189)	(0.0711)	(0.0016)	(0.9544)	(0.3166)
Whole Sample Difference Allowed - Prohibited (p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0107)	(0.0019)	(0.6543)

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 9. Changes in Efficiency and the Distribution of Stock Returns, for countries with regulatory changes, around the time of the law change

R-Squared, Cross-Autocorrelation, Probability of Extreme Market Returns, and Market Skewness, for the five countries with regulatory changes between 1990 and 2001–Hong Kong, Norway, Sweden, Malaysia, and Thailand. The sample includes firms from these countries with stock price information available from Datastream. For each country in our sample, for every year T, and for Domestic and ADR stocks, we calculate the R-squared in two modified market regressions of individual stock returns on the domestic market index, and the world market index, where we use only either positive or negative market returns. We then compute the corresponding R-squared coefficients, R^{2+}_{ijTD} and R^{2-}_{ijTD}, and average the R^2s for each country j and for every year T and group D, as in MYY. We also compute the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$, as well as the R-Squared in a standard market regression (irrespective of the sign of the market return). Market Skewness is the skewness of log(1+r), where r denotes market returns. We calculate skewness for each country and year. We compute cross-autocorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, where r^{+}_{mt} equals the market return when it is either positive or zero, and r^{-}_{mt} equals the market return when it is negative for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate $\rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD}$. To compute the frequency of extreme returns, for each firm and year, we calculate the mean and standard deviation of returns, and calculate the number of days where the return is below the average return, minus two standard deviations. We aggregate this number by country and year, and divide by the total number of firm-days in the year with available stock price information. The table shows averages of all these variables, where countries are grouped by the short sales regime. Test of differences are non-parametric Kruskal-Wallis tests. P-values are in parentheses.

			R-Squared			Cross-Autocorrelation			Market Skewness	Frequency of Extreme Negative Returns
	Mean	St.Dev	Difference Downside - Upside	Upside	Downside	Difference Downside - Upside	Upside	Downside		
Short Sales Allowed and Practiced	0.430	0.498	-0.628	0.575	-0.053	-0.213**	0.026	-0.188*	-0.731*	0.823*
			[0.85]	[0.89]	[0.17]	[2.13]	[0.34]	[1.94]	[1.69]	[1.91]
ADR0	0.129	0.337	2.603	-3.735	-1.132	-0.848***	-0.482***	0.366	1.216	-5.531***
			[0.49]	[0.80]	[0.51]	[3.50]	[2.67]	[1.56]	[1.59]	[5.29]
ADR1	0.198	0.400	4.716	-5.926	-1.21	-0.837***	-0.617***	0.219	1.656**	-5.647***
			[0.75]	[1.08]	[0.46]	[3.27]	[3.24]	[0.88]	[2.18]	[5.12]
Log (Number of Stocks)	4.116	2.454	1.106	-1.245	-0.139	-0.174***	-0.120***	0.054	0.300*	-1.118***
			[0.86]	[1.10]	[0.26]	[3.73]	[3.46]	[1.19]	[1.89]	[5.56]
Days with Zero Return (%)	-1.244	0.790	-0.165	-0.467	-0.632***	-0.078	-0.004	0.074	0.033	-0.013
			[0.37]	[1.19]	[3.40]	[1.33]	[0.10]	[1.30]	[0.20]	[0.05]
Log (GDP per capita)	9.659	0.650	-2.255	3.741	1.486	0.956*	0.351	-0.606	1.333	-1.22
			[0.55]	[1.05]	[0.88]	[1.88]	[0.92]	[1.23]	[0.72]	[0.56]
Detrended Turnover (lagged)	0.000	0.976							-0.019	
									[0.22]	
Market Return (lagged)	0.060	0.341							0.059	
									[0.28]	
Constant			14.903	-30.956	-16.054	-8.213*	-2.572	5.641	-14.842	15.006
			[0.42]	[0.99]	[1.08]	[1.74]	[0.73]	[1.23]	[0.81]	[0.74]
Mean of Dependent Variable			-0.041	0.124	0.164	-0.001	0.025	0.024	-0.098	-2.652
St. Dev. Of Dependent Variable			1.255	1.230	0.651	0.266	0.157	0.208	0.527	1.070
Observations			73	73	73	79	79	79	64	79
Number of Countries			5	5	5	5	5	5	5	5
Test ADR0 =ADR1 (p-value)			(0.1500)	(0.1000)	(0.9700)	(0.2800)	(0.2500)	(0.8200)	(0.0700)	(0.2500)
R-squared within			0.26	0.4	0.47	0.5	0.38	0.49	0.4	0.54
R-squared between			0.33	0.06	0.66	0.85	0.11	0.71	0.74	0.17
R-squared total			0.07	0.02	0	0.17	0.02	0.24	0.01	0.24
Year Fixed Effects			YES	YES	YES	YES	YES	YES	YES	YES
Country Fixed Effects			YES	YES	YES	YES	YES	YES	YES	YES

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 10. Panel Regression, countries with regulatory changes

R-Squared, Cross-Autocorrelation, Probability of Extreme Market Returns, and Market Skewness, for the five countries with regulatory changes between 1990 and 2001–Hong Kong, Norway, Sweden, Malaysia, and Thailand. The sample includes firms from these countries with stock price information available from Datastream. for each country in our sample, for every year T, and for Domestic and Dual-Listed Stocks, we calculate the R-squared in the two modified market regressions, where we use only either positive or negative market returns. We then compute the corresponding R-squared coefficients, R^{2+}_{ijTD} and R^{2-}_{ijTD} and average the R^2s for each country j and for every year T and group D. We also compute the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$. Market Skewness is the skewness of log(1+r), where r denotes market returns. We calculate skewness for each country and year. We compute cross-autocorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, where r^{+}_{mt} equals the market return when it is either positive or zero, and r^{-}_{mt} equals the market return when it is negative for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate $\rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD}$. To compute the frequency of extreme returns, for each firm and year, we calculate the mean and standard deviation of returns, and calculate the number of days where the return is below the average return, minus two standard deviations. We aggregate this number by country and year, and divide by the total number of firm-days in the year with available stock price information. The percent of zero returns is the average number of days when a stock has a zero return, divided by the number of days in the year with available return data, averaged across stocks in a given group, country, and year. The number of firms is the number of firms with available stock price data in Datastream, in each country and year. The Short Selling variable is a dummy variable that equals one when short selling is allowed and practiced in a given country and year, zero otherwise. ADR0 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are not allowed / not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are allowed and practiced, zero otherwise. We construct the average de-trended turnover for the countries in our sample as follows. We first calculate the de-trended volume by firm, by subtracting the previous-year volume from the current volume. We then calculate the sum of de-trended volumes for all firms in a given country, group of stocks, and year, and divide by the total number of shares outstanding for all the firms in the country-group with available data on volume. The sample includes firms from 46 countries with stock price information available from Datastream. Macroeconomic variables are from the Economist Intelligence Unit database. Standard errors are robust. The absolute value of the t-statistic is in brackets.

	All Countries						Countries With Regulatory Changes					
	Mean	St.Dev	Downside-minus-Upside R-Squared	Downside-minus-Upside Cross-Autocorrelation	Market Skewness	Frequency of Negative Extreme Returns	Mean	St.Dev	Downside-minus-Upside R-Squared	Downside-minus-Upside Cross-Autocorrelation	Market Skewness	Frequency of Negative Extreme Returns
Short Sales Allowed and Practiced	0.598	0.491	-0.097*	-0.205***	-0.316**	0.002	0.430	0.498	-0.153	-0.170*	-0.139*	0.28*
			[1.86]	[3.42]	[2.03]	[0.01]			[0.23]	[1.75]	[1.83]	[1.82]
Existence of Put Contracts - No Short Sales	0.124	0.330	0.023	-0.011	-0.141	-0.057	0.177	0.384	1.332**	0.043	0.2	-0.609
			[0.17]	[0.27]	[1.44]	[0.39]			[2.12]	[0.45]	[0.62]	[1.49]
ADR0	0.057	0.232	-0.208	-0.201***	0.085	-1.941***	0.129	0.337	3.406	0.841***	-0.044	-5.494***
			[0.93]	[3.44]	[0.55]	[9.56]			[0.70]	[3.46]	[0.06]	[5.25]
ADR1	0.168	0.374	0.03	0.173***	0.052	-1.881***	0.198	0.400	5.665	0.813***	0.075	-5.454***
			[0.14]	[3.01]	[0.33]	[9.47]			[1.00]	[3.19]	[0.09]	[4.97]
Log (Number of Stocks)	-0.943	1.004	0.193***	0.050***	0.01	-0.359***	4.116	2.454	1.382	0.169***	-0.006	-1.110***
			[3.18]	[3.39]	[0.26]	[6.91]			[1.18]	[3.60]	[0.04]	[5.50]
Days with Zero Return (%)	4.605	1.674	-0.198***	0.012	-0.006	-0.155***	-1.244	0.790	-0.423	0.095	-0.055	0.042
			[4.12]	[0.98]	[0.18]	[3.35]			[0.94]	[1.56]	[0.34]	[0.16]
Log (GDP per capita)	4.605	1.674	0.781**	-0.096	-0.541*	0.612	9.659	0.650	-2.178	-1.129**	1.469	-1.531
			[2.07]	[0.87]	[1.76]	[1.52]			[0.56]	[2.19]	[0.83]	[0.69]
Detrended Turnover (lagged)	-0.067	0.922			0.003		0.000	0.976			0.007	
					[0.14]						[0.08]	
Market Return (lagged)	0.110	0.330			0.089		0.060	0.341			-0.229	
					[1.52]						[1.07]	
Constant			-8.371**	0.616	5.094*	-7.340*			13.067	10.020**	-13.74	19.171
			[2.31]	[0.58]	[1.80]	[1.90]			[0.37]	[2.01]	[0.83]	[0.89]
Mean of Dependent Variable			0.189	0.033	-0.001	-2.913			-0.041	-0.001	-0.098	-2.652
St. Dev. Of Dependent Variable			0.489	0.156	0.606	0.682			1.255	0.266	0.527	1.070
Observations			823	908	763	913			75	81	66	81
Number of Countries			46	46	45	46			5	5	5	5
Prob > F			(0.0160)	(0.0360)	(0.6600)	(0.6000)			(0.0800)	(0.8200)	(0.0760)	(0.9400)
R-squared within			0.11	0.06	0.1	0.22			0.32	0.51	0.4	0.53
R-squared between			0.02	0.55	0.36	0			0.24	0.86	0.88	0.24
R-squared total			0.02	0.17	0.1	0.07			0.1	0.19	0	0.13
Year Fixed Effects			YES	YES	YES	YES			YES	YES	YES	YES
Country Fixed Effects			YES	YES	YES	YES			YES	YES	YES	YES

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 11. Short Sales Restrictions and the Existence of Put Contracts

R-Squared, Cross-autocorrelation, Probability of Extreme Market Returns, and Market Skewness, for the whole sample, and for the five countries with regulatory changes between 1990 and 2001–Hong Kong, Norway, Sweden, Malaysia, and Thailand. The sample includes firms from these countries with stock price information available from Datastream. for each country in our sample, for every year T, and for Domestic and Dual-Listed Stocks, we calculate the R-squared in the two modified market regressions, where we use only either positive or negative market returns. We then compute the corresponding R-squared coefficients, R^{2+}_{ijTD} and R^{2-}_{ijTD} and average the R^2s for each country j and for every year T and group D, as in MYY We also compute the difference $R^{2Diff}_{jTD} = R^{2-}_{jTD} - R^{2+}_{jTD}$. Market Skewness is the skewness of log(1+r), where r denotes market returns. We calculate skewness for each country and year. We compute cross-autocorrelations between one-week lagged market returns and individual stock returns. In particular, we calculate $\rho^{+}_{ijTD} = corr(r_{ijt}, r^{+}_{mjt-1})$ and $\rho^{-}_{ijTD} = corr(r_{ijt}, r^{-}_{mjt-1})$, where r^{+}_{mt} equals the market return when it is either positive or zero, and r^{-}_{mt} equals the market return when it is negative for all stocks i in group D and country j, using weekly observations in each year T. We then average the cross-autocorrelations across stocks and calculate $\rho^{Diff}_{jTD} = \rho^{-}_{jTD} - \rho^{+}_{jTD}$. To compute the frequency of extreme returns, for each firm and year, we calculate the mean and standard deviation of returns, and calculate the number of days where the return is below the average return, minus two standard deviations. We aggregate this number by country and year, and divide by the total number of firm-days in the year with available stock price information. The percent of zero returns is the average number of days when a stock has a zero return, divided by the number of days in the year with available return data, averaged across stocks in a given group, country, and year. The number of firms is the number of firms with available stock price data in Datastream, in each country and year. The Short Selling variable is a dummy variable that equals one when short selling is allowed and practiced in a given country and year, zero otherwise. The "Existence of Put Contracts - No Short Sales" dummy is a variable that equals 1 when the Short Selling variable equals 1, and the corresponding market has put options trading. Data on put options is from Charoenrook and Daouk (2004). ADR0 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are not allowed / not practiced, zero otherwise. ADR1 equals 1 if the observation corresponds to Dual-Listed Stocks in countries where short sales are allowed and practiced, zero otherwise. We construct the average de-trended turnover for the countries in our sample as follows. We first calculate the de-trended volume by firm, by subtracting the previous-year volume from the current volume. We then calculate the sum of de-trended volumes for all firms in a given country, group of stocks, and year, and divide by the total number of shares outstanding for all the firms in the country-group with available data on volume. The sample includes firms from 46 countries with stock price information available from Datastream. Macroeconomic variables are from the Economist Intelligence Unit database. Standard errors are robust. The absolute value of the t-statistic is in brackets.

			YEARS RELATIVE TO LAW CHANGE																	
		COUNTRY	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Domestic Stocks	Number of Firms	Hong Kong		1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490					
		Malaysia			1,142	1,142	1,142	1,142	1,142	1,142	1,142	1,142								
		Norway						560	560	560	560	560	560	560	560	560	560	560	560	
		Sweden							856	856	856	856	856	856	856	856	856	856	856	856
		Thailand	696	696	696	696	696	696	696	696	696	696	696	696						
		TOTAL	696	2,186	3,328	3,328	3,328	3,888	4,744	4,744	4,744	4,744	3,602	3,602	2,906	1,416	1,416	1,416	1,416	856
	Upside Cross-Autocorrelation	Hong Kong		4.34%	1.01%	-1.77%	4.07%	1.78%	2.10%	3.12%	-0.72%	2.57%	1.38%	0.46%	3.11%					
		Malaysia			12.24%	6.26%	7.92%	1.92%	4.58%	0.39%	4.81%	2.79%								
		Norway						6.62%	6.21%	3.11%	3.64%	3.97%	0.13%	2.82%	1.20%	1.63%	4.02%	0.43%	1.50%	
		Sweden							3.44%	5.32%	3.48%	3.52%	7.80%	-0.57%	2.62%	-3.12%	1.26%	1.29%	-2.44%	3.30%
		Thailand	1.11%	3.93%	-2.78%	2.65%	0.39%	1.04%	5.56%	5.26%	5.19%	-0.65%	0.09%	0.06%						
		TOTAL	1.11%	4.16%	3.53%	2.12%	4.30%	1.97%	4.00%	3.02%	2.82%	2.27%	2.45%	0.50%	2.68%	-1.07%	2.42%	0.96%	-1.01%	3.30%
	Downside Cross-Autocorrelation	Hong Kong		11.59%	-1.99%	7.39%	2.88%	5.79%	-0.95%	-4.52%	4.67%	3.95%	-0.90%	0.03%	-3.29%					
		Malaysia			10.62%	2.71%	2.86%	3.46%	-2.54%	4.40%	-0.55%	15.36%								
		Norway						5.63%	5.90%	0.99%	3.02%	2.13%	3.78%	-3.37%	5.17%	7.15%	1.12%	2.09%	2.98%	
		Sweden							8.23%	4.44%	5.71%	0.59%	2.12%	0.04%	-1.54%	-0.41%	10.00%	0.47%	-0.65%	-1.05%
		Thailand	8.07%	-2.74%	-2.11%	3.57%	2.49%	3.19%	2.93%	2.50%	-2.07%	7.82%	-2.10%	-0.78%						
		TOTAL	8.07%	5.34%	2.09%	4.77%	2.76%	4.38%	0.85%	0.84%	1.75%	7.72%	0.94%	-0.56%	-1.47%	2.86%	6.28%	1.10%	0.67%	-1.04%
	Frequency of Extreme Negative Returns	Hong Kong		6.43%	10.94%	9.67%	8.37%	5.78%	5.45%	6.03%	6.38%	5.02%	5.60%	8.54%	8.00%					
		Malaysia			10.27%	8.82%	7.84%	6.55%	7.27%	4.53%	7.26%	6.24%								
		Norway						7.19%	6.26%	9.70%	9.06%	7.04%	9.17%	7.96%	13.33%	6.59%	2.55%	5.29%	3.31%	
		Sweden							6.47%	5.26%	5.87%	7.87%	8.43%	5.42%	6.32%	12.00%	6.49%	6.50%	6.30%	3.50%
		Thailand	13.34%	12.91%	7.19%	7.18%	7.74%	6.06%	5.11%	3.95%	5.07%	2.92%	2.81%	3.34%						
		TOTAL	13.34%	9.23%	9.64%	8.68%	8.02%	6.19%	6.04%	5.34%	6.52%	5.31%	5.24%	6.71%	8.66%	9.56%	4.80%	5.99%	5.09%	3.50%
	Downside R-Squared	Hong Kong		45.07%	10.00%	38.19%	8.47%	14.61%	15.22%	13.07%	15.01%	13.54%	12.86%	13.89%	12.82%					
		Malaysia			44.53%	16.72%	9.06%	26.23%	20.96%	17.03%	15.76%	26.91%								
		Norway						17.28%	11.99%	10.28%	9.68%	13.09%	9.03%	10.25%	18.18%	13.09%	9.72%	7.36%	12.73%	
		Sweden							22.83%	6.75%	10.47%	8.31%	13.41%	9.62%	7.71%	13.99%	19.17%	9.95%	10.32%	11.52%
		Thailand	45.05%	18.70%	13.34%	18.09%	14.06%	17.47%	17.90%	8.63%	8.50%	11.75%	13.44%	23.39%						
		TOTAL	45.05%	33.60%	22.14%	25.43%	10.29%	19.04%	18.04%	12.42%	13.17%	16.84%	13.84%	14.85%	12.71%	13.59%	15.17%	8.92%	11.20%	11.52%
	Market Skewness	Hong Kong		-0.82	0.46	-1.66	0.35	0.07	0.50	-0.63	-1.19	-0.35	-0.16	-0.03	-0.03					
		Malaysia			-0.90	0.58	0.24	-0.27	0.22	0.48	0.13	-0.92								
		Norway						0.15	0.50	0.14	0.39	0.06	-0.34	0.04	-1.09	-0.06	0.85	-0.63	-0.51	
		Sweden							-0.48	0.45	0.57	0.19	0.16	0.05	0.15	-0.31	0.15	-0.23	0.20	-0.13
		Thailand	-0.45	0.56	0.02	0.19	0.02	-0.19	-0.13	0.82	0.06	-0.16	0.03	-0.97						
		TOTAL	-0.45	-0.13	-0.14	-0.30	0.20	-0.06	0.12	0.25	-0.01	-0.24	-0.05	-0.23	-0.32	-0.19	0.50	-0.43	-0.16	-0.13
Dual-listed Stocks	Number of Firms	Hong Kong		16	16	16	16	16	16	16	16	16	16	16	16					
		Norway						6	6	6	6	6	6	6	6	6	6	6	6	
		Sweden							4	4	4	4	4	4	4	4	4	4	4	4
		TOTAL		16	16	16	16	22	26	26	26	26	26	26	26	10	10	10	10	4
	Upside Cross-Autocorrelation	Hong Kong	.	.	.	.		39.36%	-3.19%	7.28%	3.15%	0.00%	-1.43%	4.64%	8.11%					
		Norway						16.57%	6.04%	1.89%	12.90%	8.22%	4.96%	10.05%	3.80%	10.00%	15.09%	-11.96%	5.22%	
		Sweden						.	.	.	.	.	.	.	23.12%	-10.12%	3.14%	-5.95%	-1.50%	9.97%
		TOTAL	.	.	.	.	.	24.16%	2.96%	5.12%	5.94%	2.35%	-0.01%	5.72%	8.69%	3.30%	11.10%	-10.45%	2.53%	9.97%
	Downside Cross-Autocorrelation	Hong Kong	.	.	.	.		-9.51%	12.54%	38.10%	4.34%	4.25%	-4.40%	2.86%	-6.58%					
		Norway						1.80%	11.94%	-2.64%	-5.58%	12.93%	5.09%	-15.10%	-0.50%	10.72%	-13.99%	24.01%	6.09%	
		Sweden						.	.	.	.	.	.	.	5.00%	-12.48%	12.88%	-19.56%	-5.79%	-7.34%
		TOTAL	.	.	.	.	.	-1.97%	12.14%	21.81%	1.51%	6.73%	-2.29%	-0.73%	-4.42%	2.99%	-5.04%	13.12%	1.34%	-7.34%
	Frequency of Extreme Negative Returns	Hong Kong	.	.	.	.		80.00%	1.54%	49.36%	29.43%	3.14%	26.87%	8.22%	2.25%					
		Norway						37.55%	2.49%	2.86%	2.30%	2.50%	2.50%	2.48%	2.11%	2.30%	2.30%	32.44%	2.04%	
		Sweden						.	.	.	.	.	.	.	92.37%	3.07%	1.92%	1.92%	23.46%	1.72%
		TOTAL	.	.	.	.	.	51.70%	2.17%	30.76%	21.67%	2.96%	21.46%	7.07%	10.42%	2.55%	2.17%	24.81%	10.61%	1.72%
	Downside R-Squared	Hong Kong	.	.	.	.	.	.		56.51%	34.92%	22.11%	30.28%	32.97%	21.39%					
		Norway						53.03%	53.73%	50.34%	57.89%	50.12%	57.54%	50.09%	62.91%	53.75%	63.44%	65.06%	30.08%	
		Sweden						.	.	.	.	.	.	.	.	.	.	.	69.96%	52.38%
		TOTAL	.	.	.	.	.	53.03%	53.73%	53.43%	41.48%	30.11%	38.07%	36.40%	29.69%	53.75%	63.44%	65.06%	46.03%	52.38%
	Market Skewness	Hong Kong	.	.	.	.		-1.08149	0.440566	0.12894	0.944364	0.182157	0.029749	-0.33961	-0.41459					
		Norway						0.424882	-0.57183	0.669763	0.092084	0.561511	-0.26512	0.020961	-1.4227	0.249274	-0.07284	-0.11885	-0.04273	
		Sweden						.	.	.	.	.	.	.	0.231174	-0.10117	0.0314	-0.05952	-0.01495	0.099716
		TOTAL	.	.	.	.	.	-0.32831	-0.06563	0.399351	0.518224	0.371834	-0.11769	-0.15932	-0.29926	0.271007	0.16331	0.188303	0.011535	0.020651

Table for the Referee. Detailed event study

Appendix: Econometric Model

I Setup

Consider a collection of N securities generated by an underlying stochastic processes Λ_t. The process Λ_t represents a common market factor.

Since we are interested in the idiosyncratic price adjustment according to the sign of the market return, the individual stock price is determined by four equi-probable models:

$$r_{it} = \mu_i + \beta_i \Lambda_t^+ + \epsilon_{it} \qquad \text{if } \Lambda_t \geq 0,\ \Lambda_{t-1} \geq 0 \tag{1}$$

$$r_{it} = \mu_i + \beta_i \left(\Lambda_t^+ + (1-q)\,\Lambda_{t-1}^-\right) + \epsilon_{it} \qquad \text{if } \Lambda_t \geq 0,\ \Lambda_{t-1} < 0 \tag{2}$$

$$r_{it} = \mu_i + \beta_i \left(q\Lambda_t^-\right) + \epsilon_{it} \qquad \text{if } \Lambda_t < 0,\ \Lambda_{t-1} \geq 0 \tag{3}$$

$$r_{it} = \mu_i + \beta_i \left(q\Lambda_t^- + (1-q)\,\Lambda_{t-1}^-\right) + \epsilon_{it} \qquad \text{if } \Lambda_t < 0,\ \Lambda_{t-1} < 0 \tag{4}$$

where Λ_t and ϵ_{it} are zero-mean normal distribution with variance σ_Λ^2 and σ^2 respectively, $\Lambda_t^\pm$ indicates the conditional distribution of Λ_t on the positive or negative sign of Λ_t, q represents the proportion of the negative shock Λ_t that is incorporated into r_{it} in the current cycle ($1-q$ is incorporated in next cycle).

In our model, q is a measure of short sales constraints. When $q = 1$, shorting is fully allowed and current stock returns fully reflect all current market returns. When $q = 0$, the is a delay of one period from the realization of a negative market return, until it is incorporated into individual stock returns.

We also assume Λ_t is the common factor for all stocks, temporarily and cross-sectionally independent and identically distributed at all leads and all lags, and independent of ϵ_{it-k} for all i, t, and k. The noise ϵ_{it} is also iid for all i and t.

We assume $\mu_i = 0$ for all i. This assumption is without loss of generality. Moreover, we assume that $\beta_i > 0$ for all i. It can be shown that our conclusions below remain even if we do not assume that all betas are positive.*

II Market returns

Following Lo and MacKinlay (1990), we define r_t as the observable market portfolio return in period t, such that:

$$r_t = \frac{1}{N}\sum_i r_{it}$$

Aggregating across all stocks, the market return is then asymptotically distributed as:

$$r_t \asymp \mu + \beta \Lambda_t^+ \qquad \text{if } \Lambda_t \geq 0,\ \Lambda_{t-1} \geq 0 \tag{5}$$

$$r_t \asymp \mu + \beta \left(\Lambda_t^+ + (1-q)\,\Lambda_{t-1}^-\right) \qquad \text{if } \Lambda_t \geq 0,\ \Lambda_{t-1} < 0 \tag{6}$$

$$r_t \asymp \mu + \beta \left(q\Lambda_t^-\right) \qquad \text{if } \Lambda_t < 0,\ \Lambda_{t-1} \geq 0 \tag{7}$$

$$r_t \asymp \mu + \beta \left(q\Lambda_t^- + (1-q)\,\Lambda_{t-1}^-\right) \qquad \text{if } \Lambda_t < 0,\ \Lambda_{t-1} < 0 \tag{8}$$

*Equivalently, we can assume $E(\beta_i) > 0$ for all i.

where

$$\mu = \frac{1}{N}\sum_i \mu_i = 0 \qquad \beta = \frac{1}{N}\sum_i \beta_i > 0$$

Note that the term $\left(\Lambda_t^+ + (1-q)\,\Lambda_{t-1}^-\right)$ could be either positive or negative, depending on q, Λ_t^+ and Λ_{t-1}^-.

III Skewness

Let us define p as the probability that $\Lambda_t^+ + (1-q)\,\Lambda_{t-1}^- > 0$:

$$\begin{aligned} p &= \mathbb{P}\left(\Lambda_t^+ + (1-q)\,\Lambda_{t-1}^- > 0\right) \\ &= \frac{2}{\pi}\arctan\left(\frac{1}{1-q}\right) \end{aligned} \tag{9}$$

Let us define as well a paramer c, where $c \in \{1,2,3,4\}$, such that:

$$c = \begin{cases} 1 & \text{if } \Lambda_t \geq 0,\ \Lambda_{t-1} \geq 0 \\ 2 & \text{if } \Lambda_t \geq 0,\ \Lambda_{t-1} < 0 \\ 3 & \text{if } \Lambda_t < 0,\ \Lambda_{t-1} \geq 0 \\ 4 & \text{if } \Lambda_t < 0,\ \Lambda_{t-1} < 0 \end{cases} \tag{10}$$

Then, we have the following events and probabilities:

$$\mathbb{P}(c=1, r_t > 0) = \frac{1}{4} \tag{11}$$

$$\mathbb{P}(c=2, r_t > 0) = \frac{p}{4} \tag{12}$$

$$\mathbb{P}(c=2, r_t < 0) = \frac{1-p}{4} \tag{13}$$

$$\mathbb{P}(c=3, r_t < 0) = \frac{1}{4} \tag{14}$$

$$\mathbb{P}(c=4, r_t < 0) = \frac{1}{4} \tag{15}$$

Which implies, unconditionally:

$$\begin{aligned} \mathbb{P}(r_t > 0) &= \frac{1}{4} + \frac{p}{4} \\ &= \frac{1+p}{4} \end{aligned} \tag{16}$$

$$\begin{aligned} \mathbb{P}(r_t < 0) &= \frac{1-p}{4} + \frac{1}{4} + \frac{1}{4} \\ &= \frac{3-p}{4} \end{aligned} \tag{17}$$

And, as $0 \leq p \leq 1$, we have the following result:

Proposition 1 *The market is positive skewed, i.e.* $\mathbb{E}\left[r_t - E\left(r_t\right)\right]^3 \geq 0$ *for all* $0 \leq q \leq 1$. *Moreover, the expected market return is negative, i.e.* $\mathbb{E}(r_t) \leq 0$ *for all* $0 \leq q \leq 1$.

Proof. We can integrate out the third moment.

$$\begin{aligned}
\mathbb{E}(r_t^3) &= \sum_{k=1}^{4} \mathbb{P}(c=k)\mathbb{E}(r_t^3|c=k) \\
&= \frac{1}{4}\sqrt{\frac{2}{\pi}}\beta^3\sigma_\Lambda^3[2+q(3+q(-3+2q))-2q^3-(2+3(-1+q)q)] \\
&= \frac{3}{2}\sqrt{\frac{2}{\pi}}\beta^3\sigma_\Lambda^3 q(1-q) \\
&\geq 0
\end{aligned} \tag{18}$$

And the expected market return is:

$$\begin{aligned}
\mathbb{E}(r_t) &= \sum_{k=1}^{4} \mathbb{P}(c=k)\mathbb{E}(r_t|c=k) \\
&= \sqrt{\frac{2}{\pi}}\beta\sigma_\Lambda(q-1) \\
&\leq 0
\end{aligned} \tag{19}$$

Therefore, $\mathbb{E}\left[r_t - E\left(r_t\right)\right]^3$ =E(r_t^3)-3×$\mathbb{E}(r_t) \times \sigma_\Lambda^2 - \left[\mathbb{E}(r_t)\right]^3 \geq 0$. ■

IV R-Squared

Individual-stock R-squared is the R-squared of a regression of r_{it} on the observable market return, r_t. In our model, it is easy to see that R_i^2 equals the square of the correlation between r_{it} and r_t.

Let us define R_i^{2+}as the R-squared of the regression of r_{it} on r_t, conditional on $r_t \geq 0$. We similarly define R_i^{2-}. Therefore:

$$\begin{aligned}
R_i^{2+} &= \mathrm{Corr}(r_{it}, r_t|r_t>0)^2 \\
&= \frac{\left(\mathrm{Cov}\left(r_{it}, r_t|r_t>0\right)\right)^2}{\mathrm{Var}(r_{it}|r_t>0)\,\mathrm{Var}(r_t|r_t>0)}
\end{aligned} \tag{20}$$

$$\begin{aligned}
R_i^{2-} &= \mathrm{Corr}(r_{it}, r_t|r_t<0)^2 \\
&= \frac{\left(\mathrm{Cov}\left(r_{it}, r_t|r_t<0\right)\right)^2}{\mathrm{Var}(r_{it}|r_t<0)\,\mathrm{Var}(r_t|r_t<0)}
\end{aligned} \tag{21}$$

The conditional covariances can be calculated using the parameter c. For example when conditioning on $r_t > 0$

(quite similar when $r_t < 0$)

$$\begin{aligned}\mathrm{Cov}\left(r_{it}, r_t | r_t > 0\right) &= \mathbb{E}(r_{it} r_t | r_t > 0) - \mathbb{E}(r_{it} | r_t > 0)\, \mathbb{E}(r_t | r_t > 0) \\ &= \sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_{it} r_t | c = k,\, r_t > 0) \\ &\quad - [\sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_{it} | c = k,\, r_t > 0)] \\ &\quad \times [\sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_t | c = k,\, r_t > 0)]\end{aligned} \tag{22}$$

$$\begin{aligned}\mathrm{Var}\left(r_{it} | r_t > 0\right) &= \mathbb{E}(r_{it}^2 | r_t > 0) - [\mathbb{E}(r_{it} | r_t > 0)]^2 \\ &= \sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_{it}^2 | c = k,\, r_t > 0) \\ &\quad - [\sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_{it} | c = k,\, r_t > 0)]^2\end{aligned} \tag{23}$$

$$\begin{aligned}\mathrm{Var}\left(r_t | r_t > 0\right) &= \mathbb{E}(r_t^2 | r_t > 0) - [\mathbb{E}(r_t | r_t > 0)]^2 \\ &= \sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_t^2 | c = k,\, r_t > 0) \\ &\quad - [\sum_{k=1,2} \mathbb{P}(c = k | r_t > 0)\, \mathbb{E}(r_t | c = k,\, r_t > 0)]^2\end{aligned} \tag{24}$$

As all the expectations above are conditional on c, i.e. the explicit equations for r_{it} and r_t are determined from equations (1) - (4) and equations (5) - (8) respectively.

Finally we derive expressions for $R^{2\pm}$, where $R^{2+} = \frac{1}{N}\sum_i R_i^{2+}$, $R^{2-} = \frac{1}{N}\sum_i R_i^{2-}$.

$$R^{2+} = \frac{1}{1 + \frac{m\cdot(1+p)}{1+M_2^+ - \frac{1}{1+p}\left(a+M_1^+\right)^2}} \tag{25}$$

$$R^{2-} = \frac{1}{1 + \frac{m\cdot(3-p)}{Q}} \tag{26}$$

where

$$Q = q^2 b + M_2^- + (b(q^2 + (1-q)^2)) + 2\cdot q(1-q)a^2 - \frac{1}{3-p}(M_1^- - q\cdot a - a)^2 \tag{27}$$

$$M_1^+ = a \times \left[\sqrt{2 + (-2+q)\cdot q} - (1-q)\right] \tag{28}$$

$$M_2^+ = a^2 \times [(2 - q\cdot[2-q])\cdot \mathrm{arccot}[1-q] - (1-q)] \tag{29}$$

$$M_1^- = a\left[1 - \sqrt{2 - q\cdot(2-q)}\right] \tag{30}$$

$$M_2^- = \frac{1}{\pi}\cdot[\pi\cdot(2 + q\cdot(q-2)) - 2\cdot(1-q) - 2\cdot(2 + q\cdot(q-2))\cdot \mathrm{arccot}[1-q]] \tag{31}$$

$$a = \sqrt{\frac{2}{\pi}} \qquad m = \frac{\sigma^2}{\beta_i^2 \sigma_\Lambda^2} \tag{32}$$

The expressions for R^{2+} and R^{2-} are not monotone in q. However, we can easily prove the following result.

Proposition 2 *There exists $\overline{q} \in [0,1]$, such that, for all $q < \overline{q}$, the downside R-squared is decreasing in q.*

Proof. Proof. Differentiating R^{2-} with respect to q in (26) yields:

$$\frac{\partial}{\partial q} R^{2-}(q=0) = -\frac{5 \times m \times \left[52 + 40 \times \left(-4 + \sqrt{2}\right) \times \pi + 75 \times \pi^2\right]}{\left(18 - 5 \times (2 + 5 \times m) \times \pi\right)^2} < 0 \tag{33}$$

Now, note that the general form of R^2 is

$$R^2 = \frac{1}{1 + \frac{m}{K}} \tag{34}$$

For the special case of R^{2-}, we have $K = \frac{Q}{3-p}$, where Q and p are functions of q from (9) and (27). Taking the first derivative with respect to q yields:

$$\frac{\partial}{\partial q} R^2 = \frac{m}{(K+m)^2} \frac{\partial K}{\partial q} \tag{35}$$

Therefore, $sign\left[\frac{\partial}{\partial q} R^2\right] = sign\left[\frac{\partial K}{\partial q}\right]$, because $m \geq 0$. Also:

$$\frac{\partial^2}{\partial q^2} R^2 = \frac{m}{(K+m)^2} \left[\frac{\partial^2 K}{\partial q^2} - \frac{2}{K+m}\left(\frac{\partial K}{\partial q}\right)^2\right] \tag{36}$$

To prove the proposition, it suffices to show that $\frac{\partial^2}{\partial q^2} R^2 > 0$, since $\frac{\partial}{\partial q} R^{2-}(q=0) < 0$. Using $K = \frac{Q}{3-p}$, we can easily compute $\frac{\partial K}{\partial q}$ and $\frac{\partial^2 K}{\partial q^2}$ from (9) and (27). Substituting[†] into (36), yields $\frac{\partial^2}{\partial q^2} R^{2-} > 0$ for $q \in [0,1]$. Therefore, $\frac{\partial K}{\partial q}$ is strictly increasing starting from a negative value (when $q = 0$ in 33). The infinite differentiability of R^{2-} (continuity of first derivative of R^{2-}) guarantees that there is a $\overline{q} \in [0,1]$ such that $\frac{\partial K}{\partial q}$ for all $q < \overline{q}$, i.e. $\frac{\partial}{\partial q} R^{2-} < 0$ for all $q < \overline{q}$. ■

.

The model predicts that, as q is closer to one, then also the downside R-squared may increase[‡] (depending on the ratio $\frac{\sigma^2}{\beta_i^2 \sigma_\Lambda^2}$. The reason is that, as above, as q tends to one, the only information that is incorporated into the current returns is the information contained in the current market return (whether it is positive or negative), and therefore the R-squared increases. In the limit, when $q = 1$, both the upside and the downside R-squared are equal.

Finally, we can prove, in a similar fashion, a negative relationship between q and the difference $\left(R^{2-} - R^{2+}\right)$.

Proposition 3 *If $0 < \frac{\sigma^2}{\beta_i^2 \sigma_\Lambda^2} < \infty$, the difference $\left(R^{2-} - R^{2+}\right)$ is decreasing in q for all $q < \overline{q}$.*

Proof. Proof. The proof proceeds in two steps. In the first step we show that $\frac{\partial}{\partial q} R^{2-} \leq \frac{\partial}{\partial q} R^{2+}$ when $q = 0$. To see that, we can compute:

$$\frac{\partial}{\partial q} R^{2+}(q=0) = -\frac{6 \cdot m \cdot \left(-44 + 24 \cdot \left(-2 + \sqrt{2}\right) \cdot \pi + 9 \cdot \pi^2\right)}{\left(28 - 3 \cdot (4 + 3 \cdot m) \cdot \pi\right)^2} \tag{37}$$

■

[†]The expressions for $\frac{\partial K}{\partial q}$ and $\frac{\partial^2 K}{\partial q^2}$ are too lenghty, and are available from the authors upon request.

[‡]Our numerical simulations show that, irrespective of σ^2, β_i, and σ_Λ^2, the value $\overline{q}$ is very close to one ($\simeq 0.96$).

$$\frac{\partial}{\partial q}R^{2-}(q=0) = -\frac{10\cdot m\cdot\left(52+40\cdot\left(-4+\sqrt{2}\right)\cdot\pi+75\cdot\pi^2\right)}{\left(36-5\cdot(4+5\cdot m)\cdot\pi\right)^2} \tag{38}$$

It can be shown that $\frac{\partial}{\partial q}R^{2-}(q=0) < \frac{\partial}{\partial q}R^{2+}(q=0)$ for all $m>0$.

In a second step, we will show that, for all $q<\tilde{q}$, $\frac{\partial}{\partial q}R^{2-} \leq \frac{\partial}{\partial q}R^{2+}$. This automatically implies that $\left(R^{2-}-R^{2+}\right)$ is decreasing in q from Proposition 2.

The general form of R^2 and its first derivative are:

$$R^2 = \frac{1}{1+\frac{m}{K}} \tag{39}$$

$$\frac{\partial}{\partial q}R^2 = \frac{m}{(K+m)^2}\frac{\partial K}{\partial q} \tag{40}$$

We will show that R^{2+} has a minimum and that R^{2-} is lower than such minimum value. Trivially, $\frac{m}{(K+m)^2}\to 0$ when $m=0$ or $m\to\infty$. Therefore R^{2+}takes two extreme values at $m=0$ and $m=\infty$. We therefore consider the non-trivial case where m is bounded away from zero and infinity. In this case the extreme of (39) is achieved at $m=K$. So we have the following extreme independent of m:

$$\frac{1}{4K}\frac{\partial}{\partial q}K \tag{41}$$

where

$$K = \frac{1}{1+p}(b+M_2^+ - \frac{1}{1+p}\left(a+M_1^+\right)^2)$$

The extreme has a lower bound at $q=0$ with value:

$$\frac{44+48\cdot\pi-24\cdot\sqrt{2}\cdot\pi-9\cdot\pi^2}{-168\cdot\pi+72\cdot\pi^2} \approx -0.00360556$$

Therefore, since $\frac{\partial}{\partial q}R^{2-}(q=0) < \frac{\partial}{\partial q}R^{2+}(q=0)$, it must be the case that $\frac{\partial}{\partial q}R^{2-} < \frac{\partial}{\partial q}R^{+}$ for all $q<\overline{q}$. ■

Our model also shows how the upside R^2 is also affected by the prohibition of short sales, that is, when negative market information cannot be immediately impounded into prices. The reason is that, even if the current market shock is positive, then individual stock returns will fully incorporate the current positive market return if the previous market shock was negative, but it will also incorporate part of the negative past shock, so the upside $R^{2-}$is indeed lower.