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January 8th, 2021
Via Electronic Mail
Secretariat to the Financial Stability Board
Bank for International Settlements
Centralbahnplatz 2
CH-4002 Basel
Switzerland
RE: Outsourcing and third-party relationships

To the committee:

This comment is intended to help provide context regarding the cross-border aspects of third-party oversight. It draws on my experience and research in the domain of securities regulation (see attachments). As the FSB report points out, third parties, their data, and their supply chain commonly reside in (multiple) foreign jurisdictions. Inevitably, this gives rise to jurisdictional conflicts will arise because no single supervisor can investigate and enforce compliance with local requirements. Indeed, one of the main conclusions of my own research is that, in cross-border settings, supervision cannot be imposed unilaterally by a supervisor, or selected by a firm. Instead, it is jointly determined by a firm and the regulators in the various jurisdictions where activities take place.

The discussion paper for public consultation, on Regulatory and Supervisory Issues Relating to Outsourcing and Third-Party Relationships mentions the current stop-gap solution: "contractual agreements with third parties grant to financial institutions (FIs), as well as to supervisory and resolution authorities, appropriate rights to access, audit and obtain information from third parties." Although contracting parties may have good intentions, such contracts must be viewed skeptically. For the contract to succeed, one jurisdiction must intrude on another. In practice, cross-jurisdictional legal conflicts are likely to render these contractual agreements useless (both for FIs and supervisors). Ultimately, this curtails supervisors' ability to anticipate, investigate, and mitigate third party risks.

Establish cooperative relationships with foreign supervisors

One solution pursued by securities regulators is to establish cooperative protocols between counterparts in relevant jurisdictions. It has taken decades and a monumental effort to made progress toward this goal. Indeed, securities regulators have achieved noteworthy success, and it may be possible to leverage the existing framework of instruments like the IOSCO MMoU in a supervisory context. However, for supervisors, this may not be as viable given that in many countries, supervisors and securities regulators are not one in the same (making the MMoU more difficult or impossible to use). Also, third parties may reside in jurisdictions that are not currently MMoU signatories. Note that, to resolve the problem, supervisors may need to achieve near universal participation. And, as more jurisdictions enter a state of cooperation with an ever-growing network of supervisors, the benefits of *non-participation* also increase (third parties may prefer the absence of oversight, and seek out jurisdictions like off-shore financial havens accordingly). Thus, it potentially encourages regulatory arbitrage, where third-parties are

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successively shepherded into more opaque and uncooperative jurisdictions (a "race to the bottom" scenario).

Prespecify the locations that third parties (and their data repositories) can or cannot reside

With comparatively less effort, cross-border issues could be substantially improved if each jurisdiction were to identify a set of foreign jurisdictions with counterpart supervisory authorities that (i) provide adequate direct supervision of third parties (upon which a domestic regulator can rely), and/or (ii) can properly cooperate to jointly supervise the third parties in a coordinated fashion. Armed with such a list, supervisors could stipulate that only third-parties that reside and store data in approved jurisdictions are eligible to provide material third-party services.[1] This would allow them to concentrate on relationship with a more limited number of jurisdictions.

An important unintended consequence of improving regulation is that that supervisory authorities may stifle innovation in the third-party market for services. Furthermore, serious consideration should be given to the risk that cooperation consolidates power in ways that create other risks.

Overall, the FSB has an important opportunity to help standardize the cooperative process by establishing protocols and norms amongst supervisors. They should leverage the experiences of securities regulators who have been over a similar road. My research regarding the issues financial regulators encounter, the solutions they pursue, and the effects thereof may be useful.

I appreciate the opportunity to share my views with the FSB. If you have additional questions, please do not hesitate to reach out.

Sincerely,
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Attachment 1: Academic study - *Cross-border cooperation between securities regulators*
Attachment 2: Academic study - *Does regulatory cooperation help integrate equity markets?*

[1] One apparent downside to this approach is that it will also create a roadmap for fraudulent activity, in the sense that banks or third parties seeking to avoid oversight know which jurisdictions they should avoid.

Does regulatory cooperation help integrate equity markets?

By Roger Silvers*

Forthcoming *Journal of Financial Economics*

Abstract: This study tests whether cooperation between securities regulators influences global market integration. I measure cooperation using arrangements between securities regulators that enable enhanced cross-border enforcement, better regulatory decisions, and reduced compliance obligations for cross-border activities. These arrangements—formed at different times for different country pairs—are associated with an 11% increase in cross-border investment. I find similar increases using other proxies for market integration. Cross-border investment and market integration thus depend, in part, on regulators working together to extend legal and institutional capacities across borders. This reframes our understanding of the role of institutions in global capital markets.

Keywords: cross-border cooperation, regulatory networks, market integration, capital mobility

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1. Introduction

Theory shows that global integration of capital markets provides important benefits. Cross-border investment helps firms raise more capital at lower costs while allowing investors to diversify their portfolios and access higher yields than in domestic markets (Grauer et al. 1976; Errunza and Losq 1985; Alexander et al. 1987). Yet investors overinvest in local assets and underinvest in foreign assets, leaving the benefits of international diversification partially unrealized, both for them and for firms (Karolyi and Stulz 2003). Multiple overlapping literatures have explored investors' reasons for forgoing the benefits of diversification. These literatures cite frictions such as capital controls, political risk, taxes, transaction costs, information asymmetry, and fear of expropriation.[1]

In domestic settings, securities regulators moderate many of these frictions as part of their mandate to facilitate capital formation, promote fair and liquid capital markets, and protect investors. In cross-border settings, however, regulators often cannot do this unilaterally. Effective regulatory requirements in one jurisdiction may, in conjunction with another country's requirements, prove burdensome, duplicative, and costly. In foreign jurisdictions, regulators have no legal right to acquire information or execute the tactics required for investigation and prosecution. As a result, they must rely on local authorities for assistance. In the past, regulators could expect little, if any, support from foreign counterparts, so the prospects for effective policy coordination or investigations were bleak. Wrongdoers who recognized cross-border regulatory gaps could easily exploit them to evade repercussions. Thus, even between two countries with effective local regulation, market integration may depend (in part) on resolving the regulatory frictions between them.

In this paper, I study whether cooperation between securities regulators resolves cross-border investment frictions and thereby enhances market integration. I evaluate the effects of regulatory cooperation on (i) aggregate cross-border ownership between country pairs, (ii) country-level integration, and (iii) firms' market-risk exposures to local and global indices in asset-pricing tests. To measure changes in cooperation policy, I exploit cooperative arrangements called memoranda of understanding (MoUs), which securities regulators use to address cross-border frictions. An MoU is a reciprocal statement of an intent to cooperate,

[1] Prior work frames global market integration in the context of asset pricing (Black 1974; Solnik 1974; Brennan et al. 1977; Stulz 1981; Dumas and Solnik 1995; Bekaert and Harvey 1995; Bekaert et al. 2002; Bekaert et al. 2011), cross-listing (Karolyi 2006; Lewis 2017), capital mobility (Feldstein and Horioka 1980; Gordon and Bovenberg 1996; Obstfeld and Taylor 2005; Bayoumi et al. 2015), foreign portfolio allocation (Adler and Dumas 1983; Stulz 1995; Brennan and Cao 1997; Portes and Rey 2005; Daude and Fratzscher 2008; Lane and Milesi-Ferretti 2008a, 2008b, 2017), home bias (French and Poterba 1991; Bekaert and Wang 2012; Coeurdacier and Rey 2013), and international capital flows (Chuhan et al. 1998; Alfaro et al. 2007; Edison and Warnock 2008; Coppola et al. 2019).

collaborate, and share information in connection with regulatory and enforcement issues. Though not legally binding, MoUs address cross-jurisdictional legal incompatibilities and enhance various regulatory tactics between the involved nations (without requiring harmonization or convergence). MoUs improve cross-border enforcement across a wide range of cases and countries (Silvers 2020a). The formation of each MoU marks a change in cross-border capacities for a pair of countries at a precise point in time, creating a complex treatment pattern that is staggered across time and country pairs. This unusual pattern helps me to identify the effect of cooperation policy. Regulators claim that MoUs enhance enforcement capacity, improve regulatory decisions (by leveraging shared experience), and reduce administrative costs, which in turn builds "investor confidence" in foreign investment (SEC 2010). Consistent with this claim, I find support for the view that cooperation resolves investment frictions and promotes market integration.

An obvious concern is that, like any institutional attribute, cooperative arrangements could arise out of an endogenous process. Typically, market forces dictate a regulator's policy agenda, and such forces may be the impetus for bilateral MoUs (arrangements that operate between only two countries). To help mitigate this issue, I draw my inferences solely from the International Organization of Securities Commissions' (IOSCO's) *Multilateral* Memorandum of Understanding (*M*MoU). Instead of being market-driven, the push to establish the *M*MoU came top-down from heads of state who were seeking ways to fight terrorism and terrorism-related money laundering following the events of 9/11. Prior research concludes that the country-pair links formed by the *M*MoU, unlike those of bilateral arrangements, are largely exogenous to investors, firms, and even regulators (Silvers 2020a). Another advantage to the *M*MoU is its wide participation, with 116 different countries forming a network of over 6,000 country-pair linkages as of January 2020. Thus, each signatory has 115 connections with counterparts, formed at different times from 2002 to the present.

Several factors affect the timing of a country's *M*MoU admission. The decision to join is generally dictated by geopolitical agendas over which market participants have minimal sway. Once this decision is made, the timing of admission depends on the country's willingness and ability to remedy issues that might disqualify it, such as arcane laws against information sharing with foreign authorities, or competence deficits. These issues exist in both sophisticated and unsophisticated regulators and create additional, seemingly random variation in the timing of admission. Unpredictability in the workloads of the applicant country's staff and of the *M*MoU verification team members introduces additional temporal

variation. Finally, a link between a given country pair is not formed until regulators from both countries are independently admitted to the *M*MoU network. Overall, these factors indicate that the *M*MoU linkages are plausibly exogenous with respect to markets.

My first analyses explore the effect of cooperation on market integration from the perspective of *investors*. Exploiting the staggered country-pair shocks created by the *M*MoU, I examine foreign portfolio investment (FPI). I use the IMF's Coordinated Portfolio Investment Survey (CPIS) from 2001 to 2017, which provides annual cross-border equity positions between pairs of countries (a *country-pair-year* unit of observation). The design compares time-series changes in FPI for a cooperating pair with time-series changes in FPI for a counterfactual benchmark (country pairs that share either the same investee or investor country as the treated pair). This is achieved using three-way fixed effects for (i) country pairs, to control for time-invariant country-pair characteristics; (ii) investee×time, to control for "pull" factors (unobserved changes in an invest*ee* country's economic conditions); and (iii) investor×time, to control for "push" factors (changes in outbound FPI that are common to all invest*ee* countries). This generalized difference-in-difference design also helps to rule out country-level omitted variables (e.g., laws, policies, domestic yields, or economic conditions), since these factors should affect investment to (or from) counterparts in a similar way. Bilateral MoUs capture the same theoretical construct as the *M*MoU but generate more endogeneity concerns, so I include them only as controls.

Although concerns about omitted variables and reverse causality cannot be ruled out, they are mitigated by the *M*MoU's elaborate network-formed linkage pattern and features of the research design. To bias the estimates, an omitted variable would have to affect the treated country pairs at the times they experience the shock but not affect the counterfactual country pairs (pairs that include either the same investee or investor country).[2]

Using Poisson pseudo-maximum likelihood (PPML) estimation (Gourieroux et al. 1984; Silva and Tenreyro 2006), I find that *M*MoU linkages are associated with an 11% increase in FPI, relative to the benchmark country pairs. This is consistent with regulatory cooperation resolving investment frictions that prevent investors from diversifying their portfolios across borders. The size of the effect is substantial. Over the sample period from

[2] Due to the multilateral nature of the *M*MoU, if a given country was enticed to enter by a single counterpart, the effect would be counteracted by 114 other linkages that are not subject to this bias. Thus, a single endogenous linkage would need to be of extraordinary magnitude to impart a substantial bias on the estimate. For multiple endogenous linkages to induce a bias, the linkages would need to map onto a very unique sequence and timing across country pairs. Neither possibility seems likely. Reverse causality (e.g., joining the *M*MoU in response to investment) also seems unlikely, as regulators would need to reverse engineer the alignment of multiple events (many of which occur in the future, and are thus beyond the applicant's control) to impart a bias on the estimate.

2001 to 2017, the average FPI across all countries is $16.8 trillion. Thus, the 11% FPI increase that is attributable to cooperation policy equates to roughly $1.8 trillion. The effects are statistically strongest where cooperation is expected to be most effective (e.g., between countries with developed markets) and are largest in magnitude where information and expropriation risks are pronounced (e.g., between country pairs that are geographically distant or include investor and/or investee countries with weak rule of law). The bulk (78%) of the observed effect occurs in the year of the treatment, and placebo tests indicate that the result is unique to the precise sequence and timing of the *M*MoU linkages.

In my second set of analyses, I explore whether the increase in FPI translates to measures of integration within an asset pricing model, this time using country-level tests based on the measure of Pukthuanthong and Roll (2009) (P&R, hereafter). P&R (2009) propose that a country's degree of global integration increases with the proportion of the country's market return variation explained by global factors. I use annual regressions of 54 countries' daily returns on global factors to yield R^2 values that serve as a *country-year* integration proxy. This country-year unit of observation serves as the dependent variable in my tests. Since integration is measured at the country-level, the tests cannot accommodate the pair-level shocks used in the FPI analyses and necessitate a modified definition of the treatment. Thus, I use the date that a country's securities regulator joins the *M*MoU as the treatment date, which creates a country-wide treatment. The treatment remains staggered because different countries join at different times (although it partially negates some of the design features relative to the within-country, staggered treatment used in the FPI tests).

Comparing the year before and year after the *M*MoU, I find that a country's level of integration increases by about 12%, on average, after the *M*MoU signing. To ensure that this result does not reflect countries' ordinary trend toward enhanced global integration or global shocks to integration that are common to all countries, I also estimate a panel that includes controls in the form of linear country time trends and fixed effects for country and year. Despite these additional controls, the estimated increase in integration persists. Cross-sectional tests indicate that the effects are larger in countries with code law and low rule of law. This suggests that cooperation is most influential in countries where institutional weaknesses expose investors to additional risks.

The third set of analyses take the perspective of the *firms* in my sample. I use asset pricing tests that regress *weekly firm-level returns* on a local and global market index, allowing risk exposures to change after a country's entrance into the *M*MoU (a country-

wide treatment, as defined above). The global sample represents 6,605 firms, both cross-listed and domestic, across 54 countries. I find an increase (decrease) in risk exposure to the world market (local market). The transfer in risk exposure from the local to the global market indicates enhanced integration (Bekaert and Harvey 1995). Cross-sectional tests indicate that larger firms in a given country experience a greater increase in integration. Country-level splits generally conform to the earlier tests (e.g., stronger results in countries with institutional weaknesses).

The final tests focus on cross-listed firms—firms that are listed in a foreign market. This allows me to redefine the treatment as the linkage between the firms' home and host market regulators via the *M*MoU (as it was in the FPI analyses). The "bonding hypothesis" proposes that a key reason why firms cross-list in foreign markets is to add firm value or enhance liquidity through adherence with incrementally better investor protection and disclosure standards in the host markets (Coffee 1999; Stulz 1999). By expanding regulators' cross-border capacities, cooperation could improve regulators ability to uphold standards for cross-listed firms, thereby strengthening the dynamic underlying the bonding hypothesis. Using the within-country staggered treatment for a global sample of 1,411 cross-listed firms across 221 distinct country pairs, asset pricing tests show evidence of increased integration when a cross-listed firm's home and host country regulators cooperate. Overall, the country- and firm-level market integration tests indicate that the changes in FPI that accompany cooperation increase market integration.

This study contributes to the literature in four ways. First, my findings support the notion that cooperation policy resolves investment frictions and integrates capital markets. My key finding—that cooperation positively impacts both firms and investors—advances several interrelated literatures on the frictions that lead investors to forgo the benefits of international diversification.

Second, this paper adds to a nascent literature on cooperation between securities regulators by demonstrating that the ramifications of cooperation are larger and broader than was previously known. Silvers (2020a) establishes that cooperation increases enforcement and enhances liquidity for firms cross-listed between participating countries. Lang et al. (2020) identify spillover effects in the form of within-country reallocations of ownership that favor US cross-listed firms. These papers focus on a limited universe of cross-listed firms and cannot provide insights into aggregate changes in cross-border investment, market integration, or market risk exposures. In contrast, this paper focuses on the *cross-*

country reallocation that takes place. It complements the earlier papers by showing that their findings are part of a more comprehensive shift in aggregate investment—one signifying increased integration even for non-cross-listed firms. Thus, the implications of my study apply to a broader set of firms.

Third, this paper is related to two additional strands of the economics and finance literatures. One of these strands stresses that a country's domestic institutional features define its suitability for foreign investment (Knack and Keefer 1995); the other portrays institutional features as a country-level phenomenon (LaPorta et al. 1998; Acemoglu et al. 2001; Glaeser et al. 2004; LaPorta et al. 2008). Although legal systems—and therefore property rights, contract enforcement, judicial quality, and securities regulation—are organized at the country level, my study reveals that institutional aspects defined at the *country-pair* level significantly influence cross-border investment.

Finally, this paper relates to the bonding hypothesis. Regulators' capacity to uphold standards for cross-listed firms depends largely on their cross-border enforcement capacity, which, in turn, depends on cooperation with foreign counterparts. Therefore, in practice, *interactive* coordination between securities regulators is a mechanism that determines how well a firm can bond to a foreign legal system. Thus, investors' level of protection and firms' access to and cost of cross-border financing depend not only on firms' decisions to cross-list but also on regulatory pairs' capacity and willingness to cooperate.

2. Motivation and related literature

By helping institutional features transcend territorial boundaries, cooperation can (i) enhance enforcement, (ii) improve regulatory decisions through learning and shared experiences, and (iii) reduce red tape. This increases "investor confidence" and makes investment more attractive to foreign investors (SEC 2010, p 4).

Absent appropriate enforcement of securities laws, investors face significant risks when investing abroad. Kang and Stulz (1997) note that investors consider risks arising from information asymmetry and political uncertainty in particular. Local investors' information advantages can lead to fraud and expropriation. Political uncertainty can result in the confiscation of, or troubles repatriating, foreign holdings. Both discourage foreign investment.

By promoting robust enforcement, cooperation between regulators can deter behaviors that unfairly take advantage of information asymmetry. Cooperation allows regulators to swiftly investigate insider trading, related-party transactions, cyberattacks,

market manipulation, front running, and clearing and settlement failures.[3] If a foreign firm is cross-listed or multinational, cooperation can ensure that the firm complies with applicable listing, auditing, and disclosure obligations. By resolving issues that prevent enforcement, cooperation deters abusive behaviors and allows for possible restitution if expropriation occurs. This makes investment more attractive to foreign investors.

Cooperation also allows regulators to benefit from a wider set of shared regulatory experiences. *M*MoU signatories meet regularly to deliberate both day-to-day issues and crises, and consult one another in IOSCO meetings, technical assistance programs, and ad hoc interactions. Consensus building among signatories allows them to understand and maintain international best practices. Leveraging shared experiences allows signatories to make their markets more suitable for FPI. For example, apt policies regarding foreign capital inflows help avoid excessive currency appreciations that destabilize the broader economy (and ultimately threaten the viability of foreign investment) (Prasad et al. 2007).

Cooperation often helps reduce regulatory red tape and complicated or duplicative requirements, both of which are particularly burdensome for international market participants.[4] For example, regulators can simplify compliance burdens on trade infrastructures by allowing ad hoc exemptions, modified requirements, or "substituted compliance" (the concept that the rules in a foreign jurisdiction, though technically different, provide a reasonable substitute for domestic requirements). By lowering the costs of foreign transactions for broker-dealers, central counterparties, transfer agents, and other back-end functions, regulators also reduce costs for investors transacting in foreign shares.

My focus on cooperation is based on the idea that cooperation will simultaneously resolve multiple frictions to foreign investment. Thus, I bypass a formal reckoning of the individual frictions responsible for fragmented markets. Enhanced enforcement should deter malfeasant behaviors, compensate harmed investors, and promote more symmetric information. Consultation between regulators should provide a richer set of experiences that help regulators arrive at better decisions. And reduced compliance costs should make

[3] As examples of tactics requiring assistance, consider acquiring records (banking, beneficial ownership, brokerage, telephone, purchase, travel); serving a defendant; contacting witnesses and deposing them or compelling their testimony; pursuing restraining orders that prohibit destruction of documents or halt flight risks; and identifying, freezing, and repatriating ill-gotten assets.

[4] This relates to a literature on regulatory harmonization. Prior work evaluates efforts to harmonize aspects of markets, including common currencies (like the European Monetary Union) (Bekaert et al. 2013; Larch et al. 2019; Glick and Rose 2016), accounting standards (Yu and Wahid 2014), and disclosure and insider trading laws (Christensen et al. 2016). However, harmonization is neither the stated goal nor the outcome of the *M*MoU. Instead, the *M*MoU promotes cross-border cooperation across regimes—even ones with very different legal procedures and regulatory frameworks. Thus, cooperation differs from harmonization.

ownership of foreign shares easier and less costly.[5]

Prior work recognizes the importance of institutional features at the country level (Hall and Jones 1999; Acemoglu et al. 2001; Alfaro et al. 2004). Yet the preceding discussion implies that, with respect to capital markets, cooperation is an important institutional feature—one that occurs at the *country-pair* level.

Only recently has the literature begun exploring cross-border cooperation between securities regulators, but the findings to date are broadly consistent with the discussion above. Silvers (2020a), the first empirical study of international cooperation between securities regulators, provides comprehensive institutional detail about the history of cooperation, including the progression of information sharing and the use of cooperative arrangements. Although cooperation can take place through numerous mechanisms, including ad hoc requests, letters rogatory, and Mutual Legal Assistance Treaties, Silvers (2020a) describes a host of problems with these methods. That paper instead argues that MoUs—and IOSCO's *M*MoU in particular—provide the main avenue for cooperation.

Silvers (2020a) finds that, after controlling for other factors, cross-border enforcement is about three times as likely after the *M*MoU connects two regulators. This is consistent with the anecdotal evidence of regulators, who indicate that the *M*MoU has revolutionized their cross-border capacities (IOSCO 2012).[6] Moreover, using share-level data, Silvers (2020a) shows that transaction costs decline for cross-listed shares (even relative to non-cross-listed firms from the same country) when the *M*MoU links the firms' home and host countries. This implies a reduction in the risks perceived, and/or costs borne, by liquidity providers. A related study by Silvers (2020b) demonstrates that US cross-listed firms' financial reporting becomes less opaque after the *M*MoU; this, too, is consistent with a decline in expropriation risks.

Focusing on US oversight of US cross-listings by firms from 27 countries, Lang et al. (2020) show that when the *M*MoU links the SEC to a foreign counterpart, funds in (unaffiliated) third-party countries free-ride on US oversight by shifting existing investment

[5] Certain political and solvency risks may also decline with the *M*MoU, since it is part of the Financial Sector Assessment Program (FSAP). The FSAP can influence IMF/World Bank lending, so risks that arise from the threat of sovereign defaults may contemporaneously decline, contributing to more suitable conditions for foreign investment.

[6] The US is not the only country that requests assistance through the *M*MoU. According to IOSCO (2017), out of the 3,330 cross-border requests for assistance in 2016, the top three requesting countries were France (374), the US (360), and the UK (329). Silvers (2020) reports that in 2017, the US securities regulator made only about 12.5% of the 4,803 total requests under the *M*MoU. Thus, US requests do not dominate the activities under the *M*MoU. Indeed, the *M*MoU "is a widely used arrangement," says Ashley Alder, chair of IOSCO and former head of the Hong Kong regulator (ESMA 2019).

out of non-US-cross-listed firms and into US-cross-listed firms from the same country. Their study is similar to this paper in that it documents investors' preference for more robust regulatory oversight, all else being equal. However, the authors' focus on spillover investor clientele effects and within-country reallocations neglects a potentially larger phenomenon: *cross-border* reallocations that increase cross-border capital mobility and market integration. Lang et al. conclude that the *M*MoU is not associated with net changes in cross-country investment; this implies that cooperation is a zero-sum game at the country level. They note, however, that their study is ill-suited to identify net cross-country investment behavior (the subject of my tests), because it cannot control for unobserved economic circumstances that could change the attractiveness of a given investee country (Lang et al. 2020, p. 28). Due to their study's different focus and approach, Lang et al. provide no insights about market integration, aggregate changes in cross-border investment, or market risk exposures.

My paper departs from prior studies by recognizing that the benefits of cooperation likely extend beyond cross-listed firms. Lang et al. (2020) and Silvers (2020b) focus exclusively on US oversight of US-cross-listed firms. However, I find that the effects of cooperation lead to enhanced demand for cross-border ownership of cross-listed and non-cross-listed firms alike.

3. FPI (Cross-border investment)

3.1 FPI: sample

The FPI (cross-border equity ownership) sample comes from the IMF's Coordinated Portfolio Investment Survey (CPIS), which provides a *country-pair-year* unit of observation. The CPIS identifies year-end cross-border positions in listed and unlisted equity securities (excluding any illiquid assets and direct investment), includes holdings in both cross-listed and purely domestic firms, and covers 88 investor and 203 investee countries annually for the years 2001–2017. The 2001–2017 time period excludes the many market liberalizations prior to the turn of the century. Not all country combinations are reported to the CPIS, so each year has a maximum of 15,355 pairs over a 17-year period (261,035 country-pair years).

Figure 1 shows that aggregate levels of equity investment throughout the sample period increase almost monotonically. Annual equity investment reaches a high of $30.5 trillion in 2017. The average level of FPI during the 17-year period is $16.8 trillion. Figure 2 provides a matrix of the sample investor and investee countries (described later in this section).

3.2 FPI: research design

In the empirical analyses, I am agnostic with respect to an "optimal" portfolio allocation (unlike in the home bias literature, which specifies the world market portfolio as the normative benchmark). Instead, I evaluate the association between cooperation and FPI. A positive association supports the hypothesis that cooperation remediates investment frictions that deter foreign investment.

As shown in Figure 2, the *country-pair-year* unit of observation can be viewed as a matrix of country-to-country investment (one matrix exists for each of the 17 sample years). In prior work on cooperation, this country-to-country matrix was sparsely populated due to the focus on cross-listed firms. In this paper, the broader focus on cross-listed *and* domestic (non-cross-listed) firms allows for a more fully populated sample of FPI. In addition to the obvious benefit of a larger sample, the extensive sample in this study enables a more sophisticated design that can tackle a variety of issues using numerous fixed effects and other controls. These include (a) country-pair fixed effects, to control for time-invariant country-pair factors that lead to different levels of investment between different country pairs; (b) investee×time fixed effects, to control for common increases in investment to a particular investee country (as might happen when a country becomes a more attractive investment target for economic reasons); (c) investor×time fixed effects, to control for an expansion in investment from a particular investor country that is common to all countries worldwide (as might happen when the investor country has excess capital and few or low-return domestic investment opportunities); and (d) linear time trends for each pair, to capture any temporal trends in FPI that are unique to the country pair.[7] The investee×time fixed effects largely remove changes due to investee-country-level economic circumstances, such as increases in FPI for a given investee country that are common to all investor countries. In combination with the investor×time fixed effects, they control for both "push" (outbound investment) and "pull" (inbound investment) factors (Griffin et al. 2004; Fratzscher 2012; Alderighi et al. 2019). I include the country-pair linear time trends because Bergstrand et al. (2015) argue that the estimated effects of economic agreements are biased by unobserved trends.

Finally, I account for factors that could alter the underlying economic relationship between two countries (and, in turn, affect FPI). I include trade agreements (from Hofmann et al. (2017)), tax treaties (from the International Bureau of Fiscal Documentation), and

[7] This design comports with the intuition in Anderson and van Wincoop (2003) that *relative* barriers determine bilateral interactions.

investment treaties (from the UNCTAD Investment Policy Hub).

Note that this is a generalized difference-in-difference design (Bertrand et al. 2004). The equation does not use the traditional treatment, post, and treatment×post indicators, because they are linear combinations of the more comprehensive fixed effects described above. The pair fixed effects also subsume all time-invariant cross-sectional characteristics, making it both unnecessary and impossible to include the variables that often appear in gravity models of trade, such as distance, common language, and colonial relationships (Tinbergen 1962). Similarly, the investor(ee)×time fixed effects make it unnecessary and impossible to include country-time variables such as GDP, market-wide returns, inflation, and other macroeconomic conditions. Thus, I isolate the *cross-border cooperation* aspect as opposed to any country-level factors that could accompany the *M*MoU (such as unobserved changes in economic circumstances that occur near in time to the *M*MoU).

Equation 1 below presents the coefficient of interest—λ_1—the indicator for the *M*MoU linkage. This coefficient captures the association between FPI and the *M*MoU after controlling for other factors (including bilateral arrangements). I estimate equation 1 using cross-border investment for country *i* in country *j* at the end of period *t* (denominated in US dollars).

$$(1) \quad Investment_{ijt} = \lambda_0 + \lambda_1 MMoU\ Link_{ijt} + \lambda_2 Bilateral\ MoU_{ijt} + \sum_{l=3}^{L} \lambda_l\ Pair\ time\ trends_{ij} + \sum_{i=L+3}^{I} \lambda_{it}\ Investor \times\ time\ FEs + \sum_{j=L+I+3}^{J} \lambda_{jt}\ Investee \times time\ FEs + \sum_{m=L+I+M+3}^{M} \lambda_m\ Investor \times Investee\ (country\ pair)\ FEs + \upsilon_{ijt}$$

Figure 2 shows the adjacency matrix for the country-pair observations in the sample. Investor countries are reported across the top and investee countries are reported on the left-hand side; each cell corresponds to a country pair. The figure is based on the actual sample countries from the CPIS survey. The CPIS covers investee countries more extensively than investor countries. For example, although Sri Lanka is observed as an investee country, it does not appear as an investor country because it does not report to the IMF's survey.

Note that Figure 2 also indicates the *timing* of the *M*MoU treatment across country pairs. Countries adopt the *M*MoU at different times, leading to the formation of multiple linkages for each new entrant: *n-1* new linkages occur as the n^{th} member joins the arrangement. To illustrate this variation in the timing of the linkages across country pairs, I organize the countries by the year they signed the *M*MoU on both the investor and investee dimensions (instead of alphabetical sorting). Cells with the same color represent country pairs that experience the treatment at the same time; cells with different colors represent

country pairs that experience the treatment at different times.

An association between the *M*MoU and inbound/outbound FPI would indicate that FPI conforms to a specific and fairly elaborate pattern of connections between country pairs. For example, Singapore's outbound investment into other countries, shown in Figure 2 in the vertical column "2005/SGP," indicates that the country formed 24 connections simultaneously upon joining the *M*MoU in 2005 and an additional 68 connections as future investee countries entered the network. Inbound investment *from* other countries *into* Singapore is represented by the horizontal "SGP" row. Singapore formed 23 connections upon joining and 42 more as future investor countries entered the network. Once again, the staggered nature of the treatment is evident from the different colors. *M*MoU-prompted changes in inbound and outbound FPI for pairs involving Singapore should occur in 2005 for Germany (DEU) and Belgium (BEL), in 2006 for Denmark (DNK), in 2007 for the Netherlands (NLD), in 2009 for Austria (AUT), in 2010 for Switzerland (CHE), and so forth. Thus, these arguably similar counterpart countries experience an offset timing of the treatment.[8]

3.3 FPI: empirical results

Recent research indicates that log-linear ordinary least square (OLS) estimates can impart substantial bias in the presence of heteroscedasticity and inconsistent estimates in the presence of many zero observations for the dependent variable (as is the case in my setting) (Silva and Tenreyro 2006). To deal with many zero observations and the heteroscedasticity they create, Silva and Tenreyro (2006) present a computationally feasible solution that uses Poisson pseudo-maximum likelihood (PPML) estimation. PPML, a consistent estimator that is naturally bounded at zero, allows for high-dimensional fixed effects. It uses dollars of FPI as a natural way to characterize investment (as opposed to a transformed or scaled dependent variable). Finally, standard errors are corrected for clustering at the country-pair level (the same level as the treatment (Abadie et al. 2017)).

In Table 1, column 1, the results using PPML show that both the *M*MoU and bilateral arrangements have strong associations with cross-border equity ownership, even after including the comprehensive three-way fixed effects (for pair, investor×year, and investee×year) and the other controls. After controlling for other factors, the *M*MoU is

[8] Alternatively, consider the connections Singapore forms with Hong Kong in 2005, China in 2007, Japan in 2008, and Taiwan in 2011.

associated with an 11% increase in FPI and is statistically significant.[9] The average FPI across all countries during the sample period is $16.8 trillion, so the 11% increase attributable to cooperation policy equates to about $1.8 trillion.[10] The estimates on the control variables related to tax, trade, and investment treaties are insignificant. The explanatory power is 0.99, which is common using this estimation technique, given the comprehensive fixed effects (see, for example, Larch et al. (2019)). Also note that the estimation drops observations that are perfectly (or nearly perfectly) predicted, reducing the number of available observations to 63,957.

A more traditional approach using a log-linear equation yields the same overall inference but with a larger magnitude. Column 2 in Table 1 shows a coefficient of 0.180 for the *M*MoU, which equates to cross-border investment being 20% greater for pairs linked via the *M*MoU (which comes from exponentiating the coefficient as described in footnote 9). This reinforces the idea that regulatory cooperation influences cross-border investment. The difference in magnitudes across the PPML and log-linear regressions is consistent with recent studies in which these same two alternative estimation techniques were used (Glick and Rose 2016; Larch et al. 2019). The design and specifications in those studies measure an effect similar to the *M*MoU's effect on FPI: the effect of currency unions on bilateral trade. PPML's advantages with respect to bias and consistency have made it the prevailing "workhorse" estimator for evaluating policies in settings with similar pairwise structures (e.g., international trade) (Weidner and Zylkin 2020). Therefore, I use PPML as the preferred methodology hereafter.

The results are consistent with cooperative arrangements having a significant effect on FPI. The primary effect of cooperation on FPI does not occur through a spillover involving unaffiliated countries, but rather via direct investment between cooperating country pairs. The evidence supports the idea that regulatory cooperation enhances international capital mobility and market integration.

[9] Poisson uses a log-link function, so the coefficient interpretation is precisely the same as in log-linear models. An economic interpretation requires transformation using the expression $\hat{g}=\exp(\theta)-1$, where θ is the coefficient estimate from the tables. The interpretation is that a one-unit change in the independent variable is associated with a $\hat{g}$ percent change in the dependent variable (Halvorsen and Palmquist 1980; van Garderen and Shah 2002; Kennedy 1981). When the independent variable is also in log form, the interpretation is as an elasticity (that is, a 1% change in the independent variable is associated with a θ% change in the dependent variable).

[10] Technically, this is investment in excess of non-cooperating country pairs that include the same investee or investor country, so, in some circumstances, it could represent less retrenchment rather than an absolute expansion in investment.

3.4 FPI: cross-sectional tests

The effect of cooperation may vary across different country pairs. Two opposing effects could condition the outcome for a given country pair: (i) the extent of existing impediments to foreign investment (e.g., expropriation risks and red tape), and (ii) the capacity of the pair to resolve these impediments (via enforcement cooperation and streamlined procedures). Larger effects could be seen in pairs where impediments like expropriation risks are most prominent. This view would predict larger effects when the investee country has poor institutional qualities. Yet countries with poor institutional qualities may also have reduced capacities to cooperate, due to limited resources, narrow endowments of authority, or incompetence. These opposing forces could either offset each other or induce U-shaped non-linearities in the cross-section. Given the complexity of the treatment pattern, cross-sectional tests are not vital to the identification strategy (as is sometimes the case for studies examining a common shock).

Empirically, I study the cross-sectional effect of the *M*MoU by exploring the interactions of the linkage indicator with partitioning variables intended to capture the following attributes: geographic distance between country pairs; capital controls; attributes of a country's institutions (e.g., legal strength and origin); and market size and development. Recall that the *uni*nteracted partitioning variable need not (indeed, cannot) be included separately because of the investor×time and investee×time fixed effects.

Prior research uses geographic distance as a proxy for information asymmetry between country pairs (Portes and Rey 2005). I interact indicators for the geographic distance tercile with the *M*MoU linkage. Panel A of Table 2 reports the percentages implied by the coefficient estimates. It shows that the effect of cooperation increases monotonically with geographic distance. FPI increases by 5%, 9%, and 15% for the small, medium, and large distances, consistent with larger effects occurring in country pairs that are farther apart and more likely to have greater information asymmetries.

Next, I use capital controls from Fernandez et al. (2015) to explore the effect of explicit prohibitions on foreign investment (i.e., policies that restrict foreign ownership). Panel B is consistent with the idea that capital controls are a friction that is unresolved by cooperation. Cooperation has no effect on FPI in countries with capital controls, but is associated with a 13.6% increase in FPI in countries without them. The effect in countries without capital controls is larger than the 11% shown in the main test; this suggests that pooling these two groups brings down the average effect.

The remaining cross-sectional tests explore various attributes of a country's institutional, economic, and market-related features using the following measures: indicators for common law legal origin (LaPorta et al. 2008); the World Bank's index for rule of law (Kaufmann et al. 2010); equity market size; and market development classifications (from MSCI). Because these dimensions vary for both the investee and investor countries, I use tercile indicators for continuous measures and interact them to break down the effects of the *M*MoU across various combinations of country attributes. I report the effects in 3×3 tables of investor/investee pairings (a 2×2 table in the case of common law legal origin).[11]

Legal systems with a common law lineage may better protect property rights, resolve disputes, and protect shareholders (LaPorta et al. 2008). Table 2, panel C shows that cooperation between two common law countries yields a larger increase in FPI (15.1%) than other pairings (ranging from 8.4% to 9.4%), although not significantly so.

The rule-of-law dimension measures agents' confidence in the rules of society—the quality of the nation's crime-prevention, contract enforcement, property rights, and courts (Kaufmann et al. 2010). Panel D shows the effect of cooperation across combinations of the rule-of-law dimension. Moving from the upper left to the bottom right corners—from two weak-rule-of-law countries to two strong-rule-of-law countries—there is a non-linear U-shaped pattern, with the largest effect occurring in pairs of weak countries, insignificantly negative effects in pairs of middle-strength countries, and a moderate effect (10.2%) in pairs of strong countries. This is consistent with the two countervailing effects described above. A country's impediments to FPI and capacity to resolve impediments via cooperation appear to simultaneously influence the effect, inducing non-linearities in the cross-section.

Next, I partition by equity market size and market development. Panel E uses market size (aggregate market capitalization from Datastream) to partition the effect. Significant increases in FPI occur exclusively in pairings that include investee countries with medium or large market sizes. This is consistent with the notion that larger market size is associated with greater regulatory sophistication, which in turn increases the capacity for, and effects of, cooperation. Panel F uses market development (from MSCI) to partition the effect of cooperation. Markets become more developed as one moves from frontier, to emerging, to developed markets. The strongest statistical relation for increases in FPI occur between

[11] These partitions do not weight the effect of the *M*MoU in a way that reconciles to the overall effect of 10.5 (11%) from Table 4. Lack of reconciliation occurs both because some variables (e.g., common law or market development) do not partition the sample with equal numbers of observations and because the *M*MoU indicator occurs disproportionately in different cells.

countries with developed markets (13.5%, significant at p<0.01), where cooperation is most likely to be effective. Cooperation may also influence frontier markets—they increase their holdings in emerging markets (26.5%) and developed markets (8.1%), and developed markets increase their investment in *them* (by 8.6%), although each effect is insignificant.

A recurring theme throughout the cross-sectional tests is that, when both paired countries possess common law backgrounds, a strong rule of law, large markets, or developed markets, the effect of cooperation on FPI is significantly positive. This is consistent with the claim that, even between two countries with effective local regulation, market integration depends on resolving regulatory frictions.

Certain other country pairings exhibit patterns that are not fully anticipated. Notably, there is a large increase in FPI from weak-rule-of-law to strong-rule-of-law countries (see Panel D). This may arise out of reciprocal investment—mirroring the increased investment that occurs from strong- to weak-rule-of-law countries. Indeed, the off-diagonals of the partitions display considerable symmetry. Also, investment from poorer countries into strong-rule-of-law countries may be motivated by the better protection of wealth overseas and by the more numerous investment options and diversification choices available in countries with more mature markets.[12] In my setting, regulatory cooperation may help resolve the distrust and perceptions of vulnerability that discourage investors from weak, frontier, or code law countries from investing in more sophisticated markets (Guiso et al. 2008, 2009).[13]

Overall, it appears that cooperation plays a critical role in cross-border investment decisions, and that this relationship is subject to complex dynamics. The cross-sectional results are consistent with both of the arguments presented above: weaker investee countries have the most to gain, but stronger countries make the best cooperative partners.

3.5 FPI: additional tests

In this section, I provide additional tests to explore the identification and robustness of the results across various subsamples and estimation methods.

I begin by mapping out the effect of the cooperation linkages in event time to explore the parallel trend assumption and to assess the timing of the effect. Figure 3 shows the six

[12] Such findings are analogous to the Lucas paradox—the well-documented observation that capital does not flow from developed countries to developing countries even though the marginal benefit should be largest in developing countries (Lucas 1990). One rationale for the Lucas paradox is that low institutional quality impedes investment from rich to poor countries (Alfaro et al. 2008).

[13] The potential for asymmetric gains from cooperation raises practical questions about fairness and reciprocity, which are core principals of effective cooperation (see Licht (1999) for game-theoretic models of cooperation between securities regulators).

years before and the six years after the *M*MoU linkage. The effect is largely concentrated in the first year of the linkage, when 78% of the total effect of 0.105 from Table 1, column 1 occurs. The trend before and after the link appears fairly level. Although no test (including this one) can conclusively affirm the appropriateness of the benchmark country pairs, there is no obvious indication that the parallel trend assumption has been violated.

It is reasonable to expect that a portion of the effect will narrowly anticipate the formal signing of the *M*MoU. New legislation is often passed to prepare a country for *M*MoU admission, and qualifying countries frequently defer the formal signing until ceremonies at the IOSCO annual meeting.[14] Investors could easily be aware of, and respond to, these signals. (Internet Appendix I provides a detailed hypothetical timeline of the application process.) It is impossible to determine whether any anticipation that does occur is due to information leakage during the process of becoming a signatory (a 14-month period, on average, according to Silvers (2020a)), to reverse causality, or to elements of both. Yet reverse causality seems unlikely. For reverse causality to explain Figure 3, the average regulator would need to anticipate increased investment over a year into the future—a doubtful premise. Furthermore, each *M*MoU admission generates multiple connections that are outside the regulator's control.

The difference-in-difference design requires that the untreated group follow the same trend in the absence of the treatment (Bertrand et al. 2004). To explore whether the benchmark country pairs meet this criterion, I perform two tests. In the first, I attempt to rule out the concern that an unknown tautological design feature or misspecification drives the results. Bertrand et al. (2004) show that random assignment of state-level treatments rejects the null hypothesis (of no effect) too often, which suggests that some generalized difference-in-difference designs can be untrustworthy. If selecting any random year to partition the time series of a country pair produces a result similar to the one in Table 1, the model could be poorly specified, or a different mechanism could underlie the result. I check for this by assigning the real *M*MoU years to countries at random and then recalculating the linkage date for country pairs as a pseudo-treatment. In 1,000 replications of this procedure, the distribution of the pseudo-treatment estimates is centered at -0.00017 and exceeds the estimates from the real treatment dates just 32 times (p=0.032).[15] (Internet

[14] See http://www.csrc.gov.cn/pub/csrc_en/affairs/AffairsIOSCO/201205/P020120524357975007952.pdf for examples.

[15] Of these, only nine of the placebo tests exceed the *statistical* significance of the real estimate (z>2.95, the value from Table 1 column 1), which suggests that they are mostly driven by a few extreme observations.

Appendix Figure 1 provides a histogram of the placebo coefficient estimates.) This finding is inconsistent with tautological design features or misspecification influencing the results. Thus, an omitted variable would need to be of an extraordinary magnitude or widespread across many of the linkages. In the latter case, the omitted variable would need to conform to an elaborate sequence and timing of the events. This seems unlikely.

In the second, I eliminate from the sample any country pairs that never experience the *M*MoU shock. The identification comes from pairs that are eventually treated but have not *yet* experienced the shock. The results in column 1 of Table 3 indicate that the *M*MoU's association with FPI persists at a similar magnitude in this subsample. A more severe sample restriction in column 2—confining the sample to the 22 developed investee and investor markets—yields similar inferences. Removing much of the heterogeneity across countries ensures that the benchmark country pairs are more similar and that the results are not concentrated in economically trivial observations (pairs of small countries with inconsequential levels of FPI). Thus, the result does not appear to be attributable to poorly identified benchmarks.

I also explore whether the time-variant country-pair controls (e.g., treaties) are coarse with respect to other evolving pair-specific economic conditions. To do this, I include (log-transformed) commodities traded between country pairs in US dollars. The trade occurs in both directions—investor to investee, and vice-versa. The data comes from the UN Comtrade dataset. Column 3 of Table 3 shows that the effect of the *M*MoU is virtually unchanged, supporting the idea that other economic factors do not drive the results. However, the use of trade as a control does weaken the estimated effect for bilateral arrangements, perhaps reflecting some endogenous relation between bilateral arrangements and economic forces.

Finally, I add controls for various potentially influential subsets of country pairs and find results similar to the main result in column 1 of Table 1. Columns 4–7 of Table 3 show that the main inference is unaffected even after I separately control for the *M*MoU's effect on specific country pairs, including pairs of EU countries (which represent a significant portion of the sample); pairs involving the US as investee or investor; pairs involving any of the 27 investee countries that have a significant number of US cross-listings (the subsample examined by Lang et al. (2020)); and pairs possessing at least one cross-listed firm. The *M*MoU estimates remain fairly stable (between 0.087 (9%) and 0.110 (12%)), demonstrating the robustness of the inference to various factors. The primary effect of cooperation is thus

extensive, not driven by US or EU observations, and more far-reaching than was previously known. The effect is exclusive neither to pairs that involve countries with significant US cross-listings nor to pairs that have cross-listings. This implies that investors perceive a reduction in investment risks even for non-cross-listed firms.

The idea that cross-border issues are relevant even for purely domestic firms underscores the global nature of capital markets. Malfeasant conduct routinely extends between jurisdictions, and there is no reason to believe that its effects are confined to cross-listed firms. As Beyea (2011) observes, it is "very rare to find a modern securities fraud case that does not have an international facet of some kind." Consistent with this view, anecdotes from staff at the US SEC suggest that more than 30% of the cases they pursue have a cross-border element, even though few of their cases involve cross-listed firms. Furthermore, cost reductions for trade infrastructures likely extend to all firms, not just cross-listed ones. Thus, the empirical support for cooperation having a broader impact than was previously characterized comports with a practical understanding of modern regulatory environments.

Overall, I find evidence that cooperation relaxes an impediment to investment. For foreign investors, who must balance the benefits of foreign diversification against the expected risks (Brennan and Cao 1997), this relaxation raises the equilibrium level of cross-border investment, leading to increased integration and capital mobility.

4. Market integration: country-level evidence using Pukthuanthong and Roll (2009) integration measure

4.1 P&R: sample

The country-level integration tests ultimately use a *country-year* unit of observation, based on Pukthuanthong and Roll's (2009) measure of integration. The measure requires, as inputs, daily country-level returns. I gather these returns from Datastream, a dataset by Refinitive (formerly Thomson Reuters). I use daily market capitalization-weighted return indices for each country from 1995 to 2018. These indices, which include reinvested dividends, are adjusted for the daily risk-free rate and denominated in US dollars (using datatype: *X(RI)~U$*). To ensure consistency with the firm-level tests that follow, I include only the 54 countries that also have firm-level data (subject to the criterion described in section 5.1). This sample includes a narrower set of countries than the ones in the FPI data.

Table 4 reports each country's Datastream return series symbol, date of *M*MoU entrance, and classifications—either high or low—on various dimensions that will serve as

partitioning variables in the cross-sectional analyses. The P&R measure of integration is an R^2 value, described in greater detail below. I report the average over the entire sample period, the values in the year before and the year after the *M*MoU, and the difference between the year before and after the *M*MoU. I sort the table by the average level of integration, producing a ranking that generally conforms to an intuitive ranking of countries' levels of integration.[16] Finally, the table also contains the number of firms and firm-years used in the firm-specific tests (described in section 5).

4.2 P&R: empirical measures, research design, and results

P&R (2009) propose a framework for measuring a country's degree of financial integration. The rationale for their approach is that, as the proportion of a country's return variation explained by global factors increases, the country's level of integration increases. That is, when a country's returns are driven primarily by global (local) factors, its R^2 when regressed on these factors—the proxy for integration—should be high (low). In their original paper, P&R identify latent global factors using the first ten principal components of the 17 countries with the longest time series of coverage in Datastream (they argue that these countries are the most globally integrated). In a more recent paper, Pukthuanthong and Roll (2016, p. 11) point out that their original (2009) study "went to a lot of trouble to extract ten global principal components" but found "virtually identical results…[using] broad indexes from ten large countries." Pukthuanthong and Roll (2016) advocate using the large economies as global factors. Following their guidance, I regress a country's returns on the ten largest markets (or the nine largest countries, in instances where the test country is included as a global factor). Like P&R, I account for time zone differences by lagging the returns for any North American global factor; require at least 50 observations; and require that all global factor returns not be missing (which drops observations for holidays, etc.). Finally, note that the P&R measure deliberately departs from a variety of prior integration proxies, many of which are inappropriate for my study because they do not accommodate my research design.[17]

The P&R R^2 measure is computed annually for each country, creating the country-year unit of observation that serves as the dependent variable for the tests. Note that the

[16] One notable exception is the level of integration for the US, which is lower than expected. Of course, the US is atypical, not only because of its economic distinction but because its time zone could create issues with the R^2 measure.

[17] For example, cointegration and vector-auto-regression-based measures typically provide an indication of how quickly markets adjust to a long-run equilibrium but offer no indication of absolute levels of integration. Correlations in asset values may indicate the degree of integration, and appear to yield long-run patterns that are often similar to other measures (Billio et al. 2017). But, as P&R (2009) point out, even in perfectly integrated markets, correlation can be low. Similar points are made in Bekaert et al. (2016).

nature of the country-year data precludes my use of the research design from the FPI analyses (where the unit of observation was country-*pair*-year). Admittedly, this country-wide treatment partially negates some of the design features relative to the within-country, staggered treatment used in the FPI tests. However, the modified treatment occurring at the country level—based on the year a country joins the *M*MoU—remains staggered, as it occurs at different times for different countries. (Bilateral arrangements occur at the country-pair level, and are necessarily excluded from the tests.)

A crude evaluation compares integration levels in the year before and the year after the *M*MoU. The difference, reported in Table 4, indicates that integration increases by 0.05—about 12% of the average integration value—which is significantly positive using a *t*-test (p=0.02). However, given that the relation between integration and R^2 is potentially non-linear, I also provide non-parametric tests. Of the 54 countries tested, 33 have increases in integration, which equates to a *p*-value of 0.04 in a binomial distribution with equal probabilities of increases and decreases. A Wilcoxon signed rank test similarly indicates that the increase in R^2 is marginally significant (p=0.02).

These crude tests suggest an increase in integration but are subject to three caveats. First, they are based on short-window tests, which are susceptible to sampling error. Second, global conditions—such as down or volatile markets—potentially affect measures of integration (Forbes and Rigobon 2002). Finally, the increase in integration may be part of a gradual trend toward global integration that occurs regardless of cooperation. Such a trend could bias the test in favor of finding an increase. Therefore, I next conduct a more rigorous test that uses the full time series of the P&R measure for each country in a panel analysis.

$$(2)\quad R^2_{c,t} = \alpha_0 + \alpha_1 Post + \sum_{c=2}^{C} \alpha_c\, Country\ FEs_{ij} + \sum_{t=C+2}^{T} \alpha_t\, Year\ FEs + \sum_{j=C+T+2}^{J} \alpha_j\, Country\ time\ trends + \varepsilon_t$$

Equation 2 allows for integration (R^2) to change as a function of a cooperation, as measured by a country's admission to the *M*MoU. The dependent variable is P&R's annual R^2 for country *c* at time *t*. The variable of interest is *Post*, set equal to 1 when a country is an *M*MoU signatory. A positive α_1 coefficient supports the notion that cooperation is associated with enhanced integration. To help avoid the criticism that integration may trend upward over time, I apply linear time trends for each country. Next, I include year fixed effects that control for fluctuations in the integration proxy that are common to all countries in any given year. Finally, because different countries are likely to have different average

levels of integration, I include country fixed effects.

I estimate equation 2 using a fractional logit regression because the integration proxy (R^2) is bounded between zero and one. Some countries' coverage begins later in the sample period, but most of the 54 countries have the full time series available. Of the 1,296 possible country-years (54 countries × 24 years), 1,218 have the data required to calculate the R^2.[18]

Column 1 of Table 5 indicates that the integration proxy increases despite country and year fixed effects. Note that the interpretation of the coefficient is that a one-unit change in the independent variable is associated with an $\exp(\alpha_1)-1$ percent change in the dependent variable (see footnote 10). The coefficient on the *Post* indicator is 0.171, which implies that cooperation is associated with a 19% increase in integration (from exponentiating the coefficient). Column 2 demonstrates that the relationship persists when controlling for linear time trends for each country (which are included in all the remaining estimations), although the economic magnitude drops to about 12%. Columns 3 and 4 yield the same inferences in support of enhanced integration when transforming the R^2 measure by squaring or taking the square root (although there are differences in economic magnitudes). This helps address the possibility that the relation between integration and the P&R proxy is non-linear.[19]

In cross-sectional analyses, I split the sample across the same dimensions as the ones used in the FPI analyses (excluding distance). All estimations include unreported country and year fixed effects and linear country time trends. In Panel A, the results are almost identical across countries with and without capital controls. Panels B and C provide evidence that the effect of cooperation on market integration at the country level is larger amongst code law and weak-rule-of-law countries, where investment risks are more prominent. In Panels D and E, there is weak evidence that integration increases the most in contexts where cooperation is likely to be more effective. Panel D shows comparable magnitudes across small and large markets, but the magnitude is statistically significant only for the large markets. Panel E indicates that the magnitudes are larger in large and developed markets, although the differences are insignificant.

[18] One purpose of the panel analysis is to account for gradual changes in integration by including linear time trends in each country. The time series begins in 1995 to ensure that the number of pre-*M*MoU observations is sufficient to estimate the time trend.

[19] I replicate the main and cross-sectional analyses using an OLS model (equivalent, in this case, to a "linear probability model"). The estimates bear similar economic magnitudes—the raw estimate of the post indicator is 0.041 (0.029 when including linear time trends). This represents 9.7% (6.9%) of the 0.423 sample average. This is comparable to the 12% found in the logistic regression.

5. Market integration: firm-level evidence

5.1 Firm-level: sample

I next use asset pricing tests to explore how cooperation between regulators affects market integration from a *firm's* perspective, based on a *firm-week* unit of observation. The data source is Datastream, which provides wide coverage of firm-level return data across the globe. To be included in the sample, firms must be listed on a regulated exchange and have non-missing data for total assets and market capitalization. The initial tests use the full sample, which includes both cross-listed and non-cross-listed firms, because the FPI tests suggest that the effects apply to all firms. In section 6, I separately analyze cross-listed firms since they have properties that allow for better identification. I exclude firms with market capitalization below $500 million US dollars.

For each firm, I calculate US dollar-denominated returns in weekly (Wednesday to Wednesday) intervals over the 52 weeks before and 52 weeks after the treatment event. Market capitalization-weighted country-level returns (from the previous section, except calculated on a weekly basis) serve as the local market indices and Datastream's World market index (using the symbol "*TOTMKWD*").[20] All returns are in US dollars and adjusted for the T-bill rate (from Ken French's website). Since the tests use an event window that includes the year before and the year after the treatment, and since the first sample country (Australia) joined in 2002 and the last sample country (Russia) joined in 2015, the sample includes observations from 2001 to 2016. Table 4 reports the 6,605 firms (630,252 firm-weeks) from 54 countries that meet these criteria.

5.2 Firm-level: research design

Asset pricing tests allow me to observe the precise changes in local and world market risk exposures (unlike the P&R approach, which obscures them). In this setting, cooperation may affect risk exposures because it removes indirect barriers to cross-border investment (for example, by addressing frictions like trading costs, information asymmetry, and expropriation risks). This is different from the previous literature, which often focuses primarily on remediating explicit investment barriers (for example, via cross-listing).[21]

Prior work examines firm-level integration based on the Alexander et al. (1987) and Errunza and Losq (1985) intuition that when investment barriers are removed, firms

[20] Using local currency returns yields inferences that are very similar.

[21] There are a few exceptions (see, for example, Nishiotis (2004) and Carrieri et al. (2013)).

can achieve a higher equilibrium price and a lower expected return than they would in a single segmented market. Those authors' models imply that a shift from local pricing of a firm (a segmented market) to global pricing of a firm (an integrated market) should lead to changes in local and world market risk exposures and the firm's cost of capital. Bekaert and Harvey (1995) formalize this intuition by combining local and international capital asset-pricing models (CAPM). The local CAPM describes expected returns in a perfectly segmented market, where assets are priced locally and the price of risk is determined locally (by risk aversion and the local risk-free rate). The international CAPM describes expected returns in a perfectly integrated market, where assets are priced globally. In the international CAPM, the implication is that assets with a given risk level are priced the same regardless of the market in which they trade.

My firm-level tests of integration rely on model (3), which presents the expected return of security i as a function of its local and world price of covariance risk (ψ) and covariance with local and world returns, where Ret, R^L, and R^W represent the firm, local market, and world market returns, respectively (and each term is adjusted for the risk-free rate).[22] Integration can be inferred from the relative exposures to the local and world indices, indicated by Φ, a continuous integration parameter ranging from 0 (a fully segmented market) to 1 (a fully integrated market). Conceptually, Φ captures the fraction of the total *quantity* of risk (composite beta) that is attributable to global market beta.

$$E_{t-1}[Ret_{it}] = (1 - \Phi_{i,t-1})\psi^L_{t-1}\, Cov_{t-1}[Ret_{it}, R^L] + \Phi_{i,t-1}\psi^W_{t-1}\, Cov_{t-1}[Ret_{it}, R^W] \quad (3)$$

I translate this to an empirical test in model (4) below, with firm and time subscripts omitted. *Post* is an indicator equal to 1 when cooperation occurs. Cetaris paribus, the integration parameter (Φ) will increase when the local beta (β_4) declines and/or the world beta (β_5) increases. Thus, declines in local beta and/or increases in world beta imply that cooperation promotes market integration. As in prior work, I estimate the model in event time, using the 52 weeks before and the 52 weeks after the treatment. This allows risk exposures to change as a function of regulatory cooperation.

[22] I am *not* endorsing the ability of this two-factor model to correctly price an asset. As Bekaert et al. (2011) point out, there is no consensus about the best asset-pricing model, since world and local betas do not fully explain the cross-section of returns. My focus is on market risk exposures that change with cooperation. Even if priced risk factors are omitted from my model, the staggered-shock design makes it unlikely that even a misspecified asset-pricing model would confound my inferences regarding changing market risk exposures.

$$(4) \qquad Ret = \beta_0 + \beta_1 R^L + \beta_2 R^W + \beta_3 Post + \beta_4 R^L * Post + \beta_5 R^W * Post + \varepsilon_t$$

I expect that cooperation between securities regulators, by reducing a variety of investor risks, resolves informal barriers to foreign investment. In the context of asset pricing, the increases in FPI in previous tests imply that firms should experience declining risk exposure to the local market and increasing risk exposure to the global market.

5.3 Firm-level: main empirical tests

The firm-level tests of integration begin by estimating model 4 on the full sample of firms. Although the sample includes some cross-listed firms (which are tested separately in the next section), it primarily consists of non-cross-listed firms. Consequently, I create a country-wide treatment using the date that a firm's home country regulator joins the *M*MoU. More specifically, the *Post* indicator is equal to 1 for observations where the date is greater than or equal to the date a country joins the *M*MoU.

The main estimation is reported in Table 7. The equilibrium betas prior to the *M*MoU are dominated by the local market (0.695) but are nontrivially influenced by global markets (0.234). After the *M*MoU, the local and world betas change in opposite directions. Exposure to the local market decreases by 0.108 (p=0.026), while exposure to the world market increases by 0.090 (p=0.138). The post-cooperation changes in betas are consistent with an increase in the integration parameter (Φ) from 0.25 [0.234/(0.695+0.234)] to 0.35 [0.324/(0.605+0.324], representing a 40% increase in market integration. As expected, the composite betas remain near 1 both before and after regulatory cooperation, indicating a stable overall quantity of market risk. Nevertheless, this shift from local to world pricing implies a reduction in the cost of capital, because it replaces local market equity risk premiums with global equity risk premiums, which are generally much lower.

5.4 Firm-level: cross-sectional tests

This section investigates subsamples split by firm size and along the country-level dimensions used in the previous tests: legal origin, rule of law, market size, and market development (see Table 4 for each country's status across these dimensions).[23] Model 4 is fully unconstrained across the various partitions by separately estimating in each partition (high or low) of the various dimensions. Only β_4 and β_5—the *changes* in the

[23] I dispense with the distance measure, since most firms do not possess a secondary regulator from which to calculate a distance.

local and global betas, respectively—are reported.

Panel A splits the sample by the median firm size in each country. The effects are stronger in the larger firms in a given country. In those firms, the local beta declines significantly (by -0.142), and the world beta increases significantly (by 0.111). Smaller firms experience insignificant changes in risk exposures. Integration increases most for large, liquid firms—the ones most likely to receive FPI (Ferreira and Matos 2008).

The cross-sectional partitions in Panels B–F reveal broadly similar patterns as the P&R (2009) proxies. Panel B indicates that countries with capital controls experience a dampened effect from cooperation. Panels C and D reveal that the changes in risk exposure are concentrated exclusively in countries with institutional weaknesses (code law and weak legal systems). Panel E provides evidence that cooperation has greater effects in large markets, which conforms to previous cross-sectional tests. Panel F indicates that the effect is concentrated in undeveloped markets; this is the only result that even mildly diverges from the country-level tests based on the P&R measure. Overall, cooperation appears to be more relevant for large firms, firms in countries without capital controls or with weak institutional characteristics (code law and weak rule of law), and firms in small markets.

5.5 Firm-level: robustness tests

To gauge the sensitivity and stability of the main result to alternative estimation horizons, I expand the estimation window. Table 9 demonstrates that the change in integration stays fairly constant over different time horizons (although absolute levels tend to decline over longer horizons). The main result does not appear to reflect a gradual trend or a temporary period of high world or low local betas.

6. Market integration: cross-listed subsample

6.1 Cross-listed firms: sample

In this section, I focus on cross-listed firms, again using *weekly firm-level* return data. I use cross-listed observations from the same data sources, subject to the same criteria that were described in Section 5 (such as size, listing status, and data requirements). The sample of cross-listed firms that meet these criteria are reported by country pair in figure 2. The home country appears as the investee country (row), and the host country appears as the investor country (column). Consistent with the bonding hypothesis, the figure indicates that firms tend to cross-list into markets that are larger and more developed and have stronger

investor protection norms. This figure demonstrates that, although certain country pairs possess more cross-listings than others, there remains substantial variation across home and host countries and in the timing of the treatment. Of course, by comparison with the FPI sample, the country-pair matrix of cross-listed firms is sparsely populated and has much less variation, particularly for host countries.

6.2 Cross-listed firms: main empirical tests

I adapt the integration tests to focus on cross-listed firms because these firms allow a more refined (within-country) treatment. Specifically, cross-listed firms have both a home and host regulator, so the treatment can be redefined as the linkage between the two countries. Furthermore, cooperation potentially provides a complementary bonding mechanism, because regulators can improve cross-border enforcement.

Prior studies that examine changes in beta(s) at the time of a US cross-listing support the notion that cross-listing promotes market integration. Using a single local market index, Foerster and Karolyi (1993) show that Canadian firms' exposure to local market risk declines following US cross-listings. Using a global sample and an analogous two-factor model that includes the local and world indices, Foerster and Karolyi (1999) observe a decline in local market betas and no change in world betas following US cross-listings. And Jayaraman et al. (1993) show a decrease in local beta and no change in US beta in 95 firms from Japan and the UK that cross-list in the United States.

The bonding hypothesis holds that a more stringent regulatory environment leads foreign shareholders to perceive a country's disclosure and investor protection as more reliable, which in turn increases ownership demand. In my setting, cooperation may enable a more stringent regulatory environment, which should enhance the signal provided by a cross listing. Note that bonding can exist in segmented or integrated markets, so the connection to changes in risk exposures is not direct but rather indirect via FPI.

Whether cross-listed firms' level of integration is sensitive to changes in regulatory cooperation is an open question. On one hand, regulatory cooperation could affect the integration level more for cross-listed firms than for other firms, given that cross-listed firms are co-supervised by a home and host regulator and that their foreign listing offers investors an easy avenue through which to act on altered preferences. On the other hand, cross-listed firms may already be more globally integrated than other firms, and the FPI tests indicate that the effects of cooperation are not confined to them.

The results reported in Table 10 are based on model 4 (where the *Post* variable is redefined to indicate the linkage between home and host countries). As shown in column 1 of Table 10, the equilibrium betas prior to the *M*MoU remain dominated by the local market: 0.685 for the local beta and 0.284 for the world beta. This indicates that the risk of the assets is priced more in the local market than in the global market. The composite beta remains close to 1. After the *M*MoU, the local and world betas change in opposite directions. Exposure to the local market decreases by 0.025, while exposure to the world market increases by 0.055, although only the latter change is significant (marginally so). The post-cooperation changes in betas are consistent with an increase in the integration parameter (Φ) from 0.29 [0.284/(0.685+0.284)] to 0.34 [0.339/(0.660+0.339], representing a 16% increase in market integration. The magnitude of this change is smaller than in the full sample (which includes domestic firms), but cross-listed firms started from a higher level of integration. Unreported analyses fail to find any statistically significant differences in the local or world betas (or changes therein) between cross-listed and domestic firms.

The cross-listed sample, unlike the samples in previous tests, is largely influenced by a single country—US cross-listings represent about 39% of the sample firms (see figure 2 for details). Therefore, I re-estimate the effects in the US-cross-listed and non-US-cross-listed subsamples, respectively. The results, presented in column 2, show that integration increases more for US cross-listings than for the full sample (for example, the local beta drops by 0.111 and the global beta increases by 0.156). This represents an increase in the integration parameter of more than 50% (from 0.28 to 0.43). The larger effect likely reflects the fact that US regulators, being among the most proactive regarding cross-border issues, utilize cooperation to its full potential. Column 3 of Table 10 shows smaller and insignificant effects for the non-US cross-listings (e.g., the post-*M*MoU global beta increases by 0.032). However, some non-US cross-listings do show evidence of integration. The top ten non-US cross-listing destinations (excluding Hong Kong, which is dominated by a single home country—China) constitute more than 65% of the non-US-cross-listed sample.[24] Column 4 indicates that these cross-listings experience results that are similar in magnitude and statistical significance to the full sample. Thus, non-US host countries also appear to achieve increases in integration. The next section characterizes the heterogeneity in the effect of cooperation in greater detail.

In terms of magnitude, the estimated effect of the *M*MoU is smaller than the effects

[24] Ranked by the number of cross-listings, these countries are the UK, Germany, Luxembourg, Canada, Sweden, Australia, the Netherlands, Taiwan, Singapore, and New Zealand.

that Foerster and Karolyi (1999) observed around US cross-listing events. This is expected, given that cross-listing events appear to have more profound implications for investability, co-bundle several factors, and are likely endogenous. In sum, Table 10 supports the premise that regulatory integration facilitates market integration for cross-listed firms.

6.3 Cross-listed firms: cross-sectional tests

The cross-sectional partitioning variables are the same as those used in previous analyses. Because geographic distance between country pairs can again be calculated, distance is reinstated. Model 4 is separately re-estimated within each partition. Only β_4 and β_5—the *changes* in the local and global betas, respectively—are reported.

Panel A of Table 11 reports the effect of geographic distance on the effect of the *M*MoU. It shows that the changes in beta that accompany the *M*MoU increase with distance (as monitoring becomes more difficult). Panel B partitions the sample based on home country capital controls. By virtue of being cross-listed, the sample firms may largely circumvent capital controls (Auguste et al. 2006), so there is no clear prediction regarding the cross-sectional magnitudes. Firms from home countries with capital controls exhibit changes in local and world betas of similar magnitude to firms from home countries without them.

In a 2x2 table for code/common law and home/host market, Panel C reports the change in the betas on local and world market indices. When both the home and host markets possess common law legal origin, the *M*MoU is associated with the largest increase in integration—a 0.02 reduction in the local market beta and a 0.16 increase in the world market beta. The second-best pairing is when the home country is a code law country and the host country is a common law country. When the host country is code law, however, the effects are either small or run mildly against the predicted direction.

Panel D describes the results partitioned by rule of law. Once again, the results appear to largely depend on a strong host market. When strong host country rule of law is paired with a weak home country rule of law, the results are the strongest. This is consistent with the bonding hypothesis, which would predict larger effects for cross-listings in markets that are larger, more developed, and have stronger investor protection norms.

Panel E partitions the results by market size. The effects are absent for firms cross-listed between two small markets and strongest for firms cross-listed between two large markets. Panel F provides the results partitioned by development classification. Increased integration is confined to instances when a firm's host country is a developed market.

Overall, the effects are stronger in US cross-listings, when the home and host countries are geographically distant, and (typically) when the host country has a common law legal system, a strong rule of law, or a large or developed market. For cross-listed firms in particular, multiple panels show the strongest effects occurring when both the home and host countries possess these attributes. Once again, the latter result is consistent with the claim that, even when two countries have effective local regulation, their market integration partly depends on resolving the regulatory frictions between them.

6.4 Cross-listed firms: robustness tests

To gauge the sensitivity of the cross-listed firms' result to alternative estimation horizons, I expand the estimation window. Table 12 demonstrates that the change in integration is fairly constant over different time horizons. This helps to rule out a gradual trend or a temporary period of high world or low local betas as an alternative explanation.

7. Conclusion

The analyses in this paper shed light on an opaque and hitherto unexplored aspect of capital market integration—cooperation between securities regulators. I study how cross-border cooperation between securities regulators affects the integration of equity markets. Using a research design whose properties rule out many alternative explanations, I find that cooperation via the *M*MoU is associated with an 11% increase in FPI, relative to the time series of other pairs that include the same investor or investee country. I find similar support for market integration using country-level proxies and firm-level asset-pricing tests. Thus, global risk sharing via investment diversification and integration with world markets appears to depend, at least in part, on regulators' capacity and willingness to cooperate. Enhanced cooperation between regulators could benefit both investors, who must balance diversification benefits against adverse selection and other risks, and firms, which gain higher valuations and lower cost of capital by integrating with global capital markets.

In addition to being relevant to investors, firms, and regulators, these findings may be applicable in the context of contemporary policy coordination issues, such as Brexit, the EU's Capital Markets Union initiative, and the regulatory responses to the COVID-19 pandemic.[25] However, policymakers should also consider the *costs* of cooperation under the current system and alternative mechanisms or configurations (which fall outside the scope of this study).

[25] For example, securities regulators have actively pursued a coordinated response to COVID-19 through IOSCO (IOSCO 2020).

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TABLE 1—CROSS-BORDER INVESTMENT

	(1) *Main Result (PPML)*	(2) *Main Result (log-linear)*
MMoU link	0.105***	0.180**
	(2.95)	(2.20)
Bilateral MoU	0.084*	0.663***
	(1.91)	(2.95)
Investment treaty	-0.034	0.047
	(-0.51)	(0.39)
Trade treaty (PTA)	0.026	-0.206*
	(0.51)	(-1.89)
Tax Treaty	-0.053	0.001
	(-1.04)	(0.01)
N	63,957	260,856
R^2	0.99	0.88
Country-pair FEs	Y	Y
Investor-year FEs	Y	Y
Investee-year FEs	Y	Y
Pair time trends	Y	Y

This table presents the results of regressions of cross-border investment using annual data from IMF's *Coordinated Portfolio Investment Survey (CPIS)* from 2001 to 2017. The specification is based on equation (1):

$$Investment_{ijt} = \lambda_0 + \lambda_1 MMoU\ Link_{ijt} + \lambda_2 Bilateral\ MoU_{ijt} + \sum_{l=3}^{L} \lambda_l\ Pair\ time\ trends_{ij} + \sum_{i=L+3}^{I} \lambda_{it}\ Investor \times time\ FEs + \sum_{j=L+I+3}^{J} \lambda_{jt}\ Investee \times time\ FEs + \sum_{m=L+I+M+3}^{M} \lambda_m\ Investor \times Investee\ (country\ pair)\ FEs + \upsilon_{ijt}$$

The dependent variable is investment from country *i* to country *j* in year *t*. *M*MoU link is an indicator for observations in which country *i* and country *j* are both signatories of IOSCO's Multilateral Memorandum of Understanding (*M*MoU). MoU link is an indicator for country-pair years that have signed a bilateral arrangement. The first column uses Poisson Pseudo Maximum Likelihood estimation. The second uses OLS with a log-transformed dependent variable. Both regressions include fixed effects for investee×time, investor×time, investee×investor (a country-pair fixed effect), and linear country-pair time trends. Standard errors are clustered by the country-pair level.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 2—CROSS-BORDER INVESTMENT ACROSS LEVELS OF PARTITIONING VARIABLES

Panel A: Distance

	Close	5.2%*
	Medium	9.1%***
	Far	14.6****

Panel B: Capital controls

Investee country	*Capital controls*	-2.0%
	(No controls)	13.6%***

Panel C: Common Law Origin

		Investor country	
		Other	*Common*
Investee country	*Other*	8.8%**	9.4%**
	Common	8.4%	15.1%***

Panel D: Rule of Law

		Investor country		
		Weak	*Middle*	*Strong*
Investee country	*Weak*	74.8%	68.4%*	32.1%***
	Middle	86.8%	-19.2%	-3.9%
	Strong	45.8%**	-2.1%	10.2%***

Panel E: Market size

		Investor country		
		Small	*Medium*	*Large*
Investee country	*Small*	-6.2%	-4.0%	-2.7%
	Medium	10.9%	0.7%	7.5%
	Large	11.8%	9.3%**	11.9%***

Panel F: Market Development

		Investor country		
		Frontier	*Emerging*	*Developed*
Investee country	*Frontier*	-0.2%	2.0%	8.6%
	Emerging	26.5%*	-6.1%	0.6%
	Developed	8.1%*	7.7%	13.5%***

This table presents the results of PPML regressions of cross-border investment using annual data from IMF's *CPIS* survey from 2001 to 2017. The specification is based on equation (1) with interactions that separately estimate the effect of the *M*MoU for each pair of country attributes. For example, for distance in Panel A, the specification is as follows:

$$Investment_{ijt} = \lambda_0 + \lambda_1 MMoU\ Link_{ijt} * \boldsymbol{Close} + \lambda_2 MMoU\ Link_{ijt} * \boldsymbol{Medium} + \lambda_3 MMoU\ Link_{ijt} * \boldsymbol{Far} + \lambda_4 MoU\ Link_{ijt} + \sum_{l=5}^{L} \lambda_l\ Pair\ time\ trends_{ij} + \sum_{i=L+5}^{I} \lambda_{it}\ Investor \times\ time\ FEs + \sum_{j=L+I+5}^{J} \lambda_{jt}\ Investee \times time\ FEs + \sum_{m=L+I+M+5}^{M} \lambda_m\ Investor \times Investee\ (country\ pair)\ FEs + \upsilon_{ijt}$$

The dependent variable is investment from country *i* to country *j* in year *t*. *M*MoU link is an indicator for observations in which country *i* and country *j* are both *M*MoU signatories. *Close*, *Medium*, and *Far* are indicators for terciles of geographic distance between country *i* and *j*. Other partitioning variables in panels B–F include capital controls (from Fernandez et al. (2015)), common law legal origin, rule of law (from Kaufmann et al. (2010)), market size (from Datastream), and developed markets (from MSCI). Each regression includes (unreported) fixed effects for investee×time, investor×time, investee×investor (a country-pair fixed effect), and linear country-pair time trends. For ease of interpretation, each coefficient has already been transformed to an economic interpretation by the expression $\hat{g}=\exp(\theta)-1$, where θ is the raw coefficient estimate for each pair of country attributes (as described in footnote 11). Standard errors are clustered by the country-pair level.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. No adjustments are made to account for performing multiple tests.

TABLE 3—CROSS-BORDER INVESTMENT (ADDITIONAL TESTS)

Test description	(1) *M*MoU countries only	(2) Developed country-pairs only	(3) Controlling for bilateral trade	(4) EU pairs	(5) US	(6) Countries with US cross-listings (from Lang et al. 2019)	(7) Controlling for cross-listings
MMoU	0.091***	0.088**	0.098***	0.087***	0.098***	0.093**	0.110**
	(2.98)	(2.13)	(3.80)	(2.71)	(3.04)	(2.29)	(2.52)
Bilateral MoU	0.122***	-0.053	0.065	0.104***	0.075*	0.075*	0.080
	(3.11)	(-0.99)	(1.33)	(2.65)	(1.89)	(1.90)	(1.61)
*MMoU*EU pair*				0.000			
				(0.00)			
*MMoU*US$_i$*					0.038		
					(1.03)		
*MMoU*US$_j$*					0.014		
					(0.44)		
*MMoU*Country with US x-list$_i$*						0.013	
						(0.36)	
*MMoU*Country with US x-list$_j$*						0.016	
						(0.54)	
Trade$_{i\ to\ j}$			-0.004				
			(-0.69)				
Trade$_{j\ to\ i}$			0.003				
			(0.57)				
*MMoU*X-list_indicator*							-0.008
							(-0.03)
Investment treaty	-0.018	0.045	-0.017	-0.010	-0.018	-0.017	0.030
	(-0.43)	(1.37)	(-0.46)	(-0.24)	(-0.46)	(-0.43)	(0.67)
Trade treaty (PTA)	0.045*	-0.114**	0.033	0.051**	0.032	0.030	-0.059
	(1.78)	(-2.19)	(0.92)	(2.05)	(1.12)	(1.04)	(-1.03)
Tax Treaty	-0.051	-0.056	-0.066*	-0.062*	-0.046	-0.044	-0.044
	(-1.45)	(-0.94)	(-1.73)	(-1.90)	(-1.29)	(-1.25)	(-0.77)
N	44,288	6,720	61,957	61,957	61,957	61,957	61,957
R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Country-pair FEs	Y	Y	Y	Y	Y	Y	Y
Investor-year FEs	Y	Y	Y	Y	Y	Y	Y
Investee-year FEs	Y	Y	Y	Y	Y	Y	Y
Pair time trends	Y	Y	Y	Y	Y	Y	Y

This table presents the results of PPML regressions of cross-border investment using annual data from IMF's *CPIS* survey from 2001 to 2017. The specification is based on equation 1 (below) with various interactions and additional controls, as described in section 3.5:

$$Investment_{ijt} = \lambda_0 + \lambda_1 MMoU\ Link_{ijt} + \lambda_2 MoU\ Link_{ijt} + \sum_{l=3}^{L} \lambda_l\ Pair\ time\ trends_{ij} + \sum_{i=L+3}^{I} \lambda_{it}\ Investor \times\ time\ FEs + \sum_{j=L+I+3}^{J} \lambda_{jt}\ Investee \times time\ FEs + \sum_{m=L+I+M+3}^{M} \lambda_m\ Investor \times Investee\ (country\ pair)\ FEs + \upsilon_{ijt}$$

The dependent variable is investment from country *i* to country *j* in year *t*. *M*MoU link is an indicator for observations in which country *i* and country *j* are both *M*MoU signatories. MoU link is an indicator for country-pair years that have signed a bilateral arrangement. *EU pair* is an indicator for pairs that are EU members. *Country with US x-list* is an indicator for countries with at least one US cross-listing. *Trade* is the amount of commodities trade from the UN Comtrade dataset. *X-list_indicator* is an indicator for at least one cross-listing between a given pair of countries (see Figure 2 country pairs with cross listings). Standard errors are clustered by the country-pair level.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 4—SAMPLE COMPOSITION BY COUNTRY

Country	*Datastream series name*	*MMoU date*	*Average P&R R^2 (integration)*	*P&R R^2 at t-1*	*P&R R^2 at t+1*	*ΔIntegration (Post-Pre)*	*Capital controls*	*Common law*	*Rule of law*	*Market Size*	*Developed*	*Firms*	*Firm-weeks*
Bahrain	TOTMKBA	2/12/2008	0.08	0.12	0.04	-0.08	1	1	0	0	0	13	1,185
Jordan	TOTMKJO	2/13/2008	0.08	0.08	0.16	0.08	0	0	0	0	0	2	194
Egypt	TOTMKEY	5/16/2012	0.13	0.08	0.05	-0.03	1	0	0	0	0	20	2,069
Oman	TOTMKOM	3/24/2012	0.13	0.07	0.10	0.03	1	0	0	0	0	7	712
Qatar	TOTMKQA	2/27/2013	0.15	0.09	0.11	0.02	1	0	0	0	0	29	2,969
Saudi Arabia	TOTMKSI	6/9/2010	0.17	0.30	0.12	-0.18	1	1	0	0	0	58	5,955
United Arab Emirates	TOTMKAE	10/11/2012	0.17	0.12	0.08	-0.04	1	1	0	1	0	35	3,566
Argentina	TOTMKAR	6/12/2014	0.20	0.13	0.19	0.06	1	0	0	0	0	27	1,553
Bulgaria	TOTMKBL	10/29/2009	0.21	0.41	0.25	-0.17	1	0	0	0	0	2	146
Malta	TOTMKMA	3/9/2006	0.21	0.15	0.25	0.10	1	0	1	0	0	2	210
Peru	TOTMKPE	5/16/2012	0.23	0.15	0.16	0.00	0	0	0	0	0	30	3,070
India	TOTMKIN	4/22/2003	0.25	0.12	0.25	0.13	1	1	0	1	0	55	5,459
Turkey	TOTMKTK	11/14/2002	0.25	0.18	0.08	-0.11	1	0	0	0	0	19	1,854
Cyprus	TOTMKCP	10/22/2009	0.26	0.61	0.50	-0.11	1	1	0	0	0	4	418
Estonia	TOTMKEO	3/4/2011	0.26	0.32	0.55	0.23	0	0	0	0	0	1	98
Thailand	TOTMKTH	6/19/2008	0.28	0.27	0.45	0.18	1	1	0	1	0	47	4,362
Israel	TOTMKIS	7/2/2006	0.30	0.16	0.47	0.31	1	1	0	1	1	48	4,631
Brazil	TOTMKBR	10/21/2009	0.33	0.63	0.61	-0.02	1	0	0	1	0	189	17,433
Greece	TOTMKGR	10/18/2002	0.33	0.30	0.24	-0.06	1	0	0	0	0	27	2,640
United States	TOTMKUS	12/19/2002	0.33	0.36	0.48	0.13	1	1	1	1	1	1,688	165,019
Japan	TOTMKJP	2/19/2008	0.34	0.44	0.41	-0.03	0	0	1	1	1	923	92,353
Luxembourg	TOTMKLX	5/8/2007	0.34	0.30	0.56	0.26	0	0	1	0	0	22	2,200
Czech Republic	TOTMKCZ	3/29/2007	0.36	0.53	0.67	0.14	1	0	0	0	0	10	1,010
Malaysia	TOTMKMY	5/7/2007	0.36	0.33	0.38	0.05	1	1	0	1	0	85	7,861
Mexico	TOTMKMX	3/14/2003	0.36	0.29	0.35	0.06	1	0	0	1	0	6	513
Taiwan	TOTMKTA	3/15/2011	0.36	0.65	0.61	-0.04	0	0	0	0	0	211	20,016
Russia	TOTMKRS	2/16/2015	0.37	0.22	0.55	0.34	1	0	0	1	0	15	450
Hungary	TOTMKHN	7/9/2003	0.39	0.20	0.35	0.16	1	0	0	0	0	6	535
Hong Kong	TOTMKHK	3/3/2003	0.40	0.36	0.38	0.01	0	1	1	1	1	93	8,883
Canada	TOTMKCN	12/17/2002	0.42	0.37	0.37	-0.00	0	1	1	1	1	243	23,396
Colombia	TOTMKCB	3/26/2012	0.42	0.49	0.26	-0.23	1	0	0	0	0	34	3,468
Poland	TOTMKPO	11/4/2003	0.43	0.15	0.39	0.24	1	0	0	0	0	14	1,372
South Africa	TOTMKSA	3/18/2003	0.44	0.20	0.37	0.18	1	1	0	1	0	57	5,311
New Zealand	TOTMKNZ	12/1/2003	0.46	0.47	0.65	0.18	0	1	1	0	1	25	2,364
Australia	TOTMKAU	10/8/2002	0.48	0.37	0.29	-0.08	1	1	1	1	1	119	11,687
Korea	TOTMKKO	6/9/2010	0.48	0.68	0.72	0.04	1	0	0	1	0	175	17,126
Singapore	TOTMKSG	11/17/2005	0.52	0.60	0.68	0.08	1	1	1	1	1	84	8,115
Norway	TOTMKNW	12/11/2006	0.55	0.44	0.71	0.27	0	0	1	1	1	41	3,761
Ireland	TOTMKIR	12/24/2012	0.56	0.88	0.55	-0.33	0	1	1	0	1	48	4,685

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Portugal	TOTMKPT	11/4/2002	0.56	0.56	0.19	-0.37	1	0	0	0	0	16	1,653
China	TOTMKCH	5/29/2007	0.58	0.52	0.91	0.39	1	0	0	1	0	764	59,791
Denmark	TOTMKDK	8/17/2006	0.58	0.51	0.79	0.28	0	0	1	1	1	48	4,610
Austria	TOTMKOE	10/28/2009	0.63	0.82	0.88	0.06	1	0	1	0	1	36	3,407
Finland	TOTMKOE	11/22/2007	0.63	0.71	0.82	0.11	0	0	1	0	1	57	5,641
Sweden	TOTMKSD	5/17/2011	0.67	0.85	0.82	-0.03	1	0	1	1	1	104	10,187
Italy	TOTMKIT	9/15/2003	0.69	0.84	0.87	0.03	0	0	0	1	1	81	7,830
United Kingdom	TOTMKUK	3/10/2003	0.71	0.80	0.73	-0.07	0	1	1	1	1	336	33,210
Belgium	TOTMKBG	4/3/2005	0.72	0.82	0.89	0.07	1	0	1	1	1	41	4,048
Switzerland	TOTMKSW	2/15/2010	0.72	0.81	0.79	-0.03	1	0	1	1	1	133	13,143
Indonesia	TOTMKID	1/21/2014	0.74	0.43	0.72	0.29	1	0	0	1	0	1	81
Spain	TOTMKES	3/24/2003	0.74	0.78	0.87	0.09	0	0	0	1	1	91	9,302
Germany	TOTMKBD	11/5/2003	0.80	0.79	0.89	0.10	1	0	1	0	1	78	7,897
France	TOTMKFR	2/19/2003	0.83	0.95	0.95	-0.00	1	0	1	1	1	181	18,483
Netherlands	TOTMKNL	11/22/2007	0.84	0.94	0.92	-0.01	0	0	1	1	1	124	12,320
		Average *Integration*	***0.42***			***Average ΔIntegration (R^2):***	***0.05***					Total: 6,605	630,252
						t-test	p=0.02						
						Binomial test	p=0.04						
						Wilcoxon signed rank test	p=0.02						

The sample includes 54 countries that have a Datastream index and at least one publicly listed firm with a market capitalization of at least $500 million from 1995–2018. I report the Datastream series name for the US-dollar returns (datatype: *X(RI)~U$*), the *M*MoU date, and the time-series average of the Pukthuanthong and Roll (2009) integration measure (subject to availability). I also report the Pukthuanthong and Roll (2009) integration measure in the year before the *M*MoU and the year after the *M*MoU, and the difference between the two. Below the difference column, I provide the *p*-values associated with a *t*-test, a binomial test of the direction of the changes, and a Wilcoxon signed rank test. I also provide indicators of each country's classification of a country as either high (1) or low (0) on the following country-level dimensions: capital controls (from Fernandez et al. (2015)), common law legal origin, rule of law (from Kaufmann et al. (2010)), market size (from Datastream), and developed markets (from MSCI). The final two columns present the firms and firm-weeks in the firm-specific tests (which are described in section 5).

TABLE 5—MARKET INTEGRATION (COUNTRY-LEVEL EVIDENCE)

	(1)	(2)	(3)	(4)
DV=	R^2	R^2	$(R^2)^2$	$\sqrt{(R^2)}$
Post	0.171***	0.111**	0.189**	0.095**
	(2.89)	(1.99)	(2.42)	(2.03)
N observations	1,218	1,218	1,218	1,218
Country FEs	Y	Y	Y	Y
Year FEs	Y	Y	Y	Y
Country time trends	N	Y	Y	Y

This table presents the estimates from logistic panel regressions of the integration proxy (from Pukthuanthong and Roll (2009)). For each country-year, I first compute the measure of integration by regressing a country's daily return in US dollars (minus the risk-free rate) on ten global factors (as described in section 5). The explanatory power of these regressions (R^2) from the first stage serves as the dependent variable, which is naturally bounded between 0 and 1 (the reason for using logistic regression). In columns 3 and 4, I transform the dependent variable by squaring or taking the square root (as indicated in the column headings). The sample (from Datastream) includes the 54 countries reported in Table 4 from 1995 to 2018. The estimates are based on equation 2:

$$R^2_{c,t} = \alpha_0 + \alpha_1 Post + \sum_{c=2}^{C} \alpha_c \, Country\ FEs_{ij} + \sum_{t=C+2}^{T} \alpha_t \, Year\ FEs + \sum_{j=C+T+2}^{J} \alpha_j \, Country\ time\ trends + \varepsilon_t.$$

The *Post* indicator is set to 1 for country-years greater than or equal to the year that a country joins the *M*MoU. Country and industry fixed effects and linear country time trends are indicated for each column (but not reported for brevity). Standard errors are bias-corrected using a nonparametric bootstrap that selects observations (with replacement) and uses the empirical distribution of estimated coefficients from 100 replications.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. Standard errors are clustered at the country-pair level.

TABLE 6—MARKET INTEGRATION: CROSS-SECTIONAL TESTS

Panel A: Capital controls

	Post
Capital controls	0.125
No capital controls	0.102

Panel B: Common law

	Post
Code	0.159**
Common	0.028

Panel C: Rule of law

	Post
Weak	0.163**
Strong	0.095

Panel D: Market size

	Post
Small	0.101
Large	0.144*

Panel E: Market development

	Post
Undeveloped	0.087
Developed	0.178***

This table presents the estimates from logistic panel regressions of the integration proxy (from Pukthuanthong and Roll (2009)). For each country-year, I first compute the measure of integration by regressing a country's daily return in US dollars (minus the risk-free rate) on ten global factors (as described in section 5). The explanatory power of these regressions (R^2) from the first stage serves as the dependent variable, which is naturally bounded between 0 and 1. The sample (from Datastream) includes the 54 countries reported in Table 4 from 1995 to 2018. The estimates are based on equation 2:

$$R^2_{c,t} = \alpha_0 + \alpha_1 Post + \sum_{c=2}^{C} \alpha_c \, Country\ FEs_{ij} + \sum_{t=C+2}^{T} \alpha_t \, Year\ FEs + \sum_{j=C+T+2}^{J} \alpha_j \, Country\ time\ trends + \varepsilon_t.$$

The *Post* indicator is set to 1 for country-years greater than or equal to the year a country joins the *M*MoU. Country and industry fixed effects and linear country time trends are indicated for each column (but not reported for brevity). Estimations are conducted in separate subsamples split by firm size, capital controls (from Fernandez et al. (2015)), common law legal origin, rule of law (from Kaufmann et al. (2010)), market size (from Datastream), and developed markets (from MSCI). Standard errors are bias-corrected using a nonparametric bootstrap that selects observations (with replacement) and uses the empirical distribution of estimated coefficients from 100 replications.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 7—CHANGES IN BETA—*FULL SAMPLE*

	(1)
R^L	0.695***
	(4.99)
R^W	0.234**
	(2.26)
Post	-0.001
	(-0.68)
R^L*post*	-0.108**
	(-2.29)
R^W*post*	0.090
	(1.49)
N observations	628,389
N firms	6,604
N clusters	53
R^2	0.401

The sample includes all firms with market capitalization above $500 million, non-missing total assets, and a home country index from Datastream. Spanning years from 2001 to 2016, there are 54 countries with at least one firm that meets these criteria. I report sample characteristics by country in the last two columns of Table 4 and describe them in section 5. I use firm-level weekly returns during the 52 weeks before and 52 weeks after a firm's home country joins the *M*MoU to estimate equation (4):

$$Ret=\beta_0+\beta_1 R^L+\beta_2 R^W+\beta_3 Post+\beta_4 R^L * Post+\beta_5 R^W * Post+\varepsilon_t$$

In this analysis, the treatment is defined at the country level by *Post*, an indicator set equal to 1 for observations where the date is greater than or equal to the week that a country joins the *M*MoU. *Ret* is the firm-level weekly return in US dollars, R^L is the weekly return in the firm's local market (provided by Datastream's indices), and R^W is the Datastream World market index in US dollars. To be included, a firm must have 75% of the observations present in both the pre- and post-*M*MoU periods. Returns are adjusted for the weekly T-bill rate (a proxy for the risk-free rate). Standard errors are clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 8—CROSS-SECTIONAL TESTS OF CHANGES IN BETA—*FULL SAMPLE*

Panel A: Firm size

		ΔR^L	ΔR^W
	Small	-0.082	0.076
	Large	-0.142***	0.111**

Panel B: Capital controls

		ΔR^L	ΔR^W
Home country	*Capital controls*	-0.071	0.024
	No capital controls	-0.144***	0.176***

Panel C: Common law

		ΔR^L	ΔR^W
Home country	*Code*	-0.154***	0.090**
	Common	0.046	0.032

Panel D: Rule of law

		ΔR^L	ΔR^W
Home country	*Weak*	-0.147***	0.170***
	Strong	0.010	-0.030

Panel E: Market size

		ΔR^L	ΔR^W
Home country	*Small*	-0.044	0.048
	Large	-0.130**	0.105*

Panel F: Market development

		ΔR^L	ΔR^W
Home country	*Undeveloped*	-0.148***	0.165***
	Developed	0.018	-0.034

The sample includes all firms with market capitalization above $500 million, non-missing total assets, and a home country index from Datastream. Spanning years from 2001 to 2016, there are 54 countries with at least one firm that meets these criteria. I report sample characteristics by country in the last two columns of Table 4 and describe them in section 5. I use firm-level weekly returns during the 52 weeks before and 52 weeks after a firm's home country joins the *M*MoU to estimate equation (4):

$$Ret = \beta_0 + \beta_1 R^L + \beta_2 R^W + \beta_3 Post + \beta_4 R^L * Post + \beta_5 R^W * Post + \varepsilon_t$$

Estimations are conducted in separate subsamples split by firm size, capital controls (from Fernandez et al. (2015)), common law legal origin, rule of law(from Kaufmann et al. (2010)), market size (from Datastream), and market development (from MSCI). In this analysis, the treatment is defined at the country level by *Post*, an indicator set equal to 1 for observations where the date is greater than or equal to the week a country joins the *M*MoU. *Ret* is the firm-level weekly return in US dollars, R^L is the weekly return in the firm's local market (provided by Datastream's indices), and R^W is the Datastream World market index in US dollars. Returns are adjusted for the weekly T-bill rate (a proxy for the risk-free rate). Standard errors are clustered at the country level.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 9—ALTERNATIVE TIME HORIZONS—*FULL SAMPLE*

Years pre/post	Φ_{Pre}	Φ_{Post}	$\Delta\Phi$
1	0.25	0.36	0.10
1.5	0.23	0.34	0.11
2	0.19	0.29	0.10
2.5	0.18	0.29	0.10
3	0.18	0.28	0.10
3.5	0.19	0.28	0.09
4	0.19	0.26	0.07

The sample includes all firms with market capitalization above $500 million, non-missing total assets, and a home country index from Datastream. Spanning years from 2001 to 2016, there are 54 countries with at least one firm that meets these criteria. I report sample characteristics by country in the last two columns of Table 4 and describe them in section 5. I use firm-level weekly returns during the 52 weeks before and 52 weeks after a firm's home country joins the MMoU to estimate equation (4):

$$Ret=\beta_0+\beta_1 R^L+\beta_2 R^W+\beta_3 Post+\beta_4 R^L * Post+\beta_5 R^W * Post+\varepsilon_t.$$

The years pre/post column indicates the number of years before and after the *M*MoU date, such that the total horizon varies between 2 and 8 years. The integration parameter, Φ, is the portion of the composite beta attributable to the world beta—defined as $[\beta_2/(\beta_1+\beta_2)]$ in the pre-*M*MoU period and $[(\beta_2+\beta_5)/(\beta_1+\beta_2+\beta_4+\beta_5)]$ in the post-*M*MoU period.

TABLE 10—MAIN TESTS OF CHANGES IN BETA—*CROSS-LISTED FIRMS*

	(1) *Main result*	(2) *US-Cross-listed*	(3) *Non-US cross-listed*	(4) *Popular cross-listing destination (excluding the US)*
R^L	0.685***	0.707***	0.700***	0.873***
	(7.25)	(7.90)	(5.88)	(23.95)
R^W	0.284***	0.271**	0.253**	0.108***
	(3.37)	(2.57)	(2.51)	(3.73)
Post	0.000	0.001	-0.000	0.001
	(0.10)	(1.18)	(-0.44)	(0.61)
R^L*post*	-0.025	-0.111**	0.006	-0.037
	(-0.71)	(-2.60)	(0.17)	(-1.49)
R^W*post*	0.055*	0.156***	0.032	0.062**
	(1.67)	(3.61)	(0.99)	(2.03)
N observations	137,497	52,896	84,628	57,413
N firms	1,411	553	858	585
N clusters	220	36	185	117
R^2	0.38	0.35	0.39	0.427

The sample includes 1,411 cross-listed firms (137,497 firm-weeks) across 221 country pairs from 2001 to 2016. The sample firms are reported by country pair in Figure 2 and described in section 6. I conduct the analysis in event time using the 52 weeks before and 52 weeks after the treatment—the week the home and host countries are linked by the *M*MoU. I use the same equation as in the previous tests:

$$Ret=\beta_0+\beta_1 R^L+\beta_2 R^W+\beta_3 Post+\beta_4 R^L * Post+\beta_5 R^W * Post+\varepsilon_t$$

In this analysis, the treatment is defined at the country-pair level by *Post*, an indicator set equal to 1 for observations where the date is greater than or equal to the week the home and host countries are joined by the *M*MoU. *Ret* is the firm-level weekly return in US dollars, R^L is the weekly return in the firm's local market (provided by Datastream's indices), and R^W is the Datastream World market index in US dollars. To be included, a firm must have 75% of the observations present in both the pre- and post-*M*MoU periods. Returns are adjusted for the weekly T-bill rate (a proxy for the risk-free rate). Standard errors are clustered at the country-pair level.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 11—CROSS-SECTIONAL TESTS OF CHANGES IN BETA—*CROSS-LISTED FIRMS*

Panel A: Distance

		ΔR^L	ΔR^W
	Close	0.05	0.02
	Medium	-0.02	0.02
	Far	-0.09**	0.12***

Panel B: Capital controls

		ΔR^L	ΔR^W
Home country	*Capital controls*	-0.03	0.07
	(No controls)	-0.03	0.06*

Panel C: Common law

		Host country			
		Code		*Common*	
		ΔR^L	ΔR^W	ΔR^L	ΔR^W
Home country	*Code*	-0.01	0.05	-0.05	0.07
	Common	0.01	-0.08**	-0.02	0.16***

Panel D: Rule of law

		Host country			
		Weak		*Strong*	
		ΔR^L	ΔR^W	ΔR^L	ΔR^W
Home country	*Weak*	-0.00	0.00	-0.10	0.13*
	Strong	0.00	0.07	-0.07	0.09

Panel E: Market size

		Host country			
		Small		*Large*	
		ΔR^L	ΔR^W	ΔR^L	ΔR^W
Home country	*Small*	-0.03	0.01	-0.02	0.08*
	Large	0.23	-0.15	-0.15	0.25**

Panel F: Market development

		Host country			
		Undeveloped		*Developed*	
		ΔR^L	ΔR^W	ΔR^L	ΔR^W
Home country	*Undeveloped*	-0.02	-0.01	-0.04	0.08
	Developed	0.14	-0.11	-0.04	0.09**

The sample includes 1,411 cross-listed firms (137,497 firm-weeks) across 221 country pairs from 2001 to 2016. The sample firms are reported by country pair in Figure 2. The analysis splits the sample into different conditions and performs a separate estimation for each subsample. For panels A and B, the sample is split along a single dimension—based on terciles of geographic distance between the home and host country in Panel A, and based on home country capital controls (from Fernandez et al. (2015)) in Panel B. Panels C–F split the sample across two dimensions defined by the cross-listed firm's home and the host country's common law legal origin, rule of law (from Kaufmann et al. (2010)), market size (from Datastream), and market development (from MSCI). I conduct the analysis in event time using the 52 weeks before and 52 weeks after the treatment—the week that the home and host countries are linked by the *M*MoU. I use the same equation as the previous tests:

$$Ret = \beta_0 + \beta_1 R^L + \beta_2 R^W + \beta_3 Post + \beta_4 R^L * Post + \beta_5 R^W * Post + \varepsilon_t$$

The treatment is defined at the country-*pair* level, by *Post*, an indicator set equal to 1 for observations where the date is greater than or equal to the week in which the home and host countries are joined by the *M*MoU. *Ret* is the firm-level weekly return in US dollars, R^L is the weekly return in the firm's local market (provided by Datastream's indices), and R^W is the Datastream World market index in US dollars. I require that firms have 75% of the observations present in both the pre- and post-*M*MoU periods. Returns are adjusted for the weekly T-bill rate (a proxy for the risk-free rate). Standard errors are clustered at the country-pair level.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 12—ALTERNATIVE TIME HORIZONS—*CROSS-LISTED FIRMS*

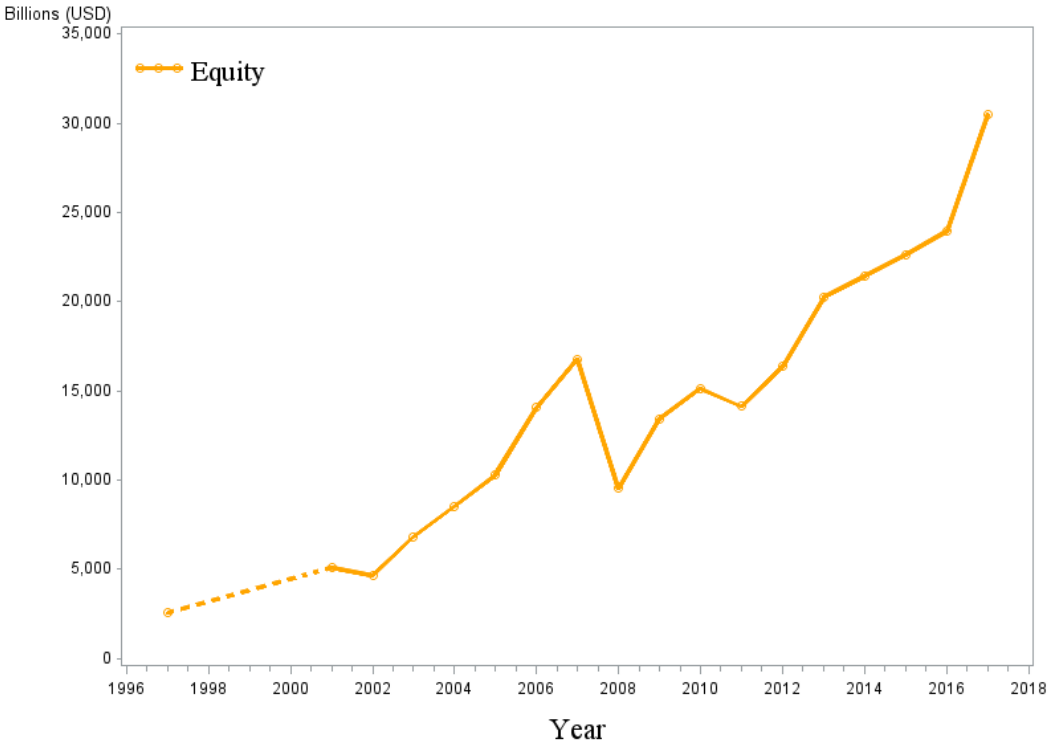
Years pre/post	Φ_{Pre}	Φ_{Post}	$\Delta\Phi$
1	0.29	0.34	0.05
1.5	0.32	0.37	0.05
2	0.30	0.37	0.07
2.5	0.31	0.37	0.06
3	0.31	0.37	0.06
3.5	0.31	0.37	0.05
4	0.32	0.36	0.04

The sample includes 1,411 cross-listed firms (137,497 firm-weeks) across 221 country pairs using windows of various lengths centered on the week that a firm's home and host countries are linked by the *M*MoU. The sample firms are reported by country pair in Figure 2 and described in section 6. I conduct the analysis in event time using the 52 weeks before and 52 weeks after the treatment—the week that the home and host countries are linked by the *M*MoU. I use the same equation as the previous tests:

$$Ret=\beta_0+\beta_1 R^L+\beta_2 R^W+\beta_3 Post+\beta_4 R^L * Post+\beta_5 R^W * Post+\varepsilon_t$$

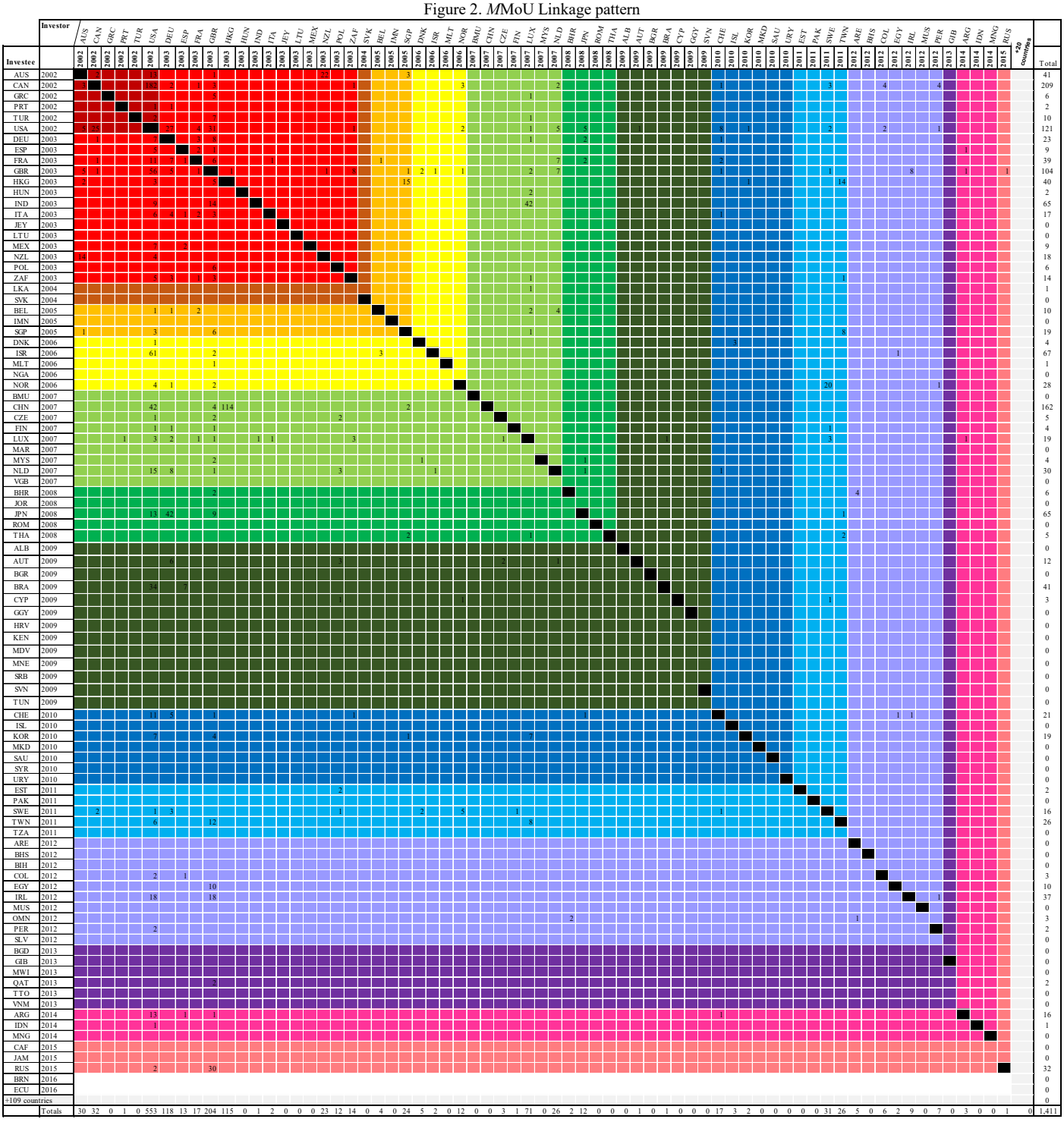
The years pre/post column indicates the number of years before and after the *M*MoU date, such that the total horizon varies between 2 and 8 years. The integration parameter, Φ, is the portion of the composite beta attributable to the world beta—defined as $[\beta_2/(\beta_1+\beta_2)]$ in the pre-*M*MoU period and $[(\beta_2+\beta_5)/(\beta_1+\beta_2+\beta_4+\beta_5)]$ in the post-*M*MoU period.

FIGURE 1. TOTAL CROSS-BORDER INVESTMENT OVER TIME



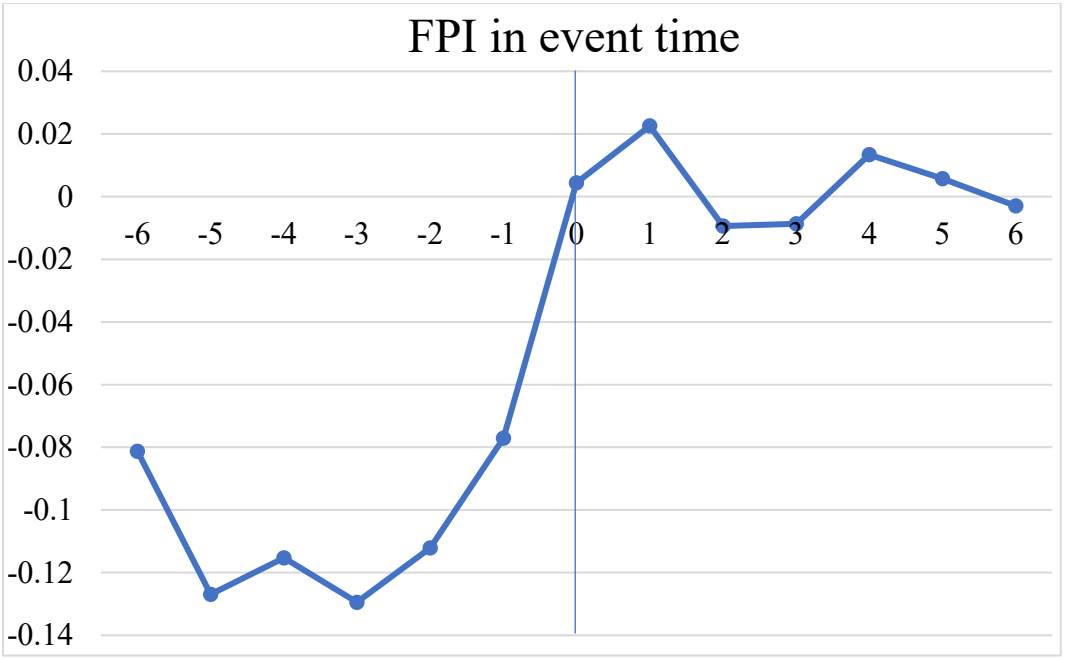
This figure shows cross-border equity investment from the IMF's Coordinated Portfolio Investment Survey (CPIS) for the available years (1997 and 2001–2017).

Figure 2. *M*MoU Linkage pattern



This adjacency matrix represents each of the country pairs in the FPI analysis and indicates when the treatment occurs for each pair. For brevity, investor and investee countries are reported using their International Organization for Standardization (ISO) three-digit codes. Shocks that occur in the same year have the same color, so blocks of country pairs with the same color experience the shock at the same time (and different-colored pairs experience the treatment at different times). The year of the treatment is the larger of the *M*MoU adoption years for the associated row and column. The matrix demonstrates that each individual country (row or column) typically has substantial variation in the treatment date, depending on its joining date and the counterpart country's joining date. Each cell has a 17-year time series. An additional 109 investee countries and 20 investor countries are suppressed because of space considerations and because they do not receive the treatment. Taiwan and United Arab Emirates are not included as investor countries in the FPI sample, but they are included here since they have associated cross-listings. The numbers in each cell represent the cross-listed firms, which are analyzed in section 6. For cross-listed firms, the home countries are in the left (investee) column and the host countries are in the top (investor) row. The total number of cross-listed firms is tabulated by home and host country.

FIGURE 3. CROSS-BORDER INVESTMENT IN EVENT TIME



This figure shows the effect of the MMoU on FPI in event time. The x-axis represents years relative to the MMoU linkage date, and the y-axis represents the raw coefficient (prior to exponentiating).

IOSCO's Committee 4 is a subcommittee comprising global representatives from IOSCO members. Its full name is the Committee on Enforcement and the Exchange of Information and the Multilateral Memorandum of Understanding Screening Group, but it is known as SG/C4. When a regulator submits its application to the *M*MoU, the application is closely examined by a specially constituted verification team (VT). The VT is usually a geographically diverse, nine-member group that, for efficiency, includes members who are familiar with the applicant. The process either starts a formal application or a consultation with the SG regarding any special circumstances in terms of a regulator's eligibility. A hypothetical timeline based on actual applicants is provided below.

January 1, 2010: Mounting global political pressure to combat terrorist financing and money laundering stirs a regulator (which I will call the "FMA") to pursue the *M*MoU. This pressure can come from parliaments (or other legislative authorities), presidential cabinet members, IOSCO itself (in 2005, IOSCO gave its members 5 years to sign the *M*MoU or risk losing their voting rights), the IMF, World Bank, FSB, or other regulatory peers.

March 1, 2010: After evaluating its own qualifications pursuant to the *M*MoU, the FMA, in conjunction with its local government, proposes new legislation to revise its legal framework for cooperation in securities supervision. This draft legislation is intended to address shortcomings arising from bank secrecy laws, blocking statutes, and procedural issues. For market participants, this is an early signal that the FMA is preparing to sign the *M*MoU.

April 1, 2010: The FMA files its application to become a signatory of the *M*MoU. As part of the application, the FMA submits a completed questionnaire, including descriptions of the legislative proposals.

April 15, 2010: The application is forwarded to the VT members for review.

July 1, 2010: Based on the FMA's answers to the *M*MoU questionnaire, an initial evaluation is made. A report is drafted with a recommendation to accept (or require revisions or further information). The report is delivered to the SG for consideration at the next semi-annual SG meeting.

August 1, 2010: The draft law proposed on March 1, 2010, is passed and enters into force on January 1, 2011.

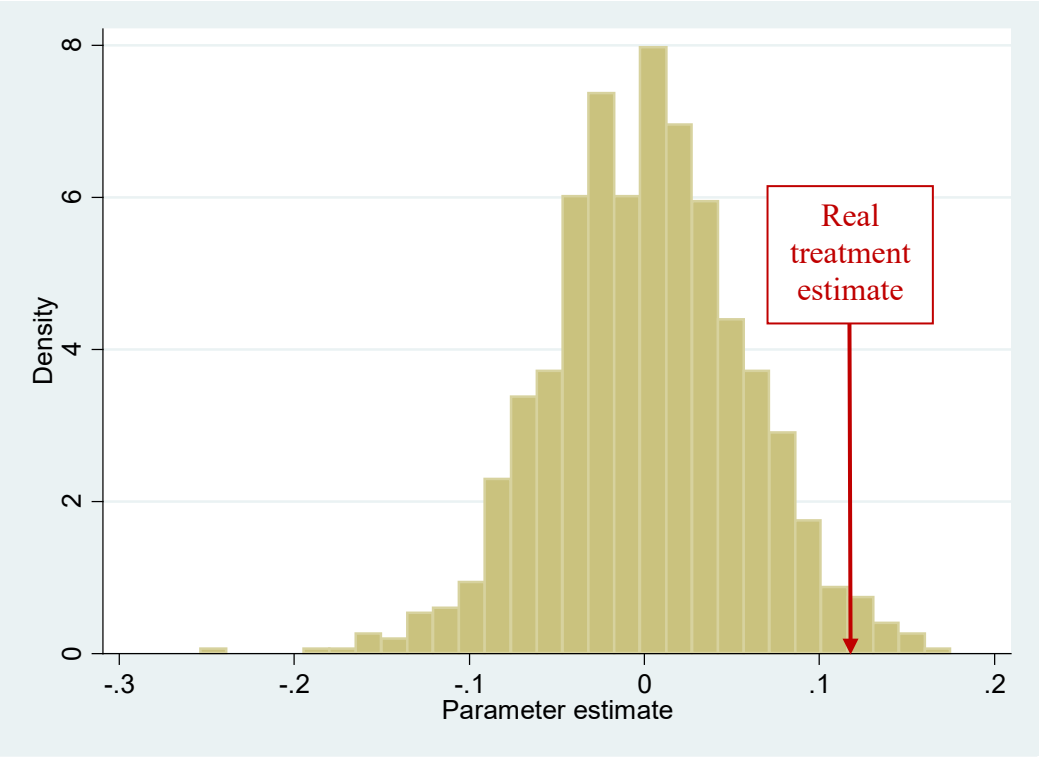
November 1, 2010: At the SG meeting, representatives of the FMA are invited to attend a discussion of the FMA's eligibility. The SG could reach a consensus that the applicant meets all of the criteria and thus proceed to the next step, or it could require additional legislative changes or solicit more information, in which case the application could be reconsidered at the next semi-annual meeting (six months later).

October 15, 2010: If additional changes are required, additional iterations of the step described on March 1 can take place.

January 1, 2011: The new laws enter into force on January 1, 2011.

February 15, 2011: The *M*MoU is signed (unless signing is delayed until the IOSCO Annual Meeting in April).

INTERNET APPENDIX FIGURE 1. DISTRIBUTION OF ESTIMATES FROM PSEUDO-TREATMENT



This histogram shows the distribution of the pseudo-treatment coefficients (as described in section 3.5).

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Cross-border cooperation between securities regulators☆

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ABSTRACT

The events of September 11, 2001, prompted sweeping cross-border coordination efforts for securities regulators around the globe. After 9/11, the International Organization of Securities Commissions (IOSCO) forged a nonbinding arrangement—the Multilateral Memorandum of Understanding Concerning Consultation and Cooperation and the Exchange of Information (MMoU)—that standardized the protocol for information sharing among participating securities regulators. Because regulators from different countries entered the MMoU at different times, their enlistments created a set of staggered shocks. I use these shocks to show that the resulting cross-border cooperation (a) increases cross-border enforcement and (b) reduces the cost of liquidity provision in the capital markets of participating countries. These results support the conclusion that the MMoU helps fill gaps

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Regulatory cooperation
Enforcement

in cross-border regulation that historically exposed investors to information asymmetry, agency costs, and expropriation risks.

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1. Introduction

In purely domestic settings, regulators are usually (by construction) supplied with the surveillance and enforcement powers necessary to carry out their mandate. The same is not true in cross-border settings. In cross-border settings, information, witnesses, and assets typically reside outside the regulators' jurisdictions. As a result, regulators are often constrained by information shortfalls, jurisdictional complexities, and legal limitations. Thus, cross-border enforcement differs from enforcement within a single regulatory system in that it requires cooperation between regulators operating in different and seemingly incompatible legal systems. Recent increases in the number of cross-border transactions suggest a growing need for better cooperation and more effective cross-border enforcement,[2] but the literature to date tells us little about regulators' attempts to keep pace.

After September 11, 2001, the need to eliminate terrorism-related financing and money laundering compelled regulators in the International Organization of Securities Commissions (IOSCO) to standardize cooperation via a special arrangement—the Multilateral Memorandum of Understanding (MMoU). The MMoU addresses the scope, confidentiality, and use of information shared between signatory regulators.[3] For these regulators, the MMoU is a conduit designed to increase information flows (e.g., transfers of brokerage and beneficial ownership records, depositions, and testimony) and extend enforcement capabilities (e.g., restraining orders that freeze assets, reduce defendant flight risks, force the identification of accounts, and prohibit destruction of critical documents).[4]

The MMoU is not a treaty but rather a cooperative arrangement structured as a *statement of intent.* As such, the MMoU is neither ratified by national legislatures nor approved by executive branches; any disputes that arise from it cannot be arbitrated by (international) courts.[5] Legal scholars are thus skeptical of its effectiveness (Zaring, 2010; Cadmus, 2011), much as they are skeptical of other policy coordination using "soft law" methods (Klabbers, 1996, 1998; Raustiala, 2005).

I begin by studying securities regulators' cross-border enforcement capacities. Using the staggered introduction of the MMoU as a set of potential shocks to cooperative capacity, I find that the US Securities and Exchange Commission's (SEC) enforcement of US-listed foreign firms is around three times as likely when the firms' home country regulators are linked to the SEC by the MMoU.[6] This suggests that the MMoU helps catalyze enforcement, despite its lack of legal force.

Next, I broaden the scope to a global sample and show that the MMoU enhances equity market liquidity. Cross-border shares whose co-supervising (home and host) regulators are united by the MMoU experience an 18%—35% reduction in spreads, depending on the model specification. This finding is consistent with the MMoU fostering effective cross-border cooperation and enforcement, which in turn reduces the risks reflected in liquidity.

Finance and accounting research has paid attention to cross-border enforcement, particularly at the SEC, since the bonding hypothesis was conceived in 1999. This hypothesis proposes that investors in foreign firms benefit from the enhanced disclosure and shareholder protection that accompany a U.S. listing (Coffee, 1999; Stulz, 1999). A key to the hypothesis is the idea that the threat of enforcement deters malfeasance, which reduces agency conflicts and thereby creates value. However, some authors challenge the plausibility of the hypothesis, on the grounds that cross-listed firms face lower and less strict standards of SEC oversight than U.S. firms (Frost and Pownall, 1994; Frost and Kinney, 1996; Siegel, 2005). Licht et al. (2018) suggest that legal obstacles and a laissez-faire approach lead to weaker SEC enforcement against cross-listed firms. Some authors even question

[2] Increased cross-border market activity is illustrated by market liberalization, new technologies (e.g., telephone and internet brokerage relationships), trading configurations (e.g., location-neutral electronic trading platforms), global consolidations of major stock exchanges (e.g., mergers between the NYSE and Euronext, between NASDAQ and OMX, and between the London Stock Exchange and the Borsa Italiana in Milan), mergers of broker-dealers, and initiatives like the European Union's directives, harmonization, and "passporting" efforts (Christensen et al., 2016; Meier, 2017).

[3] The MMoU document (revised in 2012) can be viewed here.

[4] Some capabilities—such as acquiring banking, brokerage, and beneficial ownership records and witness testimony under oath as well as removing impediments to cooperation such as secrecy laws and blocking statutes—are explicitly identified by the MMoU. For other capabilities, Section 7(a) of the MMoU simply suggests that signatories provide each other with the "fullest assistance permissible."

[5] In practice, even legally binding agreements tend to work very poorly across borders. See, for example, Supreme Court Justice Alito's commentary in the oral argument in *US v. Microsoft* (February 27, 2018), noting that, even under (enforceable) treaties, acquiring information requires months or more typically years—long enough for most cases to go cold. Ederington (2001, p.1580), speaking about legally enforceable contracts, states that "one of the challenges of international cooperation is the absence of a central authority to enforce the terms of an agreement." Such issues are magnified when the arrangement is, at its outset, known to be unenforceable.

[6] "Foreign" and "cross-border" describe ADRs, dual listings, and foreign firms listed only in the United States. I refer to firms or shares from different countries that are not listed in any other country as "domestic."

whether the *threat* of SEC enforcement exists for cross-listed firms (Licht et al., 2018; Siegel and Wang, 2013). Yet researchers have not investigated the frictions that lead to weaker SEC enforcement.

Multiple factors can constrain cross-border cooperation, which is often necessary for enforcement. Enforcement can be slowed by ad hoc examinations of requests or halted entirely by confidentiality provisions (e.g., blocking statutes and secrecy laws), dual criminality requirements (which stipulate that assistance is allowed only if the activities in question are illegal in both jurisdictions), or the need for a foreign regulator to have an independent interest in a matter. Even when cooperation occurs, a lack of competence or legal authority in a foreign counterpart can weaken cross-border enforcement.

The MMoU aims to address these issues by standardizing the protocols for cooperation. Dual criminality requirements, confidentiality provisions, and independent interest stipulations are not valid reasons for an MMoU signatory to refuse to cooperate. As a result, the arrangement improves access to local information (e.g., depositions and local regulatory correspondence), auditors (e.g., work papers), banks (e.g., account and transaction identification), brokers, and third parties (e.g., internet/telephone and purchase transaction records). In addition, IOSCO's rigorous assessment requires that applicants demonstrate the requisite legal authority and competence to comply with the arrangement.

Three novel properties of the MMoU setting enable me to draw strong inferences. First, its justification was to combat terrorist financing and money laundering after 9/11, yet its capabilities have direct implications for securities regulation. Unlike most regulatory regime shifts, its establishment is unrelated to market forces and therefore arguably exogenous to firms, investors, and even regulators. Second, because cross-border firms reside in one country (*home*) but trade in another country (*host*), an important linkage is formed when regulators in two countries are united by the MMoU. Importantly, these linkages create shocks to cross-border regulation that occur not only at different times for different countries but also at different times *within* individual countries. That is, the network formation creates a treatment that is staggered in three dimensions, because the links jointly depend on a firm's (i) home-country joining date (ii), host-country joining date, and (iii) time. To my knowledge, this is the first network-created treatment of its kind. Third, in the liquidity analyses, purely domestic observations serve as a counterfactual (benchmark). I compare the liquidity of cross-border (treated) shares with that of domestic (untreated) shares that are exposed to otherwise similar circumstances (in the same country, at the same time), while controlling for industry and liquidity-related fundamentals. These comparisons are made both before and after the MMoU links home and host regulators. This constitutes a triple difference-in-difference design.

These unusual factors—(1) arguably exogenous shocks, (2) these shocks occurring in a three-dimensional stagger, and (3) within-country benchmark shares in a triple diff-in-diff design—yield persuasive inferences about the MMoU's market effects. To affect my inferences, a correlated omitted variable would have to do more than affect the liquidity of a country at a point in time (as occurs with changes in, say, business cycles or laws); it would have to affect certain subsets of treated shares (but not have the same influence on domestic shares) at the precise times when the MMoU links the treated shares' co-supervising regulators. A variable with such specific characteristics seems unlikely.[7]

This is the first empirical study of interactions between securities regulators, and it contributes to the literature in four ways. First, it illuminates cross-border enforcement of securities laws, an increasingly important topic as markets globalize. The literature contends that identifying cross-border frictions and regulators' management of those frictions is critical (Austin, 2012) and—due to confidentiality provisions of the MMoU and the opacity of regulators—empirically challenging (Cadmus, 2011). For almost four decades, cross-border enforcement has remained a black box whose inner workings are obscure even to experts. By documenting a link between enforcement outputs and the MMoU, this study establishes that cross-border cooperation helps catalyze enforcement.[8] Historically, cross-border frictions appear to have limited the SEC's tactics and information. These frictions—and not deliberate indifference—may have led to fewer cross-border enforcement actions. This matters for the bonding literature, which views a U.S. listing as promoting better oversight but struggles to determine whether increased oversight *actually* occurs.

Second, this paper shows that the MMoU is associated with large, measurable reductions in transaction costs. These reductions vary from country to country and between country pairs, and I use this variation to explore factors that condition the MMoU's impact (as inferred from liquidity). I find evidence that country-level legal paradigms (e.g., common vs. code law), laws (e.g., blocking statutes), and economic factors (e.g., economies of scale, and reciprocity) influence the magnitude of the liquidity improvement in predictable ways. These analyses demonstrate that the effect is broader than just the US (and UK)—which indicates that the MMoU is an effective global instrument. The results offer new insights and reinforce the conclusion that cross-border cooperation, made possible by the MMoU, is a key determinant of the cost of liquidity provision.

Third, I establish the appeal of the MMoU setting and develop its institutional details. The MMoU appears to have been politically motivated by the events of 9/11 and is arguably exogenous to the firms and perhaps even to the securities regulators themselves. This property, together with the within-country staggered design, makes this an attractive setting for studies seeking exogenous variation in regulatory enforcement.

Finally, the MMoU's association with enforcement suggests that it is an effective policy tool, despite being legally nonbinding. On the surface, this association might seem unsurprising, since enhanced enforcement is the MMoU's aim. But because cooperation is entirely unenforceable, there exists considerable skepticism regarding the MMoU's effectiveness.

[7] Note that this design substantially reduces the likelihood that various types of endogeneity, including the timing of MMoU entry, explain my findings.

[8] Silvers (2016) identifies the expansion in cross-border SEC enforcement and speculates that cross-border cooperation played a role in more frequent enforcement, but provides no tests that could separate these efforts from the effects of the Sarbanes-Oxley Act, SEC budgetary increases, or regulatory preferences.

Thus, the MMoU's association with enforcement is relevant to parties seeking new soft law transnational regulatory networks, enhanced cooperation, or policy convergence.

2. Background and research design

2.1. Cross-border enforcement

The literature lacks consensus on whether public oversight can affect contracting and monitoring costs, but many authors argue that it can (Coffee, 1984; Easterbrook and Fischel, 1984; Zingales, 2009). When *cross-border* oversight is considered, the discussion centers on the bonding hypothesis, which views cross-listing in the US as a way to credibly signal to investors a firm's commitment to enhanced disclosure, governance, and minority shareholder protection (Karolyi, 2006, 2012). Other literature questions the benefit of regulation and the legitimacy of the bonding hypothesis. Several papers contend that public regulators are unnecessary, incapable, corrupt, or swayed by powerful industries and lobbyists (Coase, 1960; Stigler, 1964, 1971; Posner, 1974; Peltzman, 1976). If anything, regulatory shortcomings are magnified in cross-border contexts. More recently, bonding-theory critics have acknowledged valuation benefits associated with secondary listings in the US, but ascribe them to factors other than legal protections, mainly because they view cross-border enforcement as too rare and dysfunctional to provide benefits (Licht, 2003; Licht et al., 2018; Shnitser, 2010; Siegel, 2005).

2.2. Enforcement cooperation and information-sharing arrangements

Historically, the tools at the disposal of securities regulators in ad hoc cross-border cases—letters rogatory and mutual legal assistance treaties (MLATs)—were fairly blunt instruments. Letters rogatory are precatory petitions, written by local courts, asking foreign courts to supply information or act on behalf of the requesting court by taking or preventing a legal action based on diplomatic incentives. Requests involving more egregious crimes (human trafficking, murder, etc.) often take priority over requests for securities investigations, but even the "successful" requests must crawl through diplomatic channels, which can take years (Swire and Hemmings, 2015). MLATs can provide criminal enforcement agencies a legal right to information or allow them to extradite criminals, but only under certain conditions. Investigations by securities regulators tend to be civil in nature, and regulators often lack a statutory analog of the alleged crime, which is a common precondition for invoking an MLAT. In sum, letters rogatory and MLATs are cumbersome tools with uncertain efficacy (especially in securities regulation). This helps explain why cross-border efforts during the 1980s and 1990s were protracted, costly, and generally ineffective.

These sorts of difficulties led regulators to seek new ways to facilitate and institutionalize cooperation. This was initially done by signing *bilateral* memoranda of understanding (MOU)—nonbinding (soft law) arrangements that expressed an *intent* to cooperate. Ironically, the early bilateral arrangements routinely acknowledged that both parties lacked the legal authority to share information, but expressed intentions to obtain such authority in the future (Fedders et al., 1984; Levin, 1985; Grassie, 1987). Unlike a treaty, an MOU is not enforceable, so the risk of counterparts not upholding their pledge is high. It is thus not surprising that the effectiveness of MOUs has been questioned. Although the bilateral arrangements of the 1980s and 1990s laid important groundwork for later efforts, academic research still criticized SEC enforcement against foreign firms during this period as "infrequent and ineffective" (Siegel, 2005). This view is consistent with the general skepticism about soft law expressed by prior research (Klabbers, 1996, 1998; Raustiala, 2005).

The terrorist attacks on September 11, 2001, generated widespread political support for information-sharing efforts, which led to an extraordinary exogenous change to cross-border enforcement capacities—the MMoU. Kempthorne (2013) states: "Regulators recognized the limitations to the current network of bilateral MOUs prior to the crisis, but it had not reached a critical point where securities regulators were willing to do something to address it. September 11 was that critical point."

The MMoU resembles the bilateral memoranda in that it seeks a similar objective (regulatory cooperation) and is not legally enforceable. But it arose for an extraordinary reason and is constructed entirely differently. Problems with ad hoc investigations led to the establishment of many bilateral arrangements, but it was 9/11—or, specifically, top-down political support for cooperation in the wake of 9/11—that motivated the MMoU. IOSCO (2014) explains that "the MMoU was developed by IOSCO following the events of 11 September 2001, when IOSCO created a Special Project Team to explore how securities regulators could expand cooperation and information sharing."

The MMoU facilitates cross-border enforcement by standardizing the acquisition and sharing of information, by specifying the scope of information gathering, and by defining the confidentiality and acceptable uses of the shared intelligence. These standards allow for an ex ante understanding of how cooperation will take place. Key components of the MMoU are its focus on the regulator's practical ability to provide assistance and its acknowledgement that regulators have widely varying grants of legal authority (Slaughter and Zaring, 2006). Unlike prior cross-border arrangements, which were often aspirational for one or both sides, the MMoU application process requires IOSCO to rigorously review the laws and institutions within each applicant nation to confirm the nation's legal capacity for swift cooperation.[9] Prior to admittance, applicants must remove any

[9] The MMoU application includes detailed questions related to the applicant's capability to obtain and share information. An IOSCO verification team, composed of securities regulators from around the globe, carefully reviews the answers to these questions and assesses applicants' ability to meet a high standard for assistance.

obstacles to cooperation, such as sovereignty issues (Nadelmann, 1993), governmental transparency initiatives (e.g., the Freedom of Information Act), foreign privacy laws that prevent evidence sharing with foreign counterparts (Savarese, 2015), and dual criminality requirements. They must also remediate blocking statutes or secrecy laws by legislating exceptions known as "gateways." After countries are admitted, the MMoU encourages them not only to comply with requests from other authorities but also to make reasonable efforts to provide *unsolicited* help when they possess potentially useful information. The MMoU's monitoring group provides an ongoing assessment of signatories' performance.

Sometimes applicants must change laws or regulations before they can sign the MMoU, and these changes may contribute to cross-border cooperation. Although the new laws or rules may narrowly predate the signing, the MMoU still motivates them, and their passage does not prevent the MMoU from serving as an instrument for identifying variation in cross-border cooperation. In fact, to the extent that local enforcement capacities simultaneously increase, cross-border enforcement might be less necessary, which would bias against my later findings.

Although the MMoU is soft law, IOSCO members have much stronger incentives to join the MMoU than to enter into bilateral arrangements (Van Cauwenberge, 2012). Unlike in bilateral arrangements, MMoU membership is all but required for participation in the global financial system: the IMF's Financial Sector Assessment Program and the Financial Stability Board each weigh MMoU membership when they consider a country's financial health, and IOSCO penalizes countries that are not part of the MMoU by revoking their IOSCO voting rights and membership (IOSCO, 2005). In most nations, a political motivation to stop money laundering and terrorist financing creates an important push for MMoU participation. One final incentive is that, by joining the MMoU, regulators can use the global support for IOSCO standards to justify needed changes to their laws.

Based on these factors, I propose that the MMoU breaks down significant cross-border barriers and increases the feasibility, in cost and logistics, of cross-border enforcement. My tests focus on SEC enforcement of U.S.-listed foreign firms. In recent decades, few changes have occurred in the basic structure of US securities laws, the SEC's approach to regulatory relief, and how the SEC's cases are made public, so there is a reasonable setting and reliable dataset to support empirical tests.[10] I expect that the application to the MMoU is associated with increased cross-border SEC enforcement.[11]

Although my enforcement tests focus on the SEC, there is evidence that the MMoU's effect on enforcement reaches beyond the commission. Anecdotally, securities regulators credit the MMoU for transforming their cross-border enforcement capacities (IOSCO, 2012). Ashley Alder, former CEO of the Securities and Futures Commission in Hong Kong and current chair of IOSCO, states: "The IOSCO MMoU is a widely used arrangement under which 121 securities regulators have agreed the basis on which they exchange information for the purposes of their enforcement mandates" (ESMA, 2019). Basic statistics from IOSCO and the SEC indicate that, in 2017, 4803 MMoU requests were made; of these, less than 600 were made by the SEC to foreign regulators (SEC Congressional Budget Justification, 2017). Clearly, other regulatory agencies are actively using the MMoU.

2.3. Capital market effects of enforcement cooperation

2.3.1. Important share type distinctions and structure of data

By using liquidity as an indicator of market quality, I can assess a global sample—not just firms registered with the SEC—in my tests of the MMoU on capital markets. There are two distinct effects of the MMoU, which affect different subsets of my sample. First are *market-wide* effects, which are common to all shares in a given country's market. These could occur because MMoU admission signifies that the country's regulator has met IOSCO's regulatory standards. Meeting these standards may have required legislative solutions to existing regulatory deficiencies, greater funding for regulators, or simultaneous efforts to cultivate capital markets. Increases in learning between regulators, dissemination of best practices, and regulatory convergence could also happen (Austin, 2012). All of these factors may strengthen markets generally; if they also affect liquidity, then the benefits should accrue to all share types. Consequently, changes that are contemporaneous with the MMoU—not to mention the signal provided by the MMoU admission itself—could affect the country's entire market.

Second are *cross-border* effects, which occur only for certain subsets of shares. Specifically, these effects should be limited to cross-border shares (shares of firms that have a listing outside their home market), and should occur when a link is formed between regulators in the relevant home and host markets. The cross-border shares of a given firm can either be *host* shares, which are listed in foreign markets,[12] or *home* shares, which are listed in a firm's home country. This distinction is important because host shares are the most exposed to both information and regulatory problems (for reasons described below).

[10] In contrast, other countries have changed their laws, evolved in their approach to regulatory relief, and often do not publicize enforcement outputs.

[11] Former SEC Chairman Donaldson highlighted the importance of the MMoU to the commission's enforcement efforts, saying, "The SEC has long recognized that international cooperation is vital to an effective enforcement program. The IOSCO (M)MOU is an important contribution to cross-border enforcement cooperation and a public statement that the world's securities regulators are committed to assisting one another in preventing and prosecuting violations of our securities laws. We are pleased to be a signatory to the (M)MOU and anticipate that this agreement will enhance our ability to obtain information valuable to our enforcement investigations." (SEC Staff, 2003).

[12] These could take the form of either American or Global Depositary Receipts ("ADRs" or "GDRs"), or regular (full) listings. I depart from the term "cross-listed," because cross-listed refers to the *firm*, not the *share*, and because shares that are exclusively listed in a foreign market are still considered host shares in my study.

Firms exclusively listed in their home market (non-cross-border shares) are hereafter called *domestic* shares and later serve as a baseline that should reflect any common within-country factors. This structure identifies effects of the MMoU that are common to all stocks in the country's market, as well as incremental effects found in cross-border (home and host) shares.

2.3.2. Cross-border regulatory cooperation and its relation to liquidity

Foreign assets offer investors benefits in terms of diversification or yield, but expose them to several risks. These risks arise in part because the regulatory deficiencies (described in Section 2.2) allow agency issues and information problems to proliferate. Therefore, cross-border regulatory gaps (and their resolution) have implications for liquidity.

Firms that pursue a foreign listing typically select host markets with more demanding standards of investor protection and disclosure than their home market requires. In these cases, exposure to the threat of sanctions from a stronger host market regulator is one way to credibly commit to better governance of the firm—thereby resolving agency conflicts and enhancing liquidity and firm value. This is the rationale for the bonding hypothesis. The ability for stronger host market regulators to substitute for weaker home market regulators depends partly on cross-border enforcement capacity—which, in turn, hinges on the assistance that regulators receive from foreign counterparts. When regulators cooperate, managers face a new threat of sanctions, which can increase transparency and constrain opportunism (for example, asset taking, fraud, or related-party transactions).[13] Therefore, the MMoU has clear implications for reducing the risks that arise from agency problems.

Information problems can arise because local investors, even ones who are not insiders, often have advantages over foreign investors in terms of the amount, precision, and timing of information (Gordon and Bovenberg, 1996; Brennan and Cao, 1997; Kang and Stulz, 1997; Bae et al., 2008). For example, lenders, customers, suppliers, analysts, market makers, brokers, journalists, and lawmakers often possess nonpublic, value-relevant information about the firm. This information diffuses into local environments before reaching foreign ones, which subjects foreign investors to adverse selection risks.

Cross-border trading can also raise issues outside the scope of classic bonding/agency problems. For example, host shares' bid-ask spreads are often wide, which makes them targets for price manipulation schemes fueled by bogus orders (pump-and-dump, spoofing, layering, etc.)., [14,15]

Gaps in the enforcement capacity of securities regulators magnify foreign investors' exposure to all of these risks. In purely domestic settings, a regulator uses the threat of enforcement to curtail behaviors that illegally exploit information advantages (and/or to return money to harmed investors). But cross-border regulatory gaps create safe havens for abuse. In fact, academics and practitioners argue that miscreants exploit cross-border regulatory vulnerabilities to evade scrutiny. In the absence of regulatory cooperation, cases of insider trading, asset taking, related-party transactions, front running trades, and market manipulation are unlikely to be prevented, discovered, or sanctioned.[16] For example, if regulators fail to cooperate, illegal insider trades can be strategically routed through foreign venues, which can conceal the trader's identity and diminish the chance of sanctions. This creates incremental adverse selection risks for host shares, because counterparties have a systematic advantage.

The tactics enabled by the MMoU should help protect investors from a variety of abusive practices. For example, the MMoU allows regulators to quickly identify, freeze, and repatriate ill-gotten gains regarding insider trading. It does so by promoting swift assistance in obtaining bank, brokerage, and beneficial ownership records and in executing temporary restraining orders that freeze assets, prohibit document destruction, or reduce flight risks.[17] A fast pace is critical, because pursuing insider-trading cases is futile once a trader absconds with the money. In addition, cases involving self-dealing and asset tunneling can be strengthened by intelligence about theft or questionable related-party transactions. Under the MMoU, this type of information can be obtained quickly from regulatory counterparts. The MMoU can also enable access to internet, telephone, and purchase records, which helps regulators establish the occurrence or content of communications between defendants. And it allows signatories to subpoena third parties and depose witnesses within other members' jurisdictions.

[13] Silvers (2018) provides evidence that cross-listed firms provide more transparent financial disclosure and less earnings management after the MMoU connects their home regulator to the SEC. Silvers' finding comports with those of Brockman and Chung (2003, p 927), who argue that the "legal-regulatory environment largely determines the quantity and reliability of publicly available information, particularly at the firm level." Greater transparency, in turn, should improve liquidity. Additionally, Lang et al. (2019) find that the MMoU changes the demand for owning US-cross-listed firms. Foreign investors in third-party countries (unaffiliated with the US or the home country) increase their holdings of US-cross-listed firms after the MMoU. Foreign ownership may prompt liquidity improvements (or vice-versa).

[14] For example, in Germany's (BaFin) investigation of suspicious trading of host shares of Dutch bank ABN Amro, the regulators identified a "comparatively wide bid-ask spread" between markets as something unscrupulous agents can exploit (BaFin, 2007, p. 182–183).

[15] In addition, host shares commonly have identical shares trading in other markets (that is, most have a corresponding home share that trades in the home market), and price formation is likely to occur disproportionately on the home exchange (Hauser et al., 2011). Host-country market makers thus face added risks from home-market informed traders, arbitrageurs, and competing market makers (who privately observe the arrival of information via trade demand by local investors with superior information) (Foucault et al., 2017). contend that prices of identical assets can temporarily diverge, because of differential shocks to an asset's value that derive from either (a) news arrival or (b) liquidity needs. News-based trades achieve profits at the expense of dealers who trade at stale quotes; such trades represent "toxic" arbitrage, because they consume liquidity and widen bid-ask spreads.

[16] For example, Austin (2014, p 41) suggests that perpetrators of market abuse structure their transactions in ways that deliberately conceal their actions and identity: "In the absence of an appropriate response by regulators it is clear that [cross-border changes to markets] have increased the opportunities for persons to engage in market abuse and their ability to hide such abuse from detection."

[17] Appendix A provides specific examples of various types of cases, from around the globe.

2.3.3. Firm versus share effects

The tactics and information access enabled by the MMoU provide a comprehensive change in regulatory capacity. This, in turn, helps regulators resolve issues both at the *share level* and the *firm level*. Share-level problems, such as market manipulation, insider trading, front running, arbitrage, and threats from competing market makers, create costs that are borne by specific counterparties in specific transactions in specific markets. Firm-level problems, including asset taking, disclosure, and related-party transactions, are agency related and harm all outside investors.

Host shares (cross-border shares listed in foreign markets) suffer from both firm- and share-level issues because adverse selection, information problems, and regulatory deficiencies are inherently more problematic in foreign markets. Foreign investors likely have higher sensitivities to, and lower tolerances for, the risks that the MMoU curtails. Thus, the effect of the MMoU should be strongest in *host* shares. Yet *home* shares (cross-border shares traded in local markets) may also experience certain benefits, including firm-level benefits and second-order effects such as increased competition for order flow from host markets, improved host-country capital-raising opportunities, and a more diverse shareholder base. Relative to *host* shares, however, *home* shares are likely to experience a less pronounced effect, because they are usually subject to fewer information problems and constraints on regulation (local regulators can typically supervise their own markets without cooperation from other regulators).

Some frauds combine several misdeeds and can mix share- and firm-level factors, such as when self-dealing is concealed through false or misleading disclosures.[18] Concealment and deception become more difficult under the MMoU. Ultimately, the MMoU is expected to deter malfeasance in ways that reduce the cost of liquidity provision, particularly for cross-border shares.

2.3.4. Cross-sectional factors that condition the magnitude of the liquidity effects

The cross-sectional tests focus on host shares because the effect of the MMoU should be larger and the cross-sectional effect should be more straightforward in these shares. In these tests, I assess country-level features that are likely to condition the liquidity effects of the MMoU linkages. These features, which are discussed in detail below, include regulatory strength, legal origins, laws that hinder information sharing, and economic motivations.

Although the MMoU requires all signatories to meet a threshold regulatory capability, signatories still vary in terms of regulatory strength (e.g., resources, skills, knowledge, and political leverage). Regulatory weakness could reduce the likelihood of cross-border cases being pursued, undermine the effectiveness of the MMoU, and limit the liquidity benefits.

Legal origins are also likely to affect the regulators' ability to cooperate. Prior work views legal origin as an important determinant of property rights, dispute resolution, and shareholder protection (La Porta et al., 2008). In the context of this paper, legal origin is important not only as a surrogate for legal strength but also as a way to understand the *compatibility* between the rules of paired countries. For example, common law countries are familiar with compelled testimony and extensive pre-trial documents discovery, both of which can help regulators build cases. Civil law countries, in contrast, view such requests as unconventional and often deny them if their scope is too broad or poorly defined.[19] A shared legal lineage ensures analogous procedures, doctrines, and standards that can prevent incongruities in how courts treat evidence, discovery, and elements of civil violations. Thus shared legal perspectives could aid in regulators' cooperation and enhance the liquidity effect of the MMoU. Alternatively, the MMoU may be most important in cases where incompatibilities exist, as it could help regulators work around these differences.

Laws that explicitly obstruct the transmission of information could also influence the liquidity effect. For example, preemptive jurisdiction (blocking) statutes make it a criminal offense (often punishable with jail time) for citizens to provide information to foreign agents. These statutes aim to protect national interests and sovereignty, but in practice they deter cooperation. Many even prohibit foreign persons, including regulators, from requesting information from citizens or regulatory staff in a given country. This exposes the staffs of the both the requested and the requesting authorities to the risk of criminal liability as they pursue cross-border cases.[20] Secrecy laws pose a similar challenge. Austin (2014) argues that secrecy laws, by shielding the identities of the involved parties, make insider trading particularly hard to detect. Because the MMoU is designed to remedy blocking statutes and secrecy laws, the marginal impact of the MMoU may be higher in these instances.

Finally, economic motivations and economies of scale may also affect cooperation. Host countries may invest more in understanding the nuances of home country laws and may work more closely with home country regulators when the host country investors make more frequent transactions in home country stocks. I call this an "economies of scale" argument, because it relies on host regulators spreading the (fixed) cost of assimilating the separate legal systems across more actual or

[18] Observing larger effects for host shares than home shares is not necessarily evidence that the MMoU is primarily a share-level effect. Home and host shares have different spreads to begin with, and could be subject to complex interrelationships (e.g., better disclosure at the firm level leading to reduced market manipulation—a share-level issue).

[19] For example, depositions are executed very differently in civil law jurisdictions. Questions must often be submitted in writing in advance of the deposition, and are administered by magistrate judges. Cross-examination is often not permitted. Defendants may not be permitted to be present. All of this creates a very unfamiliar process for those trained in a different legal regime. This can be problematic because common-law judges in many jurisdictions require sufficient similarity in the style of deposition for testimony to be admissible in court proceedings.

[20] Therefore there is considerable deference to such laws unless regulators are intimately familiar with, and have a high level of confidence in, how to properly circumvent them. My interactions with the regulatory community suggest that they are keenly aware of the personal and professional risks posed by blocking statutes.

expected interactions. In the other direction, greater trading by home country investors in a host country's market may result in leverage for the host market to acquire information. Conceptually, this dynamic captures reciprocity, which could shape the impact of the MMoU. In fact, formal requests for assistance between regulators commonly refer to reciprocity by name, and authorities often remind counterparts of recent examples where their roles were reversed and the requesting authority provided assistance.

3. The association between the MMoU and enforcement

3.1. Enforcement: sample

To test for changes in enforcement, I use data from Compustat and CRSP as well as from four other sources: IOSCO (for the MMoU), the SEC's website (for bilateral SEC arrangements and data describing enforcement actions against US-listed foreign firms from 1995 to 2010), and the Stanford Class Action Clearinghouse (for data on private litigation). The sample contains all US-listed foreign firms that satisfy the data requirements (described below). This includes cross-listed, dual (full) listings, and foreign incorporated firms that are exclusively listed in the United States. The final sample is a panel of 14,592 total firm-years (1652 unique firms over 16 years).

The SEC has taken 172 enforcement actions against 173 firms (1.19% of the firm-year observations). The data related to SEC enforcement actions were hand-collected. I define enforcement actions in an economic sense—as interventions by the SEC that aim to correct or punish firms or individuals for misreporting, insider trading, or aiding and abetting other firms in the perpetration of fraud, inter alia. The bulk of these events are litigated proceedings or settled cases for alleged violations of securities laws. SEC-prompted restatements without accompanying litigation are also included. Appendix B describes the sample of SEC actions in detail.

Table 1 describes the sample across 59 countries (Panel A), 10 industries (Panel B), and 16 years (Panel C). Panel A reports that, of the 59 countries with a U.S.-listed foreign firm, 38 have applied to the MMoU by the end of the sample period. The fifth column reports, by country, the percentage of firm-year observations that are subject to SEC enforcement actions (1.19% of firm-years, overall). In Panel D, the enforcement actions are described based on the type of alleged infraction: insider trading, financial reporting, Foreign Corrupt Practices Act (FCPA), and miscellaneous. Miscellaneous includes alleged violations, such as option backdating, aiding and abetting other firms, and improper loans or compensation to officers.

3.2. Enforcement: empirical design and results

3.2.1. Enforcement: main tests

Univariate evidence is consistent with the idea that the MMoU enhances cross-border enforcement. Table 2 shows the frequency of SEC enforcement directed towards U.S.-cross-listed firms, partitioned by the MMoU. Prior to the MMoU, 0.63% of the firm-years are subject to enforcement actions. This rises to 1.92% after the MMoU, a roughly three-fold increase that is economically and statistically significant ($p < 0.01$).

When formally testing this relationship, it is important to control for other factors associated with enforcement. I thus apply the private litigation model of Kim and Skinner (2012), which uses explanatory variables from Compustat and CRSP (page 9). This model preserves a maximum number of observations, making it ideal for the current setting. To predict litigation, it uses industries with historically high litigation rates, firm size, percentage change in sales, share turnover, equity returns, and distributional properties of returns (skewness and standard deviation). These variables are defined more precisely in the appendix. The descriptive statistics in Table 3 show notable differences between MMoU and non-MMoU observations in many of these litigation-related factors. To help rule out changes in malfeasance as an explanation for changes in SEC enforcement across time and countries, I follow Silvers (2016) by including an indicator for private litigation within the previous five years. I also include indicator variables for single- and secondary-bilateral arrangements.

Model (1) below is estimated using logistic and linear regression and takes advantage of the *two-dimensionally* staggered design illustrated in Fig. 1, panel C.

$$SEC_ACTION_{it} = \alpha_0 + \alpha_1\, MMoU_FILE_{it} + \alpha_2\, BILAT_{it} + \alpha_3 2nd_BILAT_{it} + \alpha_4 CLASS_ACTION_{it} + \alpha_5\, HI_LIT_{it-1} + \alpha_6 SIZE_{it-1} + \alpha_7 PCT_CH_SALES_{it-1} + \alpha_8 RETURN_{it-1} \alpha_9 SKEW_{it-1} + \alpha_{10} RET_STD_{it-1} + \alpha_{11} TURNOVER_{it-1} + \varepsilon_{eit} \quad (1)$$

SEC_ACTION is an indicator equal to 1 when the SEC files an enforcement action and 0 otherwise. *MMoU_FILE* is an indicator equal to 1 when the MMoU is filed by the firm's home regulator and 0 otherwise. My expectation is that the coefficient on α_1 will be positive and significant.[21] I report the descriptive statistics for these control variables in Table 3 and provide their

[21] Positive coefficients on α_2 and α_3 would similarly indicate an increased likelihood of SEC enforcement for firms from foreign countries that have single- and secondary-bilateral arrangements with the SEC.

Table 1
SEC enforcement samples.

Panel A: Sample firms by country

	MMoU	Firm-Years	Pct. Firm-Years	Enforcement Actions	Pct. Firm-Years w/enforcement	Unique Firms
Antigua And Barbuda	–	10	0.07	–	–	1
Argentina	–	175	1.20	–	–	19
Australia	**1**	284	1.95	3	1.06%	35
Austria	**1**	12	0.08	–	–	1
Bahamas	–	50	0.34	–	–	5
Belgium	**1**	45	0.31	4	8.89%	7
Belize	–	12	0.08	–	–	2
Bermuda	**1**	860	5.89	16	1.86%	106
Brazil	**1**	169	1.16	2	1.18%	18
British Virgin Isl.	**1**	260	1.78	2	0.77%	36
Canada	**1**	4590	31.46	37	0.81%	496
Cayman Islands	**1**	521	3.57	–	–	90
Chile	–	235	1.61	1	0.43%	25
China	**1**	222	1.52	6	2.70%	27
Colombia	–	5	0.03	–	–	1
Curacao	–	44	0.30	–	–	3
Denmark	**1**	61	0.42	2	3.28%	6
Dominican Republic	–	8	0.05	–	–	1
Finland	**1**	71	0.49	–	–	8
France	**1**	397	2.72	7	1.76%	40
Germany	**1**	288	1.97	13	4.51%	32
Ghana	–	7	0.05	–	–	1
Greece	**1**	42	0.29	1	2.38%	5
Hong Kong	**1**	122	0.84	2	1.64%	15
Hungary	**1**	15	0.10	–	–	1
India	**1**	150	1.03	–	–	16
Indonesia	–	46	0.32	1	2.17%	5
Ireland	–	311	2.13	3	0.96%	33
Israel	**1**	1223	8.38	9	0.74%	133
Italy	**1**	167	1.14	8	4.79%	17
Japan	**1**	471	3.23	5	1.06%	39
Jersey	**1**	43	0.29	–	–	4
Jordan	**1**	5	0.03	–	–	1
Korea	**1**	129	0.88	–	–	15
Liberia	–	68	0.47	–	–	6
Luxembourg	**1**	142	0.97	–	–	15
Marshall Islands	–	166	1.14	–	–	29
Mexico	**1**	359	2.46	6	1.67%	39
Netherlands	**1**	486	3.33	13	2.67%	50
Netherlands Antilles	–	34	0.23	–	–	3
New Zealand	**1**	55	0.38	–	–	8
Norway	**1**	61	0.42	1	1.64%	8
Panama	–	68	0.47	1	1.47%	7
Papua New Guinea	–	14	0.10	–	–	1
Peru	–	22	0.15	–	–	2
Philippines	–	37	0.25	–	–	4
Poland	**1**	4	0.03	–	–	1
Portugal	**1**	27	0.19	–	–	2
Puerto Rico	–	5	0.03	–	–	1
Russia	–	48	0.33	–	–	5
Singapore	**1**	88	0.60	–	–	9
South Africa	**1**	146	1.00	–	–	16
Spain	**1**	111	0.76	1	0.90%	10
Sweden	**1**	136	0.93	1	0.74%	19
Switzerland	**1**	288	1.97	20	6.94%	24
Taiwan	**1**	79	0.54	1	1.27%	7
Turkey	**1**	12	0.08	–	–	1
United Kingdom	**1**	1066	7.31	7	0.66%	138
Venezuela	–	20	0.14	–	–	3
Total	**38**	**14,592**	**100.00**	**173**	**1.19%**	**1652**

(*continued on next page*)

Table 1 (*continued*)

Panel B: Sample by industry

	Firm-Years	Pct. Firm-Years	Enforcement Actions	Pct. Firm-Years Enforcement
Agriculture, Forestry, and Fish	102	0.70	0	0.00%
Construction	107	0.74	2	1.87%
Finance, Insurance, and Real Estate	1636	11.27	30	1.83%
Manufacturing	5568	38.37	69	1.24%
Mining	2177	15.00	12	0.55%
Public Administration	119	0.82	11	9.24%
Retail Trade	248	1.71	8	3.23%
Services	1985	13.68	17	0.86%
Transportation & Public Utilities	2339	16.12	18	0.77%
Wholesale Trade	311	2.14	6	1.93%
Total	**14,592**	**100.00**	**173**	**1.19%**

Panel C: Sample by year

Years	Firm-Years	Pct. Firm-Years	Enforcement Actions	Pct. Firm-Years Enforcement
1995	674	4.62	2	0.30%
1996	811	5.56	5	0.62%
1997	880	6.03	2	0.23%
1998	904	6.20	4	0.44%
1999	995	6.82	7	0.70%
2000	994	6.81	2	0.20%
2001	979	6.71	6	0.61%
2002	949	6.50	12	1.26%
2003	950	6.51	11	1.16%
2004	958	6.57	14	1.46%
2005	965	6.61	24	2.49%
2006	963	6.60	17	1.77%
2007	948	6.50	23	2.43%
2008	909	6.23	13	1.43%
2009	868	5.95	17	1.96%
2010	845	5.79	14	1.66%
Total	**14,592**	**100.00**	**173**	**1.19%**

Panel D: Enforcement subject matter

Enforcement Actions	
Insider Trading	52
Financial Reporting	75
FCPA	20
Miscellaneous	26
Total	**173**

Panel A reports 14,592 firm-years and distinct firms in the enforcement sample, by country, for observations from 1995 to 2010. Panel B reports the same data by industry. Panel C reveals the occurrence of enforcement events by year, and Panel D breaks down the sample by subject matter. Additional details about the enforcement sample are provided in Appendix B.

Table 2
SEC enforcement by governing arrangements.

	Firm-Years	Enforcement Actions	Percent with enforcement
No MMoU	8292	52	0.63%
MMoU	6300	121	1.92%
Total	14,592	173	1.19%
MMoU- No MMoU comparison			
Marginal difference			1.29%***
Marginal Ratio			3.06

This table reports observed proportions of SEC enforcement, measured using the percentage of firm-years with an enforcement action. There are two conditions of multilateral arrangements (firm-years governed by the MMoU and firm-years not governed by the MMoU). To understand these differences, I also present marginal differences and ratios. *, **, and *** denote significance at the 10%, 5%, and 1% levels for a two-tailed difference in proportion, respectively.

expected sign in Table 4. Thirty-eight of the 173 firms do not have the data required to estimate model 1 and must be discarded from the multivariate analyses.

In Table 4, test 1 indicates that enforcement is significantly more likely after a firm's home regulator applies to the MMoU; this is true even after controlling for factors that could influence SEC litigation rates. The coefficient on *MMoU_FILE* of 1.03 ($p < 0.01$) indicates that, after home regulators pledge to share information, the odds ratio is 2.79, meaning firms are 279% as likely to be the subject of SEC enforcement action (after controlling for other factors). This finding is consistent with the

Table 3
Descriptive statistics.

	All			No MMoU			MMoU		
	N	Mean	Std	N	Mean	Std	N	Mean	Std
SEC_ACTION	14,554	0.01	0.11	8277	0.01	0.08	6277	0.02***	0.14
MMoU_FILE	14,554	0.43	0.50	8277	0.00	–	6277	1.00***	–
BILAT	14,554	0.71	0.45	8277	0.64	0.48	6277	0.81***	0.39
2nd_BILAT	14,554	0.10	0.30	8277	0.11	0.31	6277	0.09***	0.29
CLASS_ACTION	14,554	0.05	0.22	8277	0.03	0.17	6277	0.08***	0.27
HI_LIT	14,554	0.16	0.37	8277	0.16	0.37	6277	0.17**	0.37
SIZE	14,554	6.74	2.83	8277	6.58	2.64	6277	6.95***	3.05
PCT_CH_SALES	14,554	5.45	3.86	8277	5.98	4.10	6277	4.78***	3.48
RETURN	14,554	0.06	0.62	8277	0.05	0.63	6277	0.08***	0.62
SKEW	14,554	0.24	0.82	8277	0.26	0.83	6277	0.22***	0.81
RET_STD	14,554	0.14	0.09	8277	0.14	0.09	6277	0.14***	0.08
TURNOVER	14,554	0.01	0.28	8277	0.01	0.25	6277	0.01***	0.32

This table presents descriptive statistics for the sample that has the required information for prediction of SEC enforcement. All 14,554 firm-years are shown on the left; the 8277 firm-years unaffected by the MMoU are shown in the middle; and the 6277 firms are shown on the right. *, **, and *** denote significance of the difference in means between the MMoU and non-MMoU subsamples at the 10%, 5%, and 1% levels for a two-tailed difference in proportion, respectively.

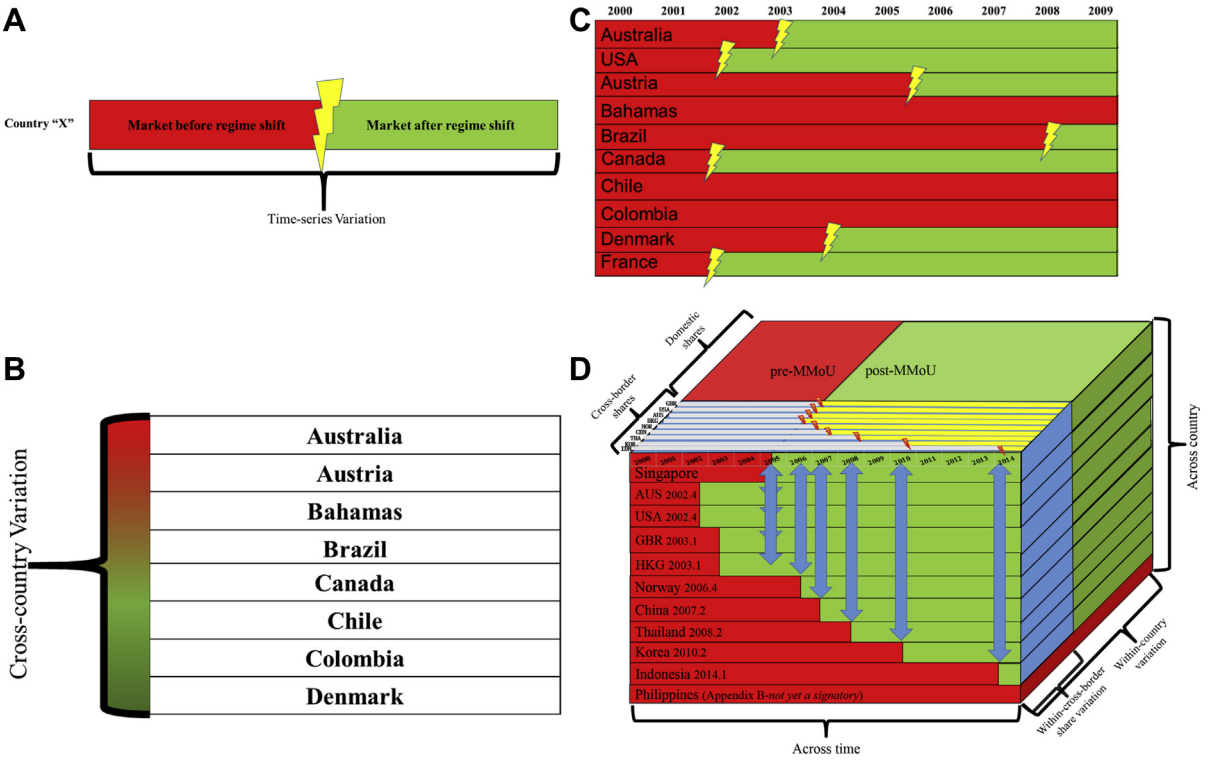


Fig. 1. Research designs. This figure describes the types of research designs often used in studies of regulation, enforcement, and new laws or mandates. These figures are for illustrative purposes only. They do not necessarily reflect the exact dates of MMoU adoption, nor do they accurately depict the fraction of a given country that is cross-listed or the relevant origins of the cross-listed firms. **A:** Across time. Pre-vs. post-event comparisons of a shock to a given country at a point in time. **B**: Across countries. Comparisons of countries across a range on a given dimension (e.g., indices for governance, legal strength, or enforcement). **C**: Two-dimensional time-series/cross-sectional. Shocks are staggered across (occur at) different times in different countries but are common to all firms in a given country (see Section 3.2 *Enforcement*). **D**: Three-dimensional (my design). Shocks are staggered in three dimensions, creating variation across time, home country, host country, and within home and host shares. Singapore illustrates the design below, with host shares in blue, and the treatment (which occurs at different times) in yellow. Note that Table 5 presents this information about the timing of the shocks for the entire sample. . (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

MMoU reducing cross-border regulatory frictions. In general, the control variables from Kim and Skinner (2012) are consistent with the expected sign (although size is the only consistently significant predictor).

Other specifications show that the inferences remain the same when controlling for country and time factors. Tests 2 and 3 use logistic regression and a linear probability model, respectively. Each includes country and year fixed effects. Both tests indicate a significant increase in the probability of SEC enforcement after the MMoU. Note that, when using these fixed effects,

Table 4
Probability of cross-border enforcement.

Parameter		(1)		(2)		(3)
		Mainresult		Country & year FEs		Linear Probability Model (country & year FEs)
		Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate
MMOU_FILE	+	1.03***	2.79	0.78***	2.18	0.84***
BILAT	+	−0.16	0.85			
2nd_BILAT	+	1.13***	3.09			
CLASS_ACTION	+	1.38***	3.96	1.37***	3.92	3.37***
HI_LIT	+	0.12	1.13	0.01	1.01	0.02
SIZE	+	0.17***	1.19	0.18***	1.20	0.13
PCT_CH_SALES	+	0.00	1.00	0.00**	1.00	0.00
RETURN	−	0.26	1.30	0.24	1.27	0.15
SKEW	−	−0.08	0.92	−0.02	0.98	−0.01
RET_STD	+	3.23***	25.24	3.23***	25.16	2.82**
TURNOVER	+	0.15	1.16	−1.44	0.24	−0.03
Intercept		−7.33***		−12.73***		−2.07
N		14,554	(135)	14,554	(135)	14,554
Country FEs		N		Y		Y
Year FEs		N		Y		Y
Pseudo-R^2/R^2		0.14		0.17		0.03
Area Under ROC Curve		80.3		80.9		*

This table presents the results from regressions with SEC enforcement as an indicator dependent variable (set equal to 1 for firm-years with SEC enforcement actions, 0 otherwise). Columns 1, 2, and 4 present logistic regressions. The third column presents a linear probability model (with coefficients multiplied by 100). The sample includes all foreign firms listed in U.S. markets (described in Table 1). Because most of the variables of interest are binary indicators, odds ratios are reported for the logistic regression. The control variables in the model come from Kim and Skinner (2012) and are defined in Appendix B. I also include indicators for the MMoU, bilateral arrangements, secondary bilateral arrangements, class action litigation in the previous five years, and key interactions of interest. Standard errors are double-clustered by country and year. Because several indicator variables are used, I apply penalized maximum likelihood to the logistic regressions to reduce coefficient bias due to quasi-complete separation (Firth, 1993; Heinze and Schemper, 2002). *, **, and *** denote significance at the 10%, 5%, and 1% levels for a two-tailed test, respectively.

I drop the bilateral arrangement indicators. I do this because very few countries engage in new bilateral arrangements with the SEC during the sample period.

3.2.2. Enforcement: robustness and identification tests

The internet appendix Tables I–IV presents a battery of additional tests (e.g., simulations and counterfactually shifting the true MMoU dates) that provide evidence consistent with the increase in enforcement corresponding to the precise times and places predicted by the MMoU. The results persist when I use constant samples, which rules out the effect of a changing sample composition.

In theory, countries that join the MMoU early could differ systematically from ones that join late. However, the timing of an applicant's MMoU admission often depends on fairly esoteric laws about capacities to gather and share information with other countries, and these laws do not appear to partition countries on market development.[22] I find that countries that join later in the sample period experience increases of similar magnitudes to those that join early. When I exclude firms whose home country joins the MMoU in 2002, 2002–2003, 2002–2004, and so on, the likelihood of enforcement is similar to the late-joining and early-joining countries. This helps rule out the possibility that the results are concentrated in certain countries in ways that could indicate more sophisticated endogeneity.

The inferences are also similar when potentially influential subsamples have been removed. For example, when I discard observations from two countries that account for the largest fractions of the sample—the United Kingdom and Canada—or from the other seven countries in the G8, the results barely change. Likewise, removal of observations from the banking, insurance, and real estate industries yields similar estimates.

The tests cannot achieve the same standard as a randomized experiment, but the attributes of the setting suggest that the MMoU's shock to cross-border oversight capabilities is plausibly exogenous.

4. The association between the MMoU and liquidity

4.1. Liquidity: sample

Next, I examine the potential for cross-border enforcement to affect the cost of liquidity provision. For the liquidity assessment, I expand the sample to all World Federation of Exchanges shares that Datastream identifies as equity and that have the information required to estimate model (2) (described below in Section 4.2) from the first quarter of 2000 to the

[22] In addition, there is some unpredictability to the verification-processing time. This could relate to the quality of the application, the workload of the verification team members (who have full-time jobs as regulators in their own markets), or idiosyncratic reasons.

second quarter of 2014. Market data on returns, market value, quoted bid-ask spreads, and volume come from Datastream.[23] To be included, a share must be listed on a regulated exchange, have an ISIN number (or an equivalent), and have a nonmissing value for total assets in the current year (to ensure that it produces accounting data).[24] I identify cross-listed shares via Datastream and use data from JP Morgan and the Bank of New York ADR websites as of January 13, 2016. The MMoU dates come from the IOSCO website.[25]

The staggered design relies on sufficient variation in the linkages between regulators, in terms of both time and country. Table 5 presents the MMoU date for each country (using three-digit abbreviations). Countries begin entering the MMoU in October 2002 and continue to join throughout the sample period.[26] The table is configured as a *matrix* that tabulates the number of unique host shares, reporting the home country ('*j*') across the top and the host country ('*i*') on the left, so that each cell represents an '*i-j*' country pair.

To illustrate how robust the linkage variation is across country pairs and time, I organize the countries by the quarter in which they signed the MMoU on both the home and host dimensions (instead of alphabetical sorting). This setup conveys the variation in the timing of the shocks to cooperation in my sample. Each first-time shock for country pairs is coded with a different color, so connected colors experience the shock at the same time. The treatment varies substantially across time and country—enough to promote strong identification. Finally, the table indicates considerable separation in linkage dates, even *within* the same column (home country) or row (host country).

Table 6 provides separate descriptive statistics for the full sample as well as for the domestic, home, and host share subsamples. Home and host shares constitute 3.9% and 5.3% of the share-quarters in the sample, respectively. There are more host share observations (59,661) than home share observations (43,980) because i) cross-listed firms can have cross-listings at one or more exchanges, and ii) some firms are listed only in a foreign market (with zero home shares).

Following prior research, I measure liquidity using the quarterly averages of the daily bid-ask spread (Christensen et al., 2013, 2016).[27] The bid-ask spread is one dimension of liquidity that should be sensitive to the risks described in the previous section. Descriptive statistics reported in Table 6 comport with previous research. Spreads range from less than 1%−19% of the share price and are, on average, narrower for home shares (1%) than for host shares (2%) and domestic shares (3%). Home shares are roughly two times more liquid than host shares; this supports the intuition that, on average, adverse selection and informational risks are greater in host shares.

4.2. Liquidity: empirical design

The next tests evaluate the association between the MMoU and liquidity. I use quoted bid-ask spreads as a proxy for transaction costs (an inverse proxy for liquidity). Bid-ask spreads—the difference between market makers' posted buy and sell quotations for a quantity of shares—compensate market makers for adverse selection (as well as order processing, inventory holding, and other costs) (Glosten and Milgrom, 1985). An important indicator of market quality, bid-ask spreads should narrow whenever investor-perceived risks decline (demonstrating enhanced liquidity). In the setting of the MMoU, such a decline would occur when regulatory enhancements improve a firm's information environment and reduce the risk of trading against informed investors. To test my expectation that the MMoU improves liquidity, I estimate a model based on prior literature, notably Christensen et al. (2013, 2016). Shown below, model (2) uses a quarterly time interval, which balances the need to discern the timing of the liquidity-MMoU association with the need to accurately measure liquidity.

$$log(BAS) = \beta_0 + \beta_1 Home + \beta_2 Home * Link + \beta_3 Host + \beta_4 Host * Link + \sum_{k=1}^{K} \beta_k Controls + \sum_{l=1}^{L} \beta_l Fixed\ effects + \varepsilon. \quad (2)$$

The model allows for separate effects across the home and host shares, as outlined in Section 2.3.1. I expect home and host shares to be influenced by the linking of securities regulators. In the model, indicators for home and host shares capture their unconditional effects, relative to domestic shares (i.e., non-cross-border firms). (Depending on the model used, these indicators are sometimes subsumed by fixed effects, as described below.) The primary variables of interest capture the effects of linking regulators that cosupervise home and host shares, captured by β_2 and β_4, respectively. The *Link* variable is set equal to 1 when both the home and host regulators are MMoU signatories, and is essentially a post-treatment indicator. The

[23] I supplement this dataset with CRSP data for US-listed shares.

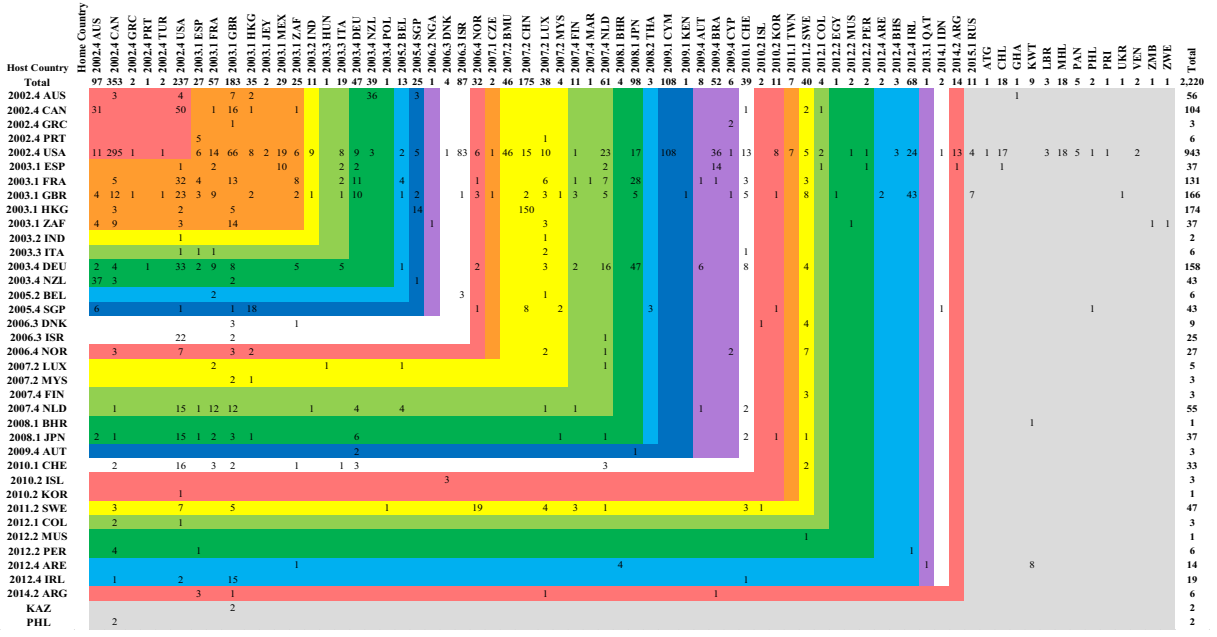
[24] Because I intend to test for public oversight, I exclude "unlisted" shares, whether sponsored or unsponsored, since they do not have the same regulatory oversight or filing requirements. (These shares are generally trading in OTC markets, alternative/growth boards, traded-not-listed boards, or multilateral trading facilities.) Details about separating listed and unlisted shares, along with Datastream coverage issues, can be found in Appendix C.

[25] For the interested reader, Internet Appendix Table VI describes the 1,128,392 share-quarters by country (Panel A) and by year (Panel B). Panel A shows wide variation across countries, while Panel B shows wide variation across time, both for the fraction of the sample affected by the MMoU and for the links between regulators connected by the MMoU.

[26] There is no obvious clustering in the timing of the MMoU adoptions; nor is adoption obviously correlated with the liquidity-related events documented previously (e.g., changes in country-level enforcement, EU directives, or IFRS (Christensen et al., 2013, 2016)).

[27] Daily bid-ask spread is the difference between the daily closing ask and the bid divided by the midpoint. I discard daily spreads that are negative or greater than a third of the midpoint. To minimize the influence of extreme observations, all continuous variables are winsorized at the 1% tails. This captures the price concessions required to execute a trade within a short period (Bessembinder and Venkataraman, 2010) and is frequently used as a proxy for market quality.

Table 5
Host share matrix.



The table presents a matrix of all 2,220 host shares in the sample. It presents the pairwise listings between host (row) and home (column) countries and uses different colors to illustrate the timing of the initial linkage, where connected colors all experience the linkage shock at the same time. It may be helpful to start by looking at one row (host market) at a time.

Table 6
Descriptive statistics.

	FULL SAMPLE							DOMESTIC (non-cross-border)						
	N = 1,128,392							N = 1,024,751						
	MEAN	STD	P1	Q1	MEDIAN	Q3	P99	MEAN	STD	P1	Q1	MEDIAN	Q3	P99
BAS	0.02	0.04	0.00	0.00	0.01	0.03	0.19	0.03	0.04	0.00	0.00	0.01	0.03	0.19
ln(BAS)	−4.45	1.25	−6.86	−5.4	−4.5	−3.52	−1.64	−4.42	1.25	−6.86	−5.4	−4.5	−3.52	−1.64
frac_vol	0.95	0.19	0.48	1	1	1	1	0.98	0.09	0.48	1	1	1	1
ln(Market value$_{t-4}$)	5.13	2.15	0.45	3.5	4.87	6.24	9.81	4.91	1.99	0.45	3.5	4.87	6.24	9.8
ln(Turnover$_{t-4}$)	3.85	2.16	−1.16	2.53	4.15	5.45	8.06	3.96	2.06	−1.15	2.53	4.15	5.45	8.06
ln(Return variance$_{t-4}$)	−6.24	0.53	−6.87	−6.63	−6.39	−6	−4.33	−6.24	0.53	−6.87	−6.63	−6.39	−6	−4.33
	HOME							HOST						
	N = 43,980							N = 59,661						
	MEAN	STD	P1	Q1	MEDIAN	Q3	P99	MEAN	STD	P1	Q1	MEDIAN	Q3	P99
BAS	0.01	0.03	0.00	0.00	0.00	0.01	0.13	0.02	0.03	0.00	0.00	0.01	0.02	0.19
ln(BAS)	−5.01	1.13	−6.77	−5.86	−5.23	−4.3	−1.97	−4.58	1.25	−6.7	−5.61	−4.61	−3.68	−1.67
frac_vol	0.77	0.3	0.01	0.57	0.94	1	1	0.43	0.42	0.00	0.01	0.29	0.96	1
ln(Market value$_{t-4}$)	7.53	2.33	1.93	5.84	7.77	9.42	10.76	7.07	2.46	1.38	5.23	7.11	9.13	10.76
ln(Turnover$_{t-4}$)	4.46	1.67	−0.58	3.62	4.89	5.6	7.28	1.42	2.66	−3.21	−0.39	1.71	3.31	6.58
ln(Return variance$_{t-4}$)	−6.35	0.46	−6.86	−6.67	−6.48	−6.17	−4.55	−6.27	0.5	−6.84	−6.63	−6.42	−6.06	−4.42
link	0.61	0.49	0.00	0.00	1	1	1	0.61	0.49	0.00	0.00	1	1	1

This table reports the descriptive statistics for the bid-ask spread and independent variables used in subsequent tests. The top left panel describes the entire sample. The top right panel describes domestic (noncross-border) shares. The bottom panels describe the two types of cross-border shares (home and host). Home shares are the primary listings that have shares cross-listed in other countries and are sometimes called primary or parent shares. Host shares—sometimes called cross-listed, foreign, dual, or secondary shares—are either subsidiary listings to a home share or listings outside of a firms' home market that trade on a host exchange. I report the raw and log-transformed values for *BAS* (the quarterly mean of the closing asking price minus the closing bid, divided by the midpoint). *ln(Market value$_{t-4}$)*, *ln(Turnover$_{t-4}$)*, and *ln(Return variance$_{t-4}$)* are lagged and logged values for market value, turnover, and return variability, respectively. Continuous variables are winsorized at the 1% tails.

uninteracted indicator does not appear in the model, because, as described later, I include country-quarter fixed effects. (*Link* would be a linear combination of these fixed effects.) Therefore, the design represents a generalized (triple) difference-in-difference approach.

To elaborate, the β_2 coefficient allows me to compare the difference between the bid-ask spread of home and domestic shares *before* the MMoU to the difference between the bid-ask spread of home and domestic shares *after* the MMoU. That is, β_2 represents the *change* in the *difference* between the bid-ask spread of home and domestic shares that occurs with the MMoU linkage. A negative β_2 coefficient indicates a narrowing of spreads, relative to what takes place for the benchmark domestic shares. β_4 analogously represents the *change* in the *difference* between the bid-ask spread of host and domestic shares that occurs with the MMoU linkage. Thus both β_2 and β_4 compare cross-border shares to a benchmark (domestic shares) that should not be exposed to cross-border problems or their resolution via cooperation. Because domestic shares are the referent group for both home and host shares, I pool them in the same regression for parsimony. Although the design has more dimensions of variation than most empirical studies, the interpretation is that β_2 and β_4 represent the effect of the MMoU linkage for *home* and *host* shares, respectively, relative to domestic shares in the same market at the same time.[28]

The continuous control variables are size, turnover, and return variance from the same quarter in the previous year; all are known determinants of liquidity. The literature proposes that liquidity issues related to venue trading preferences are an important determinant of valuation benefits (King and Segal, 2004). To control for these issues, I also include the share's fraction of total firm trading volume that takes place in a given quarter.

The primary tests use country-quarter fixed effects to identify the effect of cooperation using within-country variation in treatment events.[29] This explicitly controls for time-invariant country-level factors. It also controls for time-*variant* changes in a particular market that would affect all shares' liquidity, which may be the biggest threat to the validity of my inferences. Thus, the fixed effects should remove the liquidity effects of changes in monetary policies, economic cycles, IFRS, central counterparty clearing, laws, computerized surveillance, exchange rules, systems of spread measurement, etc., as well as any

[28] *Link* cannot be included by itself in the model because it will always be 0 for purely domestic shares. (Domestic shares do not have a second regulator and therefore cannot have linkages.) I do not use "effect coding" that compares home to domestic shares and host to home shares, because this would complicate the interpretation unnecessarily.

[29] Alternative fixed-effect structures offer different advantages: country and quarter fixed effects control for time-invariant characteristics at the country level as well as secular changes in liquidity, have low dimensionality, are consistent with many other cross-country studies, and allow for estimations of the broad effect of the MMoU on all shares (not just the effect of linkages on home/host shares). Country-quarter, plus home-country-quarter and host-country-quarter, control for time trends for home and host shares within each individual market (rather than assuming that time trends are common to all home and all host shares), at a point in time. Share and quarter fixed effects control for time-invariant determinants of liquidity at the share level and changing sample composition over time as well as for secular changes in liquidity. These and other specifications yield the similar inferences as the primary tests. For completeness, I present alternative fixed effect options in Internet Appendix Table VII.

market-wide regulatory improvements that are required by the MMoU. I include additional fixed effects for the treatment shares (home-quarter, home-country, host-quarter, and host-country fixed effects) to control for temporal and cross-sectional variation in the liquidity of home and host shares, respectively. I estimate standard errors clustered at the country level. Because there are only 58 clusters, this choice is more conservative than outcomes from other justifiable estimation techniques.

The treatment events are scattered across time and country, similar to the work of Christensen et al. (2013, 2016). This scattering reduces the likelihood of one or more concurrent events driving the results (a concern in many studies of regulatory, legal, or enforcement changes). Distinct features of the MMoU setting offer additional strength to the identification strategy. Foremost is that the treatment falls only on cross-border shares instead of on all shares in a country. This within-country variation adds a layer of complexity that reduces the likelihood of endogenous factors driving the results.

In Fig. 1, I illustrate my design and contrast it with others in the literature. My design exploits variation across time, across countries, and within country. The treatment employs all three sources of variation, so the shock is staggered in three dimensions (as opposed to being common to all firms in all countries at the same time or all firms in a given country at the same time). In addition, benchmark (domestic) shares—an enrichment of the within-country variation—help rule out the effects of possibly endogenous factors. These factors include observed and unobserved countrywide events that have been shown to affect liquidity (e.g., MiFID (Cumming et al., 2011), changes in enforcement (Christensen et al., 2013), International Financial Reporting Standards (IFRS) application (Daske et al., 2008), and European Union directives related to market abuse and transparency (Christensen et al., 2016; Meier, 2017)). None of these factors appear to be collinear with the MMoU, and all affect entire countries instead of only cross-listed firms. Therefore country-quarter fixed effects should control for these and other similar events.

4.3. Liquidity: results

4.3.1. Liquidity: main tests

Table 7 presents the results of estimating the log-linear model from Section 4.2. I begin with a subsample that includes only the treatment (home and host) shares. This ensures that any improvement measured in the full sample results from

Table 7
Liquidity effects of MMoU linkages.

	(1)	(2)
Description:	Treatment sample only	Main test (country-quarter plus additional FEs)
Sample:	Home and Host Shares	Full sample
Home	(Absorbed)	(Absorbed)
Home*link	−0.069*	−0.062*
	(-1.84)	(-1.80)
Host	(Absorbed)	(Absorbed)
Host*link	−0.292***	−0.433***
	(-3.80)	(-2.99)
Fraction of volume	−0.499	−0.360**
	(-5.89)	(-2.65)
ln(Market Value$_{t-4}$)	−0.230***	−0.294***
	(-17.10)	(-20.33)
ln(Turnover$_{t-4}$)	−0.190***	−0.194***
	(-11.38)	(-8.06)
ln(Return variance$_{t-4}$)	0.449***	0.298***
	(6.69)	(8.82)
Observations	103,641	1,128,392
Industry FE	Yes	Yes
Home-quarter FE	Yes	Yes
Host-quarter FE	Yes	Yes
Home-country FE	Yes	Yes
Host-country FE	Yes	Yes
Country-Quarter FE	No	Yes
R^2	0.746	0.746

This table reports the estimates of Model (2) on page 22. The dependent variable (bid-ask spread) is log transformed. *Home* is an indicator for shares that have affiliated shares cross-listed in other countries. *Host* is an indicator for host-listed shares. *MMoU* is an indicator for shares that are listed on an exchange whose regulatory agency has signed the MMoU. *Link* is an indicator variable equal to 1 when both the home and host regulators for a given cross-border share have adopted the MMoU. Several variables are subsumed as linear transformations of the control variables. Controls for size (year-lagged market value in US dollars), trading volumes (year-lagged turnover in US dollars), and (year-lagged) return variability are included as predictors of liquidity. Fixed effects that serve as controls are unreported. *, **, and *** denote significance at the 10%, 5%, and 1% level for two-tailed tests, respectively, using standard errors that are clustered at the country level.

changes in the treatment shares and not a deterioration in benchmark domestic shares' liquidity (which could be mistakenly interpreted as an improvement on a relative basis). Column (1) estimates the effect of the MMoU linkage using industry, home-quarter, home-country, host-quarter, and host-country fixed effects to control for cross-sectional and temporal variation in bid-ask spreads that are common to certain industries, as well as countries or periods (for all shares and within the groups of home and host shares, respectively). The MMoU's effect on home and host shares is estimated by the *Home*link* and *Host*link* coefficients, respectively. *Home*link* is −0.069* and *Host*link* is −0.292***, indicating that bid-ask spreads narrow when home and host regulators are linked. These changes represent improvements of about 6% for home shares and about 25% for host shares.[30] This provides preliminary support for the idea that the MMoU facilitates improvement in liquidity and that the largest improvements occur in host shares.

Because the treatment is staggered even within countries, the setting allows me to use domestic observations in the same market as a counterfactual (benchmark) and include *country-quarter* fixed effects to control for country-wide effects in liquidity. Column 2 shows that the estimates, when using this specification, are comparable to previous tests: they show 9% and 35% improvements for home and host shares, respectively. Note that the Internet Appendix Table VII deploys other fixed effect structures (described in footnote 28), each with different assumptions that rule out certain threats. The results from those tests are largely consistent with the inferences above, with fairly similar estimated magnitudes.

These results provide support for the idea that MMoU-enabled cross-border cooperation improves liquidity of cross-border shares. Home shares experience liquidity improvements of about 6–9%. Host shares experience larger and statistically stronger improvements, ranging from 25% to 35%. Note that the improvements to home and host shares are over and above the MMoU-related improvements for all shares in a market.[31] These results support the notion that because shares trading in a foreign venue are most exposed to information and regulatory problems, the MMoU most affects host shares.

To put these estimates in context, the effect for host shares is about twice as large as the effects for other capital market events on domestic shares reported by Daske et al. (2008), Cumming et al. (2011), and Christensen et al. (2013, 2016). This seems reasonable, given that host shares (i) start with wider spreads, (ii) are more likely to be exposed to expropriation risk, and (iii) are most deprived of regulatory oversight. The enhanced liquidity associated with MMoU links is consistent with investors perceiving value in public oversight (a key view of the bonding hypothesis). It cannot be explained by alternative causes such as market segmentation, competition in liquidity provision, or other firm changes that accompany a secondary listing, because the treatment is uncorrelated with these factors.

Finally, the control variables using firm-level characteristics (market value) and share-level characteristics (turnover and return variance) are comparable to prior research in sign, magnitude, and significance. A 1% increase in market value, turnover, and return variance is associated with changes of −0.29%, −0.18%, and 0.30%, respectively, in bid-ask spreads. And, not surprisingly, the fraction of total trading in a given firm that occurs in the share's market is associated with liquidity—a 1% increase in the fraction of trading decreases spreads by about 0.39%.

In sum, Table 7 shows that the MMoU linkages increase the liquidity of cross-border shares, with host shares improving the most. Although the magnitude of the effect varies slightly based on the fixed-effect structure, the implications of the results remain consistent. The effects are large and economically important but not implausibly so.

4.3.2. Liquidity: other tests

This section evaluates the parallel trend assumption and timing of the effect. To determine whether the parallel trend assumption is reasonable and to assess whether the improvements occur at the expected times, I plot bid-ask spreads in event time relative to the link dates. When assessing the timing, it is important to understand that the median time from a country's MMoU application to its MMoU signing is about 14 months, and that, during this time, countries sometimes pass new MMoU-related laws. When countries initiate joining the MMoU, market participants may observe changes in cooperative capacity and start to change their behavior and expectations in ways that affect spreads, leading to liquidity effects that predate the MMoU linkages. Following the linkage, market makers may further adjust bid-ask spreads if they observe changes in cross-border enforcement and update their expectations accordingly. This could generate effects that endure after the signing of the MMoU. Accounting for both of these timing issues, I expect the changes in bid-ask spreads to be *proximate* to the linkage dates and not sharp structural breaks centered at time zero.

To assess the parallel trends assumption, I plot the geometric mean of bid-ask spreads in event time for home and host shares.[32] I also plot various control groups (country, industry, and world spreads) to determine whether the treatment shares

[30] Transforming the coefficient to an economic interpretation requires the expression $\widehat{g} = \exp(\widehat{\theta}) - 1$, where θ is the coefficient estimate from the tables. The interpretation is that a one-unit change in the independent variable is associated with a $\widehat{g}$ percent change in the dependent variable (Halvorsen and Palmquist, 1980; Kennedy, 1981; van Garderen and Shah, 2002). When the independent variable is also in log form, the interpretation is that a 1% change in the independent variable is associated with a "θ%" change in the dependent variable. For interacted indicator terms, one can first add up the coefficients and then transform the sum of the coefficients to obtain estimates that are conditional on multiple indicators.

[31] Tests that do not use country-quarter fixed effects (reported in appendix Table VII) allow for an estimate of the MMoU on all shares in a market. They indicate a 7%–13% improvement, consistent with a market-wide effect described in 2.3.1, although they are not as well identified, given that omitted country-level factors may contribute to this result.

[32] Geometric means have several favorable properties for this setting, including the fact that the value represents the exponentiated arithmetic mean of the logged values—analogous to the transformations in the empirical tests. Also, geometric means strike a balance between being entirely unaffected by the information in extreme observations (as medians are) and overly influenced by them (as arithmetic means are).

exhibit parallel patterns in liquidity as domestic shares outside the event periods. The results in Table 7 indicate that these control groups, particularly the country group, may be partially treated by the MMoU. That is, the MMoU's standard-setting effect may create a bias *against* finding a result.

Fig. 2 presents *home* shares in Panels A and B and *host* shares in Panel C. Panel A shows that *home* shares have much lower bid-ask spreads than benchmark shares throughout the event-time period. Panel A's common y-axis compresses the variation in *home* shares, and the scales differ so much between groups that it is difficult to fairly evaluate the bid-ask spread behavior. Panel B reproduces the graph using a version with separate axes. It indicates a pattern of liquidity that, by and large, supports the parallel trend assumption. In terms of timing, bid-ask spreads for *home* shares begin to narrow three quarters before the MMoU linkage. This also appears to be the same point at which liquidity of the *host* shares diverges in Panel C (described below). The graphs should be interpreted with caution, however, because they do not account for other known predictors of liquidity or properly weight the observations.

The results for *host* shares, reported in Panel C, dovetail with the results in Table 7, showing that (i) the effect occurs proximate to the linkage and (ii) the parallel trend assumption seems reasonable. Spreads drop from roughly 115 basis points (1.15% of asset values) before the link to roughly 80 basis points (0.80% of asset values) afterward. Both before and after, *host* shares appear to support the parallel trend assumption, moving in tandem with all of the control groups. The effect appears to be proximate to the MMoU linkage, indicating a drop in bid-ask spreads that is concentrated in the three quarters before and after the event. That is, the departure from the other groups appears to begin about three quarters prior to the MMoU linkage and continue for another three quarters afterward. Outside of the treatment period, the liquidity pattern in the benchmark shares seems to match the pattern for treatment shares. Thus, the benchmarks seem to be a useful counterfactual, showing what might happen in the absence of the treatment (the MMoU linkage). Therefore country-quarter fixed effects appear to be a suitable way to control for unobserved heterogeneity in liquidity.

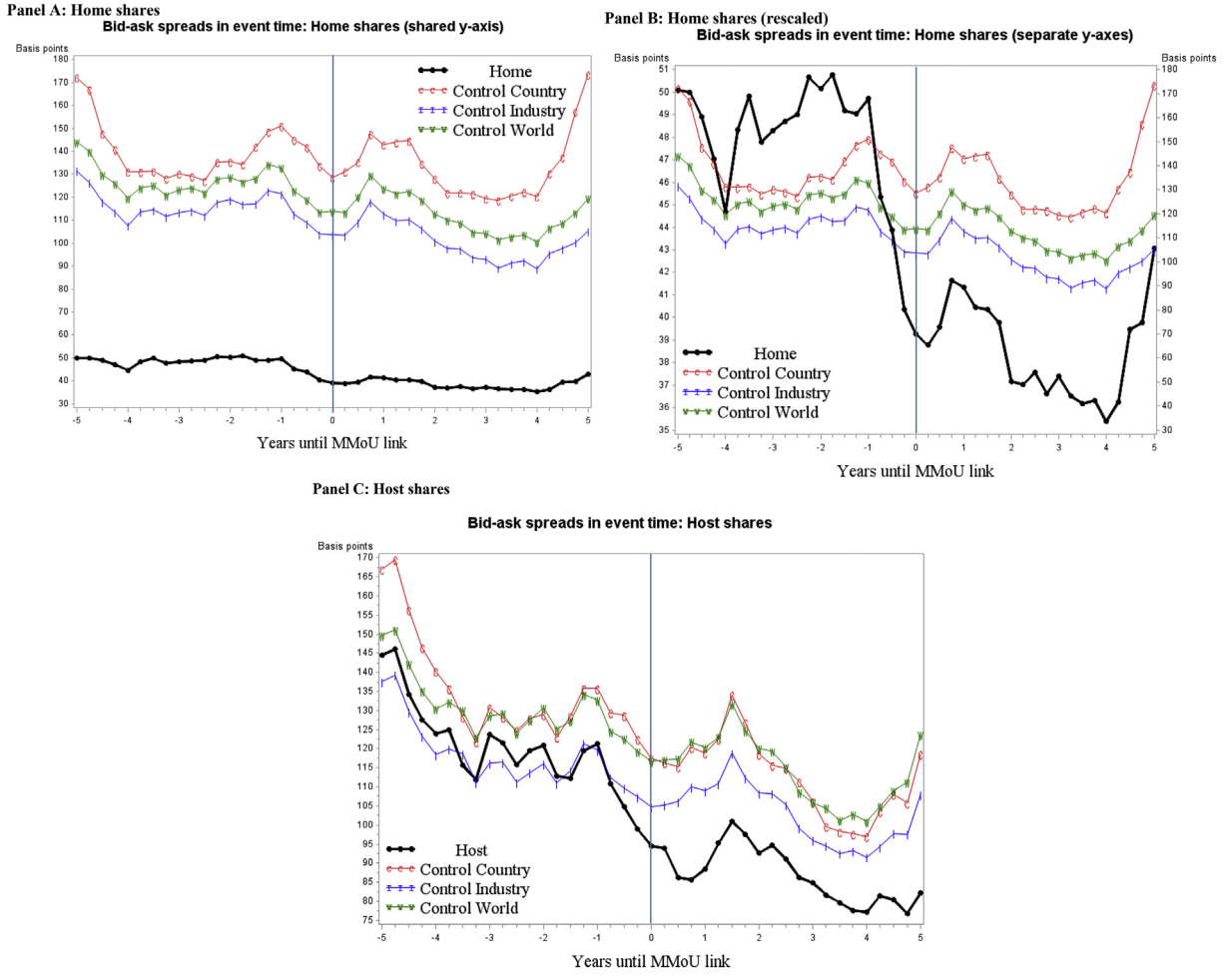


Fig. 2. Liquidity in event time. This figure presents the average bid-ask spread in event time (by quarter) for the treatment group (home or host, respectively) and three other groups (shares from the same country, same industry, or the entire world). Time '0' is the first quarter in which the MMoU links the home regulator to the host regulator.

Table 8
Cross-sectional tests of the MMoU's effect on liquidity.

LAW-Strength								
(1) Common Law		Home			(2) Disclosure Strength		Home		
		No	Yes	*0.23*			Low	High	*0.60**
Host	No	−0.12	−0.32**	*−0.20***	Host	Low	−0.21*	0.16	*0.37*
	Yes	−0.56***	−0.32**	*0.24*		High	−0.44***	−0.30	*0.14*
		*−0.44**	*0.01*	*−0.19*			*−0.23***	*−0.46*	*−0.09*
LAW-Attributes									
(3) Non-EU Blocking Statute		Home			(4) EU Blocking Statute		Home		
		No	Yes	*−0.66****			No	Yes	*−0.48***
Host	No	−0.44***	−0.53***	*−0.09*	Host	No	−0.44***	−0.83***	*−0.40****
	Yes	0.13	−0.01	*−0.14*		Yes	−0.35**	−0.25*	*0.10*
		*0.57***	*0.520****	*0.43****			*0.08*	*0.58****	*0.18*

This table constructs four 2 × 2 tables to understand the circumstances where the MMoU yields the largest (smallest) effects—one 2 × 2 for each of the four partitioning variables. The sample is the same as in Table 7, and all the control variables and fixed effects from Table 7 are included (but unreported for brevity). The numerical values represent the untransformed sums of the appropriate coefficients from regressions that include the control variables and fixed effects. The statistical significance of the pre- and post-MMoU differences for each cell and pairwise contrasts between cell differences (denoted in italics) are indicated using *, **, and ***, which denote significance at the 10%, 5%, and 1% levels for two-tailed tests, respectively, using standard errors clustered at the country level. No adjustments are applied for multiple comparisons.

In sum, these additional tests provide evidence that the liquidity effect occurs proximate to the treatment date.[33] They reveal no signs that omitted variables, time trends, or other violations of parallel trend assumptions distort my inferences.

4.3.3. Liquidity: country-level factors that condition the effectiveness of the MMoU

How much a linkage increases cross-border oversight and, in turn, liquidity may partly depend on country-level factors. As described in Section 2, I expect regulatory strength, legal paradigms, and impediments to cooperation to condition the amount of cross-border oversight—and the magnitude of the liquidity effect of the MMoU. Because the results are strongest and the theoretical arguments are clearest for host shares, the cross-sectional tests focus on these shares. I include a full set of interactions between the *link* variable and the various country-level variables. Because the scale of the variables is different, interactions of continuous measures can be difficult to interpret jointly. To simplify, continuous variables are first transformed into dichotomous variables that denote high (1) or low (0) on the various dimensions using a median split.

The MMoU's effect can then be observed in four different conditions, depending on home and host country attributes, both of which can take on yes/no (or high/low) values. The sum of the appropriate coefficient estimates is used to create a 2 × 2 table that reports the MMoU's liquidity effect in each of the four conditions. Table 8 reports the effect of the MMoU on host shares in each condition and provides statistical tests of the pre-versus post-MMoU differences as well as between-cell contrasts. This table identifies the conditions (cells) in which the MMoU provides the most (or least) benefit to cross-border shares. Note that this is a multivariate test that controls for the other factors in previous regressions (although those estimates are not reported in Table 8).

The first tests assess the strength of a country's legal systems, first using legal origins and then using disclosure quality measures. With respect to securities regulation, common law origins are often considered stronger than code law legal systems (LaPorta et al., 2008).[34] Legal origins split home and host countries into common law and code law origins, making up the four conditions. Several patterns are worth noting. First, host regulators with common law origins achieve greater improvements in liquidity, which is consistent with public regulation driving the results. The largest liquidity improvement, −0.56 (or about a 43% reduction), occurs when home markets are code law and host markets are common law—a result consistent with the bonding hypothesis. Furthermore, the tests shown in the top right and bottom left cells are consistent with the MMoU facilitating cooperation between countries with different legal customs. The only situation in which liquidity is unaltered is when both the home and host markets are code law. Unreported tests indicate that shares hosted by the US and UK contribute considerably to the common law results (as one might expect). Yet, the effects persist even after discarding US/UK-related observations. Thus, cross-border cooperation appears to be a truly global phenomenon (rather than confined exclusively to the US/UK).

A second measure of regulatory strength involves the disclosure requirements index (LaPorta et al., 2006). Like the previous tests, this measure yields the strongest result when the home market is weak—regarding disclosure, in this case—and the host market is strong. In contrast, when shares of firms from strong disclosure countries are listed in weak disclosure countries, the shares experience no significant changes in liquidity (although this could be an issue of low statistical power, particularly in the case of high home disclosure paired with high host disclosure strength). This makes sense, because firms from strong home markets are less likely to receive incremental oversight from a weak host regulator. These results add to

[33] Appendix Table VIII and its discussion explore the concept that bilateral arrangements also relate to transaction costs. Although there is some evidence that bilateral arrangements also condition the cost of liquidity provision, the inclusion of bilateral arrangements does not subsume the effect of the MMoU.

[34] The results are similar using the anti-self-dealing index (La Porta et al., 2006), rule of law index (LaPorta et al., 1998), case law as a source of law (David, 1973; LaPorta et al., 2004), and the World Bank's measure of the rule of law.

Table 9
Impact of economic motivations.

	[VAR] = Economies of scale	[VAR] = Reciprocity
	(1)	(2)
Home	(Absorbed)	(Absorbed)
Home*link	−0.000	0.015
	(-0.00)	(0.35)
Home*[VAR]	−0.000	0.003
	(-0.06)	(0.77)
Home*link*[VAR]	−0.008	−0.013***
	(-0.88)	(-2.80)
Host	(Absorbed)	(Absorbed)
Host*link	0.494	−0.362**
	(1.10)	(-2.64)
Host*[VAR]	−0.109***	−0.025
	(-2.71)	(-1.47)
Host*link*[VAR]	−0.089**	−0.014
	(-2.38)	(-0.99)
Fraction of volume	−0.343**	−0.361**
	(-2.54)	(-2.60)
ln(Market Value$_{t-4}$)	−0.294***	−0.295***
	(-19.85)	(-19.98)
ln(Turnover$_{t-4}$)	−0.193***	−0.193***
	(-7.75)	(-7.86)
ln(Return variance$_{t-4}$)	0.296***	0.297***
	(8.87)	(8.83)
N	1,129,721	1,129,721
Fixed effects	I, C−Y-Q	I, C−Y-Q
R^2	0.732	0.731
R^2-within	0.530	0.527

This table reports the estimates from tests that build on Model (2), including the controls described in Section 4.3.4. The dependent variables are in log form. *Economies of scale* is the log of host country portfolio ownership of home country stocks at year *t-1*. *Reciprocity* is the log of home country portfolio ownership of host country stocks at year *t-1*. Fixed effects are unreported. *, **, and *** denote significance at the 10%, 5%, and 1% levels for two-tailed tests, respectively, using standard errors that are clustered at the country level.

research showing that institutional features from firms' home markets continue to condition liquidity, even when those firms are cross listed within the same host country (Eleswarapu and Venkataraman, 2006).

The third and fourth tests involve a direct impediment to cooperation: blocking statutes.[35] The results indicate that blocking statutes strongly condition the liquidity effects of the MMoU. Improvements are largest where historically the most formidable obstacles to cooperation existed. Sections (3) and (4), show that the largest increases in host share liquidity occur when home regulators have blocking statutes and host regulators do not. The −0.53 estimate translates into a 41% reduction in spreads. When neither the home nor the host country has blocking statutes, liquidity increases by a smaller magnitude—about 35%. And when the *host* country has blocking statutes, the effect of the MMoU on liquidity is insignificant. This makes sense if countries with blocking statutes defer the pursuit of cross-border cases (even when the MMoU enables it), out of respect for privacy and sovereignty.

Overall, the tests show empirical support for the theoretical arguments presented in Section 2.3.4 and are consistent with cross-border cooperation being the mechanism driving the effect. Even so, these results come with the caveat that the identification of an attribute such as legal strength is imperfect and subject to substantial collinearity with other country-level measures (Isidro et al., 2016).

4.3.4. Liquidity: economic motivations

Economic incentives may also help determine the effectiveness of cross-border cooperation. I test for two such incentives: economies of scale and reciprocity. As a measure of economic incentives, I use annual portfolio ownership data from the IMF's Coordinated Portfolio Investment Survey (CPIS), which measures portfolio investment "involving debt or equity securities" (IMF, 2009, p110).

My economies of scale prediction is that, when the host country investors have more frequent transactions in home country stocks, the host country regulator will be more likely to work to understand the nuances of home country laws, since the (fixed) cost of this can be spread across more interactions. This exposure to a given market occurs when the host country's

[35] I classify the existence of blocking statutes using information from the Hague Evidence Convention and from various articles in the legal literature. This variable is tabulated in Internet Appendix Table VI.

ownership of the home country's securities is high. Therefore economies of scale is the log of host country portfolio ownership of home country stocks at year *t-1*.

In Table 9, the interaction of the *Economies of scale* variable with the *Home* (*Home*link*) indicator captures the cross-sectional variation in liquidity before (after) the MMoU linkages. The same structure is used to separately measure cross-sectional variation in the host shares. The coefficients on *Home*link*economies of scale* is small and insignificant. The *Host*link*economies of scale* estimate is significantly negative, indicating that a 1% increase in the amount of host country ownership of home market shares yields an incremental −0.089% reduction in spreads. This is consistent with economies of scale shaping the effectiveness of the MMoU.

Reciprocity may also come into play. When an authority deliberates whether to provide regulatory assistance to a requesting authority, reciprocity is often an explicit consideration. My prediction is that, when the home country has a high ownership of a host country's market, the host country can use this as leverage when it requests assistance from the home market regulator, based on reciprocity. Reciprocity is the log of home country portfolio ownership of host country stocks at year *t-1*. The effects are similar in magnitude for home shares (−0.013) and host shares (−0.014), but only the home shares reach conventional significance levels. Given measurement error, extensive fixed effects, and the interactions, failure to reach statistical significance is unsurprising. The results are broadly consistent with reciprocity helping determine the effectiveness of the arrangement.

5. Conclusion

This paper evaluates cross-border cooperation between regulators under IOSCO's MMoU. It examines the effects of this cooperation on enforcement capacity, then assesses how the observed changes in enforcement capacity affect the cost of liquidity provision. In doing so, the paper extends literature streams in economics, law, finance, accounting, and international relations.

It makes four major contributions. First, it illuminates an important but poorly understood topic: cross-border enforcement of securities laws. It shows that enforcement is significantly more likely for firms whose home and host regulators share information via the MMoU. This finding suggests that, by reducing cross-border regulatory frictions, interagency coordination and information flows can enhance enforcement. Second, it shows that cooperation enabled by the MMoU reduces the cost of liquidity provision. Cross-sectional tests reinforce the idea that the effects arise, at least in part, from remediation of cross-border regulatory frictions. Third, the use of the MMoU as a proxy for cross-border regulatory capacities seems sensible, and the research design reduces the likelihood of reverse causality or omitted variables affecting the results. This setting can therefore serve as a model for future studies that seek a better identification of the enforcement construct. Fourth, this paper shows that soft law has important consequences and helps identify factors that may determine its effectiveness.

These results are timely, given the rapid expansion in cross-border investment and the global interconnectedness of capital markets. They have implications for firms, markets, regulators, and investors and offer novel insights about how legal systems interact. An important caveat is that my study is not intended to capture the costs associated with the MMoU, which could be incurred by regulators, firms, broker-dealers, market makers, or certain investor classes. Nor does it consider social costs that could result when regulators have greater access to information and can more easily execute enforcement tactics. Such costs could include diminished financial privacy for individuals or an erosion of national sovereignty.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jacceco.2020.101301.

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