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WORLDWIDE REACH OF SHORT SELLING REGULATIONS

by

Archana Jain

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

Major: Business Administration

The University of Memphis

May 2012

DEDICATION

This dissertation is dedicated to my husband Mr. Chinmay Jain and Professor Pankaj K. Jain for encouraging me to pursue this doctoral degree.

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ABSTRACT

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This dissertation characterizes the legality and incidence of short selling in a worldwide, multimarket framework. Home country short selling restrictions curtail home market stock borrowing by 45% and reduce short selling of the country's ADRs by 68% due to *regulatory reach*. Also, the 2008 U.S. ban on short selling of financial firms reduced borrowing in foreign locations. These findings are robust to controls for option availability, enforcement, returns, firm-size, trading volume, dividends, ADR level, volatility, days-to-cover and industry sector. Further, investor conduct resulting from adherence to professional standards is a more powerful mechanism of regulatory reach than inter-government cooperation.

PREFACE

This dissertation has been submitted for publication to Journal of Financial Economics and it is currently under third round review.

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Chapter 1

Introduction

Short selling has long been a controversial trading strategy. The academic evidence on the value of short selling is mixed and market regulators' actions suggest a degree of ambivalence toward the practice.¹ On the one hand, regulators often publicly espouse the benefits of short selling in terms of its importance to the efficient processing of information in asset markets.² On the other hand, these same regulators typically react to periods of market turmoil by banning short selling, arguing that the practice exacerbates market volatility and, in the extreme, destabilizes markets. The most recent financial crisis is no exception and many regulators resorted to either outright bans on short selling, or imposed trading restrictions in an effort to stem the falling market and reduce volatility. Bris, Goetzmann, and Zhu (2007), and Charoenrook and Daouk (2008), and Beber and Pagano (2012) all provide evidence on the cross-country and time-series variation in short selling regulations.

¹ Most academic papers argue that short selling is an essential part of the price discovery mechanism (Nilsson, 2008; Boehmer, Jones, and Zhang, 2009; Kolasinski, Reed, and Thornock, 2009) whereas others express concern about price manipulation (Shkilko, Van Ness, and Van Ness, 2008). Nonetheless, Diether, Lee, and Werner (2009) find that the practice is pervasive and short selling volume is 24% of NYSE and 31% of NASDAQ trading volume. Edwards and Hanley, (2010) find that short selling begins right from the day when a stock is sold in the initial public offering.

² For example, the Financial Services Authority (2002, p. 4), the NASDAQ (<http://www.nasdaq.com/quotes/short-interest.aspx>), Australian Securities and Investments Commission (ASIC) Chairman Greg Medcraft (www.theaustralian.com.au/business/markets/securities-regulator-will-not-ban-short-selling-says-greg-medcraft/story-e6frg916-1226113803879) and SEC Commissioner Kathleen Casey (<http://www.sec.gov/news/speech/2010/spch022410klc-shortsales.htm>) have all stated that short selling is a legitimate investment activity, which plays an important role in supporting efficient markets.

The complexity of this issue is further exacerbated by the fact that, while the motivation for the bans is often clear, it is entirely unclear whether or not the bans were in any way successful in achieving these goals. The limited empirical research suggests that the bans did not reduce volatility (Bris, 2008; Boulton and Braga-Alves, 2010; Saffi and Sigurdsson, 2011) and may even have increased volatility (Boehmer, Jones, and Zhang, 2009; Charoenrook and Daouk, 2009). Indeed, it is interesting to note that the outgoing SEC chairman, Christopher Cox, admitted that the 2008 short selling bans were the “biggest mistake” of his term (Paley and Hilzenrath, 2008).³ Other regulators do not appear to share this view, however, and short selling bans were again imposed in many countries in 2011.

The purpose of our study is to provide further evidence on the effectiveness of short selling restrictions. However, unlike previous research, our paper is the first to investigate how home market restrictions affect short selling in a global multimarket setting. Specifically, we examine the extent to which national regulators are able to effectively enforce short selling restrictions both within and outside their home markets. Our focus is on firms that are cross-listed in the form of an ADR, as they provide an ideal setting for testing our research questions.

In our paper, two competing hypotheses are considered to explain the impact of short selling restrictions on foreign markets—*regulatory arbitrage* versus *regulatory reach*. The regulatory arbitrage hypothesis suggests that when the home market

³ Further, SEC Commissioner Kathleen Casey also has publicly expressed her view that the bans created “significant disruption and distortions” in the market (Williams, 2009).

introduces restrictions, short selling moves to foreign locations.⁴ In the current context, this suggests that regulatory arbitrage increases ADR short volume if traders opt to trade in unrestricted regimes, although the existence of taxes or fees on foreign transactions, capital controls, inconvertibility of currencies, and market segmentation does complicate the relationship (Foerster and Karolyi, 1999). Empirical support for this hypothesis can be found in Blau, Van Ness, and Warr (2012), who construct a feasibility index of short selling based on subjective assessment of survey responses and find evidence of increased shorting in the United States of ADRs from countries that prohibit short selling in the domestic market. An important point of distinction between Blau, Van Ness, and Warr (2012) and our paper is that we have invested substantial effort in ensuring that our legality of short selling variable accurately reflects the status of short selling in each country over time.⁵ Moreover, our data sample is more comprehensive and covers 1,035 ADRs from November 2007 to December 2010 compared to only 352 ADRs sampled over 2005 and 2006 in Blau, Van Ness, and Warr (2012).

The regulatory reach hypothesis suggests that home country restrictions curtail short selling of cross-listed stocks in foreign markets. In the current context, this

⁴ Rodrigo Buenaventura from the CNMV commented that one of the reasons short selling was banned in Spain during the crisis was to avoid attracting the pent-up short selling demand that could not be expressed in other Euro markets, which had bans in place (“Short Sales Restrictions—What Are They Good For?”, panel discussion at the IX Madrid Finance Workshop (Short Selling), IESE, Madrid, Nov. 4, 2010.)

⁵ Our effort corrects some erroneous classifications adopted in the prior research. For example, we are claiming that short selling in Spanish ADRs is high because it is legal to short sell in Spain (regulatory reach). Blau, Van Ness, and Warr (2012) conclude that short selling in Spanish ADRs is high because it is not feasible to short sell in Spain (regulatory arbitrage). The position taken in prior research is incorrect because our stock borrowing data show that it is actually very feasible to short sell in Spain. This observation is true for several countries where we observe short selling related borrowing (which has a correlation of 0.9 with short interest according to Data Explorers) occurring even though short selling is classified as infeasible.

suggests that foreign country trading restrictions decrease short selling of a stock's ADR in the U.S. market. Regulatory reach can decrease short selling of a country's ADRs in the United States through a variety of mechanisms that we group into two major themes—inter-government cooperation and investor conduct. Regulatory reach may reflect a country's bilateral investment treaties or membership in groups such as G7, OECD or the EU, which facilitate inter-government cooperation through clearer communication of the regulatory intent to foreign market participants (Lau and McNish, 2002), the court's recognition and enforcement of foreign laws (Keller, 2004), and cooperation among global law enforcement agencies (Block, 2007; Hamilton, 2008). For example, in 2008 the U.K.'s Financial Services Authority (FSA) issued Short Selling (No. 3) Instrument 2008/51, which according to Avgouleas (2010, p.17), “had a global reach covering shorting of shares in the list anywhere, e.g., on Frankfurt (Deutsche Borse) or the New York Stock Exchange.” Similarly, in its statement concerning short selling, the SEC (2008-235) stated that its actions were taken in consultation with regulators of the major developed securities markets around the world with which it coordinated in monitoring market reactions. The International Organization of Securities Commissions (IOSCO) has put in place a structure for its member agencies to cooperate and exchange information in the process of developing, implementing and promoting adherence to internationally recognized and consistent standards of regulation, oversight, and enforcement.

Alternatively, regulatory reach may be driven by investor conduct and worldwide compliance. For example, financial firms may avoid circumventing regulations in their home markets to avoid scrutiny by the regulator and possibly violating the terms of their trading license (Ellickson, 1991). Pagano, Panetta, and Zingales (1998), Coffee (1999,

2002), and Erickson, Goolsbee, and Maydew (2003) observe that the overwhelming majority of firms take a conservative stance and do not engage in regulatory arbitrage at all. Further, many individuals employed within the finance industry are governed by the CFA Institute's Code of Ethics and Standards of Professional Conduct, which states that members must understand and comply with all applicable laws, rules, and regulations of any government, regulatory organization, licensing agency, or professional association governing their professional activities. In the event of conflict, members must comply with the more strict law, rule, or regulation. Similarly, the Institute's standard relating to integrity of capital markets and market manipulation, may discourage members from undertaking stock lending and other closely related activities when short selling is unlawful.

In our paper, we have assembled a unique panel database from a variety of sources, which allows us to establish the relative effectiveness of short selling restrictions, including the relative merits of the regulatory reach versus regulatory arbitrage hypotheses. The distinction between these two hypotheses is important because in a race to the bottom (Schram, 2000), regulatory arbitrage implies that stricter rules (whether excessive or fair) decrease a country's business competitiveness relative to other countries with lax rules. Therefore, regulatory reach is essential to obtain the desired investor protection outcomes with reasonable costs in a competitive global economy.

The main results of our paper may be summarized as follows. We begin by considering the effectiveness of regulatory enforcement of short selling restrictions in the home markets. While intuitively obvious, empirical work on this issue is lacking, and, as expected, we find that short selling related stock borrowing is significantly lower in

countries that impose restrictions. To understand the dynamics of a multi-market trading environment, we combine several unique short selling datasets containing stock borrowing, short interest, and short trading volume. Univariate comparisons, matched control sample experiments, multivariate regressions, all consistently provide evidence in support of the regulatory reach hypothesis. That is to say, restrictions curtail short selling not only in the home market, but also in the U.S. market where the ADRs are cross-listed. These findings remain strongly significant after controlling for option market availability, past returns, return volatility, firm specific characteristics such as size and dividend policy, ADR level, stock borrowing costs, industrial sectors, and trading volume. Furthermore, we find that regulatory reach also works for U.S. firms in the reverse direction. Specifically, in September 2008 when the United States banned short selling of financial firms, stock borrowing for those firms declined in the foreign locations outside the United States as well. Finally, we test the mechanisms of regulatory reach and find that investor conduct is a stronger mechanism of regulatory reach than inter-government cooperation.

Chapter 2

Data sources and sample formation

Firms with cross-listed ADRs provide an ideal setting for testing our research questions. As such, a list of 2,892 eligible firms and their International Securities Identification Number (ISIN) was sourced in November 2009 from the Bank of New York Mellon and J.P. Morgan web sites.¹ Each firm's home country is identified using the first two digits of the ISIN, which represents the originating country's ISO codes. We sourced from Datastream information on firm-specific returns, market capitalization, volume, dividend yield, closing price, intraday high price, intraday low price, and sector classification information.

For each of these ADR-issuing firms, data on short selling is assembled from a variety of sources. We obtain daily information on the stock lending industry from Data Explorers for the period July 2006 to January 2010.² Data Explorers report that the correlation between publicly reported levels of short interest and the level of stock lending is approximately 0.90, which suggests that stock lending data provide a reasonable proxy for short selling. In addition to individual stock loan information, Data Explorers also provides information on the amount of stock available for loan and the stock borrowing cost. It is important to note that the database allows the identification of

¹ The cumulative sponsor bank list from J.P. Morgan and Bank of New York Mellon contains 3,013 ADRs. We removed the firms, which are listed or exchanged outside the United States, and firms that do not have information on ISIN.

² Data Explorers data are available on Bloomberg. Data Explorers is based in London and according to its website its institutional clients account for 70% of the worldwide stock borrowing related to short selling. Data Explorers covers thousands of equities worldwide and receives information on more than 3 million transactions daily from more than 100 top securities lending firms for commercial dissemination.

the country where the borrowing takes place, so that it is possible to tell whether the shares are being borrowed in the home country or elsewhere. A more detailed description of the Data Explorers dataset may be found in Saffi and Sigurdsson (2011).³ After merging the initial sample with Data Explorers stock borrowing data and Datastream firm characteristics data, our final daily data sample has 1,601 ADRs to assess regulatory effectiveness.

In addition to the daily Data Explorers stock borrowing information, we also source fortnightly short interest data from Shortsqueeze.com for more than 16,000 stocks that trade on NYSE, NASDAQ, AMEX, OTC/BB, and Pink Sheets. Short interest is defined as the total number of outstanding shorted shares for each security. In addition to the number of shares sold short, supporting data such as days to cover and institutional ownership also are available. Triangulation of the initial ADR list, the shortsqueeze.com open interest data and Datastream, yields a fortnightly data sample of 1,035 ADRs.

Our final sources of short selling data are FINRA (Regulation-SHO data) and the BATS exchange. These transaction level short sale data are aggregated to obtain daily short volume for each stock from the first availability date of August 2009 to January 2010 (the latest period for which we have Data Explorers data). Triangulation of the initial ADR list, the aggregated daily FINRA and BATS data and Datastream yields a trading data sample of 559 ADRs.

³ We clean the Data Explorers data in several ways. We eliminate exact duplicates. Data Explorers 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 Explorers includes the variable *dividend requirement* that allows us to make sure that our results are not affected by dividend capture trades. We keep the observations with dividend requirement = 100, because these are the standard loan agreements. Dividend requirement other than 100% indicates dividend capture and tax arbitrage motivated trades.

Chapter 3

Short selling regulations around the world

Information on the legality of short selling across a wide range of countries is obtained by cross-referencing the survey articles of Bris, Goetzmann, and Zhu (2007), Charoenrook and Daouk (2008), and Beber and Pagano (2012) with the practitioner's report of Clifford Chance LLP (2009). Where clarification or further information is necessary, we directly correspond with the stock exchanges and financial market regulators. Table 1 presents a summary of information on the legality status of short selling in each country with specific details of the periods when short selling was legal or illegal. In addition to considering a simple binomial measure of short selling legality, we attempt to gain additional insights into the impact of short selling restrictions by distinguishing between the different short selling rules that exist. The details of any intermediate forms of restrictions also are presented in columns 2 to 4. Apart from outright bans, other forms of restrictions include specific trading mechanisms (up-tick rule), pre-borrowing requirements (ban on naked short selling), and bans on shorting selected stocks (typically financial stocks).

Similar to previous studies, we create an indicator variable, *illegal*, which equals 1 if short selling is prohibited in the home market and 0 otherwise. Unlike the past research however, which typically specifies an unconditional measure of short selling restrictions, we allow this variable to vary over time for countries that changed their short selling rules during the sample period. For example, 19 countries imposed temporary restrictions on short selling during the 2008 financial crisis, while China lifted its

restriction on short selling for 11 brokerage firms in 2008. The intermediate forms of restrictions create interesting cross-sectional variations for our analysis.

Table 1 also presents basic metrics on the relative presence of short selling in each country. The average short interest ratio for all ADRs from each country, which is defined as short interest as a percentage of shares float, is reported in column 5. The aggregate dollar amount of short-selling related borrowing of all stocks from each country is reported in column 6. Finally, column 7 presents the aggregate scaled borrowing ratio (SBR) for each country, which is calculated as the daily average outstanding dollar borrowing divided by the country's total stock market capitalization at the end of previous year. These last two statistics are derived using Data Explorers data, where the daily data is averaged across all days in the sample period.

Preliminary insights into the impact of regulations on short selling may be obtained by considering a plot of short selling in home markets as well as in the ADR markets. Sample firms are divided in two groups of unrestricted versus restricted based on home-country short-selling regulatory regimes. The restricted category includes uptick restriction, naked ban, or a total ban on short selling. In Figure 1a, we plot the average home market stock borrowing in millions of USD for the countries in the two groups. In Figure 1b, stock borrowing is scaled by the firm's market capitalization. Both panels indicate that short selling restrictions are effective in curtailing home market stock borrowing because the stock borrowing for unrestricted countries is higher than the stock borrowing for restricted countries.

Table 1

Global shifts in short selling regulations and activity

We provide a timeline of the legality of short selling around the world, including the dates of bans implemented during the financial crisis of 2008. We also provide details both of borrowing in the home country and short selling of ADRs in the United States. We report the periods when short selling was legal (column 2) or illegal (column 3) 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 short-selling restrictions when short selling is not completely banned. In column 5, we report the ADR short interest ratio which is defined as the short interest as a percentage of share float. In column 6, we report the daily average outstanding dollar value of shares borrowed summed across all stocks from that country. In column 7, we present the scaled borrowing ratio (SBR), which is the daily average outstanding dollar borrowing during our sample period (July 2006 to January 2010) divided by the country's total stock market capitalization at the end of the previous year.

Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Argentina	Since 1999	Before 1999	Up-tick rule applies; Naked short selling prohibited	0.86	0	0.00
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: 9/22/2008 - 05/25/2009	0.35	30,258	3.04
Austria	Since inception	None	Ban on naked short selling of financial stocks: 10/27/2008 - 11/30/2010	0.00	3,777	2.43
Bahrain	None	Always		0.00	0	0.00
Bangladesh ^b	None	Always		0.00	0	0.00
Barbados	None	Always		No ADRs	0	0.00
Belgium	Since inception	None	Ban on naked short selling of financial stocks: 9/22/2008 - 9/21/2009	0.52	6,720	2.17
Bermuda	None	Always		0.00	8,985	NA
Brazil	Since inception	None	Naked short selling prohibited	10.03	22	0.00

Table 1—continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Bulgaria	None	Always		0.00	0	0.00
Canada ^c	Since inception	None; see comments	Ban on shorting financial stocks (including inter-listed in U.S.): 9/19/2008 - 10/08/2008; Up-tick rule applies	No ADRs	58,183	3.63
Cayman Islands	Since inception	None	Very little trading occurs on the stock exchange	6.71	4,395	NA
Chile	Since 1999	Before 1999	Up-tick rule applies; Naked short selling prohibited	0.36	0	0.00
China	None	Always; see comments	In 9/2008, China allowed short selling of 11 brokerage firms on a pilot basis	0.87	9,440	0.28
Colombia	None	Always		0.74	0	0.00
Croatia	None	Always		0.00	0	0.00
Cyprus	None	Always		0.00	173	1.09
Czech Republic	Since inception	None		0.00	104	0.19
Denmark	Since inception	None; see comments	Ban on shorting bank stocks: 10/13/2008–Present	0.13	3,650	1.76
Ecuador ^b	None	Always		0.00	0	0.00
Egypt ^a	None	Always		0.00	0	0.00
Finland	Since 1998	Before 1998		0.55	6,423	2.55
France	Since inception	None; see comments	Ban on naked short selling of credit institutions and insurance companies' stocks: 9/22/2008 - Present	2.63	102,719	4.77
Georgia ^b	None	Always		0.00	0	0.00

Table 1–continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Germany	Since inception	None; see comments	Investment funds except hedge funds may not short sell; Ban on naked short selling of specified financial stocks: 9/19/2008–Present	0.53	81,259	5.24
Greece	Pre 10/10/2008; 06/01/2009 - Present	10/10/2008 - 05/31/2009	Up-tick rule applies; Naked short selling prohibited	0.08	177	0.10
Hong Kong ^a	Since 1994	Before 1994	Permitted for specified securities (33 in 1994-95); Up-tick rule applies; Naked short selling prohibited	6.29	7,561	0.00
Hungary	Since 1996	Before 1996		0.05	905	2.57
Iceland	Since inception	None; see comments	Ban on naked short selling of financial stocks: 11/06/2008 - 1/31/2009	No ADRs	47	0.18
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	1.26	1	0.00
Indonesia	Pre Oct 2008; May 2009–Present	Oct. 2008 - April 2009	Legal only for specified stocks	0.24	29	0.02

Table 1–continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Ireland	Since inception	None; see comments	Ban on naked short selling of financial stocks: 9/19/2008–Present	0.97	2,349	2.03
Israel	Since inception	None	Naked short selling prohibited	1.09	293	0.17
Italy	Since inception	None	Naked short selling ban for financial stocks: 9/22/2008 - 5/31/2009; Naked short selling ban for non-financial stocks: 10/10/2008 - 1/01/2009	1.66	29,328	3.45
Jamaica	None	Always		0.00	0	0.00
Japan	Since inception	None	Up-tick rule and locate requirement apply; Ban on naked short selling: 10/30/2008–Present	0.30	47,580	1.13
Jordan	None	Always		0.00	0	0.00
Kazakhstan ^b	None	Always		0.00	0	0.00
Kuwait	None	Always		0.00	0	0.00
Latvia	None	Always		0.00	0	0.00
Lebanon ^b	None	Always		0.00	0	0.00
Lithuania	None	Always		0.00	0	0.00
Luxembourg	Since inception	None	Ban on naked short selling of banks and insurance companies: 9/19/2008–Present	3.19	5,100	5.29

Table 1—continued						
Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
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	5	0.00
Malta ^b	None	Always		0.00	0	0.00
Mauritius	None	Always		0.00	23	0.57
Mexico	Since inception	None	Naked short selling prohibited; Up-tick rule applies	1.33	1,043	0.33
Morocco	None	Always		0.00	35	0.06
Netherlands	Since inception	None	Naked short selling ban: 9/22/2008 - 6/01/2009	0.92	18,453	2.69
New Zealand	Since 1992	Before 1992	Since April 1992, specified securities eligible for short selling; After July 2000, all liquid securities eligible. Short selling is hindered by tax legislation.	0.09	760	1.91
Nigeria	None	Always		0.00	0	0.00
Norway	Since 1992	None; see comments	Ban on naked short selling of 5 specified financial stocks: 10/08/2008 - Present	0.32	5,803	2.38
Oman ^b	None	Always		0.00	0	0.00

Table 1—continued						
Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
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	0.00
Panama	None	Always		0.00	959	15.84
Peru	None	Always		0.96	0	0.00
Philippines	Since 1998	Before 1998	Naked short selling prohibited; Up-tick rule applies; Legal only for specified stocks	0.31	6	0.01
Poland	Since 2000	Before 2000	Shorting allowed only in the permitted securities	0.00	41	0.03
Portugal	Since inception	None	Ban on naked short selling of specified financial stocks: 9/24/2008 - Present	0.03	1,384	1.43
Qatar ^b	Since inception	None		0.00	0	0.00
Russia ^a	Pre 9/18/2008; and 6/16/2009 - Present	9/18/2008 - 6/15/2009	Up-tick rule applies	1.47	73	0.00
Serbia	None	Always		No ADRs	0	0.00

Table 1—continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Singapore	Since inception	None	Ban on naked short sales in buy-in market. Onshore lending is limited while offshore lending is active	0.07	3,359	1.22
Slovakia ^a	None	Always		No ADRs	0	0.00
Slovenia	Since inception	None		No ADRs	0	0.00
South Africa	Since inception	None	Naked short selling prohibited	1.02	2,259	0.34
South Korea ^a	Sep 1996 to 9/30/2008; and 6/01/2009-Present	Before 1996; 10/01/2008 - 5/31/2009	Ban on shorting financial stocks: 10/1/2008–Present; Naked short selling ban from June 2000 to Present; Up-tick rule applies	0.76	3,633	0.00
Spain	Since 1992	Before 1992	Naked short selling prohibited	0.09	30,330	2.34
Sri Lanka	None	Always		0.00	0	0.00
Sweden	Since 1991	Before 1991		1.39	11,065	2.37
Switzerland	Since inception	None; see comments	9/19/2008 - 1/16/2009: 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	0.92	30,949	2.84

Table 1—continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Taiwan	Pre 10/01/2008; 11/28/2008 - Present	10/01/2008 - 11/28/2008	Up-tick rule applies	0.76	301	0.00
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	0.00	390	0.27
Tunisia ^b	None	Always		0.00	0	0.00
Turkey	Since inception	None	Up-tick rule applies; Only specified stocks eligible	0.38	481	0.26
Ukraine	None	Always		0.00	0	0.00
UAE	None	Always		0.00	9	0.01
United Kingdom	Since inception	None; see comments	Ban on short selling of specified financial stocks: 9/19/2008 - 1/16/2009	0.55	73,044	2.33
United States ^c	Since inception	None; see comments	Up-tick rule effective: 2/01/1938 - 7/03/2007; Ban on naked short selling of 19 financial stocks: 7/21/2008 - 8/12/2008; Ban on short selling of specified financial stocks: 9/19/2008 - 10/08/2008; Quote based restrictions imposed in 2010.	No ADRs	510,764	3.01

Table 1–continued						
Country	Period when legal	Period when illegal	Nature of restriction and other comments	ADR short interest ratio	Borrowing (\$ million)	SBR
Venezuela	None	Always		0.00	3	0.00
Zambia	None	Always		No ADRs	0	0.00
Zimbabwe	None	Always		0.00	0	0.00

^a This country has some borrowing in the Data Explorers data, but we do not have market capitalization for this country.

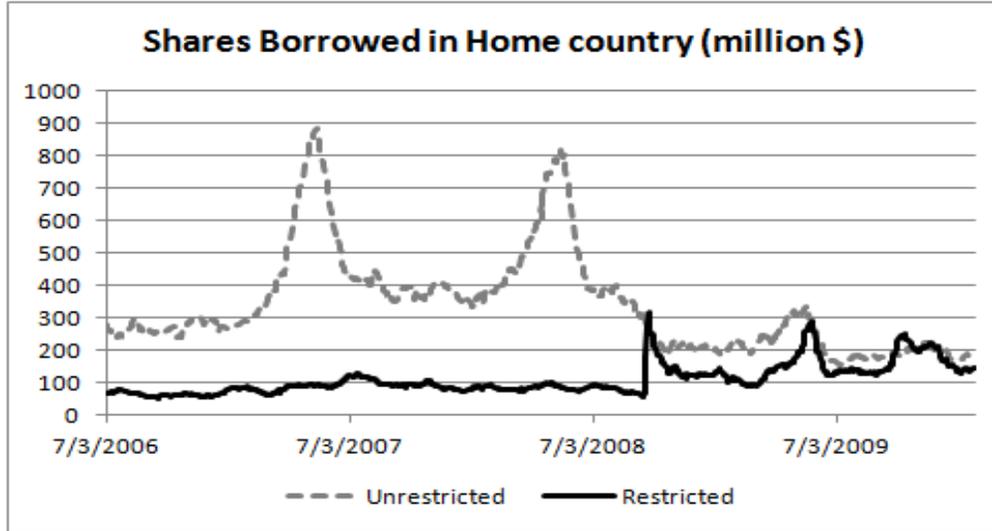
^b This country is not included in Data Explorers.

^c The United States does not have any ADRs for domestic companies. Canadian stocks also are fully fungible and do not trade as ADRs. Hence, the United States and Canada are excluded from the remainder of our analysis.

Next, we use the short interest and short volume data to provide a macro level assessment of the regulatory reach versus regulatory arbitrage hypothesis. In Figure 2a, we plot the short interest of ADRs originating from the countries where short selling is legal and from the countries where short selling is illegal. The short interest of ADRs from the countries where short selling is legal is generally higher (41 out of 48 fortnights), than the short interest of ADRs from the countries where it is illegal.

Figure 2b presents a similar plot for short volume and shows that short volume of ADRs from the countries where short selling is legal is always higher than the short volume of ADRs from the countries where it is illegal. Thus, these results provide initial evidence in support of the regulatory reach hypothesis.

a



b

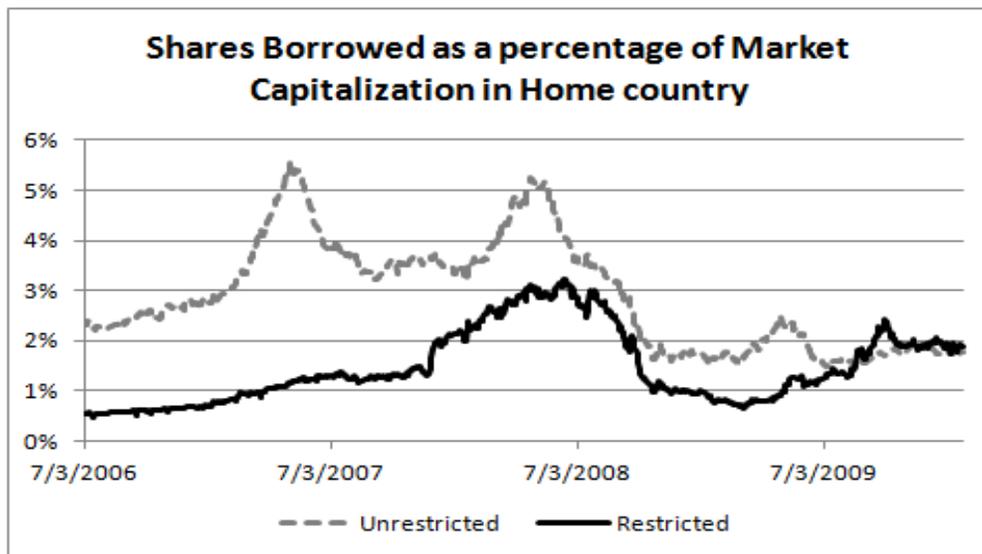


Fig. 1.

Short selling in the home country, by short selling regime

In Figure 1a, We plot short selling related borrowing (amount outstanding at the end of each day, in millions of USD) for the countries where short selling is restricted (solid line) and for the countries where short selling is unrestricted (broken line). Short borrowing data are from Data Explorers for July 2006 to January 2010. Each observation in the original dataset represents dollar stock borrowing for a given stock on a given day. Based on the originating country's short selling restriction on the relevant calendar day, each stock-day is allocated to either the restricted or the unrestricted portfolio. Then, for each country we compute the average stock borrowing across all stocks from that country and then the average across countries. In Figure 1b, we scale the dollar borrowing by the stock's market capitalization.

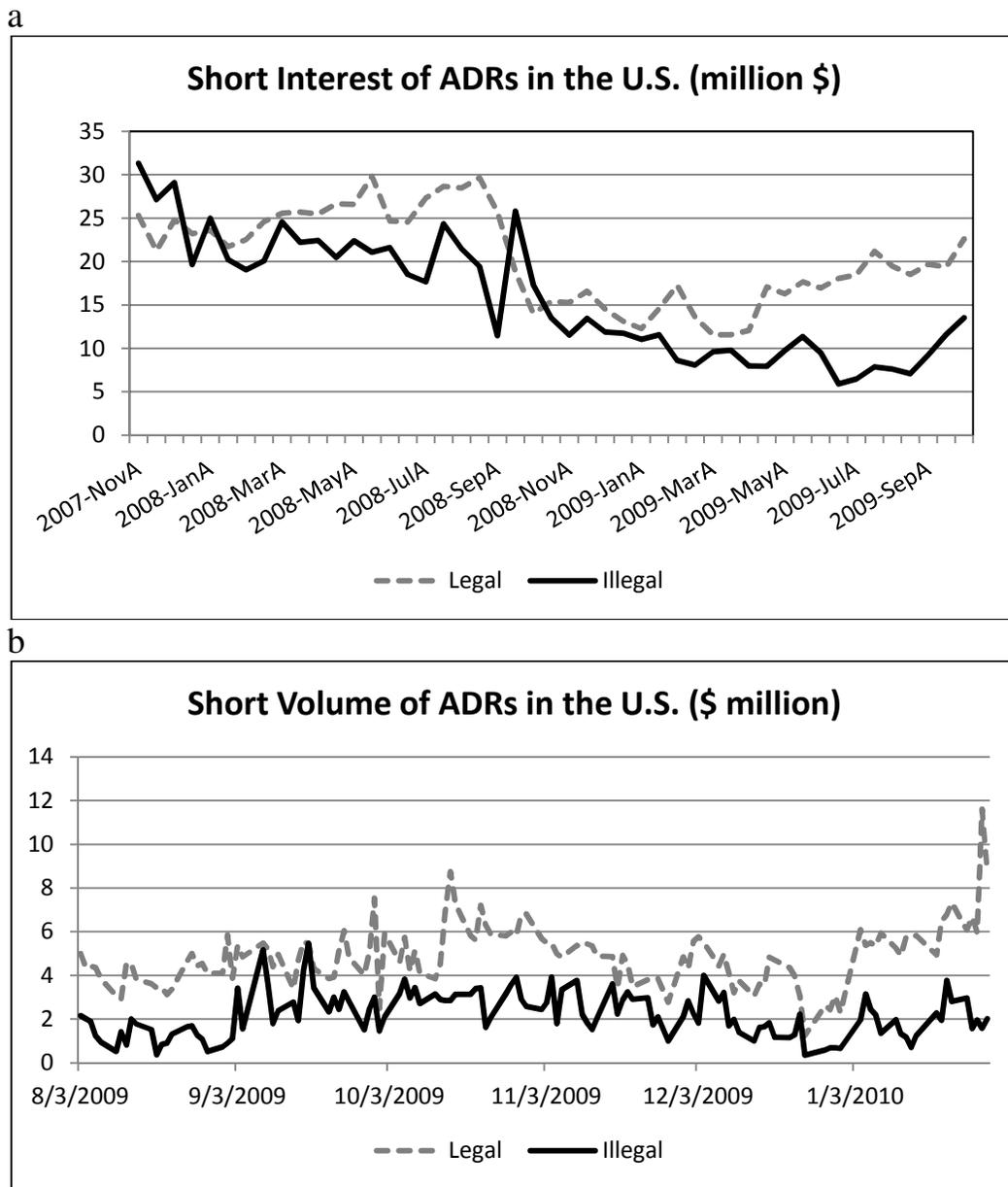


Fig. 2.

Impact of home country regulations on monthly short selling of ADRs in the United States

In Figure 2a, we plot the short interest of ADRs from countries where short selling is illegal (solid line) and from countries where short selling is legal (broken line). Short interest data are from shortsqueeze.com for November 2007 to October 2009. In Figure 2b, we plot the short volume of ADRs from the countries where short selling is illegal (solid line) and legal (broken line). Short volume data are from the FINRA and BATS exchanges for August 2009 to January 2010. Short interest data are at fortnightly frequency and short volume is at daily frequency. We follow a two-step averaging process analogous to that described in Figure 1.

Chapter 4

Empirical Results

We begin with a brief description of our general framework for the regression models and then present specific regression equations assessing home market effectiveness of short selling restrictions and pair-wise tests of worldwide regulatory reach. The Appendix shows our data source and variable definition for each of our variables.

4.1. Regulatory restrictions and other determinants of short selling

Our main dependent variable is short selling, which we measure with three alternative variables—stock borrowing in the home market, short interest of ADRs in the United States, and short volume of ADRs in the United States. Our key explanatory variable relates to the regulatory environment and captures information on whether short selling is legal or illegal and restricted or unrestricted.

The prior research suggests the need to include several control variables, although the nature of their relationship with short selling is often unclear and few papers offer any direct test of how those variables affect short selling in a multi-market context. The presence of options trading is one such variable. Figlewski and Webb (1993) find a significantly higher average level of short interest for optionable stocks and argue that options facilitate short selling, which suggests a complementary effect. Similarly, Battalio and Schultz (2011) document complementarities between short selling and options. On the other hand, Bris, Goetzmann, and Zhu (2007) propose that options reduce short selling due to a substitution effect. Stock return is another possible control variable

and Diether, Lee, and Werner (2009) as well as Jain, Jain, and McInish (2012) find that positive stock returns increase short selling. Blau, Van Ness, Van Ness, and Wood (2010) however, find that extremely negative market returns increase short selling. Diether, Lee, and Werner (2009) also show that return volatility affects short selling. 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) documents significant variations in borrowing costs across stocks, with a few stocks that become extremely special, demanding negative rebate rates (i.e., loan fees in excess of the risk-free rate). Krispy Kreme Doughnuts and Palm Inc. are examples of such stocks, exhibiting loan fees as high as 50% and 35%, respectively. To summarize, the evidence presented in these studies suggest that our model needs to include control variables for the existence of an option market in the home country, past returns, return volatility, and stock borrowing costs. We also include a number of other control variables that may relate to the level of short selling such as dividend yield, firm size (Diether, Lee and Werner, 2009), the level of the ADRs, and days to cover.

Note that D'Avolio (2002) and Asquith, Pathak, and Ritter (2005) argue that higher institutional ownership positively affects short selling by increasing the supply of loanable shares. Due to the limited availability of such data however, 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.

4.2. Regulatory effectiveness of short selling restriction in curtailing home market stock borrowing

We assess the home market effectiveness of short selling restrictions using daily Data Explorers data for short selling related borrowing. If the regulations are effectively enforced, countries with restrictions will have a lower amount of borrowing. Thus, we expect a statistically significant negative coefficient for the *illegal* variable in the regression with stock borrowing as a dependent variable. We estimate all or a subset of the following equation and report the results in Table 2:

$$\begin{aligned}
 \text{scaled shares borrowed in home country}_{i,d} = & \alpha_0 + \alpha_1 \text{illegal}_{c,d} \\
 & + \alpha_2 \text{uptick restriction}_{c,d} + \alpha_3 \text{option markets}_{c,yr} + \alpha_4 \text{return}_{i,d} + \alpha_5 \text{weekly return}_{i,d-1} \\
 & + \alpha_6 \text{monthly return}_{i,d-1} + \alpha_7 \text{half-yearly return}_{i,d-1} + \alpha_8 \text{scaled volume}_{i,d} \\
 & + \alpha_9 \text{dividend yield}_{i,d} + \alpha_{10} \text{return volatility}_{i,d} + \alpha_{11} \text{borrowing cost}_{i,d} \\
 & + \alpha_{12-15} \text{industrial sector fixed effects}_i + \varepsilon_{i,d}
 \end{aligned} \tag{1}$$

where α_0 – α_{15} are parameters to be estimated and ε is a random error term. Subscripts i , d , c , and yr denote firm, day, country, and year, respectively. The subscript $d - 1$ indicates that the return period ends on the day before day d . The dependent variable is *scaled shares borrowed*, which is the home market borrowing of each individual firm on day t , scaled by its market capitalization.

Table 2

Regulatory effectiveness of home country short selling restrictions in curtailing home market stock borrowing

For this table, our sample comprises the underlying stocks for 1,601 ADRs for the period from July 2006 to January 2010. All our variables are defined in the Appendix. For each stock i for each day d , we collect the home market dollar stock borrowing, which we divide by stock i 's market capitalization to produce our dependent variable, the firm's scaled shares borrowed in the home country. Our main independent variables are the dummy variables illegal and uptick restriction. The remaining independent variables are: option markets, return, weekly return, monthly return, half yearly return, scaled volume, dividend yield, return volatility, borrowing cost, and sector fixed effects. Subscripts i , d , c , and yr denote firm, day, country, and year, respectively. All coefficients are standardized using the SAS proc reg stb option. Continuous variables are winsorized at the 1st and 99th percentiles. Statistical significance is based on double clustered standard errors along the firm and fortnightly time dimensions following Petersen (2009).

Variable	Dependent variable: Scaled shares borrowed in home country $_{i,d}$		
	Model 1a	Model 1b	Model 1c
Intercept	0.0000	0.0000	0.0000
Illegal $_{c,d}$	-0.0063*** (-4.95)		-0.0017* (-1.69)
Uptick restriction $_{c,d}$		-0.0471*** (-5.22)	-0.0469*** (-5.20)
Option markets $_{c,yr}$	0.0321*** (7.15)	0.0156*** (3.27)	0.0156*** (3.29)
Return $_{i,d}$	-0.0067 (-1.38)	-0.0069 (-1.42)	-0.0069 (-1.42)
Weekly return $_{i,d-1}$	-0.0013 (-0.94)	-0.0011 (-0.90)	-0.0011 (-0.89)
Monthly return $_{i,d-1}$	-0.0089 (-1.23)	-0.0088 (-1.21)	-0.0088 (-1.22)
Half yearly return $_{i,d-1}$	0.0110* (1.78)	0.0069 (1.20)	0.0067 (1.16)
Scaled volume $_{i,d}$	0.4589 (1.32)	0.4578 (1.31)	0.4578 (1.31)
Dividend Yield $_{i,d}$	-0.0031 (-0.58)	-0.0132** (-2.32)	-0.0130** (-2.30)
Return volatility $_{i,d}$	-0.0031*** (-3.39)	-0.0019** (-2.46)	-0.0019** (-2.48)
Borrowing cost $_{i,d}$	0.0168 (1.38)	0.0138 (1.19)	0.0139 (1.20)
Days to cover $_{i,d-1}$	0.0114*** (4.41)	0.0095*** (4.35)	0.0095*** (4.35)
Sector fixed effects	Yes	Yes	Yes
Adjusted R Square	0.2128	0.2146	0.2146
Number of Observations	928,330	928,330	928,330

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

Hereafter, we present standardized coefficient estimates to allow comparison of the relative impact and importance of each determinant of short selling.¹ Furthermore, we report statistical significance based on double clustered standard errors along firm and fortnightly time dimensions following Petersen (2009).

We find that the coefficient of illegal is negative and significant in both models 1a and 1c presented in Table 2. Similarly, the coefficient of the uptick restriction also is negative and significant in models 1b and 1c, indicating that short selling restrictions are associated with a lower level of stock borrowing in the home country. These results point to the regulatory effectiveness of short selling restrictions in curtailing borrowing activity in the home country.

Among the control variables, the coefficient on option markets is positive and significant in all models, indicating that derivative trades have the complementary effect of increasing stock borrowing in the home market. The coefficients of the return variables are not significant in any of the three models except for the half yearly return in model 1a. The insignificant coefficient of scaled volume indicates the lack of a strong relationship between total volume and scaled stock borrowing, but we note that our raw data suggest that the unscaled dollar borrowing is proportional to the stock's trading volume. Stock borrowing is lower for dividend payers and for volatile stocks. The coefficient of borrowing cost is not significant. The positive and significant coefficient of days to cover indicates that borrowers are not deterred by the length of time that it might take to cover the aggregate borrowed positions. Instead, our findings suggest that

¹ We obtain these coefficients using the `reg 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. Thus, the standardized intercept is 0.0000. The *t*-statistics for the standardized and unstandardized coefficients are the same.

traders may apply momentum strategies and borrow previously borrowed stocks even more. Sector dummies for utilities, transportation, insurance, financial firms, and the suppressed base case of industrials are included to capture industry fixed effects.

4.3. Impact of new restrictions on short selling in the home country and on ADRs

In this section we test the regulatory reach hypothesis. We begin with univariate comparisons of differences in short-selling related borrowing in underlying markets and ADR markets during the most and least restrictive regimes, in turn.

Table 3 presents a pair-wise comparison of the least restrictive and the most restrictive short selling regimes for the 18 countries that changed their regulations during our sample period.² The different regulatory regimes in the order of increasing restrictiveness are no ban, uptick rule or naked ban, uptick and naked ban, and total ban on any type of short selling. Although regulatory effectiveness is not the main focus of our paper, our panel-data analysis of this issue is more comprehensive than previous work as prior studies either focused on a single country over time or a cross section of data across multiple countries.

We observe that short-selling-related stock borrowing scaled by market capitalization is much higher in less restrictive regimes than in more restrictive regimes. This statement applies not only to the borrowing in underlying markets, but also extends to ADRs, consistent with our regulatory reach hypothesis. There is no evidence that traders try to move their activity internationally to avoid domestic restrictions. For

² Short selling restrictions changed for China and Malaysia during our sample period; however, since we do not have stock borrowing data during different regulatory regimes for a pair-wise comparison for these countries we are unable to include these two countries in our pair-wise comparisons.

example, when Australia restricted short selling, the ratio of shares borrowed to market capitalization dropped from 2.97% to 1.55%, representing a 48% decline. More importantly, the scaled short borrowing in Australian ADRs also declined from 0.070% to 0.035%, representing a 50% decline. The averages for the 18 countries in this table support the regulatory reach hypothesis as well. When short selling is restricted, the short borrowing ratio declines by an average of 45% in the home markets and 68% in the ADR market. Both changes are statistically significant at the 0.05 level. In Panel A, we have used underlying stock's market capitalization to scale the stock borrowing of both the ADRs and the underlying stock. Using this metric, the effects of regulations are larger in magnitude for home markets than for ADRs. Alternatively, because ADR volume is smaller than the volume in home markets, we also test the differences in stock borrowing scaled by ADR daily volume in Panel B.³ Average stock borrowing drops from 6.64 times of daily volume in least restrictive regimes to 3.86 times of daily volume in the most restrictive regimes, which represents a 42% decline.

We also decompose the percentage decline in the stock borrowing in underlying and ADR markets into the 5 types of regulatory changes adopted by the countries listed in table 3. For the first type of regulatory change, where countries shift from no ban to a ban on naked shorts (Free-N), stock borrowing declines by 49% in the underlying market and 80% in the ADR market. For the second type of restriction, where countries shift from a ban on naked shorts to a complete or total ban on any type of short selling (N-TB), stock borrowing declines by 48% in the underlying market and 50% in the ADR market.

³ Datastream, CRSP, shortsqueeze.com, JP Morgan, and BNY Mellon do not report the ADR float. Since ADR volume is highly correlated with ADR float however, we are able to proxy float data using volume data for ADRs and underlying stocks that are readily available from several data sources such as Datastream.

Table 3

Impact of home market short selling restrictions on stock borrowing in home country and ADR borrowing in the United States

Our sample for this table comprises 1,695 underlying stocks and 853 ADRs from 18 countries that changed their short selling rules during July 2006 to January 2010. The acronym for restrictions (from the least restrictive to the most restrictive) in the nature of change column are as follows: no ban (Free), naked ban (N), uptick restriction (UR), naked ban plus uptick (N&UR), and total ban on any type of short selling (TB). We average the stock borrowings for all firms in a given country for each day d from Data Explorer during the less (more) restrictions in column 1 (2) for underlying shares and column 5 (6) for ADRs. In column 4 (8), we present the values in column 3 (7) converted to percentages differences. For Panel A, we scale borrowing of both ADRs and underlying stock by market capitalization of the underlying stock. For Panel B we scale borrowing of underlying stock by daily trading volume of the underlying stock and borrowing of ADR by daily trading volume of ADR. Volume based scaled borrowing is winsorized at the 1st and 99th percentiles. In the last row of each Panel, we report the t -statistic for a paired difference test.

Panel A: Scaled borrowing = \$ shares borrowed / Market capitalization									
Underlying in home country						ADRs Anywhere			
Country	Nature of change	[1] Less Restrictions	[2] More Restrictions	[3] Difference Col 2-1	[4] Percentage Difference	[5] Less Restrictions	[6] More Restrictions	[7] Difference Col 6-5	[8] Percentage Difference
Australia	N-TB	2.979%	1.551%	-1.427%	-48%	0.070%	0.035%	-0.035%	-50%
Austria	Free-N	3.131%	1.521%	-1.610%	-51%	0.004%	0.001%	-0.003%	-70%
Belgium	Free-N	1.926%	0.716%	-1.210%	-63%	0.030%	0.000%	-0.030%	-100%
Denmark	Free-TB	2.607%	0.331%	-2.277%	-87%	0.057%	0.002%	-0.056%	-97%
France	Free-N	5.152%	4.494%	-0.658%	-13%	0.093%	0.005%	-0.088%	-95%
Germany	Free-N	4.981%	2.794%	-2.187%	-44%	0.070%	0.002%	-0.068%	-97%
Greece	N&UR	0.103%	0.072%	-0.031%	-30%	0.038%	0.007%	-0.031%	-80%
Indonesia	- TB Free-TB	0.043%	0.005%	-0.038%	-89%	0.252%	0.193%	-0.059%	-24%
Ireland	Free-N	0.665%	0.079%	-0.586%	-88%	1.139%	0.018%	-1.120%	-98%
Italy	Free-N	3.300%	1.389%	-1.910%	-58%	0.031%	0.033%	0.002%	8%
Japan	UR - N&UR	1.458%	0.844%	-0.614%	-42%	0.020%	0.009%	-0.012%	-57%

Table 3–continued									
		Underlying in home country				ADRs Anywhere			
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Country	Nature of change	Less Restrictions	More Restrictions	Difference Col 2-1	Percentage Difference	Less Restrictions	More Restrictions	Difference Col 6-5	Percentage Difference
Netherlands	Free-N	3.839%	2.560%	-1.279%	-33%	0.277%	0.070%	-0.208%	-75%
Norway	Free-N	3.361%	1.648%	-1.713%	-51%	0.028%	0.000%	-0.028%	-100%
Portugal	Free-N	1.368%	0.522%	-0.846%	-62%	0.028%	0.000%	-0.028%	-100%
South Korea	N&UR - TB	0.510%	0.203%	-0.307%	-60%	0.386%	0.252%	-0.134%	-35%
Switzerland	Free-N	3.578%	2.535%	-1.044%	-29%	0.108%	0.029%	-0.079%	-73%
Taiwan	N&UR - TB	0.073%	0.022%	-0.052%	-70%	0.362%	0.257%	-0.105%	-29%
United Kingdom	Free-TB	2.604%	1.694%	-0.910%	-35%	0.129%	0.080%	-0.049%	-38%
Weighted Average		2.315%	1.277%	-1.039%***	-45%***	0.173%	0.055%	-0.118%**	-68%***
<i>t</i> values				(-6.15)	(-10.43)			(-1.97)	(-8.70)
Panel B. Scaled borrowing = Dollar value of shares borrowed / Firm's daily trading volume									
Weighted Average		42.65	15.01	-27.64	-65%***	6.64	3.85	-2.79***	-42%***
<i>t</i> values				(-1.09)	(-3.19)			(-3.40)	(-3.24)

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

For the third type of restriction, where countries shift from no ban to a complete ban (Free-TB), stock borrowing declines by 70% in the underlying market and 53% in the ADR market. For the fourth type of restriction, where countries shift from naked & uptick restriction to a complete ban (N&UR-TB), stock borrowing declines by 53% in the underlying market and 48% in the ADR market.

Finally, when countries shift from uptick restriction to a naked & uptick restriction (UR-N&UR), stock borrowing declines by 42% in the underlying market and 57% in the ADR market. Each of the five types of increases in the regulatory restrictions reduces short selling in both the underlying market and the ADR market simultaneously, consistent with the regulatory reach hypothesis.

4.4. Multivariate analysis of regulatory reach

In this section, we test the regulatory reach hypothesis in a multivariate setting by adding several firm-specific fundamentals or country characteristics. Both short interest and short volume data are analyzed. First, we estimate regressions based on all or a subset of the following equation using fortnightly short interest data from shortsqueeze.com:

$$\begin{aligned}
\text{scaled ADR short interest}_{i,ft} = & \alpha_0 + \alpha_1 \text{illegal}_{c,ft} + \alpha_2 \text{uptick restriction}_{c,ft} \\
& + \alpha_3 \text{option markets}_{c,yr} + \alpha_4 \text{enforcement index}_c \\
& + \alpha_5 \text{restrictions}_{c,ft} * \text{enforcement index}_c + \alpha_6 \text{fortnightly return}_{i,ft-1} \\
& + \alpha_7 \text{monthly return}_{i,ft} + \alpha_8 \text{half-yearly return}_{i,ft} \\
& + \alpha_9 \text{orthogonalized market capitalization}_i + \alpha_{10} \text{scaled volume}_{i,ft} \\
& + \alpha_{11} \text{dividend yield}_{i,ft} + \alpha_{12} \text{level of ADR}_i + \alpha_{13} \text{return volatility}_{i,ft} \\
& + \alpha_{14} \text{days to cover}_{i,ft} + \alpha_{15-18} \text{industrial sector fixed effects}_i + \varepsilon_{i,ft}
\end{aligned} \tag{2}$$

where α_0 – α_{18} are parameters to be estimated and ε is a random error term. Subscripts i, ft , c , and yr denote firm, fortnight, country, and year, respectively. See the Appendix for variable definitions and data sources. To ensure our regression results are robust to sector

classification effects, we include sector dummies in all models, which are generated using information sourced from Datastream.

In Table 4, we present our regression results with scaled ADR short interest as the dependent variable. The coefficient for illegal is negative and significant in all specifications.⁴ Thus, if it is illegal to short sell a stock in its home country, short selling also is reduced for that country's ADRs in the United States., which is evidence in favor of the regulatory reach hypothesis.

Enforcement index is included as a control variable because stricter enforcement with less corruption incentivizes traders to follow and implement short-selling rules more rigorously. We also use an interaction term between enforcement and short-selling restrictions because enforcement by itself is not very important if there are no restrictions in the home market. We expect the interaction term to be negative, but it is statistically insignificant.

The coefficients for the return variables are not significant in any of the three models. The negative and significant coefficient of orthogonalized market capitalization indicates that scaled short interest is lower for bigger firms, but we note that our raw data suggest that the unscaled short interest is higher for larger firms. The positive and significant coefficient for scaled volume indicates that scaled short interest is higher for firms with higher trading volume. The negative and significant coefficient for dividend yield indicates that short sellers do not maintain high open interest in high dividend paying firms.

⁴ The coefficient of illegal also is statistically significant at the 0.10 level or better if we use ordinary least squares standard errors, White's heteroskedasticity consistent errors, or errors clustered by firm and fortnight, by firm, by country and time, or by country.

Table 4

Regulatory reach of home country short selling restrictions on ADR short interest

For this table our sample comprises 1,035 ADRs present in the triangular intersection of the shortsqueeze.com dataset, Datastream, and the initial ADR list for the period November 2007 to October 2009. All of our variables are defined in the Appendix. Our dependent variable, Scaled ADR short interest, is the total short interest for firm i for fortnight ft , where number of shares outstanding for firm i is used for scaling. Our main independent variables are the dummy variables illegal and uptick restriction. The remaining independent variables are: option markets, enforcement index, restriction *enforcement index, fortnightly return, monthly return, half yearly return, orthogonalized market capitalization, scaled volume, dividend yield, level of ADR, return volatility, days to cover_(t-1), and sector fixed effects. Subscripts i , ft , c , and yr denote firm, fortnight, country, and year, respectively. All coefficients are standardized using the SAS proc reg stb option. Continuous variables are winsorized at the 1st and 99th percentiles. Statistical significance is based on double clustered standard errors along the firm and fortnightly time dimensions following Petersen (2009).

Dependent variable: Scaled ADR short interest $_{i,ft}$			
Variable	Model 2a	Model 2b	Model 2c
Intercept	0.0000	0.0000	0.0000
Illegal _{c,ft}	-0.0158** (-2.41)		-0.0141** (-2.05)
Uptick restriction _{c,ft}		-0.0198 (-1.42)	-0.0172 (-1.20)
Option markets _{c,yr}	0.0352* (1.66)	0.0288 (1.44)	0.0281 (1.41)
Enforcement index _c	0.0029 (0.12)	0.0036 (0.14)	0.0018 (0.07)
Restriction _{c,ft} * Enforcement index _c	-0.0013 (-0.05)	0.0087 (0.37)	0.0083 (0.36)
Fortnightly return _{i,ft-1}	-0.0002 (-0.03)	-0.0001 (-0.01)	-0.0001 (-0.02)
Monthly return _{i,ft}	0.0079 (0.70)	0.0074 (0.66)	0.0076 (0.67)
Half yearly return _{i,ft}	-0.0218 (-1.39)	-0.0209 (-1.33)	-0.0220 (-1.40)
Orthogonalized market capitalization _i	-0.0338*** (-3.28)	-0.0348*** (-3.38)	-0.0343*** (-3.33)
Scaled volume _{i,ft}	0.5535*** (9.09)	0.5535*** (9.10)	0.5534*** (9.10)
Dividend Yield _{i,ft}	-0.0402*** (-2.96)	-0.0418*** (-3.04)	-0.0411*** (-2.99)
Level of ADR (1-3) _i	0.1047*** (3.98)	0.1048*** (3.99)	0.1050*** (4.00)
Return volatility _{i,ft}	-0.0246** (-2.31)	-0.0274** (-2.53)	-0.0257** (-2.36)

Table 4—continued

Variable	Dependent variable: Scaled ADR short interest $i_{i,ft}$		
	Model 2a	Model 2b	Model 2c
Days to cover $_{i,ft-1}$	0.1556* (1.81)	0.1554* (1.81)	0.1555* (1.81)
Sector fixed effects	Yes	Yes	Yes
Adjusted R Square	0.3755	0.3754	0.3756
Number of Observations	24,235	24,235	24,235

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

There are three levels of ADRs and level III ADRs have the most stringent requirement for trading in the United States.⁵ We include the level of ADR as a control variable to see if short sellers are trading level III ADRs more than level I or II ADRs. We find the coefficient to be positive and significant, indicating more short selling for higher level ADRs. The negative and significant coefficient of return volatility indicates that short sellers do not want to maintain high open interest for volatile stocks. The positive and significant coefficient of days to cover indicates that traders are not deterred by the length of time that it might take to cover the aggregate short positions outstanding in the ADRs. Instead, our findings demonstrate that traders apply momentum strategies and short previously shorted stocks even more.

⁵ The 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 non-U.S. 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 United States from investors can do so through a level III ADR program by meeting standards similar to those for U.S. companies. In addition to ADRs that are freely traded, there are two types of restricted ADRs: 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 and b) Regulation S ADRs also can be used to raise capital but are not registered in the United States and can only be traded outside the United States by non-U.S. persons.

We continue to test the regulatory reach hypothesis using high frequency short volume data from FINRA and the BATS exchange. We aggregate the transaction quantity for each stock for each day to form stock-day observations for short selling volume. We estimate regressions based on all or a subset of the following equation:

$$\begin{aligned}
\text{scaled ADR short volume}_{i,d} = & \alpha_0 + \alpha_1 \text{illegal}_{c,d} + \alpha_2 \text{uptick restriction}_{c,d} \\
& + \alpha_3 \text{option markets}_{c,yr} + \alpha_4 \text{enforcement index}_c \\
& + \alpha_5 \text{restrictions}_{c,d} * \text{enforcement index}_c + \alpha_6 \text{return}_{i,d} + \alpha_7 \text{weekly return}_{i,d-1} \\
& + \alpha_8 \text{monthly return}_{i,d-1} + \alpha_9 \text{half-yearly return}_{i,d-1} \\
& + \alpha_{10} \text{orthogonalized market capitalization}_i + \alpha_{11} \text{dividend yield}_{i,d} \\
& + \alpha_{12} \text{level of ADR}_i + \alpha_{13} \text{return volatility}_{i,d} \\
& + \alpha_{14-17} \text{industrial sector fixed effects}_i + \varepsilon_{i,d}
\end{aligned} \tag{3}$$

where α_0 – α_{17} are parameters to be estimated and ε is a random error term.

We report the estimation results for equation 3 in Table 5 and find that these data largely serve to confirm the evidence presented in the previous table. For brevity, we focus the discussion on model 3c, where all variables are included.

The coefficient for illegal is negative and significant, indicating that higher levels of home country restrictions are associated with a lower level of short volume in the ADR market. The coefficient for uptick restriction, though negative in sign, is not statistically significant again, implying that its impact is not as strong as a ban on short selling. The coefficient of option markets is insignificant. The coefficient on enforcement index itself is positive and statistically significant, but the key testable implication of enforcement is in the interaction variable, which again is insignificant.

Table 5

Regulatory reach of home country short selling restrictions on ADR short volume

For this table our sample comprises 559 ADRs present in the FINRA and BATS datasets for the period August 2009 to January 2010. All of our variables are defined in the Appendix. Our dependent variable, scaled ADR short volume, is daily short volume for each firm i for each day d , where we use firm i 's total trading volume for scaling. Our main independent variables are the dummy variables illegal and uptick restriction. The remaining independent variables, defined formally in the Appendix, are: option markets, enforcement index, restriction* enforcement index, return, weekly return, monthly return, half yearly return, orthogonalized market capitalization, dividend yield, level of ADR, return volatility, and sector fixed effects. Subscripts i , d , c , and yr denote firm, day, country, and year, respectively. All coefficients are standardized using the SAS proc reg stb option. Continuous variables are winsorized at the 1st and 99th percentiles. Statistical significance is based on double clustered standard errors along the firm and fortnightly time dimensions following Petersen (2009).

Variable	Dependent variable: Scaled ADR short volume $_{i,d}$		
	Model 3a	Model 3b	Model 3c
Intercept	0.0000	0.0000	0.0000
Illegal $_{c,d}$	-0.0292* (-1.74)		-0.0272** (-2.02)
Uptick restriction $_{c,d}$		-0.0264 (-0.45)	-0.0216 (-0.37)
Option markets $_{c,yr}$	-0.0686** (-2.30)	-0.0738 (-1.56)	-0.0769 (-1.60)
Enforcement index $_c$	0.1469** (2.34)	0.1477** (2.33)	0.1460** (2.31)
Restriction $_{c,d}$ * Enforcement index $_c$	0.0690 (1.42)	0.0831 (1.56)	0.0809 (1.54)
Return $_{i,d}$	0.0220** (2.12)	0.0222** (2.13)	0.0221** (2.11)
Weekly return $_{i,d-1}$	0.0382* (1.84)	0.0388* (1.88)	0.0385* (1.86)
Monthly return $_{i,d-1}$	-0.0543 (-0.87)	-0.0542 (-0.87)	-0.0542 (-0.87)
Half yearly return $_{i,d-1}$	0.0196 (0.32)	0.0171 (0.27)	0.0184 (0.29)
Orthogonalized market capitalization $_i$	-0.0436 (0.00)	-0.0445 (0.00)	-0.0438 (0.00)
Dividend Yield $_{i,d}$	-0.0146 (-0.72)	-0.0130 (-0.65)	-0.0143 (-0.71)
Level of ADR (1-3) $_i$	0.0101 (0.23)	0.0152 (0.36)	0.0125 (0.30)
Return volatility $_{i,d}$	0.0955*** (2.89)	0.0967*** (2.91)	0.0958*** (2.89)
Sector fixed effects	Yes	Yes	Yes

Table 5–continued			
Variable	Dependent variable: Scaled ADR short volume i,d		
	Model 3a	Model 3b	Model 3c
Adjusted R Square	0.042	0.0416	0.0422
Number of Observations	27,209	27,206	27,206

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

The positive and significant coefficients for shorter term return variables are consistent with prior studies that characterize short sellers as contrarian traders who short stock when it experiences a significant price appreciation (Diether, Lee, and Werner, 2009; Jain, Jain, and McNish, 2012). The effect of the monthly and half-yearly returns on short volume is found to be insignificant. Coefficients for firm size, dividend yield, and ADR level are insignificant. Stock volatility has a positive coefficient in the volume regression, whereas it had a negative coefficient in the short interest regression. Thus, volatility induces short sellers to become active, but they are quick to cover their positions for such stocks, driving down the short open interest.

Our conclusions about the impact of home country regulations on ADRs using both fortnightly short interest data and high frequency FINRA short volume data are qualitatively similar, which is not surprising given the statistically significant positive correlation of 0.76 between these two alternative dependent variables. To estimate this measure, we sum the FINRA short volume to calculate fortnightly short volume, and, then we calculate the correlation between the two fortnightly variables. Overall, our results support the regulatory reach hypothesis.

4.5. Reverse regulatory reach

So far, we have analyzed the reach of home market restrictions on short selling of ADRs in the United States. However, the United States itself temporarily banned short

selling of financial stocks on Sept. 19, 2008. In this section, we test if there is regulatory reach in the reverse direction, i.e., we investigate the effects of short selling restrictions in the United States on stock borrowing for U.S. financial firms outside U.S. markets.

In Table 6, we present the results of an event study around the U.S. short ban period where we analyze the stock borrowing for U.S. stocks in domestic and foreign locations. We compute the changes in these variables from the period one month before to the period one month after Sept. 19, 2008. We find that the ban reduced scaled stock borrowing for the affected firms by 20% within the United States. There is no evidence of any regulatory arbitrage where traders moved their activity to foreign jurisdictions. Instead the evidence points to reverse regulatory reach of U.S. regulations in foreign locations; stock borrowing for U.S. firms reduced by 70% in foreign locations. Reverse regulatory reach applies to U.S. banks as well as to non-banking financial firms.

Additional insights into the issue of reverse regulatory reach for U.S. financial stocks borrowed in foreign locations may be obtained by estimating the following multivariate regression:

$$\begin{aligned}
 \text{scaled shares borrowed in foreign locations}_{i,d} = & \alpha_0 + \alpha_1 \text{illegal}_d \\
 & + \alpha_2 \text{option markets}_i + \alpha_3 \text{return}_{i,d} + \alpha_4 \text{weekly return}_{i,d-1} + \alpha_5 \text{monthly return}_{i,d-1} \\
 & + \alpha_6 \text{half-yearly return}_{i,d-1} + \alpha_7 \text{scaled volume}_{i,d} + \alpha_8 \text{dividend yield}_{i,d} \\
 & + \alpha_9 \text{return volatility}_{i,d} + \alpha_{10} \text{stock borrowing cost}_{i,d} + \varepsilon_{i,d}
 \end{aligned} \tag{4}$$

where α_0 – α_{10} are parameters to be estimated and ε is a random error term.

Subscripts i and d denote firm and day, respectively.

Table 6

Impact of SEC's temporary short selling ban on stock borrowing within the United States and outside the United States

We analyze the period one month before and one month after Sept. 19, 2008, when the SEC imposed a temporary short selling ban for 799 financial firms. Of these, 539 firms have stock borrowing information in Data Explorers. We analyze scaled borrowing, which is outstanding stock borrowing for each firm i on day d , scaled using each firm's market capitalization. Scaled borrowing for the firms in the United States before the ban period (during the ban period) is reported in column 1 (2). Scaled borrowing for the firms outside the United States before the ban period (during the ban period) is reported in column 5 (6). In column 3 (7), we present column 2 minus 1 (6 minus 5). In column 4 (8), we present the values in column 3 (7) converted to percentages.

	Scaled borrowing = \$ Shares borrowed / Market Capitalization							
	In U.S. - Domestic stocks or ADRs				Domestic stocks outside U.S./Underlying in Home country			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Before Ban	Ban	Col 3-2	Percentage Difference	Before Ban	Ban	Col 3-2	Percentage Difference
Overall	3.248%	2.590%	-0.657%***	-20%	0.051%	0.015%	-0.036%*	-70%
<i>t</i> -stat			(13.77)				(1.68)	
Commercial Banks	3.890%	3.210%	-0.680%	-17%	0.122%	0.027%	-0.095%	-78%
Saving Institutions and other Banks	1.855%	1.446%	-0.410%	-22%	0.000%	0.001%	0.001%	0%
Banks	2.956%	2.400%	-0.556%	-19%	0.085%	0.019%	-0.066%	-78%
Insurance Carriers	2.984%	2.227%	-0.757%	-25%	0.052%	0.016%	-0.036%	-69%
Other Non Banks	4.828%	3.773%	-1.055%	-22%	0.013%	0.011%	-0.002%	-17%
Non - Banks	4.011%	3.088%	-0.923%	-23%	0.030%	0.013%	-0.017%	-57%
ADRs	0.065%	0.040%	-0.025%	-38%	2.004%	1.282%	-0.723%	-36%

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

In this regression, the illegal dummy has a value of 1 during the period of the temporary ban on short selling in the United States from Sept. 19, 2008 to Oct. 8, 2008, and 0 otherwise. The option market dummy has a value of 1 if the stock is optionable and 0 otherwise. All variable definitions and data sources are shown in the Appendix. The results are presented in Table 7 and reveal that the coefficient for illegal is negative and significant. This suggests that where short selling is temporarily banned in the United States for a given firm, stock borrowing for that firm also is reduced in foreign locations. Thus, these results indicate that U.S. regulations also have regulatory reach, which we call reverse regulatory reach to aid clarity. The coefficient of option markets is positive and significant, implying a complementary relationship between shorting and derivatives. The coefficients for the return variables are not statistically significant as are the coefficients for scaled volume, return volatility and stock borrowing cost variables. The negative and significant coefficient for dividend yield indicates that stock borrowing is lower for dividend payers.

Overall, our results reject the regulatory arbitrage hypothesis and support the regulatory reach hypothesis, including reverse regulatory reach. To provide further insights into these relationships, we now proceed to consider the mechanisms of regulatory reach.

4.6. Mechanisms of regulatory reach

We have grouped the possible mechanisms of regulatory reach into two main categories—inter-government cooperation and investor conduct. On the one hand, discussion groups such as the G7, EU, and OECD as well as bilateral investment treaties

Table 7

Reverse regulatory reach of U.S. short selling restriction outside the United States

For this table our sample comprises 168 domestic U.S. firms that have borrowings outside the United States during July 2006 to January 2010. All of our variables are defined in the Appendix. The dependent variable, scaled shares borrowed in foreign locations, is outstanding stock borrowing for each firm i for each day d , from Data Explorer, scaled by each firm's market capitalization in the home market. Our main independent variable is the dummy variable illegal. The remaining independent variables are: option, return, weekly return, monthly return, half yearly return, scaled volume, dividend yield, return volatility, and borrowing cost. Subscripts $i, d, c,$ and yr denote firm, day, country, and year, respectively. All coefficients are standardized using the SAS proc reg stb option. Continuous variables are winsorized at the 1st and 99th percentiles. Statistical significance is based on double clustered standard errors along the firm and fortnightly time dimensions following Petersen (2009).

Variable	Dependent variable: Scaled shares borrowed in foreign locations $_{i,d}$
Intercept	0.0000
Illegal	-0.0093** (-2.36)
Option $_i$	0.1623* (1.87)
Return $_{i,d}$	-0.0003 (-0.10)
Weekly return $_{i,d-1}$	-0.0007 (-0.08)
Monthly return $_{i,d-1}$	0.0068 (0.47)
Half yearly return $_{i,d-1}$	0.0056 (0.12)
Scaled volume $_{i,d}$	0.0257 (1.04)
Dividend Yield $_{i,d}$	-0.1178* (-1.65)
Return volatility $_{i,d}$	-0.0024 (-1.59)
Borrowing cost $_{i,d}$	0.0004 (0.03)
Adjusted R Square	0.0466
Number of Observations	13,229

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

between countries, facilitate the implementation of regulatory intent through cross border recognition of laws by enforcement agencies and courts. On the other hand, investors' own behavior is influenced by an adherence to ethical practices such as those mentioned in the CFA standards of ethical and professional conduct, or conservative business practices driven by a desire to build an honest reputation. In the analysis that follows, we discriminate between these two different reasons. We proxy the mechanism of inter-government cooperation by using information on the originating country's membership in G7, EU, or OECD groups and more formal bilateral investment treaties (BITs) between countries. For the investor conduct mechanism, we have two proxies, concentration of CFA charter holders in the finance industry and the institutional infrastructure for stock borrowing. Neither of these two variables emanates directly from the short selling statutes, but both relate to the inherent desire of traders to do things in the right manner. We expect that CFA charter holders follow the professional conduct of knowing laws in different jurisdictions and adhering to the stricter law regarding short selling restrictions. Likewise, if institutions follow the spirit of the restrictions on short trades, they reduce their stock lending operations even though the law may not prohibit lending itself.

This analysis is based only on the observations where short selling is illegal in the home country (illegal =1) because we are interested in assessing the reach of regulatory restrictions, not the reach of regulatory freedom. Consequently, the illegal variable is not included in the regression model. The dependent variable is the scaled ADR short interest and the independent variables capture information on the possible mechanisms of regulatory reach as well as a number of control variables similar to those used previously:

$$\begin{aligned}
& \text{scaled ADR short interest}_{i,ft} = \alpha_0 + \alpha_1 G7_c + \alpha_2 EU_c + \alpha_3 OECD_c \\
& + \alpha_4 \text{Group (G7/EU/OECD)}_c + \alpha_5 \text{Bi-lateral investment treaty with U.S.}_c \\
& + \alpha_6 \text{CFA/Population}_c + \alpha_7 \text{option markets}_{c,yr} + \alpha_8 \text{enforcement index}_c \\
& + \alpha_9 \text{fortnightly return}_{i,ft-1} + \alpha_{10} \text{monthly return}_{i,ft} + \alpha_{11} \text{half-yearly return}_{i,ft} \\
& + \alpha_{12} \text{orthogonalized market capitalization}_i + \alpha_{13} \text{scaled volume}_{i,ft} \\
& + \alpha_{14} \text{dividend yield}_{i,ft} + \alpha_{15} \text{level of ADR}_i + \alpha_{16} \text{return volatility}_{i,ft} \\
& + \alpha_{17} \text{days to cover}_{i,ft} + \alpha_{18-21} \text{industrial sector fixed effects}_i + \varepsilon_{i,ft} \tag{5}
\end{aligned}$$

where α_0 – α_{21} are parameters to be estimated and ε is a random error term. Subscripts i, ft, c , and yr denote firm, fortnight, country, and year, respectively. See the Appendix for variable definitions and data sources. We present our analysis of these mechanisms in Table 8, which presents the regression results. The first six models are regression equations that individually test our different measures of the mechanisms of regulatory reach. We find that the coefficients for the measures of inter-government cooperation are all negative and generally significant (only the coefficient for the bilateral investment treaty with the United States is insignificant in these stand-alone regressions). Further the CFA/Population investor conduct variable is statistically significant and negative (-0.2074 in model 6). Taken together, these results suggest that both inter-government cooperation and investor conduct are effective mechanisms of regulatory reach. The final model (7) presented in Table 8 includes the group (G7/EU/OECD), bilateral investment treaty, and the CFA/Population variables. The coefficient for bilateral investment treaty is negative but statistically significant. The group variable again has a negative sign, but is

no longer significant.⁶ Finally, the CFA/Population investor conduct has a statistically significant negative coefficient in both combined regression and stand-alone regression.

The proportion of CFA charter holders is a good proxy for investor conduct not only because of their strong emphasis on high standards of ethics and professional conduct, but also because obtaining a CFA charter is a personal educational decision largely independent of the inter-government cooperation among countries. Nonetheless, we also orthogonalize this investor conduct proxy to make it statistically independent of the inter-government cooperation in a two-step regression. For the sake of brevity, we choose not to report these results, however, we do note that the coefficient for the orthogonalized CFA variable is significantly negative, indicating that investor conduct is a driving force behind the regulatory reach of foreign laws. Legal restrictions in the home market limit the shares institutions make available for borrowing, aiding regulatory reach. We test and confirm this in the data where a regression of scaled shares available to borrow on the illegal variable produces a negative coefficient for illegal variable.⁷ Thus, when a country bans short selling, fewer shares of that country's stocks are available worldwide for short sellers to borrow, which again results in short sellers being less aggressive.

⁶ We also use executive membership of International Organization of Securities Commissions (IOSCO) as an additional proxy for inter-government cooperation. We find the coefficient of the IOSCO dummy variable to be insignificant both with and without any control variables.

⁷ The results are not tabulated for brevity but are summarized in the following equation. Scaled shares available to borrow worldwide_{i,d} = 0.0000 (Intercept) - **0.0811** Illegal_{c,d} + **0.6790** Uptick restriction_{c,d} + **0.0259** Option markets_{c,yr} - 0.0012 Return_{i,d} + **0.0156** Weekly return_{i,d} - Monthly return_{i,d} + 0.0194 Half yearly return_{i,d} + **0.0858** Scaled volume_{i,d} - **0.0476** Dividend Yield_{i,d} - 0.0339 Return volatility_{i,d} - **0.0422** Borrowing cost_{i,d} - 0.0035 Days to cover_{i,d-1} + Sector fixed effects + ε_{i,d} where bold indicates significance at the 0.10 level or better using double cluster standard errors. *Shares available to borrow worldwide* is the value of current inventory available from beneficial owners for loans scaled by market capitalization of the firm.

Table 8

Mechanism of regulatory reach of home country short selling restrictions on ADR short interest

For this table our sample comprises 196 ADRs for which illegal equals one, which is a subset of the 1,035 ADRs present in the triangular intersection of the shortsqueeze.com dataset, Datastream, and the initial ADR list from November 2007 to October 2009. Our dependent variable, scaled ADR short interest, is total short interest for firm i for fortnight ft , scaled by each firm's shares outstanding. Our main independent variables are G7, EU, OECD, Group (G7/EU/OECD), Bilateral investment treaty with United States, and CFA/ Population. The remaining independent variables are: option markets, enforcement index, fortnightly, monthly, and half yearly returns, orthogonalized market capitalization, scaled volume, dividend yield, level of ADR, return volatility, days to cover $_{(t-1)}$, and sector fixed effects. Subscripts i , ft , c , and yr denote firm, fortnight, country, and year, respectively. All coefficients are standardized using the SAS proc reg stb option. Continuous variables are winsorized at the 1st and 99th percentiles. Statistical significance is based on double clustered standard errors along the firm and fortnightly time dimensions following Petersen (2009).

Variable	Dependent variable: Scaled ADR short interest i,ft						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Intercept	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
G7 $_c$	-0.0518** (-2.41)						
EU $_c$		-0.0865** (-2.58)					
OECD $_c$			-0.1352* (-1.81)				
Group (G7/EU/OECD) $_c$				-0.1372* (-1.83)			-0.1226 (-1.37)
Bilateral investment treaty with U.S. $_c$					-0.0672 (-1.38)		-0.1068** (-1.97)
CFA/Population $_c$						-0.2074*** (-2.80)	-0.0807* (-1.93)
Option markets $_{c,yr}$							0.1334 (1.16)
Enforcement index $_c$							-0.0451 (-0.47)

Table 8–continued

Variable	Dependent variable: Scaled ADR short interest $i_{i,ft}$						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Fortnightly Return $_{i,ft-1}$							0.0070 (0.52)
Monthly return $_{i,ft}$							-0.0028 (-0.15)
Half yearly return $_{i,ft}$							-0.0015 (-0.07)
Orthogonalized market capitalization $_i$							-0.0096 (-0.22)
Scaled volume $_{i,ft}$							0.7712*** (4.05)
Dividend Yield $_{i,ft}$							0.0033 (0.14)
Level of ADR (1-3) $_i$							0.0054 (0.10)
Return volatility $_{i,ft}$							-0.0356* (-1.71)
Days to cover $_{i,ft-1}$							0.0936*** (2.66)
Sector fixed effects							Yes
Adjusted R Square	0.0023	0.0071	0.0179	0.0184	0.0041	0.0426	0.6844
Number of Observations	2,389	2,389	2,389	2,389	2,389	2,389	1,197

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

4.7. Robustness tests

We find that the negative coefficient on illegal in the regulatory reach regression of scaled ADR short interest is robust to alternative model specifications and subsamples. For the sake of brevity, we do not formally tabulate these results, but instead choose to summarize our findings in this section. In this discussion of robustness tests, the benchmark value for the coefficient of illegal is -0.0158 from model 2a of Table 4.

First, we estimate the regression with unscaled dollar short borrowing without adjusting for the number of shares outstanding. The coefficient of illegal is -0.0370, which suggests a slightly stronger regulatory reach on dollar borrowing than on borrowing ratio. Second, we estimate the scaled borrowing regression using a smaller sample of only level III ADRs, which are subject to the most stringent U.S. securities regulations and trade alongside other U.S. stocks on the main stock exchanges. The coefficient of illegal is -0.0073, implying that even level III ADRs are affected by home country short selling regulations. Third, we control for institutional ownership, which has a positive relation with short selling, consistent with prior research. Due to limited data availability, when we add institutional ownership as the only control variable in the regression, the sample size still drops dramatically from 24,235 in Table 4 to 9,758. This does not change the tenor of our results however, as the coefficient of illegal remains negative (-0.0427) and statistically significant. The coefficient for institutional ownership itself is 0.2352 and statistically significant; the positive coefficient is consistent with D'Avolio (2002) and Asquith, Pathak, and Ritter (2005) who argue that higher institutional ownership positively affects short selling by increasing the supply of loanable shares. Our fourth robustness test is based on an alternative definition of days to

cover (DTC). In our main analysis presented in Table 4, we use DTC in the ADR market. DTC_h for the home market cannot be computed directly from home country borrowing data. Furthermore, DTC_h cannot be computed if a country banned short selling related stock borrowing in the home markets. Keeping in mind those limitations, we compute a surrogate home market DTC_h defined as stock borrowed divided by daily home country trading volume. With short interest as the dependent variable, the coefficient on home country DTC_h is insignificant in double clustered regressions. However, the coefficient of illegal remains statistically significant with a negative value of -0.0181. The coefficient for illegal remains statistically significant and negative also if we drop DTC from the regressions.

Next, we test the regulatory reach hypothesis for the three sub-periods before, during, and after the 2008 financial crisis. We estimate these four models with unscaled short interest as the dependent variables. The estimated coefficients for the illegal variable are negative and statistically significant in all three regressions ranging from -0.0677 to -0.0272, compared with the overall period coefficient of -0.0370. Similarly, home country short selling restrictions have a negative impact on scaled short interest, both including and excluding the crisis period. The results indicate that restrictions curtail short selling in the ADR markets and that the financial crisis did not materially change the phenomenon of regulatory reach.

Finally, we perform a control sample analysis to ensure that negative coefficient on illegal is based on regulatory reach of home country restrictions and not on any confounding factors within the United States that would affect all domestic stocks as well as the ADRs. We match each ADR with a non-ADR domestic U.S. stock. Our matching

criteria include industry, exchange listing, price-to-book value (PTBV), and market capitalization.⁸ Short selling of U.S. stocks is not expected to be affected by changes in the legality of short selling abroad for the matched stocks. We exclude the period when short selling is restricted in the United States. ADR stocks are similar to the matched control sample of U.S. stocks except that some ADRs originate from a home country with short selling restrictions whereas others originate from unrestricted countries. Using this control sample, we estimate a regression with scaled short interest as the dependent variable.⁹ The illegal variable in this model is interacted with the indicator variables for ADRs (treatment stocks) or domestic stocks (matched control sample). We find that the home country regulations reach out in lowering the ADR short interest (with a negative coefficient of -0.0516 that is statistically significant at the 0.01 level); however, those regulations appear to have no impact on short interest of matched non-ADR domestic U.S. stocks (the coefficient 0.0250 is not significant even at the 0.10 level).

Thus, the additional analysis discussed in this sub-section indicates that our results on regulatory reach are robust for different specifications and sub-samples.

⁸ For the Price to Book Value for ADRs (Non-ADR domestic U.S. firms) the means are 3.13 (3.13) and the standard deviations are 6.81 (5.91). For the Ln Market value for ADRs (Non-ADR domestic U.S. firms) the means are 7.80 (7.35) and the standard deviations are 1.99 (1.79).

⁹ The results are not tabulated for brevity but the regressions estimates can be summarized as follows: Scaled short interest_{i,ft} = 0.0000 Intercept - **0.0347** Illegal_{c,ft}*ADR + 0.0190 Illegal_{c,ft}*Non ADR domestic U.S. stocks - 0.0153 Uptick restrictions_{c,ft} - 0.0558 Option markets_{c,yr} + **0.0577** Enforcement index_c + 0.0188 Restriction_{c,d} * Enforcement index_c + 0.0002 Fortnightly return_{i,ft-1} - 0.0052 Monthly return_{i,ft} - **0.0236** Half yearly return_{i,ft} + **0.0043** Orthogonalized market capitalization_{i,ft} + **0.3808** Scaled volume_{i,ft} - 0.0307 Dividend yield_{i,ft} - 0.0298 Return volatility_{i,ft} + **0.2931** Days to cover_{ft-1} + Industry fixed effects + ε_{i,ft} where bold indicates significance at the 0.10 level or better.

Chapter 5

Summary and conclusions

In this paper, we provide the first comprehensive characterization of the worldwide market for short selling and stock borrowing using several datasets that capture short selling regulations, actual short selling, and outstanding short interest in stocks from 82 countries. The theme of our paper is the examination of global regulatory reach of short selling restrictions in a multimarket environment.

The first issue that we address is whether restrictions on short selling in a given country are effective in reducing short-selling-related borrowing. Our results suggest that short selling regulations reduce borrowing in the home country by 45%, on average.

Next, we examine whether home country restrictions on short selling reduce short selling of ADRs in the United States, 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 home country, there is greater short selling in the United States of the ADRs from that country due to short sellers’ efforts to circumvent the home country regulations. Using data from shortsqueeze.com, FINRA, BATS, and Data Explorers, we find support for the regulatory reach hypothesis in cross-sectional, event study, and panel-data tests. Due to the regulatory reach of home country short selling restrictions, stock borrowing for the affected ADRs drops by 68%, on average, in the United States. Similarly, in a multivariate regression of scaled short interest, the statistically significant negative coefficient again supports our regulatory reach hypothesis. Our results are robust to differences in firm specific characteristics, such as option market availability, past returns, firm size, trading volume, dividend yield, return

volatility, days to cover, level of ADR, and industrial sectors. We also document a reverse regulatory reach for the SEC's temporary short selling ban on shorting 799 financial stocks in 2008, which reduced stock borrowing for these firms both within and outside the United States.

Various mechanisms can cause home market regulations to have a strong global regulatory reach and we consider two possible mechanisms—inter-government cooperation and investor conduct. Inter-government cooperation can work through working groups such as G7, OECD or EU or bilateral investment treaties. Investor conduct is influenced by professional standards of bodies such as CFA institute or institutional unwillingness to conduct stock lending when short selling is illegal. Our results indicate that investor and institutional conduct strengthens regulatory reach more than membership in working groups or treaties.

Our paper contributes to the short selling and cross listing research with two main findings. First, restrictions on short selling in a given country are effective in reducing short-selling-related borrowing in that country. Second, from the investors' point of view, cross listing in the United States is not a vehicle for circumventing regulatory control on short selling in the home country. Regulatory controls in the home country also stifle short selling of ADRs. An important implication of our regulatory reach findings is that the regulators appear to have a great ability to obtain desired investor protection outcomes with little sacrifice on business competitiveness front even in a fiercely competitive global economy. Additional cooperation and coordination among the global enforcement agencies can further strengthen regulatory reach.

Appendix

Variables definitions and data sources

Variable	Definition	Source
<u>Measures of short selling (dependent variables)</u>		
Shares borrowed	Total value of borrowed/loaned securities net of double counting, reported at daily frequency	Data Explorers
Total short interest	Total number of outstanding shorted shares for each ADR reported at fortnightly frequency	Shortsqueeze.com
Short volume	Aggregate number of shares sold short each day (computed from transaction level data)	Reg SHO data from FINRA and BATS exchange
<u>Regulatory measures</u>		
Illegal	Indicator variable that has value of 1 when short selling is banned in the home country and 0 when short selling is allowed	Bris, Goetzmann, and Zhu (2007), Charoenrook and Daouk (2008), Clifford Chance LLP. (2009), and for time series Beber and Pagano (2012) and direct correspondence with stock exchanges and regulators
Uptick restriction	Indicator variable that has value of 1 when short selling is restricted by price tests in the home country and 0 otherwise	Clifford Chance LLP. (2009) and stock exchanges websites
Restriction	Indicator variable that has value of 1 when short selling is restricted by any means such as total ban, ban on naked short selling, or price tests in the home country and 0 otherwise	Bris, Goetzmann, and Zhu (2007), Charoenrook and Daouk (2008), Clifford Chance LLP. (2009), and for time series Beber and Pagano (2012) and direct correspondence with stock exchanges and regulators

Appendix –continued

Variable	Definition	Source
<u>Country and market design variables</u>		
Option markets	Number of years for which the option markets have existed in a particular country	Charoenrook and Daouk (2008)
Option	Indicator variable that has value of 1 when the options for particular stocks are traded on CBOE, and 0 otherwise.	CBOE option trading list
Enforcement index (CPI)	Corruption Perception Index (CPI) ranks each country by its perceived level of corruption relating to bribery of public officials, kickbacks in public procurement, embezzlement of public funds, and effectiveness of public sector anti-corruption efforts. Higher numbers indicate stronger enforcement and lower numbers indicate corruption and lawlessness.	Transparency International http://www.transparency.org/policy_research/surveys_indices/cpi
G7	Indicator variable that has value of 1 for G7 countries.	
EU	Indicator variable that has value of 1 for European Union countries.	
OECD	Indicator variable that has value of 1 for OECD countries.	
Group (G7/EU/OECD)	Indicator variable that has value of 1 when the country is part of G7, EU, or OECD group.	
Bilateral investment treaty with U.S.	Indicator variable that has value of 1 when the country has signed a bilateral investment treaty with the United States	United Nations Conference on Trade and Development (UNCTAD)

Appendix –continued

Variable	Definition	Source
CFA/Population	Number of charterholders in the country divided by the population of that country	CFA institute member resources and www.worldatlas.com
<u>Firm-specific variables</u>		
Return variables		
Return (Daily or fortnightly)	Log (Return index _t)-log (Return index _{t-1}). For daily returns we substitute <i>d</i> for <i>t</i> . For fortnightly returns we substitute <i>ft</i> for <i>t</i> . The Return index is adjusted for dividends. These are essentially a firm's stock returns.	Datastream International
Weekly return	Log (Return index _{d-1})-log (Return index _{d-6}).	Datastream International
Monthly return	Log (Return index _{d-1})-log (Return index _{d-21}).	Datastream International
Half yearly return	Log (Return index _{d-1})-log (Return index _{d-121}).	Datastream International
Orthogonalized market capitalization	Market capitalization is a firm's share price multiplied by the number of ordinary shares outstanding in millions of USD at the beginning of our sample period. For table 4, we orthogonalized market capitalization by regressing it on shares outstanding and trading volume. For table 5, we orthogonalized market capitalization by regressing it on trading volume.	Datastream International
Scaled volume	For daily level borrowing data regressions, it is dollar value of trading volume on day <i>t</i> divided by market capitalization. For fortnightly short interest regressions, it is trading volume in terms of number of shares on the last day of fortnight divided by shares outstanding.	Datastream International

Appendix –continued

Variable	Definition	Source
Dividend yield	Dividend per share as a percentage of the firm's share price	Datastream International
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)
Return volatility	For daily regressions, it is intraday high price minus intraday low price divided by intraday high price. For fortnightly regressions it is fortnightly high price minus fortnightly low price divided by fortnightly high price.	Datastream International
Borrowing costs	Stock borrowing cost is value weighted average stock lending fee for all open loans expressed in undisclosed fee buckets 0-5 (0 indicates the cheapest to borrow). Stock borrower indirectly pays the lending fee to the stock lender. Basically the lending fee is an imputed cost; it is the amount of rebate in the interest paid by the security lender to the security borrower on cash collateral which borrower provides to the lender.	Data Explorers
Lagged days to cover (DTC)	Current short interest divided by average daily trading volume (ratio computed for previous day)	Shortsqueeze.com
Sector fixed effects	Dummy variables for Utility, Transportation, Financial, and Insurance sectors. Base case is the "Industrials" sector.	Datastream International

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