The Real Effects of Short Selling Constraints: Cross-Country Evidence

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Abstract

We examine the effect of short selling constraints on stock prices and corporate investment. To do so, we exploit world-wide regulatory interventions to permit short selling. We find that a drop in short selling constraints causes stock prices and crash risk to drop, and price efficiency to increase. Corporate investment also drops, is accompanied by a drop in debt and equity, and becomes more responsive to growth opportunities. Our results suggest that short selling constraints can alleviate distortions in stock prices and corporate investment. Our results are consistent with stakeholders inferring information from stock prices and adjusting investment accordingly.

Keywords: *Short selling; Market efficiency; Equity mispricing; Corporate investment*

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1. Introduction

Regulators world-wide seek to reduce capital market frictions for strengthening financial markets. Such regulatory efforts raise a critical question: Does alleviating frictions in the capital markets affect stock prices and corporate investment? With the goal of extending the ongoing conversation on this issue, we focus on countries that legalize short selling for the first time, and investigate the real and financial effects of alleviating short selling constraints around the time short selling becomes legal.[1] Our results suggest that lifting short selling constraints reduces stock price overvaluation and increases stock price efficiency. Further, alleviating short selling constraints, also affects the level and quality of corporate investment, presumably through its effect on stock prices.

Past research offers some guidance on why short selling legalization may affect stock prices and corporate investment. Specifically, researchers argue that short selling can reduce stock price overvaluation and facilitate price discovery, so that stock prices incorporate the views of pessimistic investors (Miller, 1977; and Diamond and Verrecchia, 1987). A more informationally efficient stock market may have positive externalities for the real economy as it can make capital allocation more efficient. One reason is that short selling constraints can cause stock price overvaluation and keep cost of equity artificially low, which encourages firms to issue new equity, thereby encouraging corporate investment (Gilchrist, Himmelberg, and Huberman, 2005; and

[1] We consider short selling legal at the time short selling becomes legally possible. For example, in some countries there is a period when short selling is not forbidden, but securities lending is (e.g. Norway), and vice-versa. We require that both short selling and securities lending are allowed.

Baker, Stein and Wurgler, 2003). Another reason is that stock prices aggregate information from many different participants, and as a result, may contain information about firms' growth prospects that managers and other stakeholders do not yet have. This information, in turn, can guide decisions about corporate investment. When stock prices are more informationally efficient, it helps optimize capital allocation, in that prices contain more accurate information about firm's prospects (Dow and Gorton (1997), Subrahmanyam and Titman (2001), and Chen, Goldstein, and Jiang (2007)). The drop in stock prices that results from legalizing short selling may communicate to managers and stakeholders that growth prospects are lower than expected, and that the firm needs to readjust its investment strategy.[2]

Empirical research provides evidence that short selling restrictions indeed cause stock market overvaluation (Jones and Lamont, 2002).[3] Further, short selling constraints also cause stock prices to be less efficient as incorporation of negative information in prices gets delayed (Boehmer and Wu, 2013; Bris, Goetzman, and Zhu, 2007). Most inferences about short selling are derived from research conducted only in the US, though there have been some efforts to illuminate the link between short selling constraints and stock prices in other countries (Bris, Goetzman, and Zhu, 2007). Nevertheless, the impact of short selling constraints on corporate investment, and the mechanism(s) through which this effect occurs, remains shrouded in mystery. Grullon, Michenaud and Weston (2015) find that the incremental repeal of the uptick rule which prohibited short selling in declining stocks in the US dampened investment and equity issues for small firms. While

[2] For additional channels linking stock prices and corporate investment see Goldstein and Guembel (2008) and Polk and Sapienza (2009).
[3] For additional evidence that short selling constraints cause stock prices to be overvalued see Ofek and Richardson (2003), and Cohen, Diether, and Malloy (2007). There is also some evidence that short selling constraints have negligible effect on the level of stock prices (e.g.,Kaplan, Moskowitz, and Sensoy, 2013).

informative, their research does not cast light on the possible effects of tectonic shifts in short selling regulations in stock markets other than the U.S. Consider that, legalization of short selling dramatically impacts short selling constraints for both large and small stocks, whereas the repeal of the uptick rule seems to affect mostly small firms for whom short selling constraints are binding (as suggested in Grullon et al., 2015). Thus, the finding that the repeal of the uptick rule has little effect on the investment of large firms may not apply for regulatory changes that affect a larger cross-section of firms in the economy. Furthermore, stock prices tend to be quite informationally efficient in the U.S., so that stakeholders infer information about growth opportunities from prices, which may not be the case in countries where stock prices are less informative.[4] Finally, relative to the U.S., many countries rely more heavily on debt markets for financing. Consequently, Grullon et al's (2015) attribution of drop in corporate investments to equity issues will not necessarily apply internationally.[5] There is thus a need to investigate the real and financial consequences of legalizing short sales in the international context, which has not yet been studied in the literature.

Interestingly, past research shows that regulatory changes do not always result in short selling becoming feasible (or practiced). As a result, it is possible that even when short selling is legalized, it still remains very costly and/or difficult to short stock, making short selling

[4] Morck, Yeng and Yu (2000) ranks the US among the top markets in the world for the informational content of its stock market.

[5] La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997) document that the United States have relatively large equity markets, and find that the size of equity markets depends on the country's legal environment, such that countries that rank high in antidirector rights and rule of law tend to have larger equity markets. In addition, common law countries tend to have larger equity markets, compared to civil law countries (including the French, German and Scandinavian civil law subfamilies).

unfeasible.[6] For example, in some countries (e.g., Argentina) the market for lending securities is undeveloped, and thus it is very difficult to borrow the stock needed to sell short. We exploit cross-country differences in short selling feasibility with the expectation that effects associated with alleviating short selling constraints will be most prominent in countries where new regulation resulted in short selling actually becoming legal and feasible. Indeed, our results reveal that, in countries where short selling becomes legal and feasible, prices drop, incorporate negative information faster, and are less prone to crash risk, suggesting a reduction in overvaluation, and a higher quality price, that is more reflective of stock's fundamental value. Corporate investment, as measured by growth in total assets, also drops after legalization of short selling. The drop is significantly larger in countries where short selling becomes feasible compared to countries where short selling remains unfeasible. Further, the drop in investment is related to the amount of mispricing, as measured by the cumulative abnormal return around the short selling rule change. We also find that investment allocation efficiency improves in feasible countries. Specifically, we find that sensitivity of corporate investment to growth opportunities increases after legalization in countries where short selling becomes feasible.

Next, we decompose total asset growth into expansion in various asset and financing components. We find that short selling legalization reduces growth in both cash and PP&E, suggesting a strong effect of prices on real investment that goes beyond their effect on cash holdings (Stein, 1996). On the financing side, we find that both net debt issues and net equity issues drop, and thus the effect of prices on corporate investment cannot be fully explained only

[6] In some countries, certain features such as tax rules, frictions, market laws (Bris et al. (2007)), and high costs (Chang, Luo, and Ren (2014)) make short selling unfeasible.

by their impact on the cost of external equity. It seems that stock prices are also linked to investment because of the information they reveal to managers and stakeholders (including debtholders) about growth opportunities. Finally, for robustness we show that our results disappear if we use counterfactual event dates, suggesting our results are not due to spurious time trends around the event.

Further, we exploit the fact that certain countries legalize short selling for a subset of listed stocks, which allowed us to examine within-country variations in corporate investment. In our sample, there are four feasible countries where regulatory change resulted in short selling becoming legal only for some stocks. We perform difference-in-differences (DiD) analyses, comparing a treatment group of firms (stocks that became part of the short selling list, and for which short selling became legal), to a control group of firms (stocks not part of the list, and for which short selling remained illegal as the regulation change did not include them). Consistent with earlier results, within-country analyses reveal that corporate investment drops the most for those stocks where short selling becomes legal. The advantage of this analysis is that we compare firms within the same country, mitigating concerns that our earlier results may be due to national economic cycle. We are therefore able to control for country-level effects to isolate the true impact of short selling legalization on stock prices and capital investment.

Short selling constraints tend to be intertwined with financial market development, so that it can be challenging to disentangle the true impact of short selling constraints on stock prices and capital investment. One effective way to cast light on the true impact of short selling constraints is to evaluate real and financial effects around an exogenous event as we do in this study. The legalization of short selling is a regulatory decision and is not truly random (like an earthquake or

tsunami would be). However, this non-randomness is unlikely to explain our results. Regulators do not pursue short selling legalization when they foresee contraction in the country's business cycle. On the contrary, regulators are often afraid that short sales can cause stock prices to plunge, as evidenced by the many countries that placed restrictions on short selling during the recent financial debacle (including the U.S.). Our within-country analysis should alleviate concerns that the results may be attributed to variations in the economic cycle. Further, results remain unchanged when we control for GDP growth to account for changes in economic cycle. Finally, we compare countries where short selling becomes feasible (after legalization) to those where it did not, and both sets of countries seem to be in similar stages of growth and development compared to their peers: Both sets of countries where short selling becomes legal and feasible and where short selling becomes legal but not feasible have slightly higher GPD growth than their peers and slightly lower levels of stock market development in the 5 years preceding the legalization of short sales.

Putting all of our findings together, the present research suggests that alleviating short selling constraints has an effect on corporate investment through its effect on stock prices. Thus, we contribute to the growing literature on the real effects of non-fundamental shocks to stock prices, specifically to studies focusing on the impact on corporate investment (). We show that the effect is not uniquely due to equity becoming costlier to raise, since debt also drops. It seems stakeholders (including debtholders) learn from stock prices, and corporate investment is adjusted as a result. Thus, we also advance knowledge about the use of information contained in stock prices to make corporate decisions (Chen, Goldstein, and Jiang, 2007), suggesting that learning may be an important mechanism explaining the sensitivity of investment to prices.

Our research also complements the literature that examines the relation between financial market development and economic growth (King and Levine, 1993), in general, and more specifically, the literature studying the relation between stock market development and real allocation efficiency (Wurgler, 2000; Levine and Zervos, 1998). We seek to provide more direct evidence on how specific legislation targeted towards stock market development might improve allocation efficiency. Stock prices help guide investment policy, as managers, investors and stakeholders infer information contained in stock prices about a firm's information opportunities. On the practical side, our inquiry helps inform regulators wanting to legalize short selling and/or take initiatives to increase the feasibility of short selling.

In section 2 we discuss the short selling regulation changes for the 13 countries that are part of our sample, section 3 describes the data and sample, section 4 presents the results of the effects of short selling regulation changes on stock prices, section 5 presents the results of the effects of short selling regulation changes on corporate investment, section 6 presents robustness tests, and section 7 concludes the paper.

2. Cross-country Regulation on Short Selling

We start data collection by using three academic papers – namely, Bris, Goetzmann, and Zhu (2007), Charoenrook and Daouk (2009), and Jain, Jain, McInish, and McKenzie (2013) – to generate an initial list of countries where short selling becomes legal for the first time after 1990,[8] which resulted in a sample of 23 countries. The literature does not always agree on when short

[8] As long as at least one paper specifies that short selling becomes legal in a country after 1990, we include that country in our sample.

selling became legal in a country, so we reach out to regulators in these 23 countries for more information. We delete countries where regulators informed us that short sales were legalized before 1990 (Spain). Countries where regulators contend that short selling has always been legal were also eliminated (New Zealand and Hungary). We delete countries if no information was forthcoming from regulators, and we are not able to corroborate the information with at least two academic papers (Luxembourg, Fiji, Greece, Peru, Taiwan, and Namibia). Finally, countries that reneged on short selling legalization within a short time (defined as less than three years) were removed from further consideration (Malaysia). This multi-stage process concludes with a final sample of 13 countries for further investigation. Table 1 contains information on the regulation changes for each of these countries. Geographically, these 13 countries span three continents (South America, Asia, and Europe) across various degrees of economic development.

For most countries we are able to obtain the date of the regulation change from the regulator, or the regulators' website. In three cases we are not able to obtain information from the regulator (Argentina, Philippines and Poland) and thus we obtain the date from academic papers, and if there is a discrepancy in the dates we require that the dates match in at least two academic papers. Even when countries change rules to initiate short selling, the new regulation does not always result in short selling becoming feasible in the country. Every country has a constellation of market laws, regulations and institutional norms that may result in significant market frictions and costs.[10] Thus, in some countries, short selling is not practiced, although it is legal. We classify short selling in these countries as not feasible (Bris et al., 2007). We are not always able to obtain information on

[10] For example, in Argentina it is very difficult to borrow stock, making short selling unfeasible.

feasibility from primary informants.[12] As a result, we complement the information we obtain from regulators and exchanges on feasibility with information from two academic studies: Bris, Goetzmann, and Zhu (2007), and Charoenrook and Daouk (2009). In most cases, these two studies agree on the classification of feasibility, and we use their classification. When there are conflicts in classification we complement our classification with statistics on the scaled borrowing ratio (SBR) from Jain et al. (2013).[13], [14] We find that after legalization short selling becomes feasible in 6 countries: Mainland China, Hong Kong, Norway, Sweden, Thailand, and Turkey. However, short selling remains unfeasible, even after being legalized, in 8 countries: Argentina, Chile, Mainland China, India, Indonesia, Philippines, Poland, and South Korea.

The number of stocks affected by the regulatory change varies from country to country. In some countries the rule affects all stocks while in some others it only affects a subset of stocks. We obtain information on the stocks that are affected by the new rule from countries' regulators and exchanges. Short selling opens to all stocks in the following 7 countries: Argentina, Norway, Indonesia, Philippines, Poland, South Korea, and Sweden. The regulatory change affects only a subset of large and liquid stocks in the following 7 economies: Chile, Mainland China, Hong Kong, India, Thailand, and Turkey.[15]

[12] We are not able to obtain information on the feasibility of short selling from the country's regulator or exchange for the following countries: Argentina, Chile, Mainland China, Philippines, Poland, South Korea, Thailand, and Turkey.

[13] Scaled borrowing ratio (SBR) is the daily average outstanding dollar borrowing during the period from July 2006–January 2010, divided by the country's total stock market capitalization at the end of the previous year. A large number of rule changes in our sample happen significantly before 2006, however, if this statistic is low years after the rule change, then it is likely that short selling did not become feasible after the rule change. We consider short selling in a country as unfeasible when the ratio is below 0.05.

[14] For China we compute the yearly average of daily short turnover for stocks that are eligible to be shorted (short volume scaled by trading volume) between 2010 and 2014 (the numbers are respectively: 0.01%, 0.59%, 0.73%, 1.52%, 1.11%). We consider shorting feasible in 2013, because of the economically significant increase in short selling that occurs in 2013.

Some countries update the list of stocks eligible for short selling based on some pre-set criteria. For example, The Stock Exchange of Hong Kong revisited and expanded the list of stocks more than 100 times between Jan, 1994 and August, 2014. [16] Some of these revisions are a result of a change in criteria, such as the list revision of May 1997, but most are automatic list revisions based on benchmarks for liquidity and market cap. In most countries, we focus on the list of stocks when short selling was first allowed except for Hong Kong and China. In Hong Kong we set our event date to 1997. Even though Hong Kong allows short selling for the first time in 1994, it does so for a very restricted group of stocks (21 stocks only). Hong Kong expanded the list significantly in 1997 to 129 stocks, which motivated our decision to use 1997 as the event date for Hong Kong. China allowed short selling for the first time in 2010, but short selling was rare and became more common with the list expansion of 2013.[17]

Countries' decision to legalize short selling is not random. However, we do not think that our results that corporate investment drops with the legalization of short selling can be attributed to the timing of the regulation change. Country officials state that the regulation change is meant to improve market efficiency and market quality, facets of stock market development.[18] Stock market development is known to promote corporate growth (Wurgler, 2000). Further, it is unlikely that countries will legalize short selling when the business cycle is expected to drop, because of

[16] For detailed information on the list revisions, refer to http://www.hkex.com.hk/eng/newsconsul/hkexnews.
[17] See footnote 14.
[18] For example, a news release from the Hong Kong Stock Exchange states the purpose of developing and regulating short selling is to maintain an orderly and efficient market. Similarly, regulators in Thailand state that they introduced short selling for the purpose of improving overall securities trading by providing investors with more channels of investment and alternatives in risk management, while maintaining stable trading on the Stock Exchange. ("Re: Short Selling in the Exchange, 2001:Bor.Sor./Khor. 01-00". http://www.set.or.th/en/regulations/rules/member_files/BorSorKhor0100_EN.pdf)

fears that short selling would exacerbate the drop in prices.[19] Consistent with officials' stated goal we observe that countries legalizing short selling are growing a little faster and have lower levels of stock market development than other countries in the same region. We compute the 5-year average GDP growth, and the 5-year average growth in total market capitalization scaled by GDP for the period leading up to the regulation change, and compare these statistics to those in countries in the same geographical region for the same period. The 5 year GDP growth is slightly higher in the period leading up to the regulation change and the growth in market capitalization is slightly lower than comparable countries. Interestingly, both feasible and non-feasible countries tend to have similar differences in GDP growth and growth in market capitalization compared to geographically similar countries. It seems like both feasible and non-feasible countries legalize short selling at similar stages of business cycle, and thus tests contrasting the effects of short selling in feasible and non-feasible countries mitigate concerns that results are explained by the timing of the events. Further, we control for variations in business cycle with GDP growth and results remain unchanged. Finally, we perform within country analysis using feasible countries where short selling became allowed for a subset of stocks. We study corporate investment for this group of stocks compared to a matched sample of stocks from the same country, that were not allowed to be shorted, and find consistent results.

[19] In fact, during the recent financial debacle, many countries imposed short selling bans, thinking that short selling was contributing to the sharp price declines and hoped that by doing so they would be able to restore equilibrium to markets (Beber and Pagano, 2013).

3. Data and Sample

We obtain data for accounting measures and stock market returns from Thomson Reuters Datastream for the 13 countries that are part of our study, for a period of 15 years surrounding the event period.[20] The earliest date in our sample is 1984 and corresponds to data from Sweden which changed its regulation in 1991. The latest date is 2014 and corresponds to data from Mainland China which was the last country to change regulation in our sample in 2010. We look at regulation changes after 1990 because data is scarce in earlier periods.

We collect data for all firms with data available on Datastream. We use Datastream's list of active and dead stocks to avoid survivorship bias. In our initial analysis, we keep only firms that are eligible to be shorted: For countries where short selling becomes legal for a list of stocks (but not all stocks), we keep only firms that are part of the list and that have data available on Datastream; for all other countries, we keep all firms with available data. In table 1 we include the number of firms that compose our sample in each country. After excluding financial firms, our sample is composed of 681 short selling eligible firms in feasible countries, and 1,487 short selling eligible firms in non-feasible countries. We define all variables in Appendix 1.

We obtain Datastream World Index to proxy market returns, and compute returns from the Datastream variable - Total Return Index. We filter out holidays and non-trading days by deleting dates with low frequency data on non-zero returns. For each country and day, we count the number of stocks with non-zero returns. We then compare the number of non-zero returns for each day with that month's average. If the number of non-zero returns is less than 5% of the month's average,

[20] For our main analysis, we use data from 3 years before to 3 years after the event. But for falsification tests we use an identical setup around two counterfactual events: one is set to be 4 years before the event and the other 4 years after. We do not include Mainland China in the falsification test that is set 4 years after the event for lack of data.

we consider that date a holiday and delete the data for that date and country from the sample. Datastream retains the values of Total Return Index for a long time after the stock is delisted. To account for this, we get each stock's last non-zero return day, and set to missing all the zero-return dates that follow. We then use the method proposed by Ince and Porter (2006) to filter outliers.[21] We winsorize daily returns at 1st and 99th percentiles. We winsorize all accounting variables at the 5th and 95th percentiles.

4. The Effect of Short Selling on Stock Prices

4.1. Stock Market Reaction to Short Selling Regulatory Changes

In this section, we investigate the stock market reaction to the short selling regulation changes. Miller (1977) suggests that stock prices are likely overvalued when short selling is not legal. When short selling is prohibited, and investors have heterogeneous beliefs, prices only reflect the valuation of the bullish investors and of the bearish investors who already own the stock. As a result, stock prices then do not reflect information held by bearish investors who do not own the stock, because these investors are prevented from trading. [22]

We examine whether stock prices drop in countries where short selling becomes legal and feasible following the rule change. We expect the rule change to have a stronger effect in feasible countries after the rule change, and have weaker or negligible effect in non-feasible countries after the rule change. Regarding the timing of the effect, it is hard to predict when the rule change will

[21] If R_t (stock return on day t) or R_{t-1} (stock return on day t-1) is greater than 300% and $(1 + R_t)(1 + R_{t-1}) - 1$ is less than 50%, we set R_t and R_{t-1} to missing.

[22] For empirical evidence that prices drop as short selling constraints decline see: Jones and Lamont (2002); Ofek and Richardson (2003); Ofek, Richardson, and Whitelaw (2004); Cohen, Diether, and Malloy (2007); Chang, Cheng, and Yu (2007); Chang, Luo, and Ren (2014); and Grullon, Michenaud, and Weston (2015).

influence stock prices, and the timing of the effect may vary from country to country: Prices may start dropping either before the rule change in expectation of future short selling activity or after the rule change as short sellers become active in the market.

We follow traditional event study techniques to estimate abnormal returns (*ARs*) and cumulative abnormal returns (*CARs*). For each stock-day, we calculate market adjusted abnormal returns (in US dollars) by subtracting daily world index returns from individual stock returns during the event window -10 to +50 trading days, where day 0 corresponds to the day of the rule change.[23] Cumulative abnormal returns are the sum of abnormal returns during a stated window. In Figure 1, we plot cross-sectional means of *CARs* for the window -10 to +50 days. It reports *CARs* for stocks from firms headquartered in feasible countries and non-feasible countries, respectively. *CARs* in feasible countries start dropping gradually 10 days after the rule change and the magnitude of the drop is economically significant: prices drop by more than 5 percent by day 50. Stocks in non-feasible countries, the ones we expect to be least affected by the regulation changes, do not show a clear pattern, suggesting that the regulation change affects the stocks in feasible countries the most.

We complement this graph with Table 2, where we report mean *CARs* and corresponding p-values for each of the 13 countries in the sample for different event windows. Stocks experience negative price movements in 5 of the 13 countries. The countries and regions affected the most by the short selling rule change are Hong Kong, India, South Korea, Norway, and Sweden. These countries and regions experience negative and significant returns in most event windows. With the exception of India and South Korea, all these are feasible countries. We also report means and p-

[23] We also use market model to estimate *CARs*, and results are qualitatively the same.

values of *CARs* for feasible and non-feasible countries as a whole. *CARs* of feasible countries experience an economically and statistically significant drop of more than 5%. The firms from non-feasible countries do not experience a consistent drop in returns. This result suggests that the lifting of the short selling prohibition has a significant effect for only the firms in feasible countries, and suggests that short selling constraints remain large for firms in non-feasible countries.

To sum, we document that stock prices drop after the regulation changes. Prices drop only in countries where short selling becomes feasible after the rule change. Our results are consistent with the logic that short selling reduces stock price overvaluation. In the next subsection we study whether the drop in stock prices is accompanied by more informationally efficient prices.

4.2. Price Efficiency and Market Stability around Short Selling Regulatory Changes

Diamond and Verrecchia (1987) argue that short selling constraints prevent some informative trades and thus make individual stock returns adjust slowly to especially negative information. Short selling may also reduce crash risk (Hong and Stein, 2003). Short selling constraints, may cause investors with negative information to get sidelined from the market until market declines. These investors are flushed out when accumulated hidden negative information comes out, which further exacerbates crash risk and leads us to observe more negatively skewed returns. Some however argue that short selling may destabilize the market by making the market overly sensitive to negative news, and thereby cause panic selling and market crashes. In this sub-section we investigate the effect of the legalization of short selling on price efficiency and crash risk.

We estimate one measure of price efficiency and crash risk each. We estimate price efficiency using *Price Delay* following Hou and Moskowitz (2005) and Boehmer and Wu (2013).

This measure captures the portion of individual stock return variation that is explained by negative lagged market returns. A larger delay means a less efficient stock price, in that it takes longer for the stock to incorporate negative market-wide information. We regress Wednesday-to-Wednesday weekly stock returns on contemporaneous market returns and 4 lags of negative market returns for each firm, over one calendar year. We use negative market returns because short sellers primarily benefit from price declines, and we expect the short selling activity that follows the rule change to cause negative information to get incorporated faster. We require a minimum of 10 observations for each firm-year. We estimate the following unrestricted regression:

$$r_{i,t} = \alpha_i + \sum_{j=0}^{4} \beta_{i,t-j} r^-_{m,t-j} \quad (1)$$

where $r_{i,t}$ is dollar return on stock i, and $r^-_{m,t}$ is the Datastream world index return on negative return day t, and zero if market return is positive.

We also estimate a second regression that restricts the coefficients on lagged market returns to zero:

$$r_{i,t} = \alpha_i + \beta_{6i} r^-_{m,t} + \varepsilon_{i,t}\ , \quad (2)$$

The *Price Delay* is calculated using the R-squared from the unrestricted (equation 1) and restricted (equation 2) models as follows:

$$Price\ Delay_{i,t} = 1 - \frac{R^2(restricted\ model)}{R^2(unrestricted\ model)}\ , \quad (3)$$

Price Delay captures the portion of stock returns that can be explained by lagged negative market returns. A higher *Price Delay* suggests a less efficient stock price, and vice versa.

We estimate one measure of crash risk, *NCSKEW*, following Chen, Hong, and Stein (2001) and Jin and Myers (2006). We use the firm-level weekly residual return to calculate the crash risk measures. To obtain firm-level residual return ε_{jt}, we estimate the following regression:

$$r_{j,t} = \alpha_j + \beta_{1j} r_{m,t-2} + \beta_{2j} r_{m,t-1} + \beta_{3j} r_{m,t} + \beta_{4j} r_{m,t+1} + \beta_{5j} r_{m,t+2} + \varepsilon_{jt} \quad (4)$$

where, $r_{j,t}$ is the return on stock *j* on week *t* and $r_{m,t}$ is the Datastream world index return on week *t.* We also include lead and lag market returns to allow for nonsynchronous trading. Crash risk measure, *NCSKEW*, is the negative skewness of firm-level residual returns for each year. We require a minimum of 30 weekly observations for each firm-year. We compute *NCSKEW* as in Eq. (5)

$$NCSKEW_{jt} = -\frac{[n(n-1)^{3/2} \sum \varepsilon_{jt}{}^3]}{[(n-1)(n-2)(\sum \varepsilon_{jt}{}^2)^{3/2}]} \quad , \quad (5)$$

where *n* is the number of weeks. ε_{jt} is firm-level residual return for firm *j* and week *t*. A higher *NCSKEW* suggests a higher crash risk.

Table 3 contains estimates of these two measures for the pre and post periods and differences in means for stocks across the two periods for countries where short selling becomes feasible and non-feasible. Moreover, we also report difference-in-differences (hereafter, DiD) between these two groups. For stocks in feasible countries, both measures decrease significantly with the rule change, both statistically and economically. Stocks in non-feasible countries do not experience decrease in either of the measures. The DiD for both measures are -0.028 and -0.069 for the price efficiency and crash risk measures respectively. Our results suggest price efficiency increases and crash risk declines after short selling is becomes legal and feasible. Our results are consistent with the articles providing evidence of the positive impact of short selling activity on market efficiency (e.g. Bris, Goetzmann, and Zhu (2007), Boehmer and Wu (2013), Chang, Luo, and Ren (2014), and Saffi and Sigurdsson (2011)). Together with the results in the last subsection, we conclude that after short selling is legal, overvaluation problem is alleviated, price efficiency

improves, and crash risk reduces. In the next sections we investigate the effects of the legalization of short selling on corporate growth.

For robustness we estimate two alternative measures of prices efficiency and crash risk, and obtain similar results (untabulated). One alternative measure of price efficiency we calculate is, ρ_{jTD}^{Diff}, and is estimated following Bris, Goetzmann, and Zhu (2007). It is the difference between the cross-autocorrelation for negative market return days, ρ_{jTD}^{-}, and positive market return days, ρ_{jTD}^{+}. ρ_{jTD}^{-} is the cross-autocorrelations between lagged negative weekly market returns and individual stock returns for stock *j* in country *D* and year *T*. Similarly, ρ_{jTD}^{+} is the cross-autocorrelation between lagged positive weekly market returns and individual stock returns. We use weekly returns and compute cross-autocorrelations for each stock and year. Larger values of ρ_{jTD}^{Diff} correspond to less efficient stock prices. To calculate the cross-autocorrelation, we require there are a minimum of 10 observations for each firm-year.

Following Chen, Hong, and Stein (2001) and Kim, Li, and Zhang (2011), we obtain an alternative measure of crash risk – the down-to-up volatility (*DUVOL*) as defined in Eq. (6) below:

$$DUVOL_{j,t} = log\left[\frac{(n_u-1)\sum_{down}\varepsilon_{jt}^{2}}{(n_d-1)\sum_{up}\varepsilon_{jt}^{2}}\right] \quad (6)$$

where n_u and n_d are the number of up and down weeks, respectively. Specifically, we obtain residuals from regression 4 and for firm *j* in each week *t*, we first separate all the days with firm-level residual returns below the mean in each year (down weeks) from those with firm-level residual returns above the mean for each year (up weeks). We then calculate the standard deviation, separately, for each of these two subsamples. Then, *DUVOL* is the log of the ratio of the standard

deviation of the down days to the standard deviation of the up days. A higher *DUVOL* suggests a higher crash risk.

In untabulated results we find that both measures decline significantly with the rule change in countries where short selling becomes feasible. The DiD for both measures are negative and statistically significant. These results are similar to those reported in Table 3 and suggest that price efficiency increases and crash risk declines as short selling becomes legal and feasible.

5. Effect of Short Selling on Corporate Investment

5.1. Effect on Corporate Investment

Previous studies suggest that mispricing in firms' stocks can distort managers' corporate investment decisions, and that more accurate stock prices can improve the quality of corporate investment. Above, we show that stock prices drop and become more efficient after the new regulation is introduced. In this section, we investigate the effect of short selling on corporate growth and more specifically, we investigate the effect of reduction in stock price overvaluation brought about by short selling constraints on corporate growth. We expect that the rate of corporate growth drops and that its drop is proportional to the reduction in stock price overvaluation.

We again contrast the group of countries where short selling becomes legal and feasible after the rule change, to the group of countries where short selling becomes legal but does not become feasible despite the regulation change. Above, we observe that stock prices drop and stock price efficiency increases only in countries where short selling becomes feasible. Similarly, we expect corporate investment to drop more in countries where short selling becomes feasible. As discussed earlier, feasible and non-feasible countries legalize short selling at similar relative stages

of growth and development compared to geographically similar countries. Thus, comparing across these two groups of countries helps mitigate concerns that the variation in corporate investment is related to timing of the new rule.

In table 4 we present summary statistics of firm characteristics measured 1 year before the regulatory change. We compare firms with shortable stock in feasible and non-feasible countries, and test for the null hypotheses that the means and medians are equal across the two groups. We observe that most characteristics are identical across the two groups of firms, although some measures have different means or medians, but never both: Mean firm size (total assets) and debt issuance are smaller for the firms in feasible countries, and median asset growth and equity issuance are slightly higher.

Figure 2 plots mean and median corporate investment, measured as the percentage change in total assets for firms in feasible countries (firms affected the most by short selling) and firms in non-feasible countries (firms affected the least by short selling) for 7 years surrounding the short selling regulatory changes. We observe that firms in both feasible and non-feasible countries show near-parallel trends before the event, though firms in feasible countries seem to grow at a slightly higher rate. Firms in both feasible and non-feasible countries experience a drop in growth starting 1 year before the rule change, but, as expected, firms in feasible countries experience a much larger drop in growth. Growth in feasible countries drops from a level slightly above that of firms in unfeasible countries to a level slightly below.

In untabulated results we compare the average asset growth three years before the rule change to that three years after. We find that asset growth drops for both feasible and non-feasible countries, but the drop is significantly larger in feasible countries. Average asset growth drops by

13% in feasible countries and by only 6.7% in non-feasible countries. The DiD is -5.87%, and is statistically significant at the 1% level.

Results, so far, show a drop in investment around the implementation of the new short selling rules. In Table 5 we again estimate change in growth, but now we do so in a regression setting, where we control for firm characteristics known to affect investment. We also include firm-fixed effects to capture time-invariant heterogeneity across firms. We estimate panel regressions with data for 7 years surrounding the implementation of the new short selling rule, event year excluded (3 years before and 3 years after). Standard errors are robust to clustering at the firm level.

In the first regression, we include firms from both feasible and non-feasible countries, and include an additional variable to capture the marginal effect of the rule change for firms in feasible countries: *Feasible* × *After* is equal to 1 if the firm is from a feasible country and the new short selling rule is in effect. We find that the drop in investment is 5.24% greater than that in non-feasible countries (coefficient on the variable *Feasible* × *After*), and the coefficient is both statistically and economically significant. In the second regression we add time-varying firm characteristics. We control for contemporaneous cash flows, lag of logged assets and past profitability. See Appendix 1 for details on how we compute each variable. After controlling for firm characteristics, this effect isrobust. We find a drop in investment that is 3.86% larger for firms in feasible countries compared to firms in non-feasible countries. To control the effect of business cycle in different countries, we also include GDP growth in the third regression, and the effect is still quite robust.

We further investigate whether the drop in corporate investment we document can be attributed to the drop in the firm's stock price overvaluation. We measure mispricing using firm CARs for the event window of [-10, 50], and examine whether the drop in asset growth is proportional to the drop in CAR. In the last two columns in Table 5, we report the panel regression results for both feasible and non-feasible countries. We include an interaction variable of CAR with an indicator for after the rule change (*CAR* × *After*) to capture the variation in asset growth that is caused by the drop in overvaluation that follow short selling constraints. Since we document above that the rule changes reduce overvaluation only in countries where short selling becomes feasible, we expect this relation to only exist in this group of countries. The coefficient on *CAR* × *After* in the fourth column is 14.39 and is statistically significant at the 1% level. This coefficient suggests that a one percent drop in stock prices causes a drop in corporate investment of 0.15%. The coefficient on *CAR* × *After* is insignificant (column 5) or non-positive (column 4) for non-feasible countries.

In sum, we find that corporate investment drops as a result of legalization of short selling. We also provide a strong link between mispricing and corporate investment. Specifically, we find that investment drops the most for those firms with the greatest drop in overvaluation caused by the adoption of the new short selling rules. Our results suggest that the legalization of short selling causes corporate investment to drop through its effect on stock price overvaluation and efficiency.

5.2. The Allocation Efficiency of Corporate Investment

The fact that stock prices can influence corporate investment policy, suggests that more informative prices should lead to more efficient investment decisions. Dow and Gorton (1997) and

Subrahmanyam and Titman (1999) argue that managers use information embedded in stock prices to guide them on corporate decisions, such as decisions on corporate investments. One implication of this argument is that when prices become more informationally efficient, managers' corporate decision making will improve. In this sub-section, we investigate whether allocation efficiency of corporate investment improves after legalization of short selling. Firms should increase their investments when growth opportunities are good and reduce their investments when growth opportunities are poor. We expect that firms will increase their sensitivity of investment to growth opportunities, as prices become more efficient, after the regulation change. We measure growth opportunities with sales growth. The obvious choice to measure growth opportunities is market-to-book ratio. However, our measure needs to be independent of stock prices because, prices, and therefore market-to-book ratio, are relatively more overvalued before the rule change.

In Table 6, we report regression results for both feasible and non-feasible countries. The dependent variable is asset growth, and our main variable of interest is sales growth. The coefficient on this variable measures the firms' sensitivity of investment to growth opportunities. To measure the effect of short selling legalization on this sensitivity we interact sales growth with an indicator variable for after the event (*Sales Growth* × *After*). All regressions include firm fixed effects, and standard errors are clustered at the firm-level. We find that asset growth becomes more sensitive to sales growth after the introduction of short selling in feasible countries, but the rule change does not affect the asset growth sensitivity to sales growth in non-feasible countries. The coefficient on *Sales Growth* × *After* is 0.181 and is significant at the 1% level. The coefficient on *Sales Growth* × *After* for non-feasible countries is only 0.04 and significant at the 5% level, and this coefficient becomes insignificant when we control for additional firm characteristics.

Goldstein and Guembel (2008) show that bear raiders can use short selling to manipulate prices with the intention of causing managers to cancel value-creating projects, and thereby profiting from a further decline in prices. Our results are not consistent with Goldstein and Guembel.[24] Our results suggest that on average short selling improves the quality of corporate investment policy. Corporate investment becomes more tightly associated with growth opportunities after short selling becomes allowed and feasible.

5.3. Financing and Asset Growth Components

This section investigates the effect of the rule change on the various asset growth components. We decompose asset growth into all of its major components: We compute growth in cash, non-cash current assets, PP&E, and other assets; we also compute equity issuance, and debt issuance. Like before, we run a panel regression with firm fixed effects, but now the dependent variables are the components of asset growth. Table 7 presents panel regression results. The effect of the short selling rule change in feasible countries relative to non-feasible countries is captured by the dummy variable *Feasible* × *After*.

We find that growth in cash and PP&E drop significantly more in feasible countries after the rule change. Growth in cash drops by 0.94% more in feasible countries compared to non-feasible countries and growth in PP&E drops by 1.51% more. Both these drops are statistically significant at the 1% level. The coefficients on *Feasible* × *After* are not statistically significant for growth in current assets and growth in other assets, and thus we cannot reject the null hypotheses

[24] If managers base their decision to invest on stock prices, a drop in prices may cause managers to forgo a positive NPV projects. This would cause firm value to drop. Short sellers would profit because the lower stock price would cause a reduction in investment that would cause a further reduction in the stock price. Short sellers could therefore profit from price manipulation, and this price manipulation could have real investment consequences.

that growth in current assets and growth in other assets are identical in feasible and non-feasible countries. Stein (1996) argues that firms can respond optimally to stock price overvaluation by issuing cheap equity and keeping the proceeds in cash, as opposed to investing in negative NPV projects. Our results suggest that firms' response to stock price overvaluation is far from optimal. Stock price overvaluation causes cash growth to be high, but it also causes excess growth in PP&E and other assets.

Interestingly, on the financing side, reduction in asset growth is accompanied by drop in net debt and net equity issues. Net equity issues drop by an additional 3.9% and net debt issues by an additional 1.2% in feasible countries compared to non-feasible countries. Our results indicate that effect of legalization of short selling on corporate investment cannot be solely attributed to its effect on the cost of issuing external equity (Morck, Shleifer, and Vishny (1990), Baker and Wurgler (2002), and Baker, Stein, and Wurgler (2003)). Corporate investment also responds to the information revealed by the drop in stock prices to the firms' stakeholders (including firms' debtholders) about future growth opportunities (Dow and Gorton (1997), Subrahmanyam and Titman (1999), and Chen, Goldstein, and Jiang (2007)).

Overall, our results suggest that stock price overvaluation distorts corporate investment decisions, and that legalization of short selling helps improve firms' investment decisions, in that firms reduce corporate investment as the market re-evaluates their growth prospects. Further, this result cannot be fully explained by costlier external equity. Firms can benefit from the legalization of short selling regardless of their firms' main source of financing. Our results imply that the legalization of short selling helps countries achieve a more balanced economic growth, as capital allocation efficiency improves, and capital gets directed to its most productive uses.

5.4. Placebo Tests

In this subsection we check the robustness of our main results with falsification tests. Though the exact dates for short selling rule change is obtained from academic studies and consultations with regulators, we counterfactually recode the dates of the event to be 4 years before and 4 years after the date of the short selling rule change. This test helps alleviate concerns that our results are not due to some structural break surrounding the rule change.

In earlier results, we document that after short selling legalization investment drops in feasible countries, and the drop in investment corresponds to a drop in debt financing. In this section we document that these results disappear if instead we use counterfactual dates for the rule changes. Table 8 contains the results. We find that the coefficient designed to capture the effect of the counterfactual event (*Feasible* × *After*) on growth is insignificant, and the sign of the coefficient varies between positive and negative. Our results mitigate concerns that decrease in corporate investment is caused by structural changes in the economy other than the legalization of short selling.

6. Short Selling and Corporate Investment: Within Country Tests

In some countries short selling becomes legal and feasible for a list of stocks, while it remains illegal for remaining stocks. In this section we perform a differences in differences analysis, where we examine the changes in corporate growth that result from the legalization of short selling for a treatment group of firms relative to a control group. The advantage of this analysis is that we examine the effect of the legalization of short selling within the same country.

The countries that legalize short selling for a list of stocks, and where short selling becomes feasible are: Mainland China, Hong Kong, Thailand, and Turkey. Hong Kong revised its list several times during the period of January 1994 to August 2014. Mainland China does not revise its list after short selling becomes feasible before the end of 2014. For Thailand and Turkey, we are not able to gain access to their list revisions.

We match each firm eligible for short selling to a firm ineligible for short selling. We match without replacement, and require exact matches on country, industry and year. We also match on total assets, and three-year average asset growth as of the year before the stock was added to the short selling list. For these two variables, we compute the Euclidean distance between the treatment firm and each control firm based on the values of the standardized variables. We select the control firm that has the smallest Euclidean distance from the treatment firm. In Table 9, Panel A, we report descriptive statistics for both treatment and control groups. Variable means and medians are comparable among the two groups of stocks. There is no variable in which both differences in means and medians are significantly different from zero.

In panel B we perform regression analysis. We include a panel of treatment and control firms and capture the DiD effect of the rule change with the variable *Short* × *After*¸ which takes the value 1 if the firm is eligible for short selling and the observations corresponds to the year after the rule is in effect. As before, the year of the rule change is excluded from the analysis. In regression 1, we find that asset growth drops by an additional 2.55% for firms eligible for short selling relative to their ineligible pairs (coefficient on the variable *Short* × *After*). The coefficient is both statistically and economically significant. Similar to previous sections, in regression 2 we add time-varying firm characteristics. We control for contemporaneous cash flows, lag of logged

assets and past profitability. In regression 3, we add GDP growth to control for time-varying country characteristics. After controlling for both firm characteristics and country characteristics, our results remain unchanged. We find a drop in investment that is 2.64% larger for eligible firms compared to firms in the control group.

In sum, results from within country analysis are consistent with previous results, and mitigate concerns that our results can be explained by the timing of the legalization of short selling.

7. Summary and Conclusions

In this article we investigate the effect of the legalization of short selling on stock prices and corporate investment. Short selling activity can help improve stock market development, as it promotes liquidity and stock price efficiency. Stock market development may help promote economic development by promoting the allocation efficiency of real assets. The inability to short stock may cause stock prices to be overvalued, as negative information is impeded from being priced. The legalization of short selling may help reduce stock price overvaluation and cause prices to drop closer to their fundamental values and become more informationally efficient. To the extent that stock overvaluation affects corporate investment, and allocation efficiency, a reduction in stock price overvaluation should cause corporate investment to drop, and allocation efficiency of corporate investment to improve.

Our results reveal that stock prices drop and become more efficient with the introduction of the new rule in countries where short selling becomes feasible after the rule change. Corporate investment also drops after the rule change, and the drop in investment is directly linked to the drop in overvaluation brought about by the regulation change. In addition, we find that the

efficiency of capital allocation improves. The drop in total asset growth can be attributed to a drop in growth in cash, and PP&E. On the financing side, both net debt and equity issuances decline. As expected our results are largely muted in the set of countries where, despite the rule change, short selling does not become feasible. Tests exploring within country variation in the legalization of short selling reveal consistent results.

Our results suggest that the legalization of short selling helps improve stock price efficiency and reduce overvaluation. In turn, corporate over-investment falls and allocation efficiency of corporate investment to improves. The drop in investment cannot be solely explained by the inability of equity dependent firms to raise new equity at the lower, but more efficient stock prices, since the decline in investment is also accompanied by a decline debt financing. The end result is better investment policies and more sustainable economic growth regardless of firm's equity dependence.

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Table 1: Short Selling Regulatory Changes around the World

This table contains information on the countries that initiated short selling after 1990. We obtain information from each country's regulator or exchange, and from Charoenrook and Daouk (2009) (henceforth BGZ), Bris, Goetzmann, and Zhu (2007) (henceforth, BGZ), and Jain, Jain, McInish, and McKenzie (2013) (JJMM)). Column (1) presents the date of short selling regulatory change for each country; column (2) presents whether short selling becomes widely practiced/feasible in each country after the regulatory change; column (3) presents the number of short selling eligible firms in our sample; column (4) presents the details about the regulatory change and source of information for each country.

Countries	Date of regulatory change	Feasibility	No. of short selling eligible firms in our sample	Institutional Details
Argentina	9/6/1999	No	78	We get information on the date of regulatory change and feasibility from Charoenrook and Daouk (2009) (hereafter, CD), Bris, Goetzmann, and Zhu (2007) (hereafter, BGZ), and Jain, Jain, McInish, and McKenzie (2013) (hereafter, JJMM).
Chile	10/1/1999	No	16	According to Superintendency of Securities and Insurance, Chile allowed first short selling in 10/1/1999, and short selling initially opens for 23 stocks. We classify short selling as not feasible as per CD, BGZ and JJMM.
China	3/31/2010	No	83	On 3/31/2010, Chinese Securities Regulatory Commission (CSRC) introduced short selling for 90 blue-cap stocks. Short selling does not become widely practiced following the rule change (Chang, Luo, and Ren, 2014).
Hong Kong	5/1/1997	Yes	129	Hong Kong opened short selling in 1994 for 21 stocks. On 5/1/1997, the Stock Exchange of Hong Kong (SEHK) made its first major revision to the short selling list and added 129 new stocks to the short selling designated list. This is the date we use in our study. Short selling becomes feasible after the rule change as per CD, BGZ, and JJMM.

Table 1, cont'd

Countries	The date of regulatory change	Feasibility	No. of short selling eligible firms in our sample	Institutional Details
India	4/21/2008	No	130	SEBI (Capital Market Regulator in India) started regulated Short selling vide Circular - MRD/DoP/SE/Dep/Cir-14/2007 on April 21, 2008. There are 221 securities traded in the F&O segment eligible for short selling, but only 130 of those securities remain in the list through 2011. SEBI stated short selling is not yet widely practiced, which is confirmed in JJMM.
Indonesia	6/30/2008	No	566	Bapepam-LK (Indonesian Capital Market and Financial Institution Supervisory Agency) started regulated short selling in June, 2008 (see Bapepam Decree No. Kep-258/BL/2008 dated June 30, 2008). Short selling is not feasible, according to CD, BGZ, and JJMM.
Norway	9/1999	Yes	215	Short selling becomes feasible in September 1999, as per Oslo Bors and CD.
Philippines	1998	No	235	Philippine Stock Exchange allowed short selling in 1998. CD, BGZ, and JJMM agree that short selling does not become feasible after this regulatory change.
Poland	1/1/2000	No	74	Short-selling is regulated by a decree of Counsel of Ministers, and is first allowed on 1/1/2000. Both CD, and BGZ state that short selling is not widely practiced after this regulatory change.

Table 1, cont'd

Countries	The date of regulatory change	Feasibility	No. of short selling eligible firms in our sample	Institutional Details
South Korea	9/1/1996	No	305	According to the information obtained from Korea Securities Depository, short selling was allowed on 9/1/1996. However, it does not become widely practiced as a direct result of this regulatory change (see CD, and BGZ).
Sweden	8/1/1991	Yes	213	We obtain information from Sweden's financial regulator: Finansinspektionen. Although short selling was not banned for non-financial stocks, it was very difficult to short stocks before 1991. The law changed on August 1st, 1991, making short selling feasible for all market participants.
Thailand	1/1/2001	Yes	44	On January 3, 2001, the Stock Exchange of Thailand implemented new regulation to allow stocks in SET 50 to be shorted (Bor.Sor./Khor. 01-00). CD and BGZ state that short selling becomes feasible after this regulatory change. Information obtained from JJMM also suggests short selling is feasible.
Turkey	4/3/1995	Yes	80	According to information provided by Istanbul Stock Exchange (ISE), short selling is first allowed on 4/1/1995 for stocks part of ISE National 100. Short selling becomes feasible after this regulatory change (CD and JJMM).

Table 2: Cumulative Abnormal Returns around Short Selling Regulatory Changes

This table reports cumulative abnormal returns (CARs) around the short selling regulatory changes for the 13 countries in our sample. On the left we present results for feasible countries, and on the right for non-feasible countries. Abnormal returns are market adjusted and are computed as the individual stock return for each stock subtracted by the world index return. Returns are in USD. Below we document (CARs) for various event windows, where day 0 is the effective date when stocks are first allowed to be shorted. We present mean CARs and p-values in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	[-10,-1]	[-10,10]	[-10,20]	[-10,30]	[-10,40]	[-10,50]		[-10,-1]	[-10,10]	[-10,20]	[-10,30]	[-10,40]	[-10,50]
Feasible Countries							Non-feasible Countries						
Mainland China	0.002	0.033***	0.016***	-0.034***	-0.035***	-0.053***	*Argentina*	0.031***	0.053***	0.087***	0.083***	0.072***	0.064***
	(0.72)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Hong Kong	0.011**	-0.024***	-0.016*	-0.071***	-0.055***	-0.068***	*Chile*	0.003	-0.008	0.027***	0.038***	0.058***	0.094***
	(0.04)	(0.00)	(0.06)	(0.00)	(0.00)	(0.00)		(0.39)	(0.20)	(0.00)	(0.00)	(0.00)	(0.00)
Norway	-0.009	-0.015**	-0.013	-0.034***	-0.064***	-0.106***	*Indonesia*	0.034***	0.058***	0.049***	0.043***	0.067***	0.074***
	(0.14)	(0.04)	(0.16)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sweden	-0.018***	-0.011**	-0.033	-0.022***	-0.048***	-0.092***	*India*	0.081***	0.096***	0.012***	-0.026***	-0.035***	-0.116***
	(0.00)	(0.02)	(0.00)	(0.01)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Thailand	-0.007***	0.020***	0.019***	0.033***	0.081***	0.086***	*Korea*	-0.077***	-0.064***	-0.075***	-0.003***	-0.037***	-0.101***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.75)	(0.00)	(0.00)
Turkey	0.118***	0.267***	0.192***	0.207***	0.203***	0.209***	*Poland*	0.067***	0.194***	0.186***	0.226***	0.214***	0.270***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
							Philippines	0.016***	-0.048***	-0.101***	0.048***	0.045**	0.062***
								(0.01)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)
Feasible.	-0.01	0.01**	0.004	-0.020*	-0.028***	-0.052***	*Non-feasible*	0.015***	0.031***	0.007	0.036***	0.036***	0.004
	(0.89)	(0.02)	(0.33)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.22)	(0.00)	(0.00)	(0.64)

Table 3: Changes in Price Efficiency and Stock Price Crash Risk around Short Selling Regulatory Changes

This table reports the changes in price efficiency and stock price crash risk before and after short selling regulatory changes. We estimate *Price Delay* as the measure of price efficiency, and *NCSKEW* as the measure of stock price crash risk. The results for both variables are reported in this table. We present results for short selling eligible stocks in feasible countries and non-feasible countries. We compute price efficiency measures and crash risk measures for each stock for the period of three years before and three years after the regulatory change. A higher value of these measures indicates lower price efficiency and higher stock price crash risk. Point estimates are based on an OLS regression where dependent variable is regressed on a dummy for firms in the feasible countries, a dummy variable equal to 1 after short selling regulation change and the interaction term of these two variables. Differences and difference-in-differences are computed for all stocks that are in both feasible and non-feasible countries. Corresponding t-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	Price Efficiency			*Crash Risk*		
	Before	After	Diff.	Before	After	Diff.
Feasible	0.750	0.721	-0.029***	-0.025	-0.460	-0.213***
			(-3.45)			(-5.60)
Non-feasible	0.712	0.710	0.002	-0.383	-0.527	-0.144**
			(0.24)			(-2.21)
Diff-in-Diffs.			-0.028***			-0.069**
			(-2.67)			(-2.12)

Table 4: Firm Characteristics before Short Selling Regulatory Changes

This table reports summary statistics of firm characteristics for 13 countries in the year immediately before the short selling regulatory changes. On the left we present results for feasible countries, and on the right for non-feasible countries. The last two columns present t and chi-square statistics for the null hypotheses that the difference in means and medians between feasible and non-feasible countries is equal to zero. All variables are defined in Appendix 1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	Feasible Countries				Non-feasible Countries				Test for Differences	
Variable	N	Mean	Median	SD	N	Mean	Median	SD	Mean (t-stats)	Median (chi-sq)
Total Assets ($1,000,000)	829	1,930	570.0	4,970	1,954	6,180	389.0	33,400	-3.03***	4.19**
Asset Growth (%)	796	20.38	14.17	26.23	1,752	22.64	15.77	25.50	1.61	2.50
Equity Issuance	534	22.10	11.31	35.11	945	19.72	11.21	31.74	1.31	0.01
Debt Issuance	760	5.734	2.539	11.38	1,632	6.892	3.556	11.641	-2.00**	1.75
Leverage	801	26.92	25.41	19.00	1,831	27.60	26.44	19.35	-0.83	1.72
Cash Flow	783	8.923	7.647	8.363	1,603	9.078	8.350	8.485	-0.42	0.68
Profitability	815	5.752	5.519	6.859	1,925	5.582	4.973	6.710	0.36	2.46

Table 5: Corporate Investment around Short Selling Regulatory Changes

This table reports results of OLS panel regressions with firm-fixed effects. The dependent variable is growth in total assets, and the panel is composed of yearly observations for 7 years surrounding the regulation change. We omit the event year. Column headings indicate regression samples. T-statistics are in parentheses below each coefficient, and are adjusted for clustering at the firm-level. All variables are defined in Appendix 1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

	All	*All*	*All*	*Feasible*	*Non-Feasible*
After	-7.995***	-0.684	-0.146	-1.893	-1.555*
	(-13.76)	(-1.08)	(-0.23)	(-1.37)	(-1.67)
Feasible × After	-5.244***	-3.859***	-4.199***		
	(-4.44)	(-3.53)	(-3.84)		
CAR × After				14.394***	-8.158**
				(3.14)	(-2.47)
Cash flow		1.277***	1.251***	1.128***	1.186***
		(22.21)	(21.85)	(11.65)	(10.96)
Log (Asset (-1))		-11.597***	-11.571***	-18.192***	-11.432***
		(-12.17)	(-12.24)	(-6.50)	(-9.87)
Past Profitability		0.372***	0.373***	0.358***	0.392***
		(5.62)	(5.62)	(2.76)	(3.85)
GDP Growth			0.321***	0.366**	-0.395**
			(2.97)	(2.43)	(-2.09)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	14,024	12,819	12,819	3,048	4,642
Adj. R-sq	0.206	0.377	0.379	0.486	0.309

Table 6: Investment Efficiency around Short Selling Regulatory Changes

This table reports results of OLS panel regressions with firm-fixed effects. The dependent variable is growth in total assets, and the panel is composed of yearly observations for 7 years surrounding the regulation change. We omit the event year. Column headings indicate regression samples. T-statistics are in parentheses below each coefficient, and are adjusted for clustering at the firm-level. All variables are defined in Appendix 1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

	Feasible	*Non-feasible*	*Feasible*	*Non-feasible*
After	-3.417***	-1.754***	-2.847*	-1.207
	(-2.95)	(-3.19)	(-1.96)	(-1.56)
Sales Growth	0.246***	0.347***	0.244***	0.298***
	(8.79)	(19.17)	(8.39)	(16.21)
Sales Growth × After	0.181***	0.046**	0.097***	0.036
	(5.36)	(2.11)	(2.67)	(1.58)
Log (Asset (-1))	-21.327***	-10.590***	-19.619***	-9.085***
	(-9.12)	(-11.12)	(-7.46)	(-9.88)
Cash flow			0.534***	0.748***
			(4.56)	(10.06)
Cash flow × After			0.335***	0.095
			(2.62)	(1.37)
Past Profitability			0.652***	0.680***
			(5.75)	(10.18)
Firm Fixed Effects	Yes	Yes	Yes	Yes
N	2,900	8,677	2,829	7,893
Adj. R-sq	0.575	0.405	0.593	0.463

Table 7: Asset Growth Components and Corporate Financing

This table reports results of OLS panel regressions with firm-fixed effects. The dependent variables are the various components of growth in total assets: that includes growth in cash, current assets, PP&E, other assets, equity issues and debt issues. Dependent variables are indicated in column headings. The panel is composed of yearly observations for 7 years surrounding the regulation change. We omit the event year. T-statistics are in parentheses below each coefficient, and are adjusted for clustering at the firm-level. All variables are defined in Appendix 1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

	Cash	*Cur. Assets*	*PPE*	*Other Assets*	*Equity Iss.*	*Debt Iss.*
After	0.833***	-0.692**	-0.557**	0.166	-0.010	-1.215***
	(4.52)	(-2.40)	(-2.43)	(0.95)	(-0.96)	(-3.54)
Feasible × After	-0.941***	-0.227	-1.509***	-0.492	-3.910**	-1.257**
	(-2.69)	(-0.44)	(-3.56)	(-1.60)	(-2.48)	(-2.16)
Cash flow	0.250***	0.407***	0.188***	0.158***	0.022***	0.011
	(13.80)	(15.32)	(9.57)	(9.89)	(23.44)	(0.38)
Log(Asset (-1))	-2.090***	-3.600***	-2.372***	-1.529***	-0.083***	-1.959***
	(-8.76)	(-10.01)	(-9.06)	(-6.78)	(-6.12)	(-4.48)
Past Profitability	-0.067***	0.063**	0.231***	0.071***	0.002	0.056
	(-3.13)	(2.01)	(10.37)	(3.95)	(1.49)	(1.60)
Leverage (-1)					0.006***	-0.392***
					(10.62)	(-21.93)
GDP Growth	0.034	0.348***	-0.055	0.032	-0.006***	-0.002
	(1.20)	(7.64)	(-1.54)	(1.11)	(-3.62)	(-0.04)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	12,405	11,239	12,804	11,232	12,206	12,069
Adj. R-sq	0.097	0.296	0.293	0.161	0.326	0.213

Table 8: Placebo Tests

This table reports placebo test results, where we define the event year counterfactually to be 4 years before and 4 years after the event. The first two columns report results for when we define the pseudo-event year to be 4 years after the regulatory changes, and the third and fourth column report results for when we define the event to happen 4 years before the regulatory change. We run OLS panel regressions with firm-fixed effects. The dependent variables are growth in total assets, equity issues, and debt issues, and are specified in column headings. The panel is composed of yearly observations for 7 years surrounding the counterfactual event, where we omit the event year. T-statistics are in parentheses below each coefficient, and are adjusted for clustering at the firm-level. All variables are defined in Appendix 1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

	Asset Growth	*Equity Iss.*	*Debt Iss.*	*Asset Growth*	*Equity Iss.*	*Debt Iss.*
Feasible×After	3.044	0.932	1.657	4.151	0.721	0.775
	(1.23)	(0.59)	(1.61)	(1.10)	(0.36)	(1.09)
Event Year	+4	+4	+4	-4	-4	-4
with Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Corporate Investment around Short Selling Regulatory Changes: A Controlled Experiment

This table presents the unique regulatory setting in four feasible countries and regions: Mainland China, Hong Kong, Turkey, and Thailand, in which regulators introduced short selling to subgroups of stocks rather than all stocks. We match each stock added to the short selling list to a stock that is not allowed short selling within the same country. Panel A reports the summary statistics and tests for differences for major firm characteristics. Panel B reports Difference-in-Differences results of OLS panel regressions with firm-fixed effects. The dependent variable is growth in total assets, and the panel is composed of yearly observations for 7 years surrounding the regulation change. We omit the event year. Column headings indicate regression samples. T-statistics are in parentheses below each coefficient, and are adjusted for clustering at the firm-level. All variables are defined in Appendix 1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively

Panel A: Key Firm Characteristics before Short Selling Regulatory Changes

	Shortable Stocks				Non-shortable Control Group				Test for Differences	
Variable	N	Mean	Median	SD	N	Mean	Median	SD	Mean (t-stats)	Median (chi-sq)
Total Assets ($1,000,000)	627	1,820	514.0	5,580	627	1,480	483.0	4,870	1.16	1.21
3-Year Average Asset Growth (%)	627	18.91	15.81	19.60	627	18.68	15.69	18.97	0.21	0.04
Cash Flow	618	7.829	6.470	9.169	625	6.709	5.968	9.119	1.15	2.61
Profitability	621	4.605	3.894	7.533	625	3.717	3.726	7.129	2.13**	0.26

Panel B: Multivariate Difference-in-Differences Results

	Asset Growth	*Asset Growth*	*Asset Growth*
After	-3.250***	3.942***	3.963***
	(-2.84)	(3.77)	(3.78)
Short × After	-2.550*	-2.637*	-2.647*
	(-1.65)	(-1.88)	(-1.89)
Cash flow		1.248***	1.239***
		(14.73)	(14.78)
Log (Asset (-1))		-12.207***	-12.018***
		(-9.75)	(-9.44)
Past Profitability		0.282***	0.278***
		(2.87)	(2.83)
GDP Growth			0.158
			(1.38)
Firm Fixed Effects	Yes	Yes	Yes
N	6,186	6,100	6,100
adj. R-sq	0.275	0.453	0.453

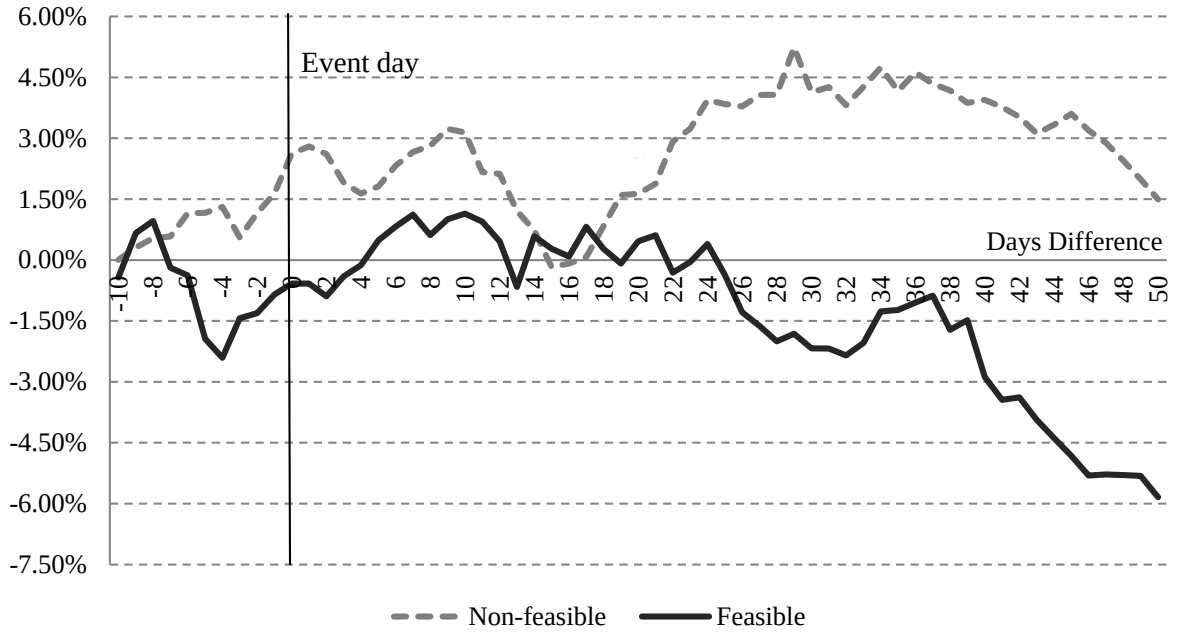
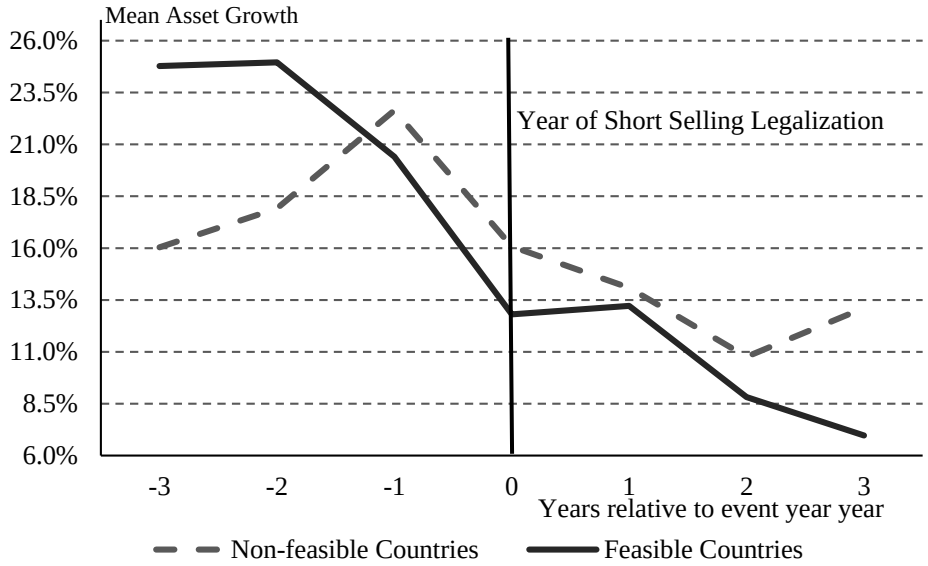
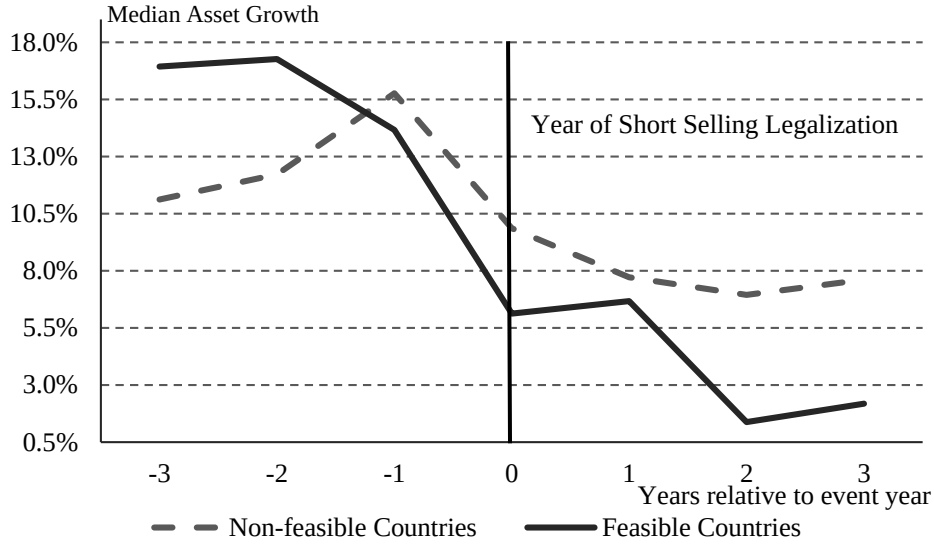


Figure 1: Cumulative Abnormal Returns around Short Selling Regulatory Changes

This figure depicts average cumulative abnormal returns (CARs) around the date short selling was legalized for shortable firms in feasible and non-feasible countries. Abnormal returns are market adjusted and are computed as the individual stock return for each stock subtracted by the world index return. Returns are in USD, and day 0 is the effective date when stocks are first allowed to be shorted.



Panel A: Mean Asset Growth around Short Selling Legalization



Panel B: Median Asset Growth around Short Selling Legalization

Figure 2: Corporate Investment around Short Selling Legalization
This figure depicts mean (Panel A) and median (Panel B) asset growth, for firms in feasible and non-feasible countries, for 7 years surrounding the year short selling was legalized. Year 0 represents the year short selling became legal.

APPENDIX

Table A1. Variable Definitions

Variables	Definition
Total Assets	Total assets in 1,000 USD (WC02999).
After	Indicator variable for the period after the country's regulation change.
AR	Abnormal return computed as individual stock return subtracted by world index return, in USD.
Asset Growth	Change in total assets as a percentage of lagged total assets, and multiplied by 100.
CAR	Cumulative abnormal returns for the event window [-10, 50].
Growth in Cash	Change in cash and short term investment (WC02001) scaled by lagged total assets, and multiplied by 100.
Cash Flow	Cash flow per share (WC05501) scaled by lagged total assets, and multiplied by 100.
Growth in Current Assets	Change in non-cash current assets (WC02201 minus WC02001) scaled by lagged total assets, and multiplied by 100.
Debt Issuance	Change in total debt scaled by lagged total assets, and multiplied by 100. Total debt is the sum of long term debt (WC03251) and short term debt (WC03051).
Equity Issuance	Change in total shareholder equity (WC03995) divided by lagged total shareholder equity, and multiplied by 100.
Feasible	Indicator variable for short selling becoming feasible or widely practiced after the country's regulatory change.
Leverage	Long term debt (WC03251) plus short term debt (WC03051) scaled by the sum of long term debt, short term debt, and total shareholders' equity (the sum of preferred stock and common shareholders' equity (WC03501)). All multiplied by 100.
Growth in Other Assets	Change in other assets scaled by lagged total assets, and multiplied by 100. Other assets is computed as Total Assets - Cash - Current Assets - PPE.
PPE	Change in net property, plant, and equipment (WC02501) scaled by lagged total assets, and multiplied by 100.
Profitability	Ratio of operating income (WC01250) before depreciation and amortization (WC01151) divided by total assets, and multiplied by 100.
Sales Growth	Change in net sales or revenues (WC01001) divided by lagged net sales or revenues, and multiplied by 100.
Short	Indicator variable for stocks introduced to short selling in feasible countries
3y Asset Growth	3-year average asset growth

Table A2: Macroeconomic Conditions around Short Selling Regulatory Changes

This table reports three-year average of country characteristics for 13 countries in the year immediately before the short selling regulatory changes. The first two columns following country column report three-year average GDP growth for each country and its belonged region, and the last two columns present three-year average growth in stock trade value scaled by GDP for both countries and their belonged regions. Stock trade value is defined as the aggregate dollar trading volume. The mean and median (in parenthesis) for all non-feasible countries and feasible countries are also reported. All variables reported are obtained from World Bank.

Country	GDP Growth	Regional GDP Growth	Growth in Stock Trade Value/GDP	Growth in Regional Stock Trade Value/GDP	Regions
Argentina	5.829	3.140	-2.017	0.204	Latin America
Chile	5.750	3.140	-10.59	0.204	Latin America
India	9.052	8.523	8.659	5.289	South Asia
Indonesia	5.846	9.840	4.451	30.34	Developing East Asia
Norway	4.312	2.477	2.843	4.098	Europe
Philippines	5.237	8.590	-3.330	1.051	Developing East Asia
Poland	5.531	2.894	1.212	17.12	Europe
South Korea	8.011	4.208	4.384	1.432	Developed East Asia
Non-feasible	6.196 (5.790)	5.352 (3.674)	0.701 (2.028)	7.467 (2.765)	
Mainland China	11.02	9.361	106.0	86.26	Developing East Asia
Hong Kong	4.223	4.606	1.213	6.394	Developed East Asia
Norway	4.312	2.477	2.843	4.098	Europe
Sweden	1.990	3.998	N/A	N/A	Europe
Thailand	0.465	5.077	0.739	6.030	Developing East Asia
Turkey	2.673	-3.304	2.400	N/A	Europe & Central Asia
Feasible	4.113 (3.448)	3.703 (4.302)	22.64 (2.400)	25.69 (6.212)	

Table A3: Changes in Price Efficiency and Stock Price Crash Risk around Short Selling Regulatory Changes: Alternative Measures

This table reports the changes in price efficiency and stock price crash risk three years before and after short selling regulatory changes. We estimate ρ_{jTD}^{Diff} as the measure of price efficiency, and *DUVOL* as the measure of stock price crash risk. The results for both variables are reported in this table. We present results for short selling eligible stocks in feasible countries and non-feasible countries. We compute price efficiency measures and crash risk measures for each stock for the period of three years before and three years after the regulatory change. A higher value of these measures indicates lower price efficiency and higher stock price crash risk. Point estimates are based on an OLS regression where dependent variable is regressed on a dummy for firms in the feasible countries, a dummy variable equal to 1 after short selling regulation change and the interaction term of these two variables. Differences and difference-in-differences are computed for all stocks that are in both feasible and non-feasible countries. Corresponding t-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	Price Efficiency			*Crash Risk*		
	Before	After	Diff.	Before	After	Diff.
Feasible	0.082	0.024	-0.058*** (-4.76)	-0.119	-0.224	-0.105*** (-6.36)
Non-feasible	0.030	0.021	-0.009 (-1.22)	-0.175	-0.219	-0.044 (-1.58)
Diff-in-Diffs.			-0.051*** (-8.20)			-0.061** (-1.98)

Table A4: Changes in Corporate Investment around Short Selling Regulatory Changes
This table reports the average asset growth three years before the regulation change, three years after and the difference between the two. Results for feasible countries are on the left and for non-feasible countries on the right. ***, **, and * indicate the significance level less than 1%, 5%, and 10% respectively.

	Before	After	Diff	T-stats		Before	After	Diff	T-stats
Feasible Countries					Non-feasible Countries				
Mainland China	37.01	16.11	-20.90***	(-3.38)	*Argentina*	13.38	18.26	4.879	(1.56)
Hong Kong	16.10	2.226	-13.88***	(-5.62)	*Chile*	26.16	5.963	-20.20***	(-6.63)
Norway	25.14	9.961	-15.18***	(-8.04)	*Indonesia*	14.56	15.06	0.499	(0.59)
Sweden	20.81	7.904	-12.91***	(-9.44)	*India*	30.19	21.37	-8.813***	(-8.73)
Thailand	3.034	6.837	3.803**	(2.01)	*South Korea*	20.85	13.52	-7.331***	(-5.87)
Turkey	70.35	68.37	-1.986	(-0.73)	*Poland*	24.32	7.15	-17.17***	(-7.10)
					Philippines	26.43	5.524	-20.91***	(-17.64)
Feasible	23.12	10.51	-12.61***	(-14.01)	*Non-Feasible*	19.07	12.33	-6.747***	(-14.00)
Diff-in-Diffs			-5.866***	(-6.07)					