Worldwide short selling: Regulations, activity, and implications*

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Abstract

We characterize the legality, feasibility and incidence of short selling in a worldwide, multimarket framework. Some countries have no restrictions on short selling while others partially or completely ban short selling. We examine how these restrictions affect short selling of both domestic stocks in each country and of ADRs in the U.S. We use data from a variety of sources including Data Explorer, Reg SHO, FINRA, Shortsqueeze, and DataStream. We find that home country short selling restrictions curtail home market stock borrowing and have international regulatory reach, curtailing short selling volume and short interest of the country's ADRs in the U.S. markets. Our evidence rules out any large scale regulatory arbitrage by short sellers migrating their trading to less restrictive regimes. We also find evidence of reverse reach, which reduces the home-country underlying stock borrowing of ADR issuers when U.S. restrictions are stricter than home country restrictions. These effects survive in a multivariate analysis that controls for past returns, firm size, dividend yield, and standard deviation of return. As an implication of regulatory reach, we find that the portfolio of ADRs from restrictive countries underperforms the portfolio of ADRs from unrestrictive countries.

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1. Introduction

Short selling is an integral part of the current trading environment.[1] Yet, the role of short selling is highly controversial. Proponents argue that short selling is an essential part of the price discovery mechanism (Boehmer, Jones and Zhang (2009) and Kolasinksi, Reed and Thornock (2009)) whereas opponents express concern about price manipulation (Shkilko, Van Ness and Van Ness (2008)). The frequency of regulatory interventions and restrictions underscores the lack of clarity or consensus when and whether short selling if beneficial or harmful. There is a rich cross-country and time-series variation in the home-country legality and feasibility of short selling (Beber and Pagano (2010), Bris, Goetzmann and Zhu (2007), and Charoenrook and Daouk (2008)). We find that national regulators able to effectively enforce short selling restrictions in their home markets. To investigate how home market restrictions affect short selling in a global multimarket setting, we introduce and test the *regulatory reach* hypothesis, which states that home country restrictions on short selling curtail worldwide short selling activity in cross-listed stocks such as ADRs from that country. The alternative hypothesis is the *regulatory arbitrage* hypothesis, which states that short selling moves to foreign locations when the home market restricts short selling.

Regulatory reach can decrease the short selling of a country's ADRs in the U.S. both directly and indirectly. The direct channels affecting *regulatory reach* are reduced production of negative information and reduced availability of shares for borrowing. First, negative information can be produced by both local and foreign researchers. Restrictions on short selling in home markets curtail local researchers' incentives to produce negative information about

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[1] Diether, Lee and Werner (2009) find that short selling volume is 24% of NYSE and 31% of NASDAQ trading volume.

firms. Thus, the aggregate global frequency and quantity of short selling is lower with home market restrictions. Ceterus paribus, traders are more to short ADRs aggressively for which negative information can be produced in both the local and foreign markets relative to ADRs for which local researchers are inactive. Second, legal restrictions in the home market limit the institutional share lending markets. Thus, fewer shares are available worldwide for short sellers to borrow, which again results in short sellers being less aggressive.

The indirect channels affecting *regulatory reach* are the enforcement actions of home country governments. Enforcement agencies often cooperate with their counterparts in other countries (Block (2007)). Hamilton (2008) reports that "following the lead of the SEC and the U.K. Financial Services Authority, and in an effort to prevent *regulatory arbitrage*, securities regulators around the world have acted to ban different forms of short selling as the crisis in the financial markets spreads globally." Regulators in the home country may target institutions that attempt to circumvent local short selling bans. Also, in many countries governments have ownership stakes in local institutions through which they can influence behavior. Countries may specify a worldwide jurisdiction for their restrictions, at least for the activities of their citizens. Lau and McInish (2002) report that the Malaysian government was able to issue regulations that prevented the trading of Malaysian equities in Singapore despite opposition from both the Singapore government and Singapore investors. This evidence is an example of our *regulatory reach* hypothesis in the context of regular trading. We are not aware of any prior academic test of this hypothesis in the context of short selling despite the spate of regulatory activity taking place in this area.

The alternate *regulatory arbitrage* hypothesis asserts that investors short sell in another country when short selling is prohibited in the home country (Kim, Szakmary, and Mathur

(2000) and Nilsson (2008)). *Regulatory arbitrage* increases ADR short volume if traders opt to trade in unrestricted regimes. However, the complexity of international arbitrage is increased by taxes or fees on foreign transactions, capital controls, inconvertibility of currencies, and market segmentation (Foerster and Karolyi (1999)). On balance, the *regulatory reach* hypothesis is more plausible than the *regulatory arbitrage* hypothesis.

We test these competing views using several unique datasets, we provide the first detailed characterization of the world market for stock borrowing, short selling, and the regulations governing these activities in 82 countries. Stocks originating from a given country are borrowed both in the home markets and in foreign markets. We find that home market restrictions effectively reduce short selling in ADR markets consistent with *regulatory reach*.

Next, we examine the factors that exacerbate or mitigate *regulatory reach*. We find that good enforcement of short selling regulations in the home country and a country's geographic distance from the U.S. decreases short selling in the U.S. and strengthens *regulatory reach*. In contrast, factors that increase the incentives and profitability of short trades are expected to weaken *regulatory reach* and increase the observed amount of ADR short selling. We identify firm size, level of ADR, standard deviation of return, and language similarity as such factors.

Our study contributes to the literature in several ways. We present the first test of effectiveness of regulatory enforcement of short selling restrictions in 82 countries. Although, there is a rich literature on the potential valuations consequences of short selling, a global analysis of the actual short selling activity is largely missing. We use the Data Explorer dataset, which has comprehensive information regarding short selling related stock borrowing worldwide. We find that short selling related stock borrowing is significantly lower in countries that impose restrictions than in countries that do not.

Second, we identify *regulatory reach* as a new determinant of short selling in the international context by combining several virgin datasets. Apart from Data Explorer, we use shortsqueeze.com, which provides short interest information concerning U.S. equities including ADRs. We also download data from the FINRA web sites made available as a result of the SEC's Regulation SHO. These rich datasets enable us to take a first look at worldwide stock borrowing activity and depict a complete picture of various facets of the short selling process, especially in the context of multi-market trading. Univariate comparison, matched control sample experiments, multivariate regressions, all consistently point to *regulatory reach*. Our findings remain strongly significant after controlling for firm specific characteristics, stock borrowing costs, industrial sectors, trading volume, dispersion of opinion, and outstanding short interest.

Third, we create a short selling regulation enforcement index. This index is a function of short selling related stock borrowing scaled by market capitalization of the country and legality of short selling in the home country. Unlike the dummy variable used in prior work (Charoenrook and Daouk (2008) and Beber and Pagano (2010)), our continuous index of actual borrowing information, from the Data Explorer dataset, is a better proxy for the effectiveness of regulatory enforcement in a country. In testing the reach of home country restrictions in curtailing ADR short selling controlling for this enforcement variable, we find results consistent with *regulatory reach*. We also provide much more detailed descriptions about the exact nature of short selling legality and restrictions by examining the specific trading mechanism (up-tick rule), pre-borrowing requirements (ban on naked short selling), and ban on shorting selected stock (mainly financial stocks). Interesting examples are from (1) the U.S. where short selling is allowed on upticks, but restricted on downticks, (2) Mexico where covered short selling is legal,

but naked short selling is illegal, (3) the U. K. where market makers were exempted from the recent short selling ban, and (4) Poland, Turkey, the U.S. and several other countries where specific lists are created for stock that can or cannot be shorted. We have rich cross-sectional as well as time-series variation in the legality and feasibility of short selling.

Fourth, we look at the regulatory reach in the reverse direction as well. We test the effect of short selling restrictions in the U.S. on short selling related borrowing of underlying stocks in the home country. We employ a research design commonly used in the hard sciences literature with a treatment group and a control sample by matching each ADR issuing firm with a non-ADR issuing home country firm based on key firm characteristics. This approach enables us to tightly control cross country differences that often are an issue with international studies. We form an index of relative strictness defined as the difference between US restrictions and home country restrictions. This index negatively affects the short selling volume of ADR issuing underlying stocks vis-à-vis non issuers.

Fifth, we study the implications of *regulatory reach* in the context of a constraints hypothesis. According to this hypothesis, when short selling is constrained, stocks become artificially overvalued and suffer from poor stock return performance in the long run (Diamond and Verrechia (1987), Miller (1977), Bris, Goetzmann and Zhu (2007), and Prado Brounen, and Verbeek (2009)). The valuation effects are expected to be particularly high when short sell constraints are binding, i.e., when the inherent shorting demand is high (Boehmer, Jones and Zhang (2008)). Using the double sorting methodology of Asquith, Pathak and Ritter (2005), ~~We~~ we compare the performance of: a) portfolios of ADRs from countries where it is legal to short sell against the portfolio of ADRs from the countries where it is illegal to short sell, and b) portfolios of ADRs with high short interest against the portfolio of ADRs low short interest ~~using~~

~~the double sorting methodology of Asquith, Pathak and Ritter (2005)~~. Using a Fama-French four factor regression model, we find that portfolios of ADRs from the countries where it is illegal to short sell underperform portfolios of ADRs from the countries where it is legal to short sell.

2. Data sources and descriptive statistics

We form our research dataset by combing information from various sources described in the data appendix. Our sample firms include ADR-issuing firms from 82 countries and a matched sample of non-issuers from the same set of home countries. This approach lets us examine the behavior of short sellers in the context of worldwide multi-market trading. We analyze short selling related borrowing, total short interest, short trading volume, and return in both the U.S. and the underlying markets. These variables are obtained from Data Explorer, shortsqueeze.com, FINRA, and Datastream.

Data Explorer is based in New York and London and according to its web site is the world's most comprehensive resource for data on short-selling related borrowing. Data Explorer covers thousands of equities worldwide and receives information on more than 3 million transactions daily from over 100 top securities lending firms for commercial dissemination. Data Explorer estimates that its institutional clients account for 70% of the worldwide borrowing market. For each security, these data include information on the value and quantity of stock borrowing, cost of borrowing (VSA), number of brokers and agents, and other variables. The location of the borrowing is also provided so that it is possible to tell whether the shares are being borrowed in the home country or elsewhere. Although, this dataset has been used by Faulkner (2008) to assess the impact of securities lending on the corporate governance landscape

and by Flatley (2009) to understand trends and changes in market micro-structure, we are the first one to characterize short selling itself and its determinants in the multi-market context.

Our data comprise daily stock borrowing activity for the period from July 2006 through Jan 2010. We clean the Data Explorer data in several ways. We eliminate exact duplicates. Data Explorer provides values in one of four currencies—USD, EUR, JPY, AUD—depending on where the data are collected. We convert all monetary values into USD based on daily exchange rates obtained from DataStream. Data Explorer includes a variable called *dividend requirement* that allow us to make sure that our results are not affected by dividend capture.

Shortsqueeze.com provides fortnightly short interest data for over 16,000 stocks that trade on NYSE, NASDAQ, AMEX, OTC/BB and Pink Sheets. Short interest is defined as total number of outstanding shorted shares for each security. In addition to the number of shares short, additional supporting data such as days to cover, number of shares outstanding, and institutional ownership are combined to provide a deeper gauge of market opportunity, stock selection and timing. This is the most comprehensive dataset of domestic U.S. short selling information. We access these data for the period from November 2007 to October 2009.

The short volume dataset is based on reporting requirements of Regulation SHO, which was implemented in January 2005 to reduce abusive naked short selling practices. Since August 2009, Regulation SHO data are publicly accessible from the Financial Industry Regulatory Authority (FINRA) website. We downloaded the daily short sale volume files from the website for the period from August 2009 through January 2010, which is the latest period for which we have Data Explorer dataset. We use this data to perform the robustness test of *regulatory reach*. This dataset allows us to use actual short volume instead of short interest. Also, this dataset

excludes the crisis period. We find evidence of *regulatory reach* in both daily and fortnightly data.

Our merged dataset enables us to depict a complete picture of various facets of the short selling process from stock borrowing to trade initiation to management of open short interest in the light of the ever changing regulatory environment.

2. 1. Short selling regulations and feasibility around the world

We obtain detailed information on legality and feasibility of short selling in each country. We begin with a survey of academic articles (Bris, Goetzmann and Zhu (2007), Charoenrook and Daouk (2008) and Beber and Pagano (2010)) and practitioners' reports and briefings (Chance (2009) report, released by well-known law firm Linex Legal). We verify and supplement these data with direct correspondence with stock exchanges and financial market regulators in each country in our sample. Initially, we follow the approach used in the papers cited above and define an indicator variable *illegal*, which equals 1 if short selling is prohibited in the home market and 0 otherwise. Subsequently, we extend the literature by going beyond the indicator variable approach and examining in more details the countries where short selling is permitted in restricted forms.

We form a *restrictions* variable that equals 0 when there are no restrictions on short selling in the home country and 3 when there is a total ban. The index equals 1 if there is either an uptick rule or a ban on naked short selling and 2 if both of these restrictions are present. We create this variable separately for financial and non-financial stocks. At a country level this variable can range from 0 to 5, because we use complete ban on short selling of financial stock or naked ban on short selling of financial stocks as two additional restrictions categories. The

restrictions variable has a value of 1 for Brazil because it prohibits naked short selling, but all other forms of short selling are allowed. Similarly, the index is 1 for Russia because it has an up-tick rule, but all other forms of short selling are allowed. The index has value of 2 for Mexico and Taiwan, both of which have a ban on naked short selling as well as an up-tick rule in place.

Both *illegal* and *restrictions* variables vary over time for countries that introduced change in short selling restriction during our sample period. For example, in the U.S, for many decades short selling was allowed on upticks, but not on downticks. The uptick rule was repealed in 2007, but shortly thereafter a similar restriction, Rule 201, was enacted. Restrictions may also vary from firm to firm within a country.16 countries imposed temporary restrictions on short selling of financial, banking or insurance stocks in the 2008 financial crisis. Thus, we consider all types of restriction and bans separately rather than just the overall legality of short selling in each country.

One of the novelties of our paper is a *feasibility index* that is calculated as the aggregate short selling related borrowing volume in the home country divided by the market capitalization of the country. We obtain market capitalization from the World Bank website and borrowing data from Data Explorer. If a country is not in Data Explorer, we assign a value of 0 to this index. For some countries we also obtain this information through direct correspondence with stock exchange officials or the country's regulators. We use this information on home country activity to calculate an *enforcement index* defined as the product of feasibility index, the illegal dummy and minus one. A higher number for the *enforcement index* indicates good enforcement of short selling regulation in the home country. We use this enforcement index as a control variable in our test of *regulatory reach* when assessing short selling of ADRs in the U.S. markets.

In Table I, we show the legality status with the specific period when short selling was legal or illegal, the nature of restrictions, and the *feasibility index* for each country in column 2 to 5. We report the average short interest ratio for all ADRs from each country in column 6, which is calculated as short interest divided by shares float, from shortsqueeze.com data. We report the global feasibility index in the table and identify the countries where there is no home country borrowing. Aggregate short selling related borrowing of all stocks from each country is reported in the last column. This statistic is available at daily frequency and we have averaged it for all days in our sample period. Overall, we observe rich cross sectional as well as time series variation in the regulatory restrictions, which we take into account in our multivariate analysis. This time series variation is important in the light of the perennial controversy surrounding the role of short selling and the vacillating regulators' stands on short selling.[2] One of our contributions is to simultaneously study the effect of changing regulations in a given country on stocks that are cross listed as ADRs on multiple exchanges with different short selling regimes.

[Insert Table I here]

2. 2. Main sample – American Depository Receipts

We focus on firms that are cross listed in multiple markets as ADRs because they provide an ideal setting for testing our research questions. The fact that their underlying shares originate from 82 countries with diverse short selling laws enable a direct test of our two hypotheses-- *regulatory reach* versus *regulatory arbitrage*. Next, our focus on ADRs allows us to test the *regulatory reach* of the U.S. restrictions in the reverse direction. Finally, Errunza and Miller

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[2] Removal of the uptick rule in the U.S. shortly followed by its reinstatement in the form of Rule 201, bans on short selling of financial stocks, bans on naked short selling in the recent financial crisis by most countries, and a pilot test by allowing short selling of 11 brokerage firms by China during the same period is evidence of the fact that there is still disagreement about the role of short selling in financial markets.

(2000) show that ADR listing helps the underlying firm reduce its cost of capital. However, regulatory restrictions may reduce some of these benefits. We test the valuation implication of *regulatory reach* by looking at the return performance of ADRs from countries that impose short selling restrictions versus those that do not.

To begin constructing our main sample of U.S. ADRs, we obtain lists of ADRs from the Bank of New York Mellon and J. P. Morgan web sites in November 2009. Both of these firms provide comprehensive datasets that have a wide variety of information on ADRs, including type or level, the number of shares underlying each ADR, ADR's ISIN code, and the underlying stock's ticker symbol.[3] We identify each firm's home country using the first two digits of the International Securities Identification Number (ISIN), which represents the originating country's ISO codes.

To be useful for research, additional data for these ADRs must be available from other datasets. A triangular intersection of the initial ADR list, shortsqueeze.com data, and Datastream international data yields a shortsqueeze sample of 1,307 ADRs with fortnightly short interest data. Similarly, the intersection of the initial ADR list, FINRA data, and Datastream international yields a FINRA sample of 918 ADRs with daily short volume. We use these shortsqueeze and FINRA samples to test the *regulatory reach* hypothesis.

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[3] Unlike ADRs, 179 cross listed securities from Toronto Stock Exchange are fully fungible with the same shares traded in the U.S. However, we refer to these Canadian stocks as ADRs too, sacrificing some linguistic accuracy for expositional convenience.
In addition to ADRs that are freely traded, there are two types of restricted ADRs that we exclude from our sample: a) SEC Rule 144(a) ADRs are private placements that do not trade on an established exchange and can be purchased only by a Qualified Institutional Buyer b) Regulation S ADRs can also be used to raise capital. These Regulation S ADRs are not registered in the U.S. and can only be traded outside the U.S. by non-U.S. persons.

2. 3 Matched control sample

Now we begin forming a matched control sample of home country non-issuer stocks that have firm characteristics similar to the ADR issuers from that country. We use country, industry, price to book value ratio (PTBV) and market capitalization from DataStream to develop this control sample.

For each ADR issuing firm, we calculate the difference between the PTBV of that firm and the PTBV of all the non-ADR issuing firms in our data within the same country and industry. We match the ADR issuing firm with a non-ADR issuing firm for which the difference in the PTBVs is at a minimum. If the PTBV difference of one ADR issuing firm is the same for more than one non-ADR issuing firm, then we match the firms based on the minimum difference in market capitalization. For the firms where we do not have the PTBV information, we find matches based on the market capitalization differences only. We form these control samples with replacement to ensure that matched firms resemble the main sample firms very closely.

We match 1,406 ADR issuing firms with 1,120 unique non-ADR issuing firms. We provide the descriptive statistic of our main sample and control sample in Table II. We use this sample to analyze *regulatory reach* in the reverse direction. Our results, not reported here, are robust to matching without replacement, where we match 1,406 ADR issuing firms with 1,406 unique non-ADR issuing firms.

[Insert Table II here]

2.4. Control variables:

Prior literature points us to various additional determinants of short selling. Diether, Lee and Werner (2009), find that short sellers increase short selling activity after positive stock

returns whereas Blau, Van Ness, Van Ness and Wood (2010) find that short selling increases after extremely negative market returns. Thus, we include past return as a control variable.

Chang, Cheng and Yu (2007) find that a short sale constraint causes overvaluations of stocks and that the overvaluation effect is higher for individual stocks with higher dispersion of opinion. Therefore, we also control for dispersion of opinion in our regression models using the standard deviation of return as a proxy.

Jones and Lamont (2002) find that stocks that are expensive to short or that enter the borrowing market have high valuations and low subsequent returns, consistent with the overpricing hypothesis. D'Avolio (2002) describes the market for lending and borrowing U.S. equities and finds that the probability of being on special (high lending fee) decreases with size and institutional ownership. Thus, we include the stock borrowing fee as a control variable. Because of its limited availability worldwide, we use institutional ownership data only in a robustness test and we expect a positive relationship between institutional ownership and the amount of short selling.

Evans, Geczy, Musto and Reed (2009) state that, unlike traders in general, a market maker can short sell without having to locate shares to borrow as a part of a bona fide hedging transaction. These authors find that market makers then choose not to borrow and instead fail to deliver stock to buyers when failing is cheaper than borrowing the stock. In the spirit of market intermediation, we include the number of active agents and the cost of stock borrowing as control variables. A higher number of active agents indicate more competition in the market. Therefore, we expect a positive relation between the extent of short selling and the number of active agents, because it will be cheaper for short sellers to trade in stocks with high competition.

Grinblatt and Keloharju (2001) argue that investors are more likely to hold, buy and sell stocks of firms that are located close to the investor and that communicate in the investor's native tongue. Therefore, in our test of regulatory reach, we also control for language and distance from the U.S. We expect higher short selling of firms from the countries where English in one of the official languages. We expect a negative relationship between short selling and distance from the U.S. We obtain data on Language and distance from CEPII research center. We calculate the distance in miles from the U.S. using the formula from Meridian World Data website.[4]

Other control variables related to short selling include dividend yield, firm size (Diether, Lee and Werner (2009)), level of ADRs and days to cover. Because these control variables are not the focus of our study, we do not have hypotheses about their relation to the extent of short selling. The Appendix shows the data sources and variable definition for each of our control variables.

3. Results

We begin by plotting the short selling activity for lenient and strict regulatory regimes in Figure I. The gray bar represents the average outstanding borrowing volume per stock in million USDs in countries where short selling is legal and unrestricted. The black bar represents the average stock borrowing in countries where short selling is illegal or restricted. This figure indicates that short selling restrictions appear to be effective in curtailing home market stock borrowing because the avearge shares borrowed is 63.25 million USD (28.99 million USD) for stocks from the countries where short selling is legal or unrestricted (illegal or restricted). Now we turn our attention to what happens outside the home markets to assess the external reach of

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[4] http://www.meridianworlddata.com/Distance-Calculation.asp

regulations. The next two bars provide the analogous comparison of monthly short volume and the last two bars compare short interest of ADRs from unrestritive and restrictive countries. The aveage monthly short volume is 53.73 million USD (18.46 million USD) for ADRs from the countries where short selling is legal or unrestricted (illegal or restricted). Similarly, the aveage short interest is 19.79 million USD (15.21 million USD) for ADRs from the countries where short selling is legal or unrestricted (illegal or restricted). These results support our *regulatory reach* hypothesis which states that there is less cross-border short selling in the U.S. of ADRs from the coutries where it is illegal to short sell. In the following section we perform multivariate regressions to confirm these findings.

[Insert Figure I here]

3. 1. Effectiveness of short selling restriction in curtailing home market stock borrowing

In this section we test the effectiveness of home country restrictions using Data Explorer data for short selling related borrowing. If the regulations are effectively enforced then we will observe a lower amount of stock borrowing in countries with restrictions. Thus, we expect a statistically significant negative coefficient for the *restriction* variable in the regression with stock borrowing as a dependent variable. We estimate all or a subset of the following equation:

Shares borrowed $= \alpha_0 + \alpha_1$ *restriction* $+ \alpha_2$ *return* $+ \alpha_3$ *market capitalization*

$+ \alpha_4$ *dividend yield* $+ \alpha_5$ *standard deviation of return* $+ \alpha_6$ *VSA*

$+ \alpha_{7\text{-}10}$ *industrial sector fixed effects* $+ \varepsilon$ (1)

where $\alpha_0 - \alpha_{10}$ are parameters to be estimated and ε is a random error term. Model 1a in Table III is estimated at the country level, whereas Model 1b and 1c are estimated at the firm level. The dependent variable is *shares borrowed,* which is the aggregate home market borrowing for all

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the stocks from a given country on day t for country level regression. For firm level regressions *shares borrowed* is the home market borrowing of a firm on day t. Please see the appendix for other variable definitions and data sources.

[Insert Table III here]

Hereafter in this paper, we present standardized coefficient estimates to allow comparison of the relative impact and importance of each determinant of short selling.[5] The coefficient of *restriction* is negative and significant in all three models, indicating that a higher level of restriction is associated with a lower level of stock borrowing in the home country. These results point to the effectiveness of short selling restrictions in curtailing borrowing activity in the home country.

3. 2. Effect of home country short selling restrictions on short selling activity of ADRs in the U.S.

In this section we test the *regulatory reach* hypothesis versus the *regulatory arbitrage* hypothesis. We also test whether additional firm-specific fundamentals or country characteristics weaken or strengthen *regulatory reach*. We estimate regressions based on all or a subset of the following equation using short interest data from shortsqueeze.com:

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[5] We obtain these coefficients using the stb function of SAS. These coefficients are estimates when all variables in the model are standardized to zero mean and unit variance prior to performing the regression computations. Of course, the standardized intercept is 0.0000. The t-statistics for the standardized and unstandardized coefficients are the same.

$$\textit{short interest} = \alpha_0 + \alpha_1 \textit{ illegal/restriction} + \alpha_2 \textit{ enforcement index} + \alpha_3 \textit{ return}$$

$$+ \alpha_4 \textit{ market capitalization} + \alpha_5 \textit{ dividend yield} + \alpha_6 \textit{ level of ADR}$$

$$+ \alpha_7 \textit{ standard deviation of return} + \alpha_8 \textit{ lagged days to cover} + \alpha_9 \textit{ language}$$

$$+ \alpha_{10} \textit{ distance from the U.S.} + \alpha_{11\text{-}14} \textit{ industrial sector fixed effects} + \varepsilon \qquad (2)$$

where $\alpha_0 - \alpha_{14}$ are parameters to be estimated and ε is a random error term. Please see the appendix for variable definitions and data sources.

In Table IV, we present the results. The coefficient for *illegal* is significant and negative in both Models 2a and 2b. If it is illegal to short sell the stock in the home country, short selling activity is also reduced for that country's ADRs in the U.S. These results support our *regulatory reach* hypothesis. In the alternative specifications of Models 2c and 2d, the main explanatory variable is *restriction,* which is a finer measure of illegality of short selling. The coefficient of *restriction* is negative and significant in Model 2c and negative in Model 2d. The more restrictions that a home country adds to the short selling, the less is the short selling of that country's ADRs in U.S.

[Insert Table IV here]

We control for the home country *enforcement index*. The *enforcement index* is constructed based on the notion of an inverse relationship between enforcement and activity, i.e., the stricter the enforcement of restrictions the lower the observed short selling in the home market. Technically, the index is defined as the yearly average of total short selling related borrowing in the home country (in USD) scaled by total market capitalization of that country during the previous year, multiplied by -1 to capture the inverse relationship. Furthermore, the index is set to 0 for countries where it is legal to short sell because there is nothing to enforce in those countries. The coefficient on the enforcement variable is negative and statistically

significant in Model 2a and 2b. This coefficient indicates that when there is stricter enforcement of restrictions in the home country there is less shorting of the ADRs in the U.S. as well.

The coefficient of *Return* is not significant in all four Models. The positive and significant coefficient of *market capitalization* in all four specifications indicates that *total short interest* is higher for larger firms. The negative and significant coefficient for *dividend yield* indicates that short sellers do not maintain high open interest in high dividend paying firms, although they actively trade and borrow those stocks for trading. This implies that the likelihood of short covering is higher for high dividend payers than for low dividend payers or non-payers. We also include *level of ADR* as a control variable to see if short sellers are trading one level more than another. We find the coefficient to be positive and significant, indicating more short selling for higher level of ADRs. This increased trading interest may be due to the fact that higher level ADRs implies increased compliance with the stricter U.S. listing standards.[6] The positive and significant coefficient of *standard deviation of return* indicates higher short-selling for firms with higher dispersion of opinion. The positive and significant coefficient of *lagged days to cover* indicates that traders are not anxious about the length of time that it might take to cover the aggregate short positions outstanding. Instead, our findings demonstrate that traders apply momentum strategies and short previously shorted stocks even more. The positive and significant coefficient of *language* in Model 2a and 2c indicates higher short selling of ADRs from countries where English is one the official languages. The negative and significant coefficient of *Distance from the U.S.* in Model 2b and 2d indicates lower selling of ADRs from

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[6] J. P. Morgan dataset indicates whether the ADR is Level I, II, or III. To qualify for having a sponsored Level I ADR, a company's shares must be traded on at least one foreign exchange and the firm must post an annual report in English on its web site, but the company is not required to meet U.S. accounting standards. To qualify for a Level II sponsored ADR, a firm must register with the SEC and comply with U.S. accounting standards. Firms meeting Level II standards can have their ADRs traded on a U.S. stock exchange. Firms wishing to raise capital in the U.S. from investors can do so through a Level III ADR program by meeting standards similar to those for U.S. companies.

countries that are farther from the U.S. These findings on *language* and *distance from the U.S.* are consistent with Grinblatt and Keloharju (2001) and home bias literature.

All our regression results are robust to sector classification effects because we include sector dummies obtained from DataStream. We also estimate these 4 regressions using daily short volume data from FINRA for the period August 2009 to January 2010. Our results using both fortnightly short interest and daily short volume data are qualitatively similar, which is not surprising given the statistically significant positive correlation of 0.66 between these two alternative dependent variables. We do not report the results of the short volume regression in the tabular format for brevity. The coefficients for *illegal/restriction* with daily short volume as a dependent variables are -0.0262, -0.0368, -0.0675 and -0.0057, for Models 2a to 2d, respectively. The first three of these coefficients are significant at the 1% level. These results strongly support the *regulatory reach* hypothesis.[7] The short volume regressions with the after crisis period data also support our argument that our results are not driven by the crisis period of 2008.

The negative coefficients on the *illegal/restriction* variables are robust to alternative model specifications and sub-samples. We do not tabulate those results for brevity, but summarize our findings in this paragraph. In this discussion of robustness tests, the benchmark value for the coefficient of *illegal* is -0.0415 from Model 2a of Table IV. First, we use *trading volume* instead of *market capitalization* to capture the size effects on the right hand side and coefficient of *illegal* becomes -0.0121. Second, we estimate the regression using a smaller sample of only level III ADRs, which have most stringent disclosure requirements, and the coefficient of *illegal* becomes -0.0328. Fourth, we control for institutional ownership. After adding institutional ownership in Model 2a the coefficient of illegal becomes -0. 0137, however,

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[7] Although, examination of Miller's divergence of opinion hypothesis is beyond our scope, our results suggest that the issuance of ADRs in the U.S. is not sufficient to allow home countries to overcome the deleterious effects of short selling restrictions.

it is not statistically significant. We do not include this variable in our main regression because we do not have observations for all the ADRs. All these coefficients are significant at the 1% level unless otherwise stated. Thus, our results on *regulatory reach* are robust for different specifications and sub-samples.

3. 3. Bi-directional regulatory reach in globally integrated markets

So far, we have focused on the effects and reach of home market restrictions. However, the short selling regime in the U.S. itself has varied including (1) restrictions on downticks for several decades, (2) unrestricted short selling allowed in 2007, (3) a complete ban on short selling financial stocks in 2008, and (4) recent restrictions based on NBBO quotes. These restrictions might well affect the short selling activity of underlying stocks that are also cross-listed as ADRs. In this section, we test whether there is regulatory reach in this reverse direction, i.e., we investigate the effects of short selling restriction in the U.S. on short selling and borrowing activity in the home market. In this context, what matters is the relative strictness of short selling regulations in the U.S. vis-à-vis the home country. Therefore, we create a dummy variable high that equals to 1 if the restrictions on short selling are higher in the U.S. than those in the home country. As an alternative, we form a detailed index of relative strictness defined as the difference between U.S. restriction index and the home country restriction index. We also create a dummy variable cross which equals to 1 for ADR issuing firms and 0 for the non issuing firms. We estimate all or a subset of following regressions equation using the stock borrowing Data Explorer data for sample of ADR issuing firm and non- issuing firm:

shares borrowed = α₀ +α₁ high *cross + α₂ high * non cross

+α₃ (US - home country) restriction *cross

+ α₄ (US - home country) restriction * non cross +α₅ return + α₆ market capitalization

+ α₇ dividend yield + α₈ standard deviation of return + α₉ VSA + α₁₀ active agents

+ α₁₁ language + α₁₂ distance from the U.S. + α₁₃₋₁₆ industrial sector fixed effects + ε

(3)

where α_0–α_{16} are parameters to be estimated and ε is a random error term. *Shares borrowed* is the total quantity of borrowed/loaned securities net of double counting from the Data Explorer dataset. We take s*hares borrowed* as our left hand side variable because it is a proxy for short selling. Please see the appendix for definitions and data sources of other variables.

In Table V, we present our results, which are based on equation 3. In Models 3a and 3b, our main independent variables are *high*cross* and *high * non cross*. We use these interactive dummy variables to separate the effect of higher short selling restriction in the U.S. on the ADR issuing firms and on matched similar firms. The coefficient of high * cross is negative and significant in both specifications. This implies that when short selling restrictions in the U.S. are higher than those in the home country, stock borrowing of ADR issuing firms declines in the home country as well, consistent with our reverse reach hypothesis. The conduit for reverse reach of U.S. regulations in reducing home market borrowing is the ADR listing in the U.S. market. Thus, only the cross-listed stocks have a negative coefficient for the high restriction variable. Stocks that are not cross-listed do not suffer from the negative consequences of high U.S. restrictions and the coefficient for such stocks is positive. In Model 3c and 3d, we use alternative interactive variables *(US - home country) restriction *cross* and *(US - home country) restriction * non cross*. Our results are similar to Model 3a and 3b. Hence, U.S. short selling

restrictions have a reach in the home markets. Our results of regulatory reach in this section are robust to including other control variables.

[Insert Table V here]

3. 4. Implication of regulatory reach

In this section, we test the effects of home country restrictions on the returns of ADR portfolios. First, we divide our ADRs into two portfolios based on the legality of short selling in the home country. Second, we use a double sort approach where after dividing the ADRs into legality portfolios we further divide them into the short interest groups. This methodology is based on Asquith, Pathak and Ritter (2005) who create portfolios based on short interest and institutional ownership. We use an alternative measure of short selling constraint--restriction on short selling in the home country. The strongest relation between short interest and abnormal returns should exist for stocks that have large short positions combined with home country restrictions on short selling. These are the stocks that are most likely to be short-sale constrained. Asquith, Pathak and Ritter (2005) assume that short interest is a proxy for short sale demand and that institutional ownership is a proxy for the supply of shares available to be shorted. The first assumption is consistent with the finding in the literature that high short interest precedes abnormal returns (see Asquith and Meulbroek, 1995; and Desai, Ramesh, Thiagarajan and Balachandran, 2002). The second assumption is consistent with the assumption in the literature that high institutional ownership prevents short-sale constraints, i.e., stocks with high institutional ownership are readily available to borrow, and, hence, the stocks do not become overpriced (see Chen, Hong and Stein, 2002; Nagel, 2005). We use legality as an alternative measure of the short sell constraint and conjecture that it is a proxy for supply of shared available

to be shorted. Our prediction is that portfolios of ADRs with high short interest and from countries with short selling restrictions, which are the most constrained, have the lowest subsequent returns. The portfolio of ADRs with high short interest and no home-country restrictions on short selling should be less constrained and should have normal or less negative subsequent returns.

We estimate regressions using portfolios of 1,350 ADRs divided in three groups: *illegal, legal* (with or without restrictions), and *no restrictions*. *Legal* (*illegal*) is the portfolio of ADRs that are from the countries where it is legal (illegal) to short sell at time t. *No restriction* portfolio is a subset of *legal* portfolio. This alternative specification excludes ADRs from countries that impose partial restrictions on short selling. Thus, *no restriction* is portfolio of ADRs that are from the countries where it is not only legal to short sell, but also there are no other restriction on short selling such as a ban on naked short sell or an up-tick rule. We revise these classifications at the end of each month to form rebalancing portfolios and look at their performance over the next one month.

We follow Asquith, Pathak and Ritter (2005), and estimate the time series regressions using the Fama-French four factor model for the period from 1980 -2010, at monthly frequency, as follows:

$$r_{pt} - r_{ft} = \alpha + \beta_m \textit{Mkt-RF}_t + \beta_s \text{SMB}_t + \beta_h \text{HML}_t + \beta_o \text{MOM}_t + \varepsilon_{pt} \tag{4}$$

where $\alpha_0 - \alpha_{10}$ are parameters to be estimated and ε is a random error term. $r_{pt} - r_{ft}$ is the monthly percentage returns calculated as the excess return over the risk-free rate on an equally weighted portfolio. Our independent variables are *Mkt-RF*, *SMB*, *HML*, and *MOM* based on the U.S. market. *Mkt-RF* is the realization of the market risk premium in the period. *SMB* is the return on a portfolio of small stocks minus the return on a portfolio of big stocks. *HML* is the return on a

portfolio of high book-to-market (value) minus low book-to-market (growth) stocks. *MOM* is the return on a portfolio of prior winners minus the return on a portfolio of prior losers. We obtain monthly factor return realizations and risk free return from Kenneth French's website.

[Insert Table VI here]

In Table VI we report the results from estimating equation 4. These results indicate that as a result of *regulatory reach* constrained stocks underperform unconstrained stocks even though the constraints may be imposed by the home market and ADRs may trade in the U.S. market. Similar to Asquith, Pathak and Ritter (2005) we use the intercept as the measure of portfolio monthly abnormal performance. We find that the intercept of *illegal* portfolios is more negative compared to the intercept of *legal* and that of *no restriction* portfolio. These results indicate that the portfolio of ADRs from the countries where it is illegal to short sell underperforming portfolios of ADRs from the countries where it is legal to short sell.

Next, we contemplate the possibility that both short selling demand and short selling restrictions may affect the price efficiency of stocks. To consider the demand side of short selling, we double sort our data based on the short interest ratio and legality status. From the shortsqueeze.com data for the period from November 2007 to October 2009, we calculate the average short interest ratio of each ADR for each month. We merge this with the return data from Datastream. Then we divide the ADRs into three groups: low, medium and high short interest ratio. We revise this classification at the end of each month to form rebalancing portfolios. We focus on the two extreme groups of low and high short interest. We then sub-divide these short interest portfolios based on their legality status similar to that in Table VII, i.e. *legal,* and *illegal,* and *no restriction*. We report the results of these double sort rebalanced portfolios in Table VII.

[Insert Table VII here]

We find that the intercept, which is a measure of abnormal return, is most negative for the portfolio where short interest is high and it is illegal to short sell in the home country. This portfolio is the portfolio of ADRs that are most constrained. Within the short interest groups, our results are similar to those reported in Table VI. Thus, the effects of short selling restrictions reach far beyond the local jurisdictions as we show in the context of ADR's mispricing. Such is the power of *regulatory reach*.

4. Summary and conclusions

We provide the first comprehensive characterization of the world market for short selling and stock borrowing using several datasets that capture short selling regulations, actual short selling activity, and outstanding short interest in stocks from 82 countries.

The theme of our paper is the effectiveness and reach of short selling regulation in a multimarket environment. We address three related research questions:

First, are restrictions on short selling in a given country effective in reducing short selling related borrowing? Many previous papers have looked at the effect of short selling restrictions on the market quality, but none examine whether the restrictions are actually effective in curtailing short selling. We perform the first test of the efficacy of these regulations using both country level and stock level data and find that short selling regulations are actually effective in reducing short selling related borrowing in the home country.

Second, we examine whether home country restrictions on short selling reduce ADR's short selling in the U.S., which we call the *regulatory reach* hypothesis. Alternatively, the competing hypothesis of *regulatory arbitrage* takes the view that if short selling is illegal in a

country that is home to ADRs underlying shares there is greater short selling of the ADRs in the U.S. due to efforts to circumvent the home country regulations. Using two years of fortnightly short interest data for 1,307 ADRs, we find support for the *regulatory reach* hypothesis in both cross-sectional and panel-data tests. Thus, government power outweighs the ability or willingness of global traders to benefit from *regulatory arbitrage*. Our results of *regulatory reach* are robust to the inclusion of a home country enforcement index as a control variable.

This finding leads us to an examination of factors that strengthen or weaken *regulatory reach*. We find that good enforcement of short selling regulations in the home country and a country's distance from the U.S. decreases short selling in the U.S. and strengthen *regulatory reach*. In contrast, factors that increase the incentives and profitability of short trades weaken *regulatory reach* and increase the ADR short selling. We indentify, firm size, ADR level, standard deviation of return, language similarity, and higher institutional ownership as such factors.

Third, do short selling restrictions in the U.S. affect short selling related borrowing in the home country of a stock? We test this aspect of *regulatory reach* using home market daily stock borrowing data of ADR issuers and a matched sample of non- issuers. In this matched control sample experiment, we find that when short selling restrictions in the U.S. are higher than those in the home country, stock borrowing in the home country declines. These results are consistent with bi-directional *regulatory reach*. Univariate comparison, a matched control sample experiment, multivariate regressions, and an event study, all consistently point to both *regulatory reach* and ADR listing effects. Our results are robust to differences in firm specific characteristics, such as past returns, firm size, dividend yield, standard deviation of return,

borrowing costs, and industrial sectors and to differences in home country characteristics such as languages and distance from the U.S.

Finally, we look at the implications of *regulatory reach* in terms of the returns of ADRs under a constrained and non-constrained short selling environment in the home country. We use the Fama-French four factor regression model. We find that portfolios of ADRs that are from countries where it is illegal to short sell underperform the portfolio of ADRs from the countries where it is legal to short sell or where there are no restrictions on short selling. Using a double sort based on short interest and legality status, we find similar results overall and within the short interest groups. The portfolio of ADRs that have higher short interest and that are from the countries where it is illegal to short sell underperform the most. These results extend the results of the existing literature by showing that short-selling-constrained stocks underperform non-constrained stocks even though the restrictions may be imposed in home country and stocks trade in both the home country and an external market in the form of ADRs. Thus, *regulatory reach* has important valuation implications.

In summary, our paper contributes to the short selling and cross listing literature with four main findings. First, restrictions on short selling in a given country are effective in reducing short selling related borrowing in that country. Second, from investors' point of view, cross listing in the U.S. is not a vehicle for circumventing the regulatory control on short selling in the home country. Regulatory controls in the home country also stifle short selling in ADRs. Third, reach also works in the reverse direction, i.e., short selling restrictions in the U.S. reduce short selling related borrowing in the home country. Finally, the valuation implication of *regulatory reach* is that short selling constrained portfolios of ADRs underperform the short selling unconstrained portfolio of ADRs.

Appendix

Variables definitions and data sources

   In this table, we provide the definition and data sources for all the variables that are used in this paper.

Variable	Definition	Source
Shares borrowed	Total quantity of borrowed/loaned securities net of double counting	Data Explorer
Total short interest	Total number of outstanding shorted shares for each ADR for each fortnight	Shortsqueeze.com
Short volume	Aggregate number of shares sold short each day	Reg SHO data from FINRA
Return	Log (Return index$_t$)-log(Return index$_{t-1}$)	Datastream International
Illegal	Indicator variable that has value of 0 when short selling is banned in the home country and 1 when short selling is allowed	Bris, Goetzmann and Zhu (2007), Charoenrook and Daouk (2008), Chance (2009), and for time series Beber and Pagano (2010) and direct correspondence with stock exchanges and regulators
Restriction	Ranges from 0 to 3 where a higher number means more restrictions on short selling in a country, such as prohibition on naked short selling, an up-tick rule, or a total ban on short selling.	Chance (2009) and direct correspondence with stock exchanges and regulators
Market capitalization	A firm's share price multiplied by the number of ordinary shares outstanding in millions of USD	Datastream International
Dividend yield	Dividend per share as a percentage of the firm's share price	Datastream International
Standard deviation of return	Standard deviation of daily returns during the previous month.	Datastream International
VSA	Value weighted average fee for all open loans expressed in undisclosed fee buckets 0-5 (0 indicates the cheapest to borrow)	Data Explorer
Sector	Dummy variables for Industrial, Utility, Transportation, Financial and Insurance industrial sectors	Datastream International
Enforcement index	Yearly average of total short selling related borrowing in a country (in USD) scaled by total market capitalization of that country during the previous year multiplied by -1to capture the	Borrowing from Data Explorer and market capitalization from World Bank website

	inverse effects of enforcement on activity. The index is set to 0 for countries where it is legal to short sell because there is nothing to enforce in those countries.	
Level of ADR	Ordinal variable that equals 1(OTC), 2 (exchange listed), or 3 (public offering to raise capital)	Bank of New York Mellon (www.adrbnymellon.com) and JP Morgan (www.adr.com)
Lagged days to cover	Current short interest divided by average daily trading volume (ratio computed for previous day)	Shortsqueeze.com
Language	Dummy variables equals 1 for countries that have English as one of its official language and 0 otherwise	CEPII research center
Distance from the U.S.	Distance of a country in miles from the U.S.	CEPII research center http://www.meridianworlddata.com/Distance-Calculation.asp
Cross	Dummy variable equals 1 if the firm is an ADR-issuing firm and 0 if the firm is a non-issuing control firm from the home country	Bank of New York Mellon (www.adrbnymellon.com) and JP Morgan (www.adr.com)
High	Dummy variable equals 1 if the restrictions on short selling are higher in the U.S. than those in the home country and 0 otherwise	Chance (2009) and direct correspondence with stock exchanges and regulators
(US - home country) restriction	Difference between the restriction variable for the U.S. and the restriction variable for the home country	Chance (2009) and direct correspondence with stock exchanges and regulators
Active Agents	Number of custodians and lending agents with open loans	Data Explorer
Mkt_RF	Market risk premium	Kenneth French's website
SMB	Return on a portfolio of small stocks minus the return on a portfolio of big stocks	Kenneth French's website
HML	Return on a portfolio of high book-to-market (value) minus low book-to-market (growth) stocks	Kenneth French's website
MOM	MOM is the return on a portfolio of prior winners minus the return on a portfolio of prior losers	Kenneth French's website

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Table I

Global shifts in short selling regulations, feasibility, and activity

We provide a history of the legality of short selling around the world, including the dates of bans implemented during the recent financial crisis. We also provide details both of borrowing in the home country and short selling of ADRs in the United States. In columns 2 and 3, we report the periods when short selling was legal or illegal in a particular country. For these two columns, we classify the period as illegal based on a total ban. *None, always*, and *since inception* in these two columns refer to periods within our sample period. In column 4, we report other restrictions on short selling when it is not completely banned. In column 5, we present a feasibility index, which is calculated as the total borrowing volume for all of the stocks in a country (in USD) during our sample period (July 2006 to January 2010) divided by the country's average market capitalization (for the years 2005 to year 2009). In column 6, the ADR short interest ratio is calculated as short interest divided by share float. In column 7, we report average outstanding shares borrowed.

Country	Period when legal	Period when illegal	Nature of restriction and other comments	Global Feasibility Index	ADR Short interest ratio	Borrowing ($ millions)
Argentina	Since 1999	Before 1999	Up-tick rule applies; Naked short selling prohibited	0.00	0.86	0
Australia	Pre 09/22/2008; 11/20/2008 - Present	09/22/2008 - 11/19/2008	Naked short selling prohibited since 2001 Ban on shorting financial stock: 09/22/2008 - 05/25/2009	3.04	0.35	30,258
Austria	Since inception	None	Ban on naked short selling of financial stocks: 10/27/2008 - 11/30/2010	2.43	0.00	3,777
Bahrain	None	Always		0.00	0.00	0
Bangladesh	None	Always		0.00[†]	0.00	0
Barbados	None	Always		0.00	0.00	0
Belgium	Since inception	None	Ban on naked short selling of financial stocks: 9/22/2008 - 9/21/2009	2.17	0.52	6,720
Bermuda	None	Always		NA	0.00	8,985
Brazil	Since inception	None	Naked short selling prohibited	0.00	10.03	22
Bulgaria	None	Always		0.00	0.00	0
Canada	Since inception	None; see comments	Ban on shorting financial stocks (including inter-listed in U.S): 09/19/2008 - 10/08/2008; Up-tick rule applies	3.63	0.00	58,183
Cayman Islands	Since inception	None	Very little trading occurs on the stock exchange	NA	6.71	4,395
Chile	Since 1999	Before 1999	Up-tick rule applies; Naked short selling prohibited	0.00	0.36	0
China	None	Always; see comments	In Sep2008, China allowed short selling of 11 brokerage firms on a pilot basis	0.28	0.87	9,440
Colombia	None	Always		0.00	0.74	0
Croatia	None	Always		0.00	0.00	0
Cyprus	None	Always		1.09	0.00	173

Table I – continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	Feasibility Index	ADR short interest ratio	Borrowing ($ millions)
Czech Republic	Since inception	None		0.19	0.00	104
Denmark	Since inception	None; see comments	Ban on shorting bank stocks: 10/13/2008 – Present	1.76	0.13	3,650
Ecuador	None	Always		0.00†	0.00	0
Egypt	None	Always		0.00†	0.00	0
Finland	Since 1998	Before 1998		2.55	0.55	6,423
France	Since inception	None; see comments	Ban on naked short selling of credit institutions and insurance companies' stocks: 09/22/2008 - Present	4.77	2.63	102,719
Georgia	None	Always		0.00†	0.00	0
Germany	Since inception	None; see comments	Investment funds except hedge funds may not short sell; Ban on naked short selling of specified financial stocks: 09/19/2008 – Present	5.24	0.53	81,259
Greece	Pre 10/10/2008; 06/01/2009 -Present	10/10/2008 - 05/31/2009	Up-tick rule applies; Naked short selling prohibited	0.10	0.08	177
Hong Kong	Since 1994	Before 1994	Permitted for specified securities (33 in 1994-95); Up-tick rule applies; Naked short selling prohibited	0.00†	6.29	7,561
Hungary	Since 1996	Before 1996		2.57	0.05	905
Iceland	Since inception	None; see comments	Ban on naked short selling of financial stocks: 11/06/2008 - 01/31/2009	0.18	0.00	47
India	Since 12/20/2007	Before 12/20/2007 (Badla trading existed)	Badla trading means carry over transaction with extended rolling settlements; Naked short selling is prohibited; On 10/20/2008, SEBI disapproved stock lending by FIIs of participatory notes (PNs) stocks	0.00	1.26	1
Indonesia	Pre Oct 2008; May 2009 – Present	Oct 2008 - Apr 2009	Legal only for specified stocks	0.02	0.24	29
Ireland	Since inception	None; see comments	Ban on naked short selling of financial stocks: 09/19/2008 – Present	2.03	0.97	2,349
Israel	Since inception	None	Naked short selling prohibited	0.17	1.09	293
Italy	Since inception	None	Naked short selling ban for financial stocks: 09/22/2008 - 05/31/2009; Naked short selling ban for non-financial stocks: 10/10/2008 - 01/01/2009	3.45	1.66	29,328
Jamaica	None	Always		0.00	0.00	0
Japan	Since inception	None	Up-tick rule and locate requirement apply; Ban on naked short selling: 10/30/2008 – Present	1.13	0.30	47,580
Jordan	None	Always		0.00	0.00	0
Kazakhstan	None	Always		0.00†	0.00	0
Kuwait	None	Always		0.00	0.00	0
Latvia	None	Always		0.00	0.00	0

Table I – continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	Feasibility Index	ADR Short interest ratio	Borrowing ($ millions)
Lebanon	None	Always		0.00[†]	0.00	0
Lithuania	None	Always		0.00	0.00	0
Luxembourg	Since inception	None	Ban on naked short selling of banks and insurance companies: 09/19/2008 – Present	5.29	3.19	5,100
Malaysia	Pre 1997; Jan 2007 – Present	Sep 1997 to Dec 2006	Naked short selling prohibited; Uptick rule applies; Legal only for specified stocks	0.00	0.00	5
Malta	None	Always		0.00[†]	0.00	0
Mauritius	None	Always		0.57	0.00	23
Mexico	Since inception	None	Naked short selling prohibited; Up-tick rule applies	0.33	1.33	1,043
Morocco	None	Always		0.06	0.00	35
Netherlands	Since inception	None	Naked short selling ban: 09/22/2008 - 06/01/2009	2.69	0.92	18,453
New Zealand	Since 1992	Before 1992	Since Apr 1992, specified securities eligible for short selling; After Jul 2000, all liquid securities eligible. Short selling is hindered by tax legislation.	1.91	0.09	760
Nigeria	None	Always		0.00	0.00	0
Norway	Since 1992	None; see comments	Ban on naked short selling of 5 specified financial stocks: 10/08/2008 - Present	2.38	0.32	5,803
Oman	None	Always		0.00[†]	0.00	0
Pakistan	Since inception	None	"Regulations for Short Selling under Ready Market" introduced in 2002: Naked short selling is prohibited; Up-tick rule applies; Short selling allowed only in prescribed securities	0.00	0.00	0
Panama	None	Always		15.84	0.00	959
Peru	None	Always		0.00	0.96	0
Philippines	Since 1998	Before 1998	Naked short selling prohibited; Up-tick rule applies; Legal only for specified stocks	0.01	0.31	6
Poland	Since 2000	Before 2000	Shorting allowed only in the permitted securities	0.03	0.00	41
Portugal	Since inception	None	Ban on naked short selling of specified financial stocks: 09/24/2008 - Present	1.43	0.03	1,384
Qatar	Since inception	None		0.00[†]	0.00	0
Russia	Pre 09/18/2008; and 06/16/2009 -Present	09/18/2008 - 06/15/2009	Up-tick rule applies	0.00[†]	1.47	73
Serbia	None	Always		0.00	0.00	0
Singapore	Since inception	None	Ban on naked short sales in buy-in market. Onshore lending is limited while offshore lending is active	1.22	0.07	3,359
Slovakia	None	Always		0.00[†]	0.00	0
Slovenia	Since inception	None		0.00	0.00	0

Table I – continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	Feasibility Index	ADR Short interest ratio	Borrowing ($ millions)
South Africa	Since inception	None	Naked short selling prohibited	0.34	1.02	2,259
South Korea	Sep 1996 to 09/30/2008; and 06/01/2009 -Present	Before 1996; 10/01/2008 - 05/31/2009	Ban on shorting financial stocks: 10/1/2008 – Present; Naked short selling ban from June 2000 to Present; Up-tick rule applies	0.00[†]	0.76	3,633
Spain	Since 1992	Before 1992	Naked short selling prohibited	2.34	0.09	30,330
Sri Lanka	None	Always		0.00	0.00	0
Sweden	Since 1991	Before 1991		2.37	1.39	11,065
Switzerland	Since inception	None; see comments	09/19/2008 - 01/16/2009: Swiss Federal Banking Commission and SIX Swiss Exchange prohibited naked short selling; SWX-Europe also prohibited creation or increase of a net short position in certain specified UK and Swiss financial stocks	2.84	0.92	30,949
Taiwan	Pre 10/01/2008; 11/28/2008 - Present	10/01/2008 - 11/28/2008	Up-tick rule applies	0.00[†]	0.76	301
Thailand	Since Jan 2001	Before Jan 2001	Only specified securities are eligible (underlying securities of SET 50 index, ETF, and underlying securities of ETF); Up-tick rule applies; Naked short selling prohibited	0.27	0.00	390
Tunisia	None	Always		0.00[†]	0.00	0
Turkey	Since inception	None	Up-tick rule applies; Only specified stocks eligible	0.26	0.38	481
Ukraine	None	Always		0.00	0.00	0
UAE	None	Always		0.01	0.00	9
United Kingdom	Since inception	None; see comments	Ban on short selling of specified financial stocks: 09/19/2008 - 01/16/2009	2.33	0.55	73,044
United States	Since inception	None; see comments	Up-tick rule effective: 02/01/1938 - 07/03/2007; Ban on naked short selling of 19 financial stocks: 07/21/2008 - 08/12/2008; Ban on short selling of specified financial stocks: 09/19/2008 - 10/08/2008; Quote based restrictions imposed in 2010.	3.01	0.00	510,764
Venezuela	None	Always		0.00[†]	0.00	3
Zambia	None	Always		0.00	0.00	0
Zimbabwe	None	Always		0.00	0.00	0

[†] These countries do not have any local home market borrowing.

Table II

Descriptive statistics of underlying stocks and their matched samples

  In this table, we report the descriptive statistics for ADRs underlying firms and their matched non-underlying domestic firms from the home country. We perform this matching based on country, industry, PTBV and market capitalization.

	Number of firms	Price to book value			Ln market capitalization		
Cross listed firms and matched non cross listed firms							
		Mean	Median	StdDev	Mean	Median	StdDev
Cross listed firms	1,406	2.68	2.08	2.30	7.84	8.08	1.85
Non - cross listed firms	1,406	2.61	2.08	2.24	5.52	5.60	1.86

Table III

Effectiveness of home country short selling restrictions in curtailing home market stock borrowing

  We estimate regressions using the Data Explorer dataset for the period from July 2006 to January 2010. For Model 1a, the dependent variable is *shares borrowed* at the country level, which is the aggregate home market borrowing daily for all the stocks from a given country. The dependent variable in Models 1b and 1c is the shares borrowed at the firm level. Our main independent variable is *Restriction*, which ranges from 0 to 3. A higher number indicates more restrictions on short selling in the home market. These restrictions include a prohibition on naked short selling, an up-tick rule, or a total ban on short selling. *Return* is return for the stock during the previous day. *Market capitalization* is the share price multiplied by the number of ordinary shares outstanding in millions of USD at the end of previous year. D*ividend yield* is dividend per share as a percentage of the share price. *Standard deviation of return* is a measure of the dispersion of opinion for the previous month. *VSA* is the value weighted average fee for all new loans expressed in undisclosed fee buckets 0-5 (0 is the cheapest to borrow). *Utility, Transportation, Insurance* and *Financial* are dummy variables that equal 1 if the firm belongs to the respective industry and 0 otherwise. All coefficients are standardized using the SAS proc reg stb option. Statistical significance is based on White heteroscedasticity-consistent standard errors.

Variable/Dependent variable	Shared borrowed in home country (daily)		
	Country level	Firm level	
	Model 1a	Model 1b	Model 1c
Intercept	0.0000	0.0000**	0.0000**
Restriction	-0.0132†	-0.0030**	-0.0027**
Return	-0.0006	-0.0003	-0.0002
Market value	0.0134**	0.2339**	0.2299**
Dividend Yield	-0.0055	0.0025**	0.0014**
Standard deviation of return		0.0027**	0.0046**
VSA		-0.0193**	-0.0167**
Utility			0.0491**
Transportation			0.0093**
Insurance			0.0059**
Financial			0.0216**
Adjusted R Square	0.0002	0.0563	0.059
Number of Observations	21,048	9,879,715	9,879,715

**Significant at 0.01 level, *Significant at 0.05 level

†Significant at 0.10 level

Table IV
Effect of home country short selling restrictions on short selling activity of ADRs in the U.S.

   We report the results of estimating four OLS models. Our dependent variable is *total short interest*, which is the total number of outstanding shorted shares. We use a number of independent variables. We create two variables to capture the regulatory framework; *illegal* and *restriction*. *Illegal* equals 1 for the period when short selling is illegal in the home market and 0 otherwise. *Restriction* ranges from 0 to 3 where a higher number means more restrictions on short selling in the home market, such as prohibition on naked short selling, an up-tick rule, or a total ban on short selling. *Enforcement Index* is calculated as total borrowing volume in USD divided by the market capitalization of the country multiplied by *illegal* and -1. Other control variables are defined as follows. *Return* is return for the stock during the previous fortnight. *Market capitalization* is the share price multiplied by the number of ordinary shares outstanding in millions of USD at the beginning of our sample period. *Dividend yield* is dividend per share as a percentage of the share price. *Level of ADR* is an ordinal variable ranging from 1 to 3 for each level of ADR. *Standard deviation of return* is a measure of dispersion of opinion during the previous month. *Lagged days to cover* is the number of days required for cumulative daily trading volume to equal the current number of shorted shares outstanding at time (t-1). *Language* is the dummy variable that takes a value of 1 for countries that   have English as one of its official languages and 0 otherwise. *Distance from the U.S.* is the distance in miles from the U.S. All coefficients are standardized using the SAS proc reg stb option. Continuous variables are winsorized at the 1st and 99th percentile. Statistical significance is based on White heteroscedasticity-consistent standard error.

Variable/Dependent variable	Total Short Interest (fortnightly)			
	Model 2a	Model 2b	Model 2c	Model 2d
Intercept	0.0000**	0.0000**	0.0000**	0.0000**
Illegal	-0.0415**	-0.0389**		
Restriction			-0.0213**	-0.0043
Enforcement index	-0.0048*	-0.0109**	0.0037	0.0006
Return	0.0087	0.0075	0.0096	0.0083
Market capitalization	0.2477**	0.2447**	0.2439**	0.2442**
Dividend Yield	-0.0648**	-0.0666**	-0.0671**	-0.0685**
Level of ADR	0.3661**	0.3520**	0.3684**	0.3536**
Standard deviation of return	0.0220**	0.0276**	0.0211**	0.0253**
Lagged days to cover	0.0796**	0.0785**	0.0797**	0.0790**
Language	0.0487**		0.0406**	
Distance from the U.S.		-0.0650**		-0.0617**
Sector fixed effects	Yes	Yes	Yes	Yes
Adjusted R Square	0.2178	0.2195	0.2167	0.2182
Number of Observations	25,068	25,068	25,068	25,068

**Significant at 0.01 level, *Significant at 0.05 level

Table V
Effect of short selling restrictions in the U.S. on short selling activity in home country
   We estimate regressions with a sample of 1,406 ADR-issuing firms and their matched control sample of
1,406 non-issuing firms. We use a number of independent variables. We create three dummy variables as
follows. High equals to 1 if the restrictions in the U.S. are higher than those in the home country and 0
otherwise. Cross equals to 1 for ADR – issuing firms and 0 for their matched control firms. Non cross
equals to 0 for ADR – issuing firms and 1 for their matched control firms. We use *High * cross* and *High
* non cross* in Model 3a and 3b as independent variables. As an alternative to variable high, we use (US -
home country) restriction, which is the difference between the restriction index for the U.S. and the
restriction index for the home country (restriction index ranges from 0 to 3 where a higher number means
more restrictions on short selling, such as prohibition on naked short selling, an up-tick rule, or a total ban
on short selling). We use *(US - home country) restriction *cross* and *(US - home country) restriction **
non cross in Model 3c and 3d as independent variables. *Return* is return for the stock during the previous
day. *Market capitalization* is the share price multiplied by the number of ordinary shares outstanding in
millions of USD. D*ividend yield* is dividend per share as a percentage of the share price. *Standard
deviation of return* is a measure of dispersion of opinion during the previous month. *VSA* is the value
weighted average fee for all new loans expressed in undisclosed fee buckets 0-5 (0 is the cheapest to
borrow). *Active agents* is the number of custodians and lending agents with open share lending
transactions. *Language* is a dummy variable that takes a value of 1 for countries that have English as an
official languages (possibly among others) and 0 otherwise. *Distance from the U.S.* is the distance in
miles from the U.S. All coefficients are standardized using the SAS proc reg stb option. Observations are
winsorized at the 1st and 99th percentile values of continuous variables to eliminate any potential data
errors and outliers. Statistical significance is based on White heteroscedasticity-consistent standard errors.

Variable/Dependent variable	*Shares borrowed (daily)*			
	Model 3a	*Model 3b*	*Model 3c*	*Model 3d*
Intercept	0.0000**	0.0000**	0.0000**	0.0000**
High * cross	-0.0083**	-0.0123**		
High * non cross	0.0145**	0.0017**		
(US - Home country) restriction * cross			-0.0208**	-0.0297**
(US - Home country) restriction * non cross			0.0085**	0.0159**
Return	-0.0016*	-0.0012	-0.0015*	-0.0013
Market capitalization	0.2244**	0.2109**	0.2208**	0.2067**
Dividend Yield	0.0126**	0.0265**	0.0120**	0.0267**
Standard deviation of return	0.0250**	0.0537**	0.0219**	0.0513**
VSA	0.0419**	0.0170**	0.0437**	0.0206**
Active agents	0.4771**	0.4422**	0.4739**	0.4400**
Language	0.2077**		0.2059**	
Distance from the U.S.		-0.0143**		-0.0170**
Sector fixed effects	Yes	Yes	Yes	Yes
Adjusted R Square	0.3725	0.3325	0.3728	0.3335
Number of Observations	1,444,996	1,444,996	1,444,996	1,444,996

 **Significant at 0.01 level, *Significant at 0.05 level

Table VI

Implications of *regulatory reach* for price efficiency and future returns

   Following Asquith, Pathak and Ritter (2005), we report time series regression results using the Fama-French four factor model for the period from 1980-2010. We report the regression for *legal*, *illegal* and *no restriction* portfolios, rebalanced based on the legality status at the end of the previous month. *Legal* is the portfolio of ADRs that are from countries where it is legal to short sell at time *t*. *Illegal* is the portfolio of ADRs that are from countries where it is illegal to short sell at time *t*. *No Restriction* is the portfolio of ADRs that are from countries where it is not only legal to short sell, but also there are no other restriction on short selling such as a ban on naked short selling or an up-tick rule. Our dependent variable is monthly percentage returns calculated as r_{pt}- r_{ft}, the excess return over the risk-free rate on an equally weighted portfolio. Our independent variables are *Mkt-RF*, *SMB, HML*, and *MOM* based on the U.S. market. *Mkt-RF* is the realization of the market risk premium in each period. *SMB* is the return on a portfolio of small stocks minus the return on a portfolio of large stocks. *HML* is the return on a portfolio of high book-to-market (value) minus low book-to-market (growth) stocks. *MOM* is the return on a portfolio of prior winners minus the return on a portfolio of prior losers. Statistical significance is based on White heteroscedasticity-consistent standard errors.

Legality	Intercept	Mkt_RF	SMB	HML	MOM	R Square
Fama- French four factor regression model by legality (n = 358)						
Illegal	-0.54*	0.05	0.28***	0.23**	-0.05	0.0377
Legal (with or without some restrictions)	-0.41*	0.11*	0.25***	0.28***	-0.01	0.0607
No restriction	-0.23	0.15**	0.21**	0.28***	0.00	0.0556

***Significant at 0.01 level, **Significant at 0.05 level, *Significant at 0.10 level

Table VII
Double sorted portfolios: Impact of *regulatory reach* and borrowing demand for price efficiency and future returns

Following Asquith, Pathak and Ritter (2005), we report time series regression results using the Fama-French four factor model for the period from November 2007 to October 2009. We sort our sample in two ways. First, we create portfolios based on the short interest at the end of each month. We divide our sample into three parts, low short interest, medium short interest and high short interest; we focus on the two extreme groups. Second, within each short interest group, we sort based on the legality status or restrictions on short selling for the home country of each ADRs. We report the regression for *legal* and *illegal* and *no restriction* portfolios. *Legal* is the portfolio of ADRs that are from the countries where it is legal to short sell at time t. *Illegal* is the portfolio of ADRs that are from the countries where it is illegal to short sell at time t. *No restriction* is the portfolio of ADRs that are from the countries where it is not only legal to short sell, but also there are no other restriction on short selling such as a ban on naked short sell or an up-tick rule. Our dependent variable in the regression model is the monthly percentage returns calculated as $r_{pt}- r_{ft}$, the excess return over the risk-free rate on an equally weighted portfolio. Our independent variables are *Mkt-RF*, *SMB, HML*, and *MOM* based on the U.S. market. *Mkt-RF* is the realization of the market risk premium in period. *SMB* is the return on a portfolio of small stocks minus the return on a portfolio of big stocks. *HML* is the return on a portfolio of high book-to-market (value) minus low book-to-market (growth) stocks. *MOM* is the return on a portfolio of prior winners minus the return on a portfolio of prior losers. Statistical significance is based on heteroscedasticity-consistent standard errors.

Level of Restriction	Intercept	Mkt_RF	SMB	HML	Mom	R Square
Fama- French four factor regression model by legality (n=23)						
Short interest (Low)						
Illegal	-2.79*	0.24	-0.21	-0.21	-0.18	0.1729
Legal (with or without some restrictions)	-1.75	0.41**	-0.09	-0.17	-0.02	0.1975
No restriction	-1.61	0.42**	-0.32	-0.25	-0.10	0.1932
Short interest (High)						
Illegal	-3.92*	0.36	-0.09	-0.46	-0.40	0.2193
Legal (with or without some restrictions)	-1.56	0.41*	-0.39	-0.19	-0.17	0.1725
No restriction	-1.33	0.43*	-0.48	-0.17	-0.16	0.1892

***Significant at 0.01 level, **Significant at 0.05 level, *Significant at 0.10 level
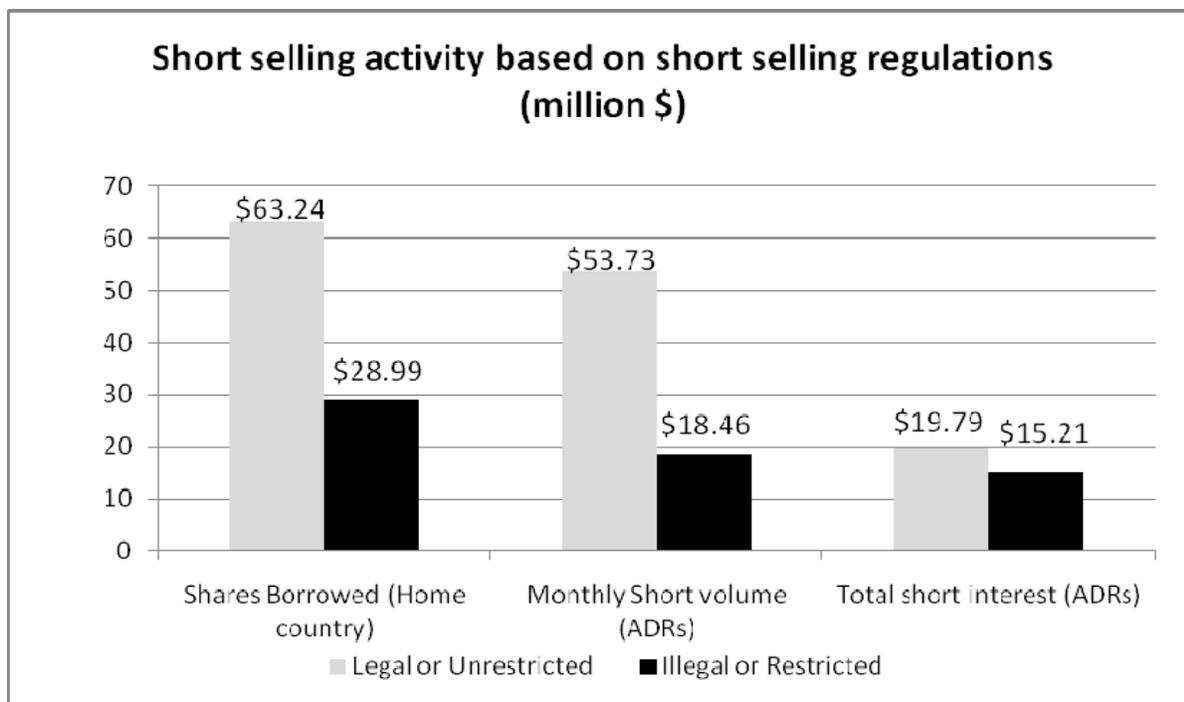
Figure I: Short selling activity based on short selling regualtions.
In this figure, we show the short selling activity separately for different short selling regulation regimes. The gray bar represents the average stock borrowing in million USDs in countries where short selling is legal or unrestricted in the home market. The black bar represents the average stock borrowing in million USD in countries where short selling is illegal or restricted in the home market. The next two bars provide the analogous comparison of monthly short volume and the last two bars compare short interest of ADRs from unrestritive and restrictive countries.