Short Selling Bans and Limits to Multi-Market Regulatory Arbitrage[†]

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Abstract

We evaluate the role of foreign short-sale bans in muting the full return-response following negative earnings surprises for stocks cross-listed in unbanned markets. We update the global timeline of short-sale restrictions until the COVID-19 crisis period. Instead of regulatory price arbitrage, we surprisingly observe cross-border reach of bans manifested in delayed price responses, accompanied by a reduction in short interest and failures to deliver. Nonetheless, large profit opportunities result in price arbitrage and full return-response. Analysis of earnings management practices and CEO compensation structure reinforces the trade-off between compliance overreach versus profit opportunity in determining the effects of short-sale bans.

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1 Introduction and Literature Review

In a multi-market regulatory framework, short selling restrictions have been studied under two competing hypotheses in the literature. On the one hand, the *regulatory arbitrage* hypothesis posits that short sellers subject to restrictions in a security's home country are displaced to foreign unrestricted markets (Blau, Van Ness, and Warr, 2012; Nilsson, 2008; Brockman and Hao, 2011) weighing-down the regulation's effectiveness. Some of the mechanisms through which regulatory arbitrage may occur include restructuring of transactions, financial engineering, trading correlated securities or geographic relocation (Kolasinski, Reed, and Thornock, 2013; Ljungqvist and Qian, 2016; Pagano and Steil, 1996).[1]

On the other hand, the *regulatory reach* hypothesis postulates that there are costs of engaging in compliance work-around in foreign jurisdictions, potentially extending the home country restrictions to cross-listed securities in foreign markets (Jain, Jain, McInish, and McKenzie, 2013). The mechanisms through which we expect regulatory reach to occur include inter-government co-operation between regulators, especially within working groups such as G7, OECD, EU, IOSCO or across countries with bi-lateral investment treaties.[2] For instance, amid the COVID-19 health crisis, different European countries including Spain, France, Italy and Belgium, coordinated almost

[1]For instance, Boulton and Braga-Alves (2010) explores the 2008 temporary restrictions on naked short selling of 19 financial firms, finding that naked short sales increased dramatically for a closely matched sample of financial firms during the restricted period. In addition, Jiang, Shimizu, and Strong (2019) observe an increase in the single-stock futures during the 2008 US short selling ban period. However, Battalio and Schultz (2011) refute that short sale restrictions can be circumvented by trading in options markets. Regulatory arbitrage may be facilitated because the ban's jurisdiction is limited to the stock's home country whereas foreign investors can short sell the cross-listed ADR or GDR, as suggested by the functional convergence hypothesis (Siegel, 2005).

[2]For instance, several SEC actions concerning short selling during the financial crisis were decided in consultation with regulators of the securities markets around the world (SEC 2008-235 statement; Block, 2007; Hamilton, 2008). Furthermore, there are explicit regulatory intents in a multi-jurisdictional setting such as UK FSA's short selling ban which applies to cross-listed stocks (Avgouleas, 2010), Netherlands AFM and Spain CNMV. Another example is the US being a signatory to international conventions regulating the enforcement of arbitration awards (Keller, 2004). Other factors that may give room to regulatory reach may arise from taxation, fees, capital controls, currency inconvertibility and market segmentation (Foerster and Karolyi, 1999; Hagerty and McDonald, 1996; Engelberg, Reed, and Ringgenberg, 2018; Acharya, Lochstoer, and Ramadorai, 2013). Investors' conduct may also help explain the reach premises, as investors may seek benefits of compliance with the spirit as well as the requirements of regulations, abiding by the stricter of the rules when they have activities across multiple jurisdictions. For example, CFA Code of Ethics and Standards of Professional Conduct.

simultaneous short selling prohibitions with similar features.[3,4]

In this paper, we examine the current tension between these two hypotheses in the context of the price discovery process. In this framework, a regulatory reach setting implies that foreign short selling restrictions may result in delayed price responses even in unbanned markets, whereas a regulatory arbitrage setting implies that short selling restrictions are less effective when stocks are cross-listed in unbanned markets. While the proponents of each hypothesis have so far evaluated their premises in isolation, we show that the two hypotheses may hold conditionally on two important factors: the expected profit intensity from a short sale, and the costs of regulatory arbitrage. We propose that when short selling is banned in the home market of a stock that is cross-listed in an unbanned market, the degree of short selling is better portrayed as a pendulum that swings in a continuum defined by these two factors. When the profits from short selling are high (low) and the costs of shorting in foreign jurisdictions are low (high), short selling activity increases (decreases). Our view advances previous pricing models in which informed traders always circumvent short selling restrictions amid bad news (e.g., Diamond and Verrecchia, 1987), as we point out that the decision to engage in foreign regulatory arbitrage depends not only on the value of the asset, but also on the costs of short selling in the foreign jurisdiction. Moreover, our findings also imply that regulatory arbitrage does not preclude regulatory reach. This is so given that regulatory reach can potentially become a precursor to misvaluation, moving the pendulum towards a limiting case of a sizeable profit opportunity that will be conducive to regulatory arbitrage.

In order to form our predictions, we adapt the model of Diamond and Verrecchia (1987). In their single-market framework, the price response to earnings surprises is delayed by a short selling prohibition. The model also explores the case where short selling is restricted, but it is still possible.

[3]Instances of cross-border reach of regulations are not rare. For instance, a bulletin from Goldman Sachs following the enactment of new global bans related to the European Debt Crisis in 2011 urged investors to seek independent legal advice pertaining to all applicable regulatory restrictions when submitting orders. See at: https://www.goldmansachs.com/disclosures/gset-archive/pdf/d1f9868619ae46c681cd218a9f284718_PDF.pdf

[4]Another example is the recent case of Zoom Video Communications, a US-based firm, banning US accounts that broadcasted an event deemed illegal in China. See Toh, M. and Iyengar, R., (2020) *Rights group says Zoom shut down its account after Tiananmen Square anniversary event*, CNN Business, 06/11/20 [online]. Available at: https://www.cnn.com/2020/06/11/tech/zoom-us-china-tiananmen-event-intl-hnk/index.html

In this case, following bad news, informed traders who do not own the stock always short. We adapt this premise to a multi-market setting. Amid a binding short selling restriction, an informed trader who does not own the stock will only short if the benefits from exploiting the misvaluation are greater than the costs to circumvent home-market short selling restrictions in foreign unbanned jurisdictions.

We test our hypotheses empirically by comparing the initial price response following negative earnings surprises of stocks that are cross-listed in unbanned markets, across periods in which short-sales are banned and unbanned in the respective home markets. Our control group is a sample of foreign stocks that are not cross-listed, and thus, regulatory arbitrage is not plausible. We utilize longitudinal data spanning the years 2000 to 2019, with supplemental 2020 data, to conduct a difference-in-differences analysis across these two groups of stocks.[5]

In the case of our single-market control group (securities that are not-cross-listed), we observe that when a short sales ban is in effect, the initial response (on days t_{-1} to t_{+1} and t_0 to t_{+3}) to negative earnings surprises is significantly reduced.[6] Additionally, the volatility during the initial response window is significantly lower when a ban is binding, which is consistent with Chang, Cheng, and Yu (2007).

Subsequently, we examine the sample of multi-market cross-listed stocks (treatment group). In this case, we find that the price response to negative earnings surprises for banned stocks is weak or strong depending on the expected intensity of the profit opportunity for short sellers. We use dispersion of beliefs, captured by the dispersion of analysts' earnings forecasts, as a proxy for the intensity in short sellers' profits, considering that prior literature postulates dispersion of investors' opinions as a necessary condition for overvaluation (Boehme, Danielsen, and Sorescu, 2006; Nutz and Scheinkman, 2020; Blau, Van Ness, and Warr, 2012) and that dispersion is associated with

[5]While various events such as SEOs (Henry and Koski, 2010), IPOs (Boulton, Smart, and Zutter, 2020; Edwards and Hanley, 2010) or cases of financial misconduct (Karpoff and Lou, 2010) may be used to evaluate the speed of adjustment to new information, we select earnings announcements, given that these events take place with a higher frequency, allowing us to retain an appropriate number of observations in our analyses.

[6]In such setting, short selling is not plausible.

future price declines (Berkman et al., 2009; Diether, Malloy, and Scherbina, 2002). Among this group of (cross-listed) stocks, when a short sales ban is in effect, the initial response (on days t_{-1} to t_{+1} and t_0 to t_{+3}) to negative earnings surprises is significantly reduced when the expected short sellers' profits are low (low dispersion of beliefs). Alternatively, large expected profits (for short sellers) from wide dispersion of beliefs result in price arbitrage, suggestive of the cost-benefit trade-off of compliance overreach. Our results suggest that in the absence of heterogeneous beliefs (low dispersion), the profits from the arbitrage opportunity for short sellers may not exceed the costs of engaging in compliance work-around in foreign jurisdictions and hence, the pendulum moves towards a regulatory reach setting.[7] The situation is different in the presence of heterogeneous beliefs, which create a much higher cross-market arbitrage profit opportunity. In this case, arbitrage dominates and the bans have a trivial effect on the speed of price adjustment to earnings surprises.

We alternatively measure the intensity of the profit opportunity by evaluating variations in borrowing costs, which directly influence (reduce) the net profits for short sellers. In order to do so, we take advantage of the recent COVID-19 shock period. Using securities lending data from IHS Markit, we confirm that following the announcement of COVID-19 as a pandemic by the World Health Organization, the marginal effect from a home country ban (delayed price response) increases with the cost of borrowing of securities in the US (unbanned) market. In this case, a higher cost of short selling in the unbanned foreign jurisdiction reduces short seller's expected net profits and places the pendulum further into a regulatory reach setting.

Finally, if the intensity of short selling activity is defined by the comparative relation between the expected profits and the costs to circumvent home country bans, we should be able to confirm such a relationship in other contexts as well. We do so by looking at earnings management practices and short sellers' disciplining role (Fang, Huang, and Karpoff, 2016; Massa, Zhang, and Zhang, 2015). For this task, we adopt Fang, Huang, and Karpoff (2016) methods. In this context, we consider firms from countries where CEO compensation is generally stock-based, as those representing high

[7] The increased cost of short selling through arbitrage can be deemed a short selling constraint in itself which is in line with previous research (Jones and Lamont, 2002).

expected profits for short sellers (Baker, Collins, and Reitenga, 2003; Bergstresser and Philippon, 2006; Cheng and Warfield, 2005), whereas firms from countries where CEO compensation is mainly offered as salary represent low expected profits for short sellers.[8] Among salary-based countries, earnings management still occurs and it may be explained by loss avoidance (Burgstahler and Eames, 2003), perk consumption, empire building, or promotion (Zhao, Zhou, Zhao, and Zhou, 2019).

Within the pool of countries dominated by CEO salary compensation (low profit opportunity for short sellers), we show that the regulatory effect from the home country ban is observable (regulatory reach; firms from banned countries engage more in earnings management vis-à-vis firms from unbanned countries). In this setting, when local short sellers are curtailed by a ban, firm managers may feel it is safe to increase earnings management practices (similar to Fang, Huang, and Karpoff, 2016). We presume that among these firms, global short sellers are not of concern, given that they are generally not monitoring firms from these countries, where the expected profit opportunity is low. These results under low expected profit intensity for short sellers are much different from the next sample under high expected profit intensity. Among countries where CEO compensation is mainly linked to firm value (high profit opportunity for short sellers), we do not find evidence any difference in earnings management practices between firms under a home-market short selling ban vis-à-vis firms that are not under a home-market ban (i.e., ban's effect seems absent due to cross-market arbitrage). We presume that firm managers may not feel safe to increase earnings management practices even when a home-market ban is in place, given that global short sellers are intensely monitoring firms from these countries where the expected profit opportunity is high, and short selling of the stock in unbanned markets is still possible.

Overall, we find evidence of cross-border regulatory reach of a short selling ban, resulting in delayed price responses of the cross-listed securities in unbanned markets, with the exception of large profit opportunities, which still result in price arbitrage and full return response. We find

[8]CEO compensation and its determinants has been largely studied by previous academic research. (See, for instance Frydman and Jenter, 2010; Holthausen, Larcker, and Sloan, 1995). Dechow, Sloan, and Sweeney (1995) also explore the causes and consequences of earnings manipulation.

consistent results when measuring earnings surprises from IBES analysts' forecasts or seasonal quarterly differences (Bernard and Thomas, 1990; Ke and Ramalingegowda, 2005).[9] We also confirm that our results are not different when controlling for institutional ownership and the availability of put options. Our results are robust to two-way clustered standard errors and fixed effects,[10] alternative event windows,[11] alternative definitions of earnings surprise,[12] and sub-samples that exclude the great financial crisis.[13]

We contribute to the literature in the following ways: (i) Our view advances previous pricing models in which informed traders always circumvent short selling restrictions amid bad news (i.e. Diamond and Verrecchia, 1987), as we point out that the decision to engage in foreign regulatory arbitrage depends not only on the value of the asset, but also on the trade-off between the costs of short selling in the foreign jurisdiction versus the benefits of compliance over-reach. In doing so, (ii) we conciliate the previous conflict between the regulatory reach and arbitrage hypotheses by characterizing the limits to arbitrage in the scope of stock price responses to new information. (iii) Our cross-country setting allows us to explore the effects of short selling restrictions in a widespread time horizon spanning 20 years, including the US financial crisis, the European debt crisis and the recent COVID-19 health crisis. The rest of the paper is organized as follows: Section 2 presents our hypotheses, Section 3 presents our data and methodology, Section 4 discusses the results and Section 5 concludes.

[9] Using Variance inflation factor tests, we also validate that the cross-listing categorization is not significantly correlated with our variables of interest.

[10] We report our regressions using industry fixed effects. We do not include country or firm fixed effects as doing so may capture the effects from short sales regulatory settings that are in multiple cases time invariant. Notwithstanding, we confirm that our findings are consistent if using country fixed effects.

[11] In all our exercises, we utilize both (-1, +1) as well as (0, +3) event windows with consistent findings.

[12] Our main empirical work defines negative and positive earnings surprises making use of the median of the SUE distribution within a year. As robustness, we run our regressions using the top and bottom quintiles instead with consistent findings.

[13] In general, we exclude those observations in which the US bans short sales (2008 Temporary Short Selling Ban). Thus, in our sample, the US is always an unbanned market. As robustness, we also run our empirical work excluding 2008 with consistent results.

2 Hypotheses

In general, short sellers are considered as well-informed traders (Jones, Reed, and Waller, 2016) or sophisticated information processors with superior predictive ability (Engelberg, Reed, and Ringgenberg, 2012; Kelley and Tetlock, 2017; Rapach, Ringgenberg, and Zhou, 2016). They reduce bias towards optimistic investors' views (Diether, Lee, and Werner, 2009b; Miller, 1977), thus enhancing stock price efficiency (Boehmer and Wu, 2012; Boehmer, Jones, and Zhang, 2013; Saffi and Sigurdsson, 2010), and reducing sell-side adverse selection (Dixon, 2021).[14]

Other works explore less favorable dimensions of short sellers, associating their activities with market crashes (Hong and Stein, 2003), predatory trading (Brunnermeier and Pedersen, 2005; Goldstein and Guembel, 2008; Grullon, Michenaud, and Weston, 2015), or insider trading (Christophe, Ferri, and Angel, 2004).[15] In addition, short sellers have been associated with an increased volatility (Chang, Cheng, and Yu, 2007), intensified in the presence of heterogeneous beliefs (Hibbert, Kang, Kumar, and Mishra, 2020).[16] These views are echoed by regulators often banning short sales in the midst of markets turmoil.[17] The recent COVID-19 crisis is a good example. In March 2020, regulators in Italy, Spain and France, among other countries, enacted short selling prohibitions.[18]

[14] Cohen, Diether, and Malloy (2007) furthermore isolate shorting demand as an important predictor of future stock returns. Drechsler and Drechsler (2014) examine instead the predictability of future returns by short-rebate fees.

[15] Trades on inside information are linked to less efficient stock prices (Fishman and Hagerty, 1992). Such practices may be explained by corporate insiders exercising informational monopoly power over their trades (Dalko and Wang, 2016).

[16] Additionally, Chen and Singal (2003) find that short sellers contribute to an enhanced weekend effect while Zheng (2009) refutes previous evidence of short sales curbing the post-earnings-announcement drift (PEAD), and Berkman and McKenzie (2012) attributes instead such effects to institutional investors. Hirshleifer, Myers, Myers, and Teoh (2008) alternatively de-links PEAD from individual investors. Nagel (2005) finds that short sale constraints are most likely to bind among stocks with low institutional ownership. Other works have claimed that short-sale constraints contribute to idiosyncratic volatility (Jiang, Peterson, and Doran, 2014).

[17] One of the concerns of regulators may be related to practices of predatory trading (Brunnermeier and Pedersen, 2005). Nonetheless, some studies have claimed that there is no evidence in favor of the positive effects of short selling restrictions (Beber and Pagano, 2013; Gagnon and Witmer, 2014; Jain, Jain, and McInish, 2012; Kolasinski, Reed, and Thornock, 2013; Massa, Zhang, and Zhang, 2015; Shkilko, Van Ness, and Van Ness, 2012).

[18] See Serafino, P. and Torsoli, A., (2020) *France, Italy, Spain Ban Short Selling to Curb Market Plunge*, Bloomberg, 03/17/20 [online]. Available at: https://www.bloomberg.com/news/articles/2020-03-17/france-italy-spain-ban-short-selling-to-curb-market-plunge; Also Thomas, L., Za, V., and Jones, H. (2020) *European exchanges pledge to stay open in face of coronavirus stampede*, Financial Post, 03/17/20 [online]. Available at: https://financialpost.com/pmn/business-pmn/european-exchanges-pledge-to-stay-open-in-face-

However, without perfect international cooperation and integration, can such restrictions be effective in a multi-market setting where the securities may be cross-listed in other unbanned regimes?

In order to formulate our hypotheses, we rely on the model of Diamond and Verrecchia (1987) which is based on Glosten and Milgrom (1985). The model assumes risk-neutral market makers who face no inventory costs or constraints and earn zero expected profits from each trade. A proportion of the traders (*c1*) can short sell costlessly, while others face either short selling restrictions (*c2*) or a total prohibition (*c3*). It is understood that these settings span all traders and hence $c1+c2+c3=1$. Uninformed traders will only short sell given a liquidity shock and if it is costless to do so. Informed traders with bad news will only refrain from short selling when a full prohibition is binding.

The model examines the effects from a short sales prohibition to the price discovery process by estimating the expected number of periods ($E[\widetilde{N}]$) in which the price of the asset converges with the boundaries P^H or P^L eventually reflecting all new information in the good or bad state of the world (v), respectively. $E[\widetilde{N}]$ is defined as:

$$E\left[\widetilde{N}\right] = \frac{E\left[\log\left(\widetilde{\Lambda}_N\right)\right]}{E\left[\widetilde{Z}\right]}; \tag{1}$$

where

$$E[\log(\widetilde{\Lambda}_N)] = E[\log\{(\frac{q_1^A}{q_0^A})^N\}] \quad \text{and} \quad E\left[\widetilde{Z}\right] = E[\log(\frac{q_1^A}{q_0^A})], \tag{2}$$

where q_v^A is the probability of action A, which is a member of Ω ={buy, sell or short or no trade}, given bad or good news pertaining the fundamental value of the asset. $\tilde{Z}$ is a random variable with realization Z^A, with $A \in \Omega$, and $\widetilde{\Lambda}$ is a Bernoulli variable defined either by the decision to accept or reject given the state of the world (v).

In a *Single-Market World* (not-cross-listed stocks) where short sale ranges from being costless ($c1=1$; $c2=0$; $c3=0$) to fully prohibited ($c3=1$), the expected number of periods required for the

of-coronavirus-stampede-2; In addition, see Ashworth, M., (2020) *Short-Selling Bans Only Delay the Inevitable*, Bloomberg, 03/13/20 [online]. Available at: https://www.bloomberg.com/opinion/articles/2020-03-13/short-selling-bans-only-delay-the-inevitable adjustment of prices *E[$\tilde{N}$]* to both bad and good news increases with the proportion of traders who are banned (*c3*). A slower speed of adjustment implies a weaker initial response *E[ΔP]* following both negative and positive earnings surprises when a ban is in place. With regard to positive news, this prediction may be explained by the long trades of sophisticated investors that are active in the market, or else by the possibility of short covering (Boehmer, Duong, and Huszár, 2018; Lasser, Wang, and Zhang, 2010).[19] Alternatively, in a *Multi-Market World* where short selling can only be restricted, while still possible through cross-listed stocks, the expected number of periods required for the adjustment of prices *E[$\tilde{N}$]* to both bad and good news decreases. In this setting, the model implies a stronger initial response *E[ΔP]* following earnings surprises, even when a ban is in place. The model explains this prediction by noise traders being driven out of the market by the restrictions, and a higher informativeness of the remaining trades. For clarity, in Table I, we apply the set of probabilities defined in Diamond and Verrecchia (1987) to our multi-market setting, and we summarize our predictions following both negative and positive earnings surprises.[20]

Throughout our work, we rely on the following benchmark premise, which relates to our control group (securities that are not cross-listed), in essence a single-market setting.

Benchmark Premise: Short Selling Bans and Price Response to New Information. A Ban in the Home Market of a foreign security, which is not cross-listed in the US, significantly reduces the response to negative earnings surprises.

[19] Short sellers face the risk of substantial losses following positive outcomes of the shorted stocks, which may drive them to swiftly cover their positions. For instance, Bloomberg reports that short sellers absorbed $20billion in losses and promptly covered substantial short positions, following a stock price ballooning as the result of massive trades by retail investors (Greifeld, K. and Wang, L., 2021. "GameStop Short Interest Plunges in Sign Traders Are Covering", Bloomberg. See https://www.bloomberg.com/news/articles/2021-02-01/gamestop-short-interest-plummets-in-a-sign-traders-are-covering). Another example, in January 2020, short sellers lost more than $1.5 billion in mark-to-market losses in a single day (Franck, T. 2020. "Tesla short sellers lose more than $1.5 billion in one day as stock skyrockets on earnings", CNBC. See http://www.cnbc.com/2020/01/30/tesla-short-lose-more-than-1-billion-as-stock-surges-on-earnings.html)

[20] In the model, the probabilities of a long trade, conditional to either a good or bad state of the world do not change across short selling absolute regulatory settings (fully unbanned, banned or restricted). Hence, we can infer the expected differential effects to the initial response following earnings surprises across unbanned (costless short selling, *c1=1*), restricted (*c2=1*) and fully banned (*c3=1*) observations by comparing the conditional probabilities of selling or short selling as defined in the paper. Our baseline predictions are dependent on the numerical probabilities in Diamond and Verrecchia (1987), which assumes that all parameters are equal to one half (see Figure 2 for reference).

We can now state two hypotheses for cross-listed securities:

Our first hypothesis relates to our core research question on whether regulatory arbitrage or reach holds in the scope of the price response to new information. On the one hand, the regulatory arbitrage hypothesis suggests that short selling restrictions will simply displace short sales to the unrestricted jurisdictions in which a security is cross-listed, thereby enabling full price response to news, despite the home market ban. On the other hand, the regulatory reach hypothesis suggests that a ban in the home country of a foreign stock will also curtail shorting activity in the US markets, and hence, the initial response is delayed following earnings surprises. In this sense, we subdivide our first hypothesis as follows:

Hypothesis 1a: Regulatory Arbitrage by Short Bans. A Short selling ban in the Home Market is rendered less effective for a foreign security which is cross-listed in the US, and the home-market ban does not significantly affect the price response to negative surprises.

versus

Hypothesis 1b: Regulatory Reach of Short Bans. A Ban in the Home Market of a foreign security has worldwide reach, and it is effective even when the stock is cross-listed in the US and the home country ban significantly delays the response to negative surprises.

Our second hypothesis accounts for the role of the intensity in the profit opportunity for short sellers, which must be sufficiently higher than the direct and indirect costs of working around the ban for cross-border regulatory arbitrage (Hypothesis 1a) to work successfully. Along these lines, Blau, Van Ness, and Warr (2012) posit that greater short selling of ADRs under home country restrictions is partly explained by stocks with greater dispersion of investors' opinion. Relying on this rationale, we employ dispersion of beliefs as a proxy for short sellers' profit intensity. Dispersion of beliefs is also associated with overvaluation by Berkman et al. (2009), Boehme, Danielsen, and Sorescu (2006), Chang, Cheng, and Yu (2007), Diether, Malloy, and Scherbina (2002), and Miller (1977). Thus, in the trade-off between Hypothesis 1a and Hypothesis 1b, we expect that a weaker intensity in short sellers' expected profits (proxied by lower dispersion of beliefs) leads Hypothesis

1b (Regulatory Reach) to dominate, given that the expected profits in the arbitrage opportunity may not exceed the costs of trading in foreign locations away from the banned jurisdiction.

Hypothesis 2: Role of Intensity of the Profit Opportunity in Short Bans. A weaker intensity in the expected profit opportunity for short sellers (proxied by a lower dispersion of beliefs) leads regulatory reach to dominate regulatory arbitrage.

In Figure 2, we present the tree diagram from Diamond and Verrecchia (1987) adapting their model to our multi-market framework. We assume that banned not-cross-listed stocks are such that correspond to a setting where $c3=1$, implying a full prohibition. We consider banned stocks that are cross-listed in unbanned markets as such corresponding to a setup where $c2=1$, where short selling is restricted at home, while still possible abroad. Conditional to negative news ($v=0$), when $c2=1$, we add the scenario in which the profit from engaging in regulatory arbitrage is higher than the costs of doing so, with a probability π. This adjustment changes the probability of *selling or short-selling* in the original model from $1/2gh(1+a)$ as in Diamond and Verrecchia (1987) to $1/2gh(1+a)+ga(1-h)\pi$. We report this adjusted probability in Table I. All other probabilities remain unchanged. We find that such a fine-tuning would not be applicable for the case of positive earnings surprises ($v=1$), given that in the model, an informed trader never short sells when $v=1$. Given that short selling activity is more closely related to negative news, we focus on the case of negative earning surprises.

Alternative test of the role of Profit Opportunity in Short Bans (Hypothesis 2): The case of Corporate Earnings Management.

Short bans and regulatory reach make reported earnings inaccurate if corporate managers start managing earnings because they are not monitored closely by short sellers. But when excessive misvaluations create intense profit opportunities, regulatory (cross-border) arbitrageurs step in to fix these problems. To test the role of the profit intensity (leading either regulatory reach or arbitrage to dominate) in this analogous context, we exploit the fact that earnings management practices (and thus short sellers expected profits from research and monitoring efforts) are influenced by the CEO compensation structure. We test our hypotheses using a univariate analysis around a home market ban, with a difference-in-differences test for cross-listed and non-cross-listed stocks, and using multivariate regression analyses.

3 Data

Our overall sample period spans the period between January of 2000 and March of 2020, covering the special case of the COVID-19 market crisis. Earnings per share forecasts and actual values are sourced from IBES using both US and International files. We source cross-listed security prices, returns, trading volume and market benchmarks of New York Stock Exchange (NYSE), American Stock Exchange (AMEX) and NASDAQ financial and non-financial firms from the Center for Research in Security Prices (CRSP), to compute abnormal returns and control variables such as lagged returns, turnover and volatility. In our sample of foreign firms, securities' prices, returns and market benchmarks are obtained from Compustat Global Security Daily file. In addition, we download from Datastream those observations that are not matched between IBES and Compustat Global Security Daily file. We find that the unmatched observations correspond to many infrequently traded stocks that are excluded from the final sample, because they do not meet the minimum number of observations required in the calculation of the abnormal returns in our event study setup. We build a comprehensive summary of the historical legality of short sales across countries. We construct this time series from the works of Bris, Goetzmann, and Zhu (2007), Charoenrook and Daouk (2009), Beber and Pagano (2013), Jain, Jain, McInish, and McKenzie (2013), Beber, Fabbri, Pagano, and Simonelli (2020), Boulton, Smart, and Zutter (2020), Maffett, Owens, and Srinivasan (2017), and updating the latest information from legal briefs, and exchange or regulatory websites. Although our empirical analysis ends in 2020, countries continue to ban and to relax short sales in 2020 and 2021. For instance, in 2021 India, South Korea, and Malaysia lifted short selling bans enacted earlier as response to the COVID-19 crisis. Countries like Taiwan and Thailand similarly relaxed the short volume caps and tightened uptick restrictions, which are beyond the scope of our short bans study. Our sample period displays a rich cross-sectional and time series variation, spanning three major waves of short selling restrictions: (i) the US Financial Crisis, (ii) the European Debt Crisis and (iii) the recent COVID-19 Health Crisis, and (iv) normal benchmark periods before and in between these crises. Institutional Ownership data are sourced from Bloomberg. Short Interest data are from Compustat North America supplemental file. Fails-to-deliver data are sourced from the Securities and Exchange Commission (SEC).[21] We obtain the countries' legal origin from La Porta, Lopez-De-Silanes, and Shleifer (1999).

As pointed out by Doidge, Karolyi, and Stulz (2020), foreign companies can opt to cross-list and trade their stocks in the US Markets through direct listing or more commonly as an American Depository Receipt (ADR) sponsored by J.P. Morgan, the Bank of New York Mellon or Citibank.[22,23] Global Depository Receipts (GDRs) is another form of cross-listing in other global markets, where short selling may not be banned. The CEO compensation structure data used in the analyses in Section 5.1 are sourced from Perrin (2005).

4 Formal Empirical Tests and Results

4.1 HISTORICAL LEGALITY OF SHORT SALES AROUND THE WORLD

In our setup, the global regulatory variations regarding short sales serve as exogenous shocks to shorting intensity in the home country of the security, deeming our setting equivalent to a quasi-natural experiment.[24] In the cases where there is no regulatory framework to accommodate short sales, we assume that a ban is in place, given that the conventional mechanisms to allow short trades are not legally viable. In Figure 1, we illustrate the variations in the legal status of short-sales. In general, we drop those observations in which the US bans short sales (2008 Temporary

[21] https://www.sec.gov/data/foiadocsfailsdatahtm

[22] See SEC website at https://www.sec.gov/reportspubs/investor-publications/investorpubsininvesthtm.html

[23] We compile all ADRs and GDRs listed from these three sources and we subsequently remove firms do not have information on International Securities Identification Number (ISIN). See https://www.adr.com, https://www.adrbnymellon.com and https://www.depositaryreceipts.citi.com, respectively.

[24] We use the date of the actual implementation of the ban to define the variable, and we assume June 1^{st} in the cases when the year is specified, but the exact date is not available despite our own, and other researchers' efforts.

Short Sales Ban).[25] Therefore, in our final sample, the US markets always provide the opportunity for regulatory arbitrage when a ban is binding in the home market of cross-listed stocks.[26] We do not consider Rule 201 as a short selling ban, given that: (i) it is only triggered after a 10 percent intra-day price decline, which can be considered a rare event (Jain, Jain, and McInish, 2012) and (ii) although shorting activity may be subject to a price test breaker, short selling is ordinarily taking place with no impact of price test rules on return or volatility at the daily level according to Diether, Lee, and Werner (2009a).[27]

In the analyses that follow, we demonstrate the role of the intensity of traders' profit opportunity and CEO's compensation incentives on the hypothesized effects of short selling regulations. Whereas in terms of short selling activity we find evidence of regulatory reach of bans, in terms of the return response to larger earnings surprises, we actually find evidence consistent with price arbitrage. Our next layer of findings show that an intense profit opportunity strongly encourages market participants to engage in regulatory arbitrage.

4.2 REACH VS. ARBITRAGE & BASELINE SHORT SELLING ACTIVITY

In our sample of not-cross-listed foreign stocks, the absence of short sales when a ban is in place is a factual matter. In contrast, when stocks are cross-listed in unbanned markets, a home country ban may result in an increase or reduction of shorting activity in the US Markets, depending on whether the regulatory arbitrage (Hypothesis 1a) or reach (Hypothesis 1b) premise holds, respectively.

In Figure 3, we show that a home country ban substantially reduces the average short interest per firm in foreign jurisdictions, providing support to the regulatory reach premises (Hypothesis 1b). Interestingly, the spread in short interest observable between cross-listed stocks from countries

[25] As robustness, we also re-run our empirical work excluding the year 2008, with consistent results.

[26] Interested readers may find the details of our data repository, containing additional country and institutional information (e.g., number of stocks/observations, financial development index, average size of firms, and legal origin by country) at the following anonymous link: https://drive.google.com/file/d/1nEw95YvAPwL9DIFobSZZSqE–FKkpPrL/view?usp=sharing.

[27] For similar reasons, we do not consider Rule 10a-1 (Uptick Rule) as a short selling ban in US or tighter short volume caps and uptick restrictions in countries like Taiwan and Thailand.

where short selling is banned and cross-listed stocks from countries where short selling is unbanned, seems to fade around periods of abrupt market shocks (i.e., Dot-com crash, 2008 financial crisis, trade-war, COVID-19) suggesting a regulatory arbitrage setting. These periods arguably provide higher profit opportunities to short sellers and thus such a finding is consistent with our Hypothesis 2 (regulatory reach dominates when the profit opportunity is not intense).

Second, we examine the pattern of the short activity specifically around earnings announcements, when a ban is binding in the home market of a foreign stock. We are particularly interested in evaluating the role of the intensity of the expected profits, which may incentivize short sellers to engage in cross-border regulatory arbitrage (Hypothesis 2). The results are presented in Figure 4. In Panel A, we present the short interest scaled by shares outstanding. Amid a home market ban, the lack of short selling activity is a factual matter for not-cross-listed stocks (regulatory arbitrage is not possible). Thus, we do not have short interest data for these stocks. When a stock is cross-listed, and short sellers have the possibility to engage in regulatory arbitrage, we notice that short interest is lower when dispersion of beliefs (proxy for short sellers' expected profits) is lower. This finding seems to corroborate our Hypothesis 2.

Given that the widely available short interest data is fortnightly, we acknowledge that we cannot match it to our examined window on a daily frequency. Therefore, to ensure the validity of our results we use fails-to-deliver (FTD) data sourced from the US Securities and Exchange Commission (SEC) as a proxy for shorting selling activity in Panel B.[28] We keep in mind that a short trade can be marked as a delivery-failure only after the lagged settlement outcome, and therefore FTD could be thought of as a lagged indicator of the intensity of short selling and of naked short selling (Putniņš, 2010). Because of this reason, we look at the difference in the FTD between the days t_{+1} and t_{-1} around the earnings announcements, scaled by the number of shares outstanding. Our results from FTD are also consistent with our Hypothesis 2. Short selling activity (proxied by either short interest or FTD) is low due to ban's reach when dispersion of beliefs is low (short sellers' expected

[28] There is a growing literature on fails-to-deliver (Devos, McInish, McKenzie, and Upson, 2014; Edwards and Hanley, 2010; Evans, Geczy, Musto, and Reed, 2009; Fotak, Raman, and Yadav, 2014; Jain and Jain*, 2015).

profits are low).

But how does the foreign regulation affect the price response to large versus small earnings surprises (new information), or the short sellers' monitoring role? We continue to answer these questions below.

4.3 REACH VS. ARBITRAGE AND RESPONSE TO EARNINGS SURPRISES

Univariate Analysis: To test the effects of short selling restrictions on the speed of adjustment to new information, we examine earnings announcement events. Following previous academic work, we construct the standardized unexpected earnings (SUE), as the differential between the one-quarter-ahead analysts' forecast consensus and the actual earnings per share, scaled by the stock's lagged price. We categorize a surprise as negative (positive) if it is below (above) the median of the cross-sectional distribution of SUE observations within each year.

$$SUE = \frac{(Actual - Forecast)}{Price_{t-30}}. \tag{3}$$

We follow the traditional literature when conducting our event study (Ball and Brown, 1968; Fama, Fisher, Jensen, and Roll, 1969; Hung, Li, and Wang, 2014; MacKinlay, 1997). In line with MacKinlay (1997), we use the market model as the baseline specification to estimate normal performance and the abnormal returns (AR): $R_{i,t} = \alpha_i + \beta_i R_{m,t} + e_{i,t}$. Our parameter estimation window is [-60, -15] and the overall event window around earnings announcement is [-10, +60]. We drop firm-date pairs which do not have at least 30 observations in either the estimation or the event window. The calculation of the cumulative abnormal return (CAR) and average cumulative abnormal return (ACAR) are as follows:

$$CAR_i\left(t_1, t_2\right) = \sum_{t=t_1}^{t_2} AR_{i,t} \quad \text{and} \quad ACAR_t = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,t} \tag{4}$$

where N is the number of firm-events in our sample. Our additional cumulative abnormal returns specifications allow t_1 to span between the day before and the event date and t_2 covers between the event date and until three days after. We evaluate the magnitude, direction and statistical significance of the CARs following earnings surprises across banned and unbanned periods for each of our cross-listed and not-cross-listed foreign stocks.

A preliminary univariate analysis of CARs is presented in Panel A of Table III for negative surprises. Within the not-cross-listed sample, the mean values of CAR (-1, +1) are -0.24% and -1.07% for banned and unbanned stocks respectively and the difference is statistically significant at the one percent level.[29,30] This result is consistent with the benchmark premise that short selling bans mute the price response to new information. For cross-listed stocks, the mean values of CAR (-1, +1) are -1.53% and -1.95% for banned and unbanned stocks, respectively, and the difference is statistically significant at the five percent level. These numbers indicate that there is a trade-off between regulatory arbitrage and regulatory reach as hypothesized in 1a and 1b. With perfect arbitrage, the return response for cross-listed stocks would be the same across banned and unbanned groups, given that cross-listed market trading would negate any home country ban. But the returns are dissimilar, suggesting that regulatory reach is at play. However, comparing -1.53% for cross listed banned stocks to -0.24% for non-cross-listed stocks, we notice that the ban is much less effective for cross-listed stocks, and thus regulatory arbitrage is also at play. Therefore, additional factors such as the intensity of the profit opportunity could potentially determine which of the two effects dominate, as we demonstrate later in Section 4.4.

Before examining the role of the intensity of the expected profits from short selling (in foreign jurisdictions) through regulatory arbitrage, we examine volatility and additional SUE models.

[29] For brevity, we describe the results of the CAR (-1, +1). The results of CAR (0, +3) are always consistent with those of CAR (-1, +1) unless stated otherwise.

[30] Our research questions and thus the description of our results focus on the initial response window following earnings announcements. We also report the pre-event and drift windows as these are necessary for the correct interpretation of the results. On the one hand, the drift window allows us to examine whether the initial response was efficient or not. On the other hand, the pre-event window allows us to account for information incorporated before the announcement.

Reach vs. Arbitrage and Volatility: How does a short selling ban affect volatility, which is important for several reasons including derivative pricing, as a risk factor, and the implications for market stability? In Panel B of Table III, we evaluate if a short selling ban in the home country of a foreign security affects the stock price volatility around earnings surprises and whether such effects show evidence in favor of the regulatory reach or the regulatory arbitrage hypothesis. Previous works find that there is an enhanced volatility of the returns when short sales are allowed (Chang, Cheng, and Yu, 2007) and that such a volatility effect is intensified in the presence of heterogeneous beliefs (Hibbert, Kang, Kumar, and Mishra, 2020). In this exercise, we focus on the volatility of abnormal returns in the initial response window (-1, +3) around earnings announcements.

For the benchmark of not-cross-listed stocks, we observe that following negative earnings surprises, the volatility of the abnormal returns is lower when short sellers are banned out of the market. This baseline result is consistent with Chang, Cheng, and Yu (2007) and corroborates our benchmark premise for not-cross listed stocks. Our innovation in Column (7) is of particular interest, as we compare the difference in the regulatory effect between not-cross-listed versus cross-listed stocks. Following negative earnings surprises, we notice that the short selling ban's reduction of volatility is significantly lower if a stock is cross-listed in an unbanned market.

Multivariate Analysis: In order to attain a deeper understanding about the cross-border effects of bans on the price response to new information, and to examine the role of the intensity in short sellers' profit opportunities, we estimate the following ordinary least squares model specification:

$$
\begin{aligned}
CAR(t_1,t_2)_{i,t} = \alpha &+ \beta_1 NegativeSurprise * ShortBan * CrossListed_{i,t} \\
&+ \beta_2 NegativeSurprise * ShortBan_{i,t} + \beta_3 NegativeSurprise_{i,t} \\
&+ \beta_4 ShortBan * CrossListed_{i,t} + \beta_5 ShortBan_{i,t} \\
&+ \beta_6 NegativeSurprise * CrossListed_{i,t} + \beta_7 CrossListed_{i,t-1} \\
&+ \beta_X Controls_{i,t} + \lambda_\gamma + \omega_\tau + \varepsilon_{i,t}
\end{aligned} \tag{5}
$$

where i indicates a firm and t indicates an announcement date. Our dependent variable $CAR(t_1, t_2)$ corresponds to the cumulative abnormal return observed in the specified t_1, t_2 window. *Negative Surprise* is a dummy variable taking a value of 1 if an earnings surprise is ranked below the median of the distribution of the SUE values within a year. *Cross Listed* is a dummy variable taking a value of one if the stock is cross-listed in the US market or if the stock is traded via global depository receipts (GDR) in another unbanned market. We define our control variables as follows: *Size* corresponds to the natural log of the market value of a firm. *ReturnVariance* is the standard deviation of the returns of a firm. *AnalystCoverage* is the number of estimates for a given announcement as reported by IBES. *AnalystDispersion* is the dispersion across analysts' estimates for a given announcement as reported by IBES. *TransactionCost* is proxied by the proportion of daily zero returns in a given month for a firm (Lesmond, Ogden, and Trzcinka, 2015). *Turnover* is the ratio of trade volume over shares outstanding. *Return3,5(6,8)* correspond to the lagged returns of a given firm during the two quarters (*-3* to *-5* and *-6* to *-8* months) prior to the estimation window. *CommonLaw* is a dummy variable taking a value of 1 if the legal origin of the company corresponds to the English common law or zero otherwise (La Porta, Lopez-De-Silanes, and Shleifer, 1999).[31] λ_γ and ω_τ are industry and year fixed effects respectively.[32] Two way cluster-robust standard errors are used in all specifications.[33] The complete definitions of all variables are presented in the Appendix A.

We define the regulatory setting as banned or unbanned in accordance with previous academic works, legal briefs, countries' regulators websites, among other official sources. We create the dummy variable *Short Ban*, which is equal to one if the country-date specification corresponds to a banned period or zero otherwise. This variable varies over time to account for regulatory changes within our sample period. We present the summary statistics for all our variables in both the subsamples

[31] Common law, which is English in origin, provides the strongest rights to both shareholders and creditors. This legal origin also implies a higher quality of law enforcement than the French-civil-law, but weaker than the German or Scandinavian law. The quality of law is a relevant control when evaluating the likelihood of regulatory arbitrage.

[32] We winsorize continuous variables at the one percent level. However, we confirm that our inferences are the same whether or not we winsorize.

[33] In many cases, the short sales regulatory setting may be time-invariant and hence, we do not include country or firm fixed effects that would otherwise capture our explored relationships, although results are not different when including these effects in robustness tests.

of cross-listed (Panel A) and not-cross-listed (Panel B) stocks separately in Table B.1 of our Online Appendix.[34]

The regression results of equation 5 are presented in Table IV. We present our results using both CAR $(0, +3)$ and CAR $(-1, +1)$ as dependent variables. Overall, we observe that the interaction term *Negative Surprise*Short Ban* is positive and significant with a coefficient of 1.568 and 1.300 when looking at CAR (0, +3) and CAR (-1, +1) respectively (Columns 1a and 1b), confirming the benchmark premise that a short ban mutes price response to negative news. However, when we evaluate cross-listed stocks, the coefficients of *Negative Surprise*Short Ban*Cross Listed* are -1.438 and -1.422 when looking at CAR (0, +3) and CAR (-1, +1) respectively, suggesting that the cross-listing cancels out the effect of the short selling regulation. Hence, these results favor our Hypothesis 1a for prices. These results considering the return perspective can be conciliated with our finding of a significant reduction of shorting activity given a higher informativeness of the remnant short sales (Brockman and Hao, 2011; Diamond and Verrecchia, 1987) which ultimately preserves the speed of adjustment unaffected. Given the stronger support for 1a with prices and 1b with activity we examine the role of large profit opportunities in this trade-off.

5 ROLE OF INTENSITY IN THE EXPLOITATION OF THE PROFIT OPPORTUNITY THROUGH ARBITRAGE

We presume that short sellers' expected profits are greater when higher dispersion of beliefs exist (Blau, Van Ness, and Warr, 2012; Berkman et al., 2009; Boehme, Danielsen, and Sorescu, 2006; Chang, Cheng, and Yu, 2007; Diether, Malloy, and Scherbina, 2002). Thus, in Hypothesis 2, a weaker intensity in the short sellers' profit opportunity (proxied by a lower dispersion of beliefs) leads regulatory reach to dominate regulatory arbitrage. In our multivariate framework, we examine the specific case of earnings announcements where low dispersion of beliefs exists, and thus

[34] We also confirm that our results remain consistent when excluding the financial crisis period. Results are qualitatively similar and are available upon request

the profits in the arbitrage opportunity may not exceed the costs to remain in compliance with the stock's home country regulation. We present our results in columns (2a) and (2b) of Table IV. Similar to Columns (1a) and (1b), we observe that the interaction term *Negative Surprise*Short Ban* is positive and significant, suggesting that a ban in the home country of a foreign security significantly reduces the initial response to negative earnings surprises. The triple interaction term with cross-listing in this regression helps us test the effects of short ban's cross-market reach versus arbitrage. Within the sub-sample of earnings announcements with low dispersion of beliefs, the triple interaction term *Negative Surprise*Short Ban*Cross Listed* is not statistically significant. This result is insightful, as it implies that the cross-listing of a stock does not cancel out the effect of the short selling ban when low dispersion of beliefs exist. In the low profit setting, traders are cautiously better-off to remain in compliance with the home-country regulations resulting in its overreach. Conversely, in Columns (3a) and (3b), we re-run the regressions, focusing on the sample of announcements occurring under high dispersion of beliefs. The benchmark interaction term *Negative Surprise*Short Ban* is once again positive and significant. However, similar to columns (1a) and (1b), the triple interaction term *Negative Surprise*Short Ban*Cross Listed* is now negative and significant suggesting that the cross-listing deems the foreign short ban less effective, as participants engage in highly profitable price arbitrage. Thus, in a high-profit setting, a short selling prohibition does not affect the speed of adjustment when a stock is cross-listed in an unbanned market. These findings corroborate Hypothesis 2, and suggest that short sellers will pay more attention to compliance if the profit opportunity is lower whereas they will take advantage of the regulatory arbitrage opportunity when the profits are large.[35] In Table B.3 of our Online Appendix, we re-run our analyses estimating the SUE from the seasonal quarterly differences (Bernard and Thomas, 1990; Foster, 1977; Ke and Ramalingegowda, 2005).[36] Additionally, we repeat our exercises using

[35]The full set of results including all control variables is reported in Table B.2 of the Online Appendix.

[36]The Foster model assumes that earnings seasonal differences follow a first-order auto-regressive process:

$$\mathbb{E}(Q)_t = Q_{t-4} + \delta$$

In line with Bernard and Thomas (1990), we estimate the standardized unexpected earnings (SUE) as the forecast errors of the Foster Model 2 (in seasonal differences) scaled by the estimation period standard deviation. A window market adjusted returns in lieu of abnormal returns (Table B.4 of Online Appendix), and we define a negative earnings surprise when the SUE is below the 20^{th} percentile of the SUE distribution versus below the median of the SUE distribution (Table B.5 of Online Appendix). For reader's convenience, in Table V, we present an extract of the results for both samples where short sellers' expected profits are low (Column 2b) versus high (Column 3b), for each of these three robustness tables. In all columns, the magnitude and statistical significance of the coefficients are qualitatively similar to the corresponding columns in Table IV (main specification). When the profit opportunity is high (Column 3b), the triple interaction term *Negative Surprise*Short Ban*Cross Listed* is negative and significant suggesting that the cross-listing cancels-out the effect of the short ban. This is not the case when the profit opportunity is low (Column 2b), where the triple interaction term *Negative Surprise*Short Ban*Cross Listed* is insignificant, and thus the ban remains effective. Finally, we confirm that our results are not different if we control for institutional ownership and the availability of put options. The results are presented in Table B.6 of the Online Appendix.

5.1 ROLE OF BORROWING COSTS: COVID-19 CASE STUDY

The role of the intensity of short sellers' expected profits (Hypothesis 2), pertaining to the decision of short sellers to circumvent home country bans (versus complying with its spirit globally) is also influenced by stock borrowing costs (Asquith, Pathak, and Ritter, 2005) that reduce the net profits for short sellers, and it is therefore worthwhile examining this layer. The recent COVID-19 global shock provides us with a valuable opportunity to examine our Hypothesis 2 in a unique and extreme setting. For this purpose, we identify March 11^{th}, 2020 as our event date. This is the day in which the World Health Organization declared COVID-19 a pandemic, which can be considered a negative shock to stocks from all countries. In Figure 5, we plot the steep decline displayed by four major global indexes (Dow Jones, S&P 500, FTSE 100 and SSE) on this date. We subsequently design a placebo test following Chang, Cheng, and Yu (2007) methods, which are

of 24 observations is used with a minimum of 16 observations.

similar in spirit to those of Ikenberry, Lakonishok, and Vermaelen (1995) and Kothari and Warner (1997). First, we form a simulated sample with similar characteristics to those of the banned group of stocks. In line with Chang, Cheng, and Yu (2007), we do this in three steps: (i) we choose a (randomly) simulated pseudo event date between January 2^{nd}, 2020 and February 19^{th}, 2020, (ii) on this date, we form a pool of eligible placebo-stocks with similar size and turnover as the actual banned firms on March 11^{th}, 2020 (treated stocks). More specifically, these eligible stocks fall between the boundaries determined by both the largest and smallest size percentile and the highest and lowest annual turnover of the treated stocks. (iii) We randomly select from the pool of eligible stocks (without replacement) the same number of stocks as the treated group. We then calculate the abnormal returns for both the placebo group and the treated group. We repeat this process 1,000 times in line with Chang, Cheng, and Yu (2007).

We present our results in Table VI. We evaluate the event windows (-1, +1) and (0, +2). We depart from the previous window (0, +3) to avoid confounding effects from overlapping successive events: (i) The evening before t_{+3} corresponds to Sunday, March 15th, 2020. On this day, the FOMC held an unscheduled meeting announcing economic alleviating measures in response to the health-crisis and (ii) on Monday, March 16th (t_{+3}), a Market-Wide circuit breaker was triggered at 9:30 AM. In Columns (1a) and (1b) of Table VI, we find that the interaction term *COVID*Short Ban* is positive and significant, suggesting that stocks subject to a shorting ban in their home countries experienced a less negative initial response following the announcement of COVID-19 as a pandemic, even though these stocks are cross-listed in unbanned markets. These findings are in line with the notion that amid a market-wide shock, short selling restrictions result in delayed market responses and market closures. We further explore the role of short sellers' expected profit in the arbitrage opportunity. In Columns (2a) and (2b), we examine the group of firms subject to costly borrowing fees (low profit opportunity for short sellers). In these columns, we consider that a short ban is in place given two conditions: (i) the home country prohibits short selling and (ii) borrowing fees are above median. In Columns (3a) and (3b), however, we consider that a short ban is in place given two conditions: (i) the home country prohibits short selling and (ii) borrowing fees are below median. Given that COVID-19 is a market-wide shock, we focus on the combined marginal effect of both the COVID-19 shock and the short selling ban by adding the two coefficients. This combined effect is -3.437 for the low profit opportunity firms (Column 2a) whereas it is -4.344 for the high profit opportunity firms (Column 3a), when looking at the CAR(0, +2). These results suggest that the level of the lending fees reduces the profits expected from short selling, and thus, from a global array of firms under the COVID shock, short sellers target those that are not subject to high fees (and may not engage in cross-border regulatory arbitrage if fees are high).

5.2 REACH VS. ARBITRAGE: CORPORATE EARNINGS MANAGEMENT AND SHORT BANS

As another robustness exercise for our findings on the reach versus arbitrage, we test our hypotheses once again, but within the different context of earnings management practices. If a ban remains fully effective in a multi-market setting (Hypothesis 1b: regulatory reach), we expect that firms from countries under a (short selling) ban are more likely to engage in earnings management (even when stocks are cross-listed in unbanned markets) vis-à-vis firms from unbanned countries. Our expectation is sustained by Fang, Huang, and Karpoff (2016). Their work finds that discretionary accruals decrease when short sellers are not subject to restrictions (i.e. price tests), implying that short sellers exert a monitoring role over firms.

More precisely, considering the role of the intensity in the profit opportunity (Hypothesis 2), we expect that <u>when a stock is cross-listed</u>, the home market regulation's effect is moderated when a large profit opportunity exists for short sellers (regulatory arbitrage dominates; Hypothesis 1a), but the regulatory effect is significant, due to worldwide reach, when short sellers' expected profits from the arbitrage opportunity are low (regulatory reach dominates; Hypothesis 1b). Following Fang, Huang, and Karpoff (2016), our baseline model in this exercise is the following:

$$DA = \alpha + \beta_1 ShortBan_{i,t} + \beta_2 Size_{i,t} + \beta_3 MB_{i,t} + \beta_4 ROA_{i,t} + \beta_5 LEV_{i,t} + \lambda_\gamma + \omega_\tau + \varepsilon_{i,t} \tag{6}$$

where i indicates a firm and t indicates a year. Our dependent variable DA corresponds to the discretionary accruals as in Fang, Huang, and Karpoff (2016). This variable is constructed from the discretionary accruals measure of Kothari, Leone, and Wasley (2005).[37] *Short Ban* is a dummy variable taking a value of 1 if the country-date specification corresponds to a banned period or zero otherwise. *Size* corresponds to the natural log of the market value of a firm. *MB* is market to book ratio, *ROA* is the return on assets, and *LEV* is the ratio of total liabilities to total assets. We also include the variable *CEO Variable Compensation*, which is a dummy variable taking value one if more than 50% of firms in a given country offer variable compensation, or zero otherwise. λ_γ and ω_τ are industry and year fixed effects respectively. Two way cluster-robust standard errors are used in all specifications.

We present our results in Table VII. The coefficient of *CEO Variable Compensation* is significant and positive in the overall sample (Column 1a), confirming that this group of firms (from countries where CEO compensation is generally variable) are linked to higher earnings management practices (high profit opportunity for short sellers). In Column (1b), we focus on *Short Ban* in our model, and we confirm that both *Short Ban* as well as *CEO Variable Compensation* are linked to greater practices of earnings management. This is consistent with our benchmark premise, and with the

[37] First, the following cross-sectional model is estimated within each year and Fama-French 48 industry:

$$\frac{TA_{i,t}}{ASSET_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{ASSET_{i,t-1}} + \beta_2 \frac{\Delta REV_{i,t}}{ASSET_{i,t-1}} + \beta_3 \frac{PPE_{i,t}}{ASSET_{i,t-1}} + \varepsilon_{i,t}$$

Next, the fitted normal accruals are estimated as:

$$NA_{i,t} = \hat{\beta}_0 + \hat{\beta}_1 \frac{1}{ASSET_{i,t-1}} + \hat{\beta}_2 \frac{(\Delta REV_{i,t} - \Delta AR_{i,t})}{ASSET_{i,t-1}} + \hat{\beta}_3 \frac{PPE_{i,t}}{ASSET_{i,t-1}}$$

The definitions of the related variables are available in Appendix A. Finally, firm-year-specific discretionary accruals are calculated as:

$$DA_{i,t} = (TA_{i,t}/ASSET_{i,t-1}) - NA_{i,t}$$

notion that CEO compensation that is linked to the value of a firm may suggest higher incentives for earnings management, and hence higher profit opportunities for short sellers that identify and target such firms (Baker, Collins, and Reitenga, 2003; Bergstresser and Philippon, 2006; and Cheng and Warfield, 2005). In Columns (2) and (3), we separately examine the cases of cross-listed firms from countries dominated by CEO Salary Compensation (low profit opportunity for short sellers) and those from countries dominated by Variable Compensation (high profit opportunity for short sellers), respectively. Among salary-based countries, earnings management may be explained by loss avoidance (Burgstahler and Eames, 2003), perk consumption, empire building, or promotion (Zhao, Zhou, Zhao, and Zhou, 2019).

Among firms from countries mainly providing salary compensation (Column 2), we find that *Short Ban* is positive and significant, which is consistent with Hypothesis 2. This result suggests that among countries where CEO compensation is mainly based on a fixed component (low expected profits for short sellers), when a home market ban is in place, firm managers may feel safe to increase earnings management practices. The home market ban thus drives away not only local short sellers, but also global short sellers, given that the ex-ante profits from engaging in cross-border regulatory arbitrage may not exceed the costs to remain in compliance with the foreign regulation, and thus the home country short selling ban remains effective, even when stocks are cross-listed in unbanned markets. However, among the mostly variable-compensation countries, we presume that global short sellers are intensely monitoring firms (due to high profit opportunity), and firm managers may not feel safe to increase earnings management practices, even when a home-market ban is in place. We focus on these firms in Column (3), where the sign of *Short Ban* is negative. This is consistent with a setting in which regulation is less relevant (or it may exacerbate short selling, as in Blau, Van Ness, and Warr, 2012) when the expected profits are greater for short sellers, also in line with Hypothesis 2.

6 Conclusion

While previous research studies the effects of home-country bans on stock borrowings or short activity, there is sparse work on the final effects of home country shorting restrictions on the price response to new information, which is a critical question regarding the impact of regulations on financial markets. In the baseline single market setting, it is expected that short sellers will make the initial response to earnings surprises efficient and conversely, shorting restrictions are expected to reduce efficiency by delaying such response. In a multi-market setting, the *regulatory reach hypothesis* posits that home country restrictions curtail short selling of cross-listed stocks in both home and foreign host markets, while the *regulatory arbitrage hypothesis* postulates that home country restrictions simply displace the shorting activity to foreign unbanned markets. Our findings indicate a trade-off between the intensity of the profit in the cross-border regulatory arbitrage opportunity and the cost and consequences of engaging in compliance work-around in foreign jurisdictions.
In the case of our control sample of not-cross-listed securities, for which cross-border regulatory arbitrage is not plausible, we verify that when a short sales ban is in effect in the home market, the initial absolute price response to earnings surprises, shorting intensity and the volatility around the post-earnings announcement period are significantly lower (consistent with our benchmark premise). In the case of cross-listed securities, our results are conditional on the strength of the expected incentives, as measured by dispersion of beliefs. We observe regulatory reach of a home market short selling ban, which curtails the short intensity around the post-earnings announcement period when there is low dispersion of beliefs (proxy for low expected profits). In contrast, the scope of the price response to earnings surprises is much larger with high dispersion of beliefs (proxy for high expected profits), indicating cross-border regulatory arbitrage. We further confirm the role of the intensity in the profit opportunity by examining the analogous case of earnings management practices and the monitoring role of short sellers. Overall, countries with a high proportion of firms extending their CEOs variable compensation (vis-à-vis fixed salary component) display a higher degree of earnings management proxied by discretionary accruals. Among cross-listed stocks from these countries,

where ex-ante profit opportunities may be greater for short sellers, home-market bans are less effective (global short sellers maintain a monitoring role even when home market bans are in place), and earnings management does not increase when a ban is in place, as firm managers may still be fearful of potential short selling in unbanned markets. In turn, among cross-listed stocks from countries where CEO compensation is mainly offered in the form of salary (fixed), implying lower ex-ante profits for short sellers, our results suggest that a home-market ban drives short sellers out of the market (ban is effective) and firm managers increase earnings management practices, as they may not be concerned about global short sellers who are generally not monitoring them (given the low expected profits for short sellers). Our overall results imply that short sellers may cross the foreign regulatory limits through work-around when a large profit opportunity exists. Such finding conciliates the previous conflict between regulatory reach and arbitrage hypotheses by defining the limits to arbitrage as demarcated by the profit intensity versus the costs of the (regulatory) arbitrage opportunity. We contribute to the literature in the following ways: (i) Our view advances previous pricing models in which informed traders always circumvent short selling restrictions amid bad news (i.e. Diamond and Verrecchia, 1987), as we point out that the decision to engage in foreign regulatory arbitrage depends not only on the value of the asset, but also on the costs of short selling in the foreign jurisdiction. In doing so, (ii) we are also the first to evaluate whether the premises of the short sales regulatory reach or the regulatory arbitrage hypothesis hold in the scope of stock price responses to new information, and to define the limits to regulatory arbitrage. (iii) Our cross-country setting allows us to explore such effects in a more widespread time horizon that washes out the complexities related to the analysis of the stand-alone US financial crisis period, which was a limitation faced by prior research on short bans. Our sample period spans 20 years including three major waves of short selling restrictions: the US financial crisis, the European debt crisis and the recent COVID-19 health crisis.

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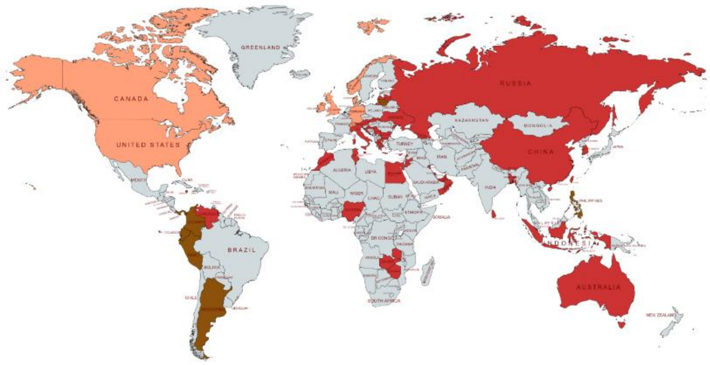
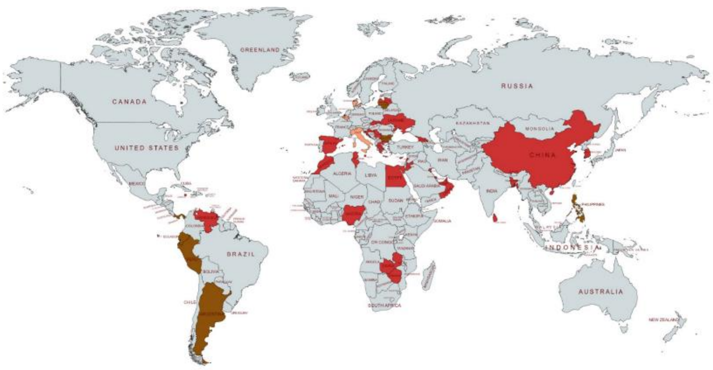
Panel A. Short Selling Legality in 2008 (US Financial Crisis)



Panel B. Short Selling Legality in 2012 (European Debt Crisis)



Panel C. Short Selling Legality in 2020 (COVID-19 Health Crisis)

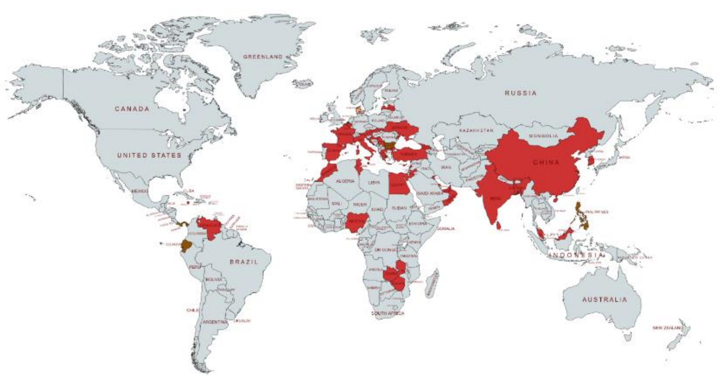


Figure 1. Short Selling Bans around the World. In this figure we present the historical variations in the legality status of short sales across the years 2008 (Panel A), 2012 (Panel B) and in 2020 (Panel C), corresponding to the US Financial Crisis, European Debt Crisis and COVID-19 Health Crisis, respectively. Countries in color orange are under a partial ban (i.e. financial stocks). Brown indicates countries where a regulatory framework does not exist for short selling activity, and red indicates a full ban on shorting activity. Figure created using mapchart.net®

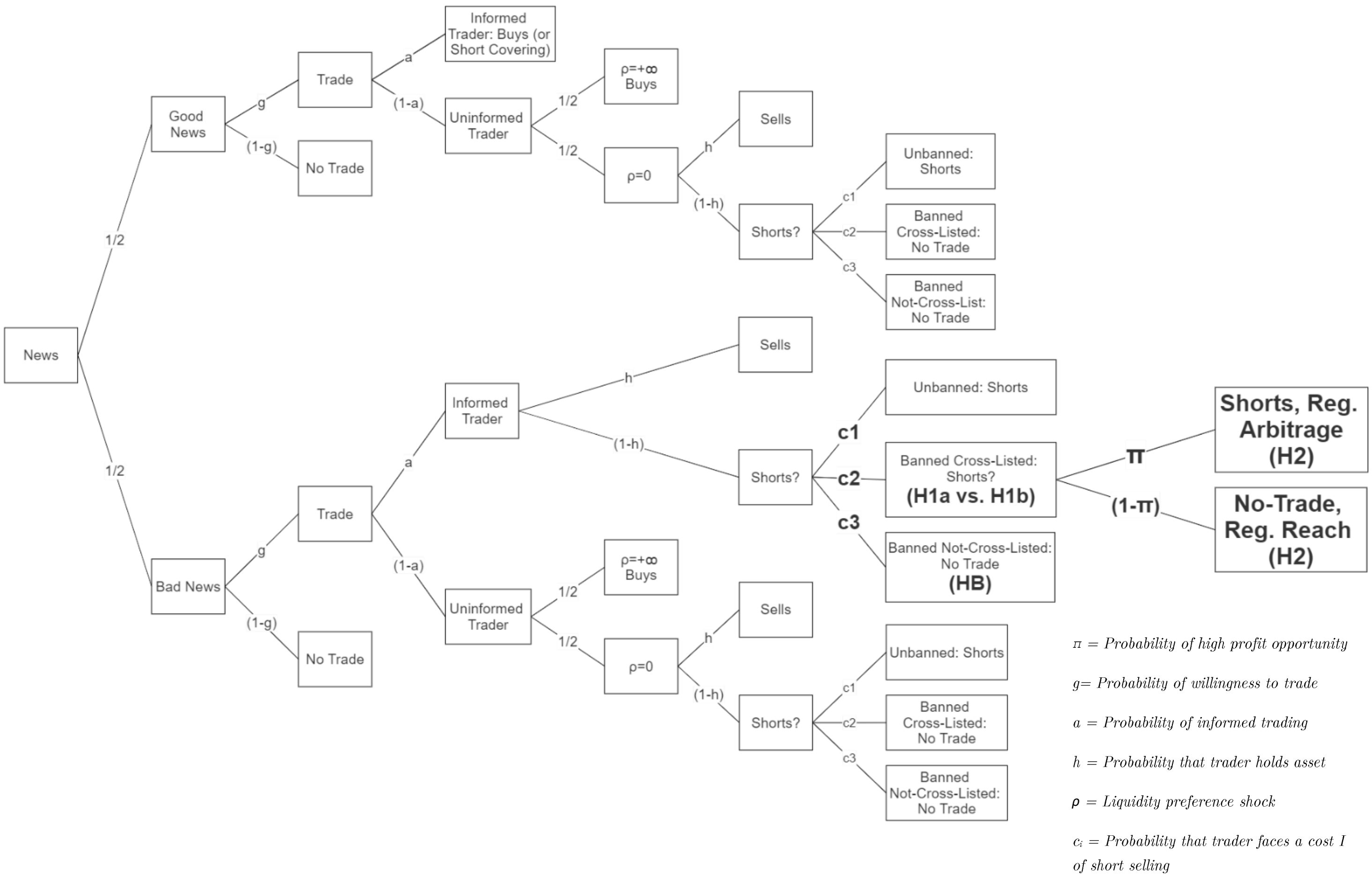


Figure 2. Cross-border Application of Diamond and Verrecchia (1987). Diagram of the process that induces trading with the market maker, where v is the value of the asset, g is the probability that a trader wants to trade, a is the probability of informed trading, h is the probability that a trader holds the asset, ρ is a liquidity preference shock and c_i is the probability that a trader faces a cost i of short selling, π is the probability that profit from engaging in cross-border regulatory arbitrage exceeds the work-around related costs. We constrain the setting in which $v=0$ and $v=1$ to be equivalent to positive and negative earnings surprises following earnings announcements, respectively. We also adopt the different costs of short selling c_1, c_2, c_3 as unbanned securities, banned cross-listed securities and banned not-cross-listed securities which we assume as equivalent to Diamond and Verrecchia (1987)'s postulation of costless, restricted or prohibitive costs for short selling, respectively. While our hypotheses and predictions are therefore limited to such assumptions, the empirical results are not.

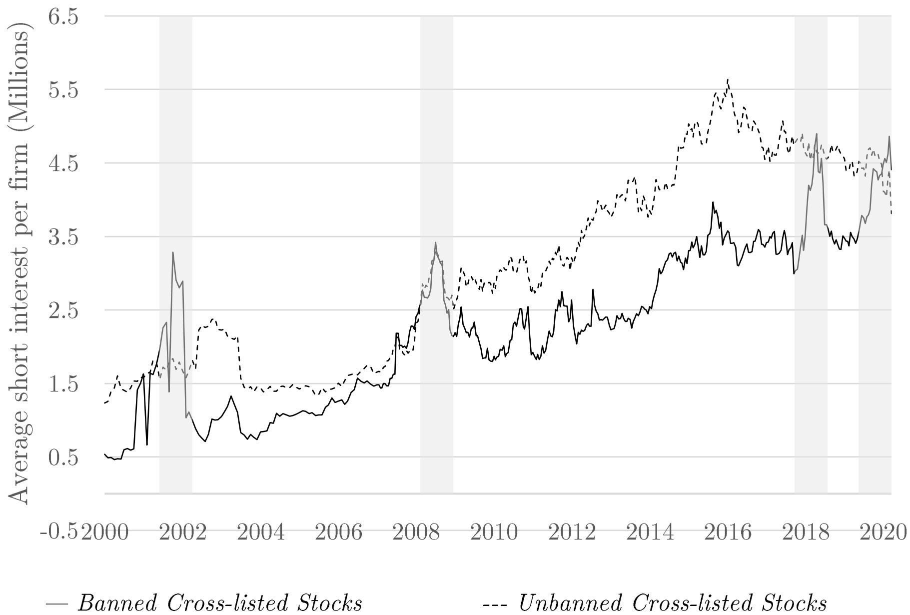
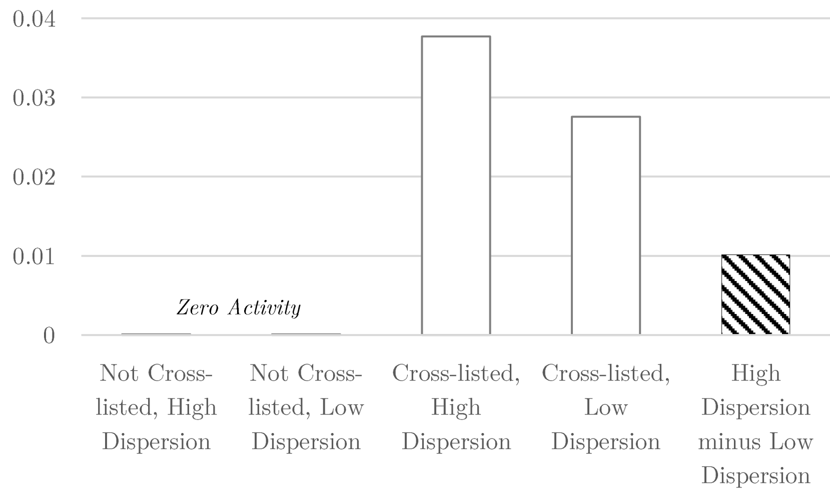


Figure 3. Short Interest of cross-listed firms across banned and unbanned observations. In this figure, we plot of the average short interest per firm (in millions) during the period of January 2000 to March 31st, 2020. The solid line corresponds to the banned observations and the dashed line corresponds to the unbanned observations. The banned or unbanned setting is taking place in the home country of foreign stocks that are cross-listed in an unbanned jurisdiction (e.g., US or London Markets). The gray areas overlap the Dot-com crash, financial crisis, trade-war and anticipatory news related to COVID-19.

Panel A. Short Interest around earnings announcements amid a home market ban



Panel B. Change in Fails-to-Deliver around earnings announcements amid a home market ban

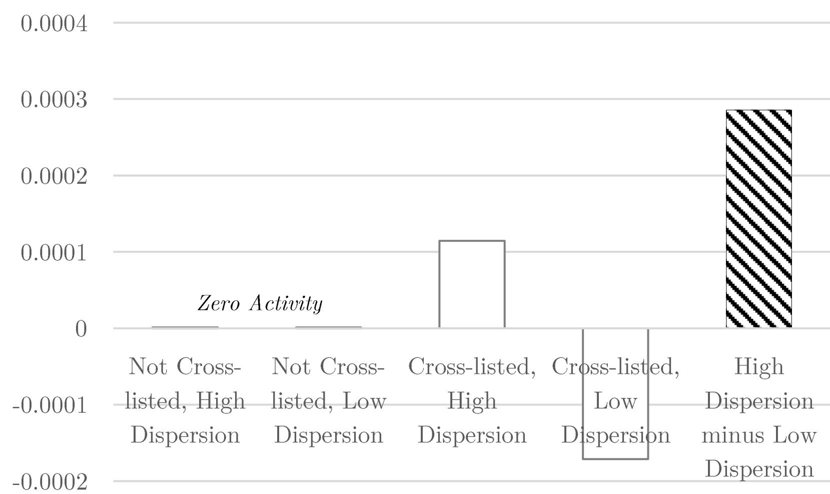


Figure 4. Short selling intensity around earnings announcements. In this figure, we plot the average short interest (Panel A, Short Interest scaled by shares outstanding) and the change in fails-to-deliver (Panel B, $FTD_{t+1} - FTD_{t-1}$ scaled by shares outstanding) around earnings announcements of stocks when a ban is in place in the respective home market. We use daily fails-to-deliver as a proxy of the volume of shorting activity that we can match to earnings announcements with daily frequency.

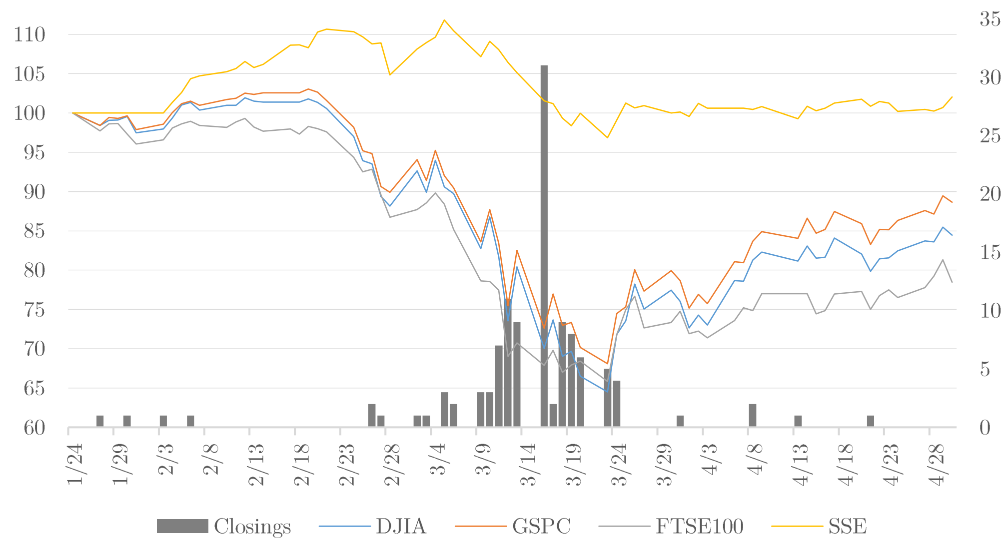


Figure 5. Case Study of the COVID-19 Shock in March 2020. In this figure, we plot the Dow Jones, S&P 500, FTSE 100 and SSE Composite Indexes around the date in which the World Health Organization (WHO) declared COVID-19 a pandemic (March 11th, 2020). The left Y-axis corresponds to the value of each index scaled to a 100-points basis. The right Y-axis corresponds to the number of countries ordering school lock-downs on each day, which we plot as an additional proxy of the severity of the health crisis shock globally. On Friday, March 13th, the US declares a National Emergency and an international travel ban is enacted for several countries affected by the virus. On Sunday, March 15th, the FOMC holds an unscheduled meeting announcing a reduced fed funds rate, support to the flow of credit to households and businesses and coordinated central bank action for US dollar liquidity. On Monday, March 16th, 9:30 AM (EDT) S&P 500 declines trigger a Level 1 Market-Wide circuit breaker. (Source: Federal Reserve Bank of St. Louis[1]).

[1] See more details at Federal Reserve Bank of St. Louis (https://fraser.stlouisfed.org/timeline/covid-19-pandemic#https://fraser.stlouisfed.org/timeline/covid-19-pandemic#17)

Table I

Short Selling and Initial Price Response to Earnings Surprises: Layers and Predicted Signs

In this table, we summarize our predictions of the effects to the initial response to earnings surprises resulting from a short selling prohibition in the home country of a foreign stock that is cross-listed in an unbanned jurisdiction. In a single market World (not-cross-listed stocks, control group), bans fully cancel short sellers' effects. In a multi-market World, a dual-listing provides a channel to circumvent home-country restrictions. Regulatory Reach or Arbitrage Hypotheses predict opposite outcomes. Table II summarizes these layers following positive earnings surprises. In Column 3, short sellers' presence displays a (P) if short sellers are present or (A) if absent. Column 4 shows the probability of selling-or-short-selling predicted by the model of Diamond & Verrecchia (1987) adapted to our framework as explained in Section 2 (Hypotheses). In Column 5, E[Ñ] corresponds to the expected number of time-periods that are needed so that the new information (earnings surprise in our setting) is fully reflected in the stock's price. In Column 6, considering E[Ñ], we predict E[ΔP], which is the expected change in a stock following the announcement of an earnings surprise. In Column 7, we present our expected difference between the E[ΔP] across banned and unbanned observations. More details in Section 2 (Hypothesis).

World Setting	Hypothesis (1)	Reg. Setting (2)	Short Sellers Presence (P) or (A) (3)	P[Sell|Short] Diamond & Verrecchia (1987) (4)	Adjust. Periods E[Ñ] (5)	E[ΔP] (6)	ΔInitial Price Response (Ban - No Ban) (7)
Negative Earnings Surprises							
Single Market (Not-Cross-Listed Stocks)	**Benchmark Premise.** Short Bans Initial Pr. Response	No Ban	In the Market (P)	$1/2g(1+a); 3/8$	$E[\tilde{N}]_{(A)} > E[\tilde{N}]_{(P)}$	$E[\Delta P]_{(A)} > E[\Delta P]_{(P)}$	+
		Ban	Out of Market (A)	$1/2gh(1+a); 3/16$			
Multi-Market (Cross-Listed Stocks)	**H1a.** Regulatory Arbitrage	No Ban	In all Markets (P)	$1/2g(1+a); 3/8$	$E[\tilde{N}]_{(A)} \approx E[\tilde{N}]_{(P)}$	$E[\Delta P]_{(A)} \approx E[\Delta P]_{(P)}$	Insignificant
		Ban	Home Ban increases US shorts (P)	$1/2gh(1+a) + \boldsymbol{ga(1-h)\pi; 2/8}$ **(Hypothesis 2)**			
	H1b. Regulatory Reach	Ban	Home Ban reduces US shorts (A)	$1/2gh(1+a); 3/16$	$E[\tilde{N}]_{(A)} > E[\tilde{N}]_{(P)}$	$E[\Delta P]_{(A)} > E[\Delta P]_{(P)}$	+

Table II. Positive Earnings Surprises

World Setting	Hypothesis (1)	Reg. Setting (2)	Short Sellers Presence (P) or (A) (3)	P[Sell|Short] Diamond & Verrecchia (1987) (4)	Adjust. Periods E[Ñ] (5)	E[ΔP] (6)	ΔInitial Price Response (Ban - No Ban) (7)
Single Market (Not-Cross-Listed Stocks)	Benchmark Premise. Short Bans Initial Pr. Response	No Ban	In the Market (P)	$1/2g(1-a); 1/8$	$E[\tilde{N}]_{(A)} > E[\tilde{N}]_{(P)}$	$E[\Delta P]_{(A)} < E[\Delta P]_{(P)}$	-
		Ban	Out of Market (A)	$1/2gh(1-a); 1/16$			
Multi-Market (Cross-Listed Stocks)	H1a. Regulatory Arbitrage N/A	No Ban	In all Markets (P)	$1/2g(1-a); 1/8$	$E[\tilde{N}]_{(A)} \approx E[\tilde{N}]_{(P)}$	$E[\Delta P]_{(A)} \approx E[\Delta P]_{(P)}$	Insignificant
		Ban	Home Ban increases US shorts (P)	$1/2gh(1-a); 1/16$			
	H1b. Regulatory Reach	Ban	Home Ban reduces US shorts (A)	$1/2gh(1-a); 1/16$	$E[\tilde{N}]_{(A)} > E[\tilde{N}]_{(P)}$	$E[\Delta P]_{(A)} < E[\Delta P]_{(P)}$	-

Table III

Return Response to Negative Earnings Surprises across Unbanned and Banned Periods

In Panel A, we compare the **cumulative abnormal returns (CARs)** across periods in which short selling is unbanned and banned in the home country of a foreign security. CARs estimated for different windows in the event of a negative earnings surprise (surprise below the cross-sectional median of the SUE distribution within the same year). In Panel B, we present the volatility of the daily abnormal returns (AR) during the five-day window around earnings announcements (-1, +3). (Left) Right Panel exhibits the results for the sample of foreign firms which are (not) cross-listed in the US markets. Short Sellers Presence or absence in the described setting indicated by a (P) and an (A) respectively. Columns (3) and (6) report the difference between banned and unbanned foreign stocks. Column 7 reports the difference-in-difference between Not-Cross-Listed and Cross-Listed stocks. Significance at the 1%, 5% and 10% level is denoted by ***, **, * respectively[2].

	Not-Cross-Listed (Arbitrage not possible)			Cross-Listed (Arbitrage vs Reach?)			
Ret. Window	(1) Ban (A)	(2) Unban (P)	(3) Diff	(4) Ban (A)	(5) Unban	(6) Diff	(7) DiD (6)–(3)
Panel A. Cumulative Abnormal Returns							
(-1,+1)	-0.24%***	-1.08%***	0.84%***	-1.53%***	-1.95%***	0.43%**	-0.41%***
	(-4.26)	(-39.77)	(13.37)	(-8.55)	(-28.66)	(2.23)	(-2.436)
(0,0)	-0.03%	-0.59%***	0.56%***	-0.77%***	-1.00%***	0.23%	-0.33%***
	(-0.88)	(-29.19)	(14.49)	(-5.70)	(-20.79)	(1.61)	(-2.707)
(0,+1)	-0.27%***	-1.12%***	0.86%***	-1.45%***	-2.04%***	0.59%***	-0.27%***
	(-5.54)	(-40.21)	(15.30)	(-7.83)	(-29.77)	(2.99)	(-1.551)
(0,+2)	-0.27%***	-1.33%***	1.06%***	-1.59%***	-2.19%***	0.60%***	-0.46%***
	(-4.54)	(-42.17)	(15.91)	(-7.56)	(-27.74)	(2.67)	(-2.367)
(0,+3)	-0.31%***	-1.38%***	1.08%***	-1.62%***	-2.28%***	0.66%***	-0.42%***
	(-4.69)	(-44.43)	(14.95)	(-8.30)	(-30.02)	(3.14)	(-2.187)
Panel B. Volatility of Daily Abnormal Returns							
AR Std. Deviation	2.03%***	2.38%***	-0.35%***	3.24%***	3.34%***	-0.10%	0.25%***
(-1, +3)	(249.58)	(118.88)	(-18.036)	(128.39)	(43.07)	(-1.243)	(4.113)

[2] These statistics are consistent when (i) using cumulative market adjusted returns in lieu of abnormal returns and (ii) using seasonal quarterly differences to define SUE in lieu of IBES analysts' forecasts. Results in Online Appendix B.

Table IV

Initial Response Following Earnings Surprises across Unbanned and Banned Periods

In this table, we present the results from OLS regressions where the dependent variables are the cumulative abnormal returns (CAR). *Negative Surprise* is a dummy variable which equals one when the standardized earnings surprise (SUE) is ranked below median or zero otherwise. *Short Ban* is a dummy variable which equals one when short selling is banned or zero otherwise. *CrossListed* is a dummy variable which equals one when a foreign stock is cross-listed in an unbanned jurisdiction or zero otherwise. Control variables are included in the regressions but are not presented in this table due to lack of space (Size, ReturnVariance, AnalystCoverage, AnalystDispersion, TransactionCost, Turnover, Lagmreturn35, Lagmreturn68 and CommonLaw). The full table including the control variables is reported in our Online Appendix B. Definition of all variables in Appendix A. Significance at the 1%, 5% and 10% level is denoted by ***, **, * respectively.

	Overall Cross-border Arbitrage dominates		Low Dispersion of Beliefs Cross-border Reach, No Arbitrage		High Dispersion of Beliefs Cross-border Arbitrage	
Dependent Variable	(1a) CAR(0,+3)	(1b) CAR(-1,+1)	(2a) CAR(0,+3)	(2b) CAR(-1,+1)	(3a) CAR(0,+3)	(3b) CAR(-1,+1)
Negative Surprise*Short Ban*CrossListed	-1.378***	-1.375***	-0.949	-0.614	-1.571***	-1.675***
(Cross-listing cancels regulatory effect)	(-3.781)	(-3.922)	(-1.385)	(-0.670)	(-3.378)	(-4.062)
Negative Surprise*Short Ban	1.560***	1.300***	1.287***	0.785*	1.685***	1.507***
(Reduced negative response when ban)	(4.339)	(4.908)	(3.511)	(1.917)	(4.211)	(4.339)
Negative Surprise	-2.538***	-2.244***	-2.601***	-2.321***	-2.523***	-2.226***
	(-16.13)	(-15.72)	(-12.95)	(-12.86)	(-15.51)	(-14.61)
Short Ban*CrossListed	0.817***	0.902***	0.346	0.350	0.980**	1.095***
	(2.932)	(3.339)	(1.022)	(1.047)	(2.844)	(3.448)
Short Ban	-0.217	-0.302*	0.00755	-0.103	-0.312	-0.394*
	(-0.886)	(-1.770)	(0.0265)	(-0.527)	(-1.234)	(-2.066)
Negative Surprise*CrossListed	-0.706***	-0.959***	-0.899***	-1.106***	-0.678**	-0.941***
	(-3.232)	(-4.033)	(-3.050)	(-3.420)	(-2.834)	(-3.506)
CrossListed	0.0689	0.296*	-0.149	0.0545	0.138	0.376**
	(0.512)	(1.992)	(-0.797)	(0.244)	(1.007)	(2.438)
Intercept	1.136**	1.324***	2.660***	2.800***	0.691	0.908**
	(2.453)	(3.696)	(3.785)	(4.196)	(1.034)	(2.259)
Controls	Y	Y	Y	Y	Y	Y
Ind & Yr FE and 2 Clust SE	Y	Y	Y	Y	Y	Y
Observations (N)	65,415	65,422	16,414	16,417	48,999	49,003
R-squared	0.046	0.051	0.060	0.065	0.044	0.049

Table V

Robustness Checks: Additional Metrics

In this table, we present the summary of results from OLS regressions from Table IV with alternative metrics as robustness checks, where we measure market-adjusted returns in lieu of abnormal returns (see Table B.5), define a negative earnings surprise when the SUE is below the 20th percentile of the SUE distribution (see Table B.6) and earnings surprises are defined using seasonal quarterly earnings instead of IBES (see Table B.7). Complete results are presented in tables B.5, B.6 and B.7 of Appendix B. *Negative Surprise* is a dummy variable which equals one when the standardized earnings surprise (SUE) is ranked below median or zero otherwise. *Short Ban* is a dummy variable which equals one when short selling is banned or zero otherwise. *CrossListed* is a dummy variable which equals one when a foreign stock is cross-listed in an unbanned jurisdiction or zero otherwise. Control variables are included in the regressions but are not presented in this table due to lack of space (Size, ReturnVariance, AnalystCoverage, AnalystDispersion, TransactionCost, Turnover, Lagmreturn35, Lagmreturn68 and CommonLaw). The full table including the control variables is reported in our Online Appendix B. Definition of all variables in Appendix A. Significance at the 1%, 5% and 10% level is denoted by ***, **, * respectively.

	Low Dispersion of Beliefs Cross-border Reach, No Arbitrage			High Dispersion of Beliefs Cross-border Arbitrage		
	(2b)	(2b)	(2b)	(3b)	(3b)	(3b)
Dependent Variable	MAR(-1,+1)	CAR(-1,+1) SUE Bottom Quintile	CAR(-1,+1) Seasonal Quarterly Earnings	MAR(-1,+1)	CAR(-1,+1) SUE Bottom Quintile	CAR(-1,+1) Seasonal Quarterly Earnings
Negative Surprise*Short Ban*CrossListed	-0.705	-1.614	0.423	-1.752***	-1.531**	-1.307**
(Cross-listing cancels regulatory effect)	(-0.754)	(-1.083)	(0.737)	(-4.260)	(-2.688)	(-2.426)
Negative Surprise*Short Ban	0.922*	1.883**	0.495	1.508***	1.320**	1.236***
(Reduced negative response when ban)	(2.051)	(2.684)	(1.761)	(4.831)	(2.423)	(4.424)
Negative Surprise	-2.464***	-2.946***	-1.856***	-2.392***	-1.941***	-2.469***
	(-13.95)	(-11.34)	(-12.64)	(-13.86)	(-11.58)	(-12.29)
Short Ban*CrossListed	0.277	0.203	-0.298	1.325***	0.664**	0.686
	(0.672)	(0.579)	(-0.813)	(3.700)	(2.323)	(1.646)
Short Ban	-0.0816	0.0114	-0.0701	-0.469**	0.0340	-0.844***
	(-0.312)	(0.0591)	(-0.346)	(-2.258)	(0.256)	(-4.512)
Negative Surprise*CrossListed	-1.313***	-1.198**	0.0271	-1.175***	-1.006***	0.178
	(-3.828)	(-2.456)	(0.131)	(-3.831)	(-4.432)	(0.781)
CrossListed	0.0166	0.0546	0.0107	0.416**	0.326***	-0.232
	(0.0724)	(0.346)	(0.0657)	(2.488)	(2.936)	(-1.030)
Intercept	2.696***	2.123**	2.390***	0.756*	0.696*	-0.106
	(3.427)	(2.515)	(9.545)	(2.050)	(1.915)	(-0.278)
Controls	Y	Y	Y	Y	Y	Y
Ind & Yr FE and 2 Clust SE	Y	Y	Y	Y	Y	Y
Observations (N)	16,417	16,417	17,364	49,003	49,003	33,961
R-squared	0.065	0.029	0.047	0.047	0.029	0.026

Table VI
Response to COVID-19 across Unbanned and Banned Countries

In this table we present OLS regressions where the dependent variables are the cumulative abnormal returns (CAR). *COVID* is a dummy variable which equals one when CARs are estimated around March 11th, 2020 (WHO announcement of COVID-19 as a pandemic), and zero otherwise. *Short Ban* is a dummy variable which equals one when short selling is banned and zero otherwise. In Column 2 (3), we consider a ban when both a home market ban is in place and securities lending rate is above (below) cross-sectional median. Securities lending rate is sourced from HIS Markit. Definition of other variables in Appendix A. Significance at 1%, 5% and 10% level denoted by ***, **, * respectively.

	Overall Sample Arbitrage is limited by Short Ban		Low Profit Opportunity (Ban & Costly Borrowing Fees) Cross-border Reach, No Arbitrage		High Profit Opportunity (Ban & Cheap Borrowing Fees) Cross-border Reach is less effective	
Dependent Variable	(1a) CAR(0,+2)	(1b) CAR(-1,+1)	(2a) CAR(0,+2)	(2b) CAR(-1,+1)	(3a) CAR(0,+2)	(3b) CAR(-1,+1)
COVID	-8.247***	-8.580***	-7.412***	-6.297***	-7.014***	-5.491***
	(-31.20)	(-27.45)	(-35.49)	(-25.49)	(-35.19)	(-23.29)
COVID*Short Ban	3.150***	6.371***	3.975***	4.879***	2.670***	0.679
(Reduced negative response when ban)	(8.425)	(14.41)	(8.456)	(8.776)	(4.620)	(0.992)
Short Ban in Home Market	2.269***	1.462***	0.292	0.637	0.749*	1.106**
	(8.315)	(4.532)	(0.865)	(1.597)	(1.742)	(2.177)
Intercept	-2.130***	-2.032***	-1.055***	-1.432***	-1.080***	-1.427***
	(-11.04)	(-8.906)	(-6.887)	(-7.903)	(-7.449)	(-8.317)
Size & Market Cap Matching	Y	Y	Y	Y	Y	Y
Observations (N)	300,348	300,348	300,348	300,348	300,348	300,348
R-squared	0.006	0.004	0.005	0.003	0.004	0.002

Table VII
Earnings Management across Unbanned and Banned Periods

In this table we present the results from OLS regressions where the dependent variable is the discretionary accruals variable (DA) as in Fang et al. (2016). *Short Ban* is a dummy variable which equals one when short selling is banned and zero otherwise. *CEO Variable Compensation* is a dummy variable taking value one if the percentage of firms that offer stock based compensation in the home country of the firm is above the median in our sample. *Size* is the natural logarithm of the market value of a firm. *MB* is the market-to-book ratio, *LEV* is leverage and *ROA* is the return on assets. Significance at the 1%, 5% and 10% level is denoted by ***, **, * respectively.

	Overall Sample		Cross-Listed, Salary Comp., Low Profit Opportunity, Reach Dominates	Cross-Listed, Variable Comp., High Profit Opportunity, Arbitrage Dominates
Sample	(1a) DA	(1b) DA	(2) DA	(3) DA
Short Ban (Increased earnings management when ban is effective)		0.0386*** (4.004)	0.0839** (2.133)	-0.218** (-2.110)
CEO Variable Compensation (Increased earnings management when CEO compensation is variable)	0.176*** (8.882)	0.186*** (9.804)		
Size	-0.0314* (-1.901)	-0.0316* (-1.915)	0.0224*** (3.529)	-0.0996*** (-2.891)
MB	-0.00296*** (-2.941)	-0.00349*** (-3.551)	-0.0206** (-2.597)	-0.0260 (-1.238)
ROA	0.0287 (1.218)	0.0289 (1.222)	-0.102*** (-4.462)	0.0460* (1.923)
LEV	0.224*** (7.608)	0.224*** (7.611)	0.181*** (3.039)	0.225*** (7.572)
Intercept	0.629* (1.919)	0.624* (1.908)	-0.393*** (-3.155)	2.229*** (3.558)
Ind FE and Clust SE	Y	Y	Y	Y
Observations (N)	80,085	80,085	2,943	27,672
R-squared	0.136	0.136	0.103	0.123

Appendix A: Definition and source of variables

Variable	Definition	Source
Main Analyses: Cumulative abnormal (market-adjusted) returns		
CAR (t_1, t_2)	Cumulative abnormal return in the specified t_1,t_2 window	- Previous academic works, legal briefs, exchange or regulatory websites. Details in Section 3.1
MAR (t_1, t_2)	Market adjusted return in the specified t_1,t_2 window	
Short Ban	Dummy variable taking a value of 1 if an observation belongs to a country-year when short sales are banned in home country	
Negative(Positive) Surprise	Dummy variable taking a value of 1 if the earnings surprise is ranked above (below) the median of the cross-sectional SUE distribution within the same year	
LowDisp	Dummy variable taking a value of 1 if analyst dispersion is ranked below 25th percentile, or zero otherwise	
ShortInterest	Short interest of a stock	- Short Interest sourced from Compustat North America
Fails-to-deliver (FTD)	Daily failures-to-deliver as reported by the Securities and Exchange Commission (SEC)	- Securities and Exchange Commission (SEC) https://www.sec.gov/data/foiadocsfailsdatahtm
Loan Fee	Securities lending rate	- IHS Markit Securities Lending Data
High Fee	Dummy variable taking a value of 1 if the loan fee is ranked above the median of the cross-sectional fee distribution during the COVID shock period or zero otherwise.	
Main Analyses: Control Variables		
Size	Natural log of the market value of a firm	- (Not)Cross-Listed Stocks from CRSP (Compustat Global)
ReturnVariance	Standard deviation of the returns of a firm	- (Not)Cross-Listed Stocks from CRSP (Compustat Global)
AnalystCoverage	Number of estimates for a given announcement	- IBES US and International Files
AnalystDispersion	Dispersion across analysts' estimates for a given announcement as reported by IBES	- IBES US and International Files
TransactionCost	Proportion of daily zero returns in a given month for a firm (Lesmond, Ogden, and Trzcinka, 1999)	- (Not)Cross-Listed Stocks from CRSP (Compustat Global)
Return(3,5)(6,8)	Lagged return of a given firm during the 3-5 (6-8) lagged-months period before the earnings announcement	- (Not)Cross-Listed Stocks from CRSP (Compustat Global)
Turnover	Ratio of volume over shares outstanding	- (Not)Cross-Listed Stocks from CRSP (Compustat Global)
CommonLaw	Dummy Variable taking a value of 1 if legal origin is English common law and zero otherwise	- La Porta et al. (1999) https://scholar.harvard.edu/shleifer /publications/quality-government
InstOwn	Number of shares owned by institutional investors as percentage of the number of shares outstanding	- Bloomberg
Robustness: Reach vs. Arbitrage and Short Sellers Monitoring Role		
DA	Discretionary Accruals as proxy for earnings management. Following (Fang et al., 2016). See details in Section 4.5	- (Not)Cross-Listed Stocks from North America (Compustat Global)
CEO Variable Compensation	Dummy variable taking value one if more than 50% of firms in a given country offer variable compensation, or zero otherwise.	- Towers and Perrin (2005)
Size	Natural logarithm of the market value of a firm	- (Not)Cross-Listed Stocks from CRSP (Compustat Global)
MB	Market to book ratio calculated as the market value of equity divided by the book value of equity (CEQ)	- Compustat North America (Global) file for cross-listed and not-cross-listed stocks.
ROA	Return on Assets calculated as the net income divided by total assets of the firm	- Compustat North America (Global) file for cross-listed and not-cross-listed stocks.
LEV	Debt ratio calculated as total liabilities divided by total assets of the firm	- Compustat North America (Global) file for cross-listed and not-cross-listed stocks.

Appendix B – Online

Tables of Appendix B are available online using the link below:

https://drive.google.com/file/d/1A1eZ0SUWeJ3q_gIrNUn68kHmqD4ZSNnu/view?usp=sharing