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Does regulatory cooperation help integrate equity markets?[☆]

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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.

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]

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[1] Prior work frames global market integration in the context of asset pricing (Black, 1974; Solnik, 1974; Brennan et al., 1977; Stulz, 1981; Bekaert and Harvey, 1995; Dumas and Solnik, 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;

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0304-405X/

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, 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, 2020). 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 identify the effect of cooperation policy. Regulators claim 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 (MMoU). Instead of being market-driven, the push to establish the MMoU 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 MMoU, unlike those of bilateral arrangements, are largely exogenous to investors, firms, and even regulators (Silvers, 2020). Another advantage to the MMoU is its wide participation, with 116 different countries forming a network of over 6000 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 MMoU 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 MMoU 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 MMoU network. Overall, these factors indicate the MMoU 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 MMoU, 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 design is achieved using three-way fixed effects for the following: (i) country pairs, to control for time-invariant country-pair characteristics; (ii) investee $\times$ time, to control for "pull" factors (unobserved changes in an invest*ee* country's economic conditions); and (iii) investor $\times$ 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), because these factors should affect investment in (or by) counterparts in a similar way. Bilateral MoUs capture the same theoretical construct as the MMoU but generate more endogeneity concerns, so I include them only as controls.

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,b, 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).

Although concerns about omitted variables and reverse causality cannot be ruled out, they are mitigated by the MMoU'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 but not the counterfactual country pairs (pairs that include either the same investee or investor country) at the times they experience the shock.[2]

Using Poisson pseudo-maximum likelihood (PPML) estimation (Gourieroux et al., 1984; Silva and Tenreyro, 2006), I find MMoU linkages are associated with an 11% increase in FPI, relative to the benchmark country pairs. This finding 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 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 MMoU linkages.

In my second set of analyses, I explore whether the increase in FPI translates into 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). Pukthuanthong and Roll's (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. Because 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 MMoU 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).

[2] Due to the multilateral nature of the MMoU, if a given country were 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, they would need to map onto a unique sequence and timing across country pairs. Neither possibility seems likely. Reverse causality (e.g., joining the MMoU in response to investment) also seems unlikely, because 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.

Comparing the year before and year after the MMoU, I find a country's level of integration increases by about 12%, on average, after the MMoU signing. To ensure 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 the effects are larger in countries with code law and low rule of law. This finding suggests 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 MMoU (a country-wide treatment, as defined above). The global sample represents 6605 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 focus allows me to redefine the treatment as the linkage between the firms' home and host market regulators via the MMoU (as it was in the FPI analyses). The "bonding hypothesis" proposes that a key reason that 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 1411 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 has a positive impact on 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 previously known. Silvers (2020) 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. By 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 jurisdictional boundaries, cooperation can (i) enhance enforcement, (ii) improve regulatory decisions through learning and shared experiences, and (iii) reduce red tape. These efforts increase "investor confidence" and make investment more attractive to foreign investors (SEC, 2010).

Absent appropriate enforcement of securities laws, investors face significant risks when investing abroad. Investors consider risks arising from information asymmetry and political uncertainty in particular (Kang and Stulz, 1997). 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, thus making investment more attractive to foreign investors.

Cooperation also allows regulators to benefit from a wider set of shared regulatory experiences. MMoU 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 ownership of foreign shares easier and less costly.[5]

[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 observation relates to a literature on regulatory harmonization. Prior work evaluates efforts to harmonize aspects of markets, including common currencies (e.g., the European Monetary Union) (Bekaert et al., 2013; Glick and Rose, 2016; Larch et al., 2019), 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 MMoU. Instead, the MMoU promotes cross-border cooperation across regimes-even ones with very different legal procedures and regulatory frameworks. Thus, cooperation differs from harmonization.

[5] Certain political and solvency risks may also decline with the MMoU, because it is part of the Financial Sector Assessment Program (FSAP). The FSAP can influence IMF/World Bank lending, so risks that arise from the

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 (2020), 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 (2020) describes a host of problems with these methods. The author instead argues MoUs—and IOSCO's MMoU, in particular—provide the main avenue for cooperation.

Silvers (2020) finds that, after controlling for other factors, cross-border enforcement is about three times as likely after the MMoU connects two regulators. This finding is consistent with the anecdotal evidence of regulators, who indicate the MMoU has revolutionized their cross-border capacities (IOSCO, 2012).[6] Moreover, using share-level data, Silvers (2020) shows transaction costs decline for cross-listed shares (even relative to non-cross-listed firms from the same country) when the MMoU links the firms' home and host countries. This finding implies a reduction in the risks perceived, and/or costs borne, by liquidity providers. A related study by Silvers (2021) demonstrates US cross-listed firms' financial reporting becomes less opaque after the MMoU; this finding is also 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 MMoU links the SEC to a foreign counterpart, funds in (unaffiliated) third-party countries free-ride on US oversight by shifting existing investment 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 the MMoU is not associated with net changes in cross-country investment, which implies 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 (2021) focus exclusively on US oversight of US-cross-listed firms. However, I find 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 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).

Fig. 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. Fig. 2 provides a matrix of the sample investor and investee countries (described later in this section).

3.2. FPI: research design

The empirical analyses are 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 Fig. 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 is 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

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 MMoU. According to IOSCO, (2017), of the 3330 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 MMoU. Thus, US requests do not dominate the activities under the MMoU. Indeed, the MMoU "is a widely used arrangement," says Ashley Alder, chair of IOSCO and former head of the Hong Kong regulator (ESMA, 2019).

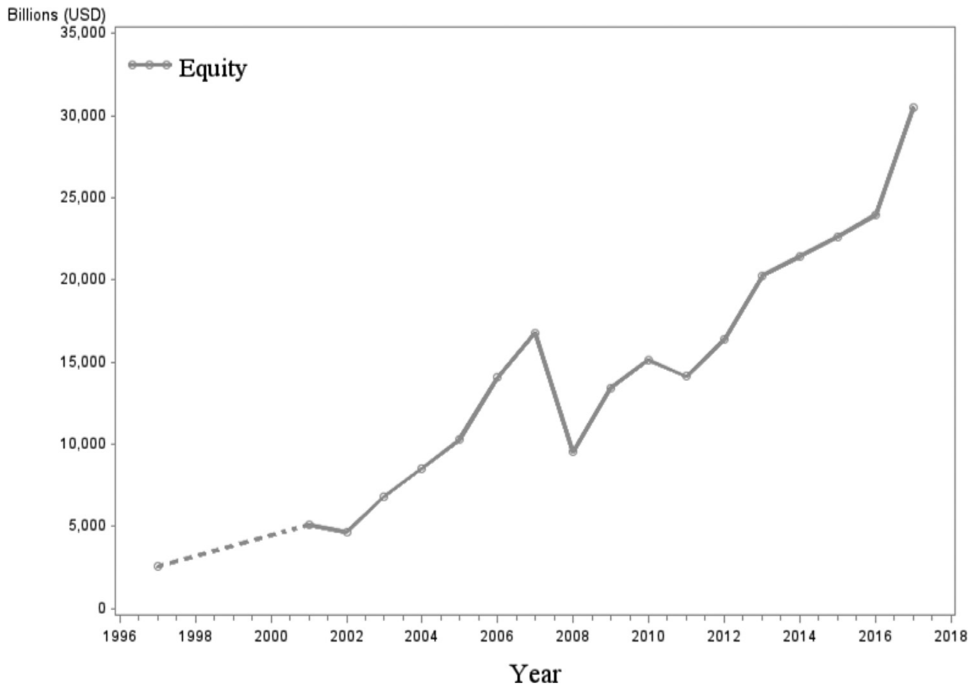

Fig. 1. Total cross-border equity investment over time. This figure shows cross-border equity investment from the IMF's Coordinated Portfolio Investment Survey (CPIS) for the available years (1997 and 2001–2017).

tackle a variety of issues using numerous fixed effects and other controls. These include the following: (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 investment treaties (from the UNCTAD Investment Policy Hub).

Note that this is a generalized difference-in-differences 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, so including the variables that often appear in gravity models of trade (such as distance, common language, and colonial relationships (Tinbergen, 1962)) both unnecessary and impossible. 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 MMoU (e.g., unobserved changes in economic circumstances that occur near in time to the MMoU).

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

$$Investment_{ijt} = \lambda_0 + \lambda_1 MMoU\ Link_{ijt} + \lambda_2 Bilateral\ MoU_{ijt} + \sum_{l=3}^{L} \lambda_l Pair\ time\ trends_{ij}$$

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

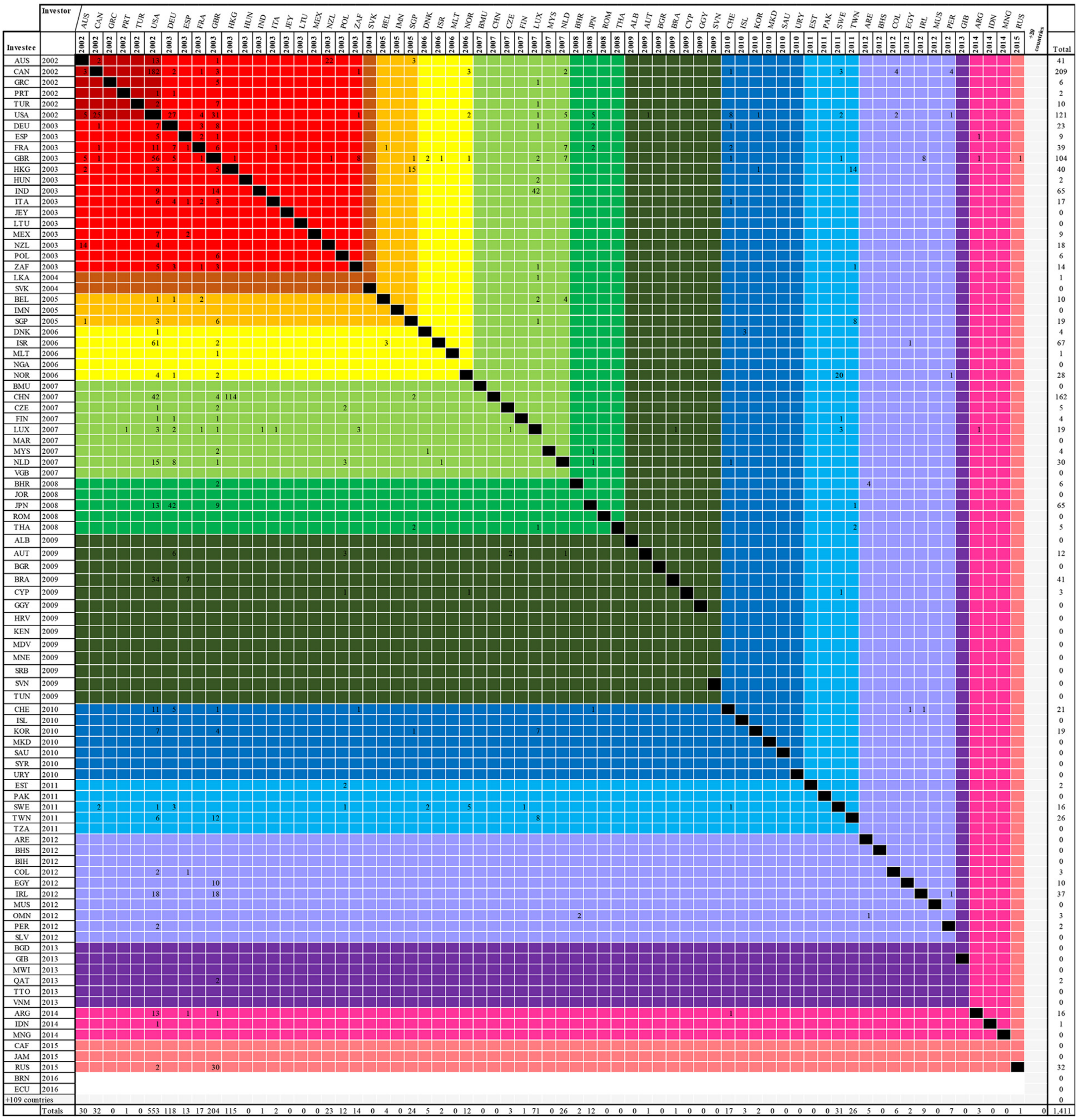

Fig. 2. MMoU Linkage pattern. This adjacency matrix represents each of the country pairs in the FPI analysis and indicates when the treatment occurs for each pair. For brevity, investor and investee countries are reported using their International Organization for Standardization (ISO) three-digit codes. 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 MMoU 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 because 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.

$$+\sum_{i=L+3}^{I}\lambda_{it}Investor\times\ time\ FEs$$
$$+\sum_{j=L+I+3}^{J}\lambda_{jt}Investee\times time\ FEs$$
$$+\sum_{m=L+I+J+3}^{M}\lambda_{m}Investor$$
$$\times\ Investee\ (country\ pair)\ FEs+\upsilon_{ijt} \qquad (1)$$

Fig. 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.

Fig. 2 also indicates the *timing* of the MMoU treatment across country pairs. Countries adopt the MMoU 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 MMoU 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 MMoU and inbound/outbound FPI would indicate 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 Fig. 2 in the vertical column "2005/SGP," indicates the country formed 24 connections simultaneously upon joining the MMoU 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. MMoU-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 squares (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 both the MMoU 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 MMoU is 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 is equal 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, e.g., 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 MMoU, which is equal to cross-border investment being 20% greater when pairs are linked via the MMoU (which comes from exponentiating the coefficient as described in footnote 9). This finding 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 that use these same two alternative estimation tech-

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

[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 $\hat{g}=\exp(\hat{\theta})-1$ 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 $\hat{g}$% 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 as an elasticity (i.e., a 1% change in the independent variable is associated with a θ% change in the dependent variable).

[10] Technically, this amount 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.

Table 1
Cross-border investment.

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 eq. (1):

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

The dependent variable is investment from country i to country j in year t. MMoU link is an indicator for observations in which country i and country j are both signatories of IOSCO's Multilateral Memorandum of Understanding (MMoU). 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% level. ** Significant at the 5% level. * Significant at the 10% level.

	(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

niques (Glick and Rose, 2016; Larch et al., 2019). The design and specifications in those studies measure an effect similar to the MMoU'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.

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 in which impediments such as 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 MMoU 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 *un*interacted 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 MMoU 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 con-

Table 2
Cross-border investment across levels of partitioning variables.

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 Eq. (1) with interactions that separately estimate the effect of the MMoU for each pair of country attributes. For example, for distance in Panel A, the specification is as follows:

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

The dependent variable is investment from country i to country j in year t. MMoU link is an indicator for observations in which country i and country j are both MMoU 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 $\hat{g} = \exp(\hat{\theta}) - 1$, 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% level. ** Significant at the 5% level. * Significant at the 10% level.

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%***

trols 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 finding suggests 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 MMoU 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-

[11] These partitions do not weight the effect of the MMoU in a way that reconciles with 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 MMoU indicator occurs disproportionately in different cells.

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 observation 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 finding 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 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 finding 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, a large increase in FPI occurs 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 (Guisoet al., 2008; 2009).[13]

Overall, cooperation appears to play a critical role in cross-border investment decisions, and this relationship seems to be 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-trends assumption and to assess the timing of the effect. Fig. 3 shows the six years before and the six years after the MMoU 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, I find no obvious indication that the parallel-trends assumption has been violated.

We can reasonably expect that a portion of the effect will narrowly anticipate the formal signing of the MMoU. New legislation is often passed to prepare a country for MMoU 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.) Determining 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 2020), to reverse causality, or to elements of both, is impossible. Yet, reverse causality seems unlikely. For reverse causality to explain Fig. 3, the average regulator would need to anticipate increased investment over a year into the future-a doubtful premise. Furthermore, each MMoU admission generates multiple connections that are outside the regulator's control.

The difference-in-differences 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

[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].

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

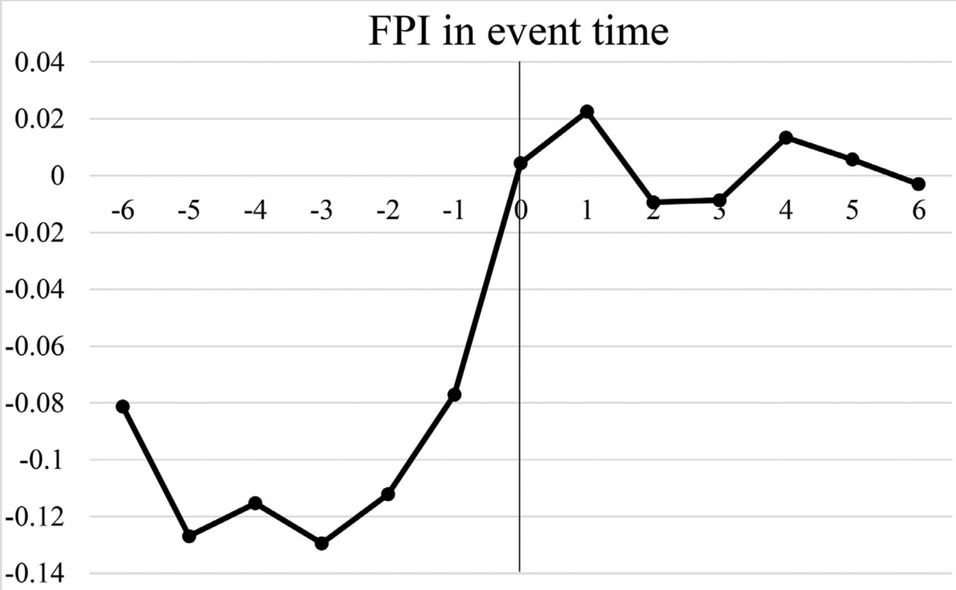

Fig. 3. Cross-border investment in event time This figure shows the effect of the MMoU on FPI in event time. The x-axis represents years relative to the MMoU linkage date, and the y-axis represents the raw coefficient (prior to exponentiating).

the null hypothesis (of no effect) too often, which suggests that some generalized difference-in-differences 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 possibility by randomly assigning the real MMoU years to countries and then recalculating the linkage date for country pairs as a pseudo-treatment. In 1000 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 ($p = 0.032$). (Internet Appendix Fig. 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 possibility seems unlikely.

In the second, I eliminate from the sample any country pairs that never experience the MMoU 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 MMoU'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 so, 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 come from the UN Comtrade dataset. Column 3 of Table 3 shows that the effect of the MMoU 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 MMoU'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 MMoU 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 finding implies that investors perceive a reduction in investment risks even for non-cross-listed firms.

Table 3
Cross-border investment (additional tests).

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 eq. 1 (below) with various interactions and additional controls, as described in Section 3.5:

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

The dependent variable is investment from country i to country j in year t. MMoU link is an indicator for observations in which country i and country j are both MMoU 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 Fig. 2 country pairs with cross listings). Standard errors are clustered by the country-pair level.

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

Test description	(1) MMoU countries only	(2) Developedcountry-pairs only	(3) Controlling for bilateral trade	(4) EU pairs	(5) US	(6) Countries withUS cross-listings(from Lang et al. 2019)	(7) Controllingfor 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*USi					0.038		
					(1.03)		
MMoU*USj					0.014		
					(0.44)		
MMoU*Country with US x-listi						0.013	
						(0.36)	
MMoU*Country with US x-listj						0.016	
						(0.54)	
Tradei to j			−0.004				
			(−0.69)				
Tradej 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	6720	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

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 I have no reason to believe 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 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's (2009) integration measure

4.1. Pukthuanthong and Roll's (Pukthuanthong 2009): 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 criteria 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 MMoU entrance, and classifications—either high or low—on various dimensions that will serve as partitioning variables in the cross-sectional analyses. The Pukthuanthong and Roll's (2009) 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 MMoU, and the difference between the year before and after the MMoU. 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.[15] Finally, the table also contains the number of firms and firm-years used in the firm-specific tests (described in Section 5).

[15] 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 also because its time zone could create issues with the R^2 measure.

4.2. Pukthuanthong and Roll's (2009): empirical measures, research design, and results

Pukthuanthong and Roll's (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 10 principal components of the 17 countries with the longest time series of coverage in Datastream (they argue these countries are the most globally integrated). In a more recent paper, Pukthuanthong and Roll (2016, p. 11) point out that their original Pukthuanthong and Roll's (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 10 largest markets (or the nine largest countries, in instances in which the test country is included as a global factor). Like Pukthuanthong and Roll's (2009, 2016), 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 the Pukthuanthong and Roll's (2009) 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.[16]

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. The 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 MMoU—remains staggered, because 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 MMoU. The difference, reported in Table 4, indicates integration increases by 0.05—about 12% of the average integration value—which

[16] 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 Pukthuanthong and Roll's (2009) point out, even in perfectly integrated markets, correlation can be low. Similar points are made in Bekaert et al. (2016).

Table 4
Sample composition by country.
The sample includes 54 countries that have a Datastream index and at least one publicly listed firm with a market capitalization of at least $500 million from 1995 to 2018. I report the Datastream series name for the US-dollar returns (datatype: X(RI)~U$), the MMoU 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 MMoU and the year after the MMoU, 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).

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	1185
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	2069
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	2969
Saudi Arabia	TOTMKSI	6/9/2010	0.17	0.30	0.12	−0.18	1	1	0	0	0	58	5955
United Arab Emirates	TOTMKAE	10/11/2012	0.17	0.12	0.08	−0.04	1	1	0	1	0	35	3566
Argentina	TOTMKAR	6/12/2014	0.20	0.13	0.19	0.06	1	0	0	0	0	27	1553
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	3070
India	TOTMKIN	4/22/2003	0.25	0.12	0.25	0.13	1	1	0	1	0	55	5459
Turkey	TOTMKTK	11/14/2002	0.25	0.18	0.08	−0.11	1	0	0	0	0	19	1854
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	4362
Israel	TOTMKIS	7/2/2006	0.30	0.16	0.47	0.31	1	1	0	1	1	48	4631
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	2640
United States	TOTMKUS	12/19/2002	0.33	0.36	0.48	0.13	1	1	1	1	1	1688	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	2200
Czech Republic	TOTMKCZ	3/29/2007	0.36	0.53	0.67	0.14	1	0	0	0	0	10	1010
Malaysia	TOTMKMY	5/7/2007	0.36	0.33	0.38	0.05	1	1	0	1	0	85	7861
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

(*continued on next page*)

Table 4 (*continued*)

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
Hong Kong	TOTMKHK	3/3/2003	0.40	0.36	0.38	0.01	0	1	1	1	1	93	8883
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	3468
Poland	TOTMKPO	11/4/2003	0.43	0.15	0.39	0.24	1	0	0	0	0	14	1372
South Africa	TOTMKSA	3/18/2003	0.44	0.20	0.37	0.18	1	1	0	1	0	57	5311
New Zealand	TOTMKNZ	12/1/2003	0.46	0.47	0.65	0.18	0	1	1	0	1	25	2364
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	8115
Norway	TOTMKNW	12/11/2006	0.55	0.44	0.71	0.27	0	0	1	1	1	41	3761
Ireland	TOTMKIR	12/24/2012	0.56	0.88	0.55	−0.33	0	1	1	0	1	48	4685
Portugal	TOTMKPT	11/4/2002	0.56	0.56	0.19	−0.37	1	0	0	0	0	16	1653
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	4610
Austria	TOTMKOE	10/28/2009	0.63	0.82	0.88	0.06	1	0	1	0	1	36	3407
Finland	TOTMKOE	11/22/2007	0.63	0.71	0.82	0.11	0	0	1	0	1	57	5641
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	7830
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	4048
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	9302
Germany	TOTMKBD	11/5/2003	0.80	0.79	0.89	0.10	1	0	1	0	1	78	7897
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:	6605	630,252
				t-test		$p = 0.02$							
				Binomial test		$p = 0.04$							
				Wilcoxon signed rank test		$p = 0.02$							

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 is equal 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.

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

Eq. (2) allows for integration (R^2) to change as a function of a cooperation, as measured by a country's admission to the MMoU. 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 MMoU 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 Eq. (2) using a fractional logit regression because the integration proxy (R^2) is bounded between 0 and 1. Some countries' coverage begins later in the sample period, but most of the 54 countries have the full time series available. Of the 1296 possible country-years (54 countries $\times$ 24 years), 1218 have the data required to calculate the R^2.[17]

Column 1 of Table 5 indicates the integration proxy increases despite country and year fixed effects. The interpretation of the coefficient is that a one-unit change in the independent variable is associated with an $\exp(\alpha_1)-1$% change in the dependent variable (see footnote 10). The coefficient on the *Post* indicator is 0.171, which implies 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 differences exist in economic magnitudes). This finding helps address the possibility that the relation between integration and the P&R proxy is nonlinear.[18]

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 of Table 6, 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 among code-law and weak-rule-of-law countries, where investment risks are more prominent. In Panels D and E, evidence that integration increases the most in contexts in which cooperation is likely to be more effective is weak. 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.

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. 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 because they have properties that allow for better identification. 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. I exclude firms with market capitalization below US $500 million.

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)

[17] 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 the number of pre-MMoU observations is sufficient to estimate the time trend.

[18] 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 estimate represents 9.7% (6.9%) of the 0.423 sample average. This percentage is comparable to the 12% found in the logistic regression.

Table 5
Market integration (country-level evidence).
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 10 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 Eq. (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 MMoU. 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% level. ** Significant at the 5% level. * Significant at the 10% level.

DV=	(1) R^2	(2) R^2	(3) $(R^2)^2$	(4) $\sqrt{(R^2)}$
Post	0.171***	0.111**	0.189**	0.095**
	(2.89)	(1.99)	(2.42)	(2.03)
N observations	1218	1218	1218	1218
Country FEs	Y	Y	Y	Y
Year FEs	Y	Y	Y	Y
Country time trends	N	Y	Y	Y

serve as the local market indices and Datastream's World market index (using the symbol "*TOTMKWD*").[19] All returns are in US dollars and adjusted for the T-bill rate (from Ken French's website). Because the tests use an event window that includes the year before and the year after the treatment, and because 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 6605 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 (e.g., by addressing frictions such as trading costs, information asymmetry, and expropriation risks). By contrast the previous literature often focuses primarily on remediating explicit investment barriers (e.g., cross-listing).[20]

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 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, in which 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).[21] 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:

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

I translate this equation into an empirical test in model (4) below, with firm and time subscripts omitted. *Post* is an indicator equal to 1 when cooperation occurs. Ceteris 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

[19] Using local currency returns yields inferences that are very similar.
[20] A few exceptions exist (see, e.g., Nishiotis, 2004; Carrieri et al., 2013).
[21] I am *not* endorsing the ability of this two-factor model to correctly price an asset. As Bekaert et al., (2011) point out, no consensus about the best asset pricing model exists because 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 the possibility that even a misspecified asset-pricing model would confound my inferences regarding changing market risk exposures unlikely.

Table 6
Market integration: cross-sectional tests

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 10 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 Eq. (2):

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

The Post indicator is set to 1 for country-years greater than or equal to the year a country joins the MMoU. 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% level. ** Significant at the 5% level. * Significant at the 10% level.

Panel A: Capital controls	
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***

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 approach allows risk exposures to change as a function of regulatory cooperation:

$$\text{Ret} = \beta_0 + \beta_1 R^L + \beta_2 R^W + \beta_3 Post + \beta_4 R^L * Post + \beta_5 R^W * \ Post + \varepsilon_t. \tag{4}$$

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 firms should experience declining risk exposure to the local market and increasing risk exposure to the global market.

Table 7
Changes in beta-full sample.

The sample includes all firms with market capitalization above $500 million, non-missing total assets, and a home-country index from Datastream. Spanning years 2001 to 2016, I find 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 Eq. (4): Ret = $\beta_0 + \beta_1 R^L + \beta_2 R^W + \ \beta_3 Post + \beta_4 R^L * Post + \beta_5 R^W * \text{Post} + \varepsilon_t$.
In this analysis, the treatment is defined at the country level by Post, an indicator set equal to 1 for observations for which the date is later than or equal to the week that a country joins the MMoU. 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-MMoU 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% level. ** Significant at the 5% level. * Significant at the 10% level.

	(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	6604
N clusters	53
R^2	0.401

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 consists primarily of non-cross-listed firms. Consequently, I create a country-wide treatment using the date that a firm's home country regulator joins the MMoU. More specifically, the *Post* indicator is equal to 1 for observations later than or equal to the date the firm's home country joins the MMoU.

The main estimation is reported in Table 7. The equilibrium betas prior to the MMoU are dominated by the local market (0.695) but are nontrivially influenced by global markets (0.234). After the MMoU, 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).[22] Model 4 is fully unconstrained across the various partitions by separately estimating each partition (high or low) of the various dimensions. Only β_4 and β_5—the *changes* in the 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 the 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 Pukthuanthong and Roll's (2009) proxies. Panel B indicates countries with capital controls experience a dampened effect from cooperation. Panels C and D reveal 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 the effect is concentrated in undeveloped markets; this result is the only one 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. Table 8

5.5. Firm-level: robustness tests

To gage 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 (e.g., size, listing status, and data requirements). The sample of cross-listed firms that meet these criteria are reported by country pair in Fig. 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, substantial variation remains across home and host countries and in the timing of the treatment. Of course, compared 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 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 US.

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

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

Table 8
Cross-sectional tests of changes in beta-full sample.

The sample includes all firms with market capitalization above \$500 million, non-missing total assets, and a home-country index from Datastream. Spanning years 2001 to 2016, I find 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 Eq. (4): $\text{Ret} = \beta_0 + \beta_1 R^L + \beta_2 R^W + \beta_3 Post + \beta_4 R^L * Post + \beta_5 R^W * \text{Post} + \varepsilon_t$.
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 for which the date is later than or equal to the week a country joins the MMoU. 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% level. ** Significant at the 5% level. * Significant at the 10% level.

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

linkage between home and host countries). As shown in column 1 of Table 10, the equilibrium betas prior to the MMoU remain dominated by the local market: 0.685 for the local beta and 0.284 for the world beta. This finding 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 MMoU, 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 Fig. 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 (e.g., the local beta drops by 0.111 and the global beta increases by 0.156). This finding 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-MMoU global beta increases by 0.032). However, some non-US cross-listings do show evidence of integration. The top 10 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.[23] 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.

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

Table 9
Alternative time horizons-full sample.

The sample includes all firms with market capitalization above \$500 million, non-missing total assets, and a home-country index from Datastream. Spanning years 2001 to 2016, I find 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 Eq. (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 MMoU date, such that the total horizon varies between two and eight 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-MMoU period and $[(\beta 2+\beta 5)/(\beta 1+\beta 2+\beta 4+\beta 5)]$ in the post-MMoU period.

Years pre/post	ΦPre	$\Phi Post$	$\Delta\Phi$
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

In terms of magnitude, the estimated effect of the MMoU is smaller than the effects that Foerster and Karolyi (1999) observed around US cross-listing events. This finding 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 MMoU. It shows that the changes in beta that accompany the MMoU 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 no clear prediction exists 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 2 × 2 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 MMoU 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

Table 10
Main tests of changes in beta-cross-listed firms.

The sample includes 1411 cross-listed firms (137,497 firm-weeks) across 221 country pairs from 2001 to 2016. The sample firms are reported by country pair in Fig. 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 MMoU. 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 for which the date is greater than or equal to the week the home and host countries are joined by the MMoU. 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-MMoU 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% level. ** Significant at the 5% level. * Significant at the 10% level.

	(1) Main result	(2) US-Cross-listed	(3) Non-US cross-listed	(4) Popular cross-listing destinations (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	1411	553	858	585
N clusters	220	36	185	117
R^2	0.38	0.35	0.39	0.427

Table 11
Cross-sectional tests of changes in beta-cross-listed firms.

The sample includes 1411 cross-listed firms (137,497 firm-weeks) across 221 country pairs from 2001 to 2016. The sample firms are reported by country pair in Fig. 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 MMoU. I use the same equation as the previous tests:

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

The treatment is defined at the country-pair level, by Post, an indicator set equal to 1 for observations for which the date is later than or equal to the week in which the home and host countries are joined by the MMoU. 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-MMoU 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% level. ** Significant at the 5% level. * Significant at the 10% level.

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**

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 occur 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.

Table 12
Alternative time horizons—cross-listed firms.

The sample includes 1411 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 MMoU. The sample firms are reported by country pair in Fig. 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 MMoU. I use the same equation as the previous tests:

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

The years pre/post column indicates the number of years before and after the MMoU 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-MMoU period and $[(\beta 2+\beta 5)/(\beta 1+\beta 2+\beta 4+\beta 5)]$ in the post-MMoU period.

Years pre/post	Φ*Pre*	Φ*Post*	ΔΦ
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

6.4. Cross-listed firms: robustness tests

To gage 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 finding helps 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 previously 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 MMoU 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 a 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.[24] 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).

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

Declaration of Competing Interest

The author was formerly an economist with the Securities and Exchange Commission. This paper won a €5,000 prize from the Federation of European Securities Exchanges.

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