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Productivity spillovers from FDI: A firm-level cross-country analysis

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PRODUCTIVITY SPILLOVERS FROM FDI: A FIRM-LEVEL CROSS-COUNTRY ANALYSIS*

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Abstract

This paper provides cross-country firm-level evidence on productivity spillovers from foreign direct investment (FDI), separately for greenfield FDI and cross-border mergers and acquisitions (M&As). The granularity of bilateral sector-level FDI datasets allows for addressing possible endogeneity issues by applying a two-step approach whereby an exogenous FDI measure is constructed from a gravity-type regression of bilateral FDI flows. When looking at the effects of greenfield investments on firm labor productivity we find: i) positive intra-industry spillover effects for firms located in advanced countries, and ii) positive backward spillover effects for firms located in emerging and developing countries. These spillovers are driven entirely by FDI from advanced countries. The results from cross-border M&As are noisier, with weakly suggestive evidence for positive intra-industry spillovers in advanced countries but negative backward spillovers in emerging markets and developing countries.

Keywords: Foreign direct investment; Cross-border M&A; Intra-industry spillovers; Backward spillovers; Forward spillovers

JEL Classification: F14; F21; F23; F60

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1 Introduction

Global trade liberalisation and advances in information and communications technology (ICT) over the past three decades greatly facilitated the compartmentalisation of the production process and international production sharing, leading to the proliferation of multinational corporations (MNCs) in the age of global value chains (GVCs) (Antràs, 2020). The consequent surge in global foreign direct investment (FDI) has been widely seen as key to promoting economic growth in host countries, not only in a traditional manner by expanding the stock of capital and creating jobs, but also through spillovers from the advanced technology brought by MNCs.

However, rising geopolitical tensions are making more concrete the risk of a reversal of the global economic integration that has characterised the past three decades (Aiyar *et al*, 2023a). When considering FDI, the recent interest in reshoring and friend-shoring of cross-border investment is translating into actual relocation decisions (Alfaro and Chor, 2023; Freund *et al*, 2023; Gopinath *et al,* 2024), with investment decisions increasingly likely to be driven by geopolitical considerations (Aiyar *et al,* 2024). Therefore, a better understanding of the potential channels through which FDI could affect host countries is increasingly relevant to gauge the potential costs of geoeconomic fragmentation (Aiyar *et al,* 2023b).

This paper adds to the large literature on FDI spillovers with three important contributions. First, we employ a cross-country firm-level setting and exploit the granularity of bilateral sector-level FDI data to identify the varying degree of specific spillover channels across host and source country income groups. Considering substantial heterogeneity across destination countries in various dimensions including the income level as well as the composition of source countries, it is not surprising that previous empirical results in the literature have been inconclusive, in part because of data limitations. As such, using investment level data in a large cross section of countries greatly enables us to re-evaluate respective FDI spillover channels.

Second, we separately estimate the spillovers from greenfield FDI and cross-border M&As, whose spillovers could materialise through different channels (eg Antràs and Yeaple 2014). Thus far, empirical studies could hardly distinguish different types of FDI, while most of the theoretical studies on FDI spillovers have focused on greenfield FDI, without considering cross-border M&As with potentially distinct motives such as reducing competition (eg Neary, 2007; Cunningham *et al*, 2021), obtaining access to innovation (eg, Bena and Li, 2014; Phillips and Zhdanov, 2013), or acquiring non-mobile capabilities (eg Nocke and Yeaple, 2007). To our knowledge, this paper is the first to compare spillovers from greenfield FDI and cross-border M&As in a unified empirical framework.

Lastly, we mitigate endogeneity issues by applying a two-step approach, whereby an exogenous FDI measure is constructed from a gravity-type regression of bilateral FDI flows. Specifically, we employ cross-country firm-level data, matched with data on project-level greenfield FDI as well as deal-level cross-border M&As (ie brownfield FDI) at the country-sector-year level for the period 2003-2021. Further incorporating global input-output tables into FDI data, we estimate the extent to which inward FDI

affects average firm-level labor productivity growth through intra-industry and inter-industry (ie backward and forward linkages) spillover channels. Along the way, potential endogeneity concerns could arise as a country-sector with stronger growth potential tends to attract more foreign investment, likely causing upward bias. Our approach addresses such concerns by essentially taking the exogenous portion of FDI flows from a gravity-type regression with bilateral geographical and geopolitical distance variables.

When considering greenfield FDI we find that firms in advanced countries benefit from intra-industry spillover effects, suggesting that the entry of multinationals could increase productivity of domestic firms in the same sector through knowledge spillovers and competitive pressures (Haskel *et al*, 2007; Keller and Yeaple, 2009). These effects are not present in emerging markets and developing countries, where domestic firms instead can take advantage of foreign affiliates in downstream sectors (ie backward linkages), as these foreign firms may source inputs locally, increasing demand for domestic firms and providing incentives to domestic suppliers to upgrade their production management or technology (Javorcik, 2004). In both cases, spillovers are driven entirely by FDI sourced from advanced countries. When looking at spillovers from upstream multinationals (ie forward linkages), we find effects that tend to be weakly negative and mostly due to non-manufacturing FDI. These findings are consistent with a widely held notions that FDI from advanced source countries are more likely to occur through knowledge diffusion via either backward linkage (in emerging and developing countries) and competitive pressures (in advanced host countries) than via forward linkage.

By contrast, estimation results from cross-border M&As are noisier, with weakly suggestive evidence that domestic firms in advanced economies benefit from positive intra-industry spillovers, while those located in emerging markets and developing countries experience negative backward spillovers. These findings suggest that the nature of FDI—greenfield or M&As—is important in considering potential spillovers to EMDEs; an issue that has not received much attention in the literature to date.

Related literature. Aggregate-level cross-country studies reveal that the effect of inward FDI is uneven across countries. Borensztein *et al* (1998) show those countries with a sufficiently high level of human capital can benefit more from a given level of inward FDI than other countries with a low level of human capital, suggesting that FDI can contribute to economic growth only when sufficient capability to absorb advanced technologies is available in the host economy. Similarly, Alfaro *et al* (2004) find that a country with a better financial system can exploit inward FDI more efficiently, confirmed by a positive coefficient estimate on the interaction term between FDI inflows and a measure of financial development. Panizza *et al* (2022) employ a novel instrumental approach to find that there is a positive and statistically significant correlation between FDI and growth for countries with sufficiently well-developed financial sectors or high levels of human capital but statistically insignificant relationship for countries with average levels of education or financial depth, the degree of which tends to vary over time. We further explore

heterogeneity stemming from source country income levels on top of host country characteristics.

Considering that foreign entrants may have different implications for intra-industry domestic competitor firms as opposed to inter-industry domestic suppliers/buyers, recent empirical studies have explored various firm-level datasets to identify specific spillover channels.[1] For intra-industry spillover effects, Aitken and Harrison (1999) find a negative spillover effect in Venezuela, which is attributed to the market-stealing effect caused by entering foreign firms, whereas Haskel *et al* (2007) and Keller and Yeaple (2009) report positive spillover effects in the United Kingdom and United States, respectively. By contrast, inter-industry spillover effects tend to be found mostly positive, particularly for backward linkages. Javorcik (2004) explores Lithuanian firm-level data to separately estimate intra-industry and inter-industry spillover effects where the latter is further broken down into backward and forward linkages. The estimation results support the strong presence of backward linkages: positive productivity spillovers from FDI take place mostly through contacts between foreign firms and their local suppliers in upstream sectors. Blalock and Gertler (2008) and Gorodnichenko *et al* (2014) confirm positive productivity spillovers from FDI via backward linkages among Indonesian firms and those located in transition economies, respectively. Jiang *et al* (2018) find both backward and intra-industry spillover effects from international joint ventures in China. Jude (2016) and Newman *et al* (2015) confirm positive backward spillover effects and negative forward spillover effects in Romania and Vietnam, respectively. Amendolagine *et al* (2019) provide suggestive evidence that the local sourcing of intermediate products is behind strong backward spillover effects present in developing countries. Mercer-Blackman *et al* (2021) is closest to the current study by employing an identical set of greenfield FDI and firm-level datasets to provide rich evidence on the varying degree of FDI spillovers with respect to the extent of GVC participation. Our paper is unique in that we evaluate FDI spillovers separately for greenfield FDI and cross-border M&As in an extended cross-country firm-level setting.

An important premise behind spillover effects from inward FDI is that foreign firms are superior to average domestic firms in various dimensions such as size, productivity, wage, etc. This has been backed by empirical evidence from firm-level data across countries, dating at least back to Willmore (1986) who compared foreign and domestic firms in Brazil. This tends to be true not only for developing countries but also for advanced countries. For example, Griffith and Simpson (2004) report that foreign firms in UK are more productive and grows faster than British domestic firms. However, to the extent that productive domestic firms are more likely to be an attractive target of acquisition by foreign investors, foreign owned firms' superiority could be simply due to selection effects rather than stem from inherent advantage in managerial and/or innovative practices. Guadalupe *et al* (2012) explore Spanish data

[1] The conventional approach in the firm-level literature is to infer the presence or absence of FDI spillovers from measured changes in TFP or labor productivity. Alternatively, patent citations data can be used to measure FDI spillovers such as in Branstetter (2006) for Japanese firms' spillovers in the US; Globerman *et al* (2000) for domestic spillovers from Swedish outward FDI; Akcigit *et al* (2024) for spillovers from the foreign corporations that invest in US startups; and Ahn *et al* (2024) for both worldwide inward and outward FDI spillovers.

to answer the question and find the presence of such selection effects (ie cherry-pick), but, even after controlling for such selection effects, it turns out that foreign owned firms outperform domestic firms through more active innovation, which could eventually lead to improvements in nontarget firms' performance in the host country via, for example, the corporate governance spillover channel (Albuquerque *et al,* 2019). To address potential endogeneity issues that could stem from reasons discussed above, we take a two-step approach to consider exogeneous portion of FDI flows extracted from a gravity-type regression.

The paper is organised as follows. Section 2 introduces the sample data for our main analysis. 3 elaborates the baseline estimation model and two-step approach. Section 4 presents main empirical findings. Section 5 concludes.

2 Data

2.1 Greenfield FDI from fDi Markets

Our analysis relies on proprietary data on bilateral greenfield foreign direct investment from fDi Markets, a service from the Financial Times which tracks new physical project or expansion of an existing investment which creates new jobs and capital investment. fDi Markets serves as underlying data for global greenfield FDI reported in the World Investment Report by UNCTAD. It does not track mergers and acquisitions, or other international equity investments, investment projects that do not create new jobs, companies which establish a foreign subsidiary without a physical company presence. The data are collected primarily from publicly available sources (eg media sources, industry organisations, investment promotion agencies newswires) and report investment-level information for over 300,000 FDI deals since January 2003. For each investment, we know the source and destination countries, as well as the sector, activity (eg business services, sales, R&D), type (new investment or expansion), volume (in USD) and number of jobs created. The volume of the capital investment and the associated jobs are often estimated. The reliability of these data is tested in Toews and Vézina (2022) and Aiyar *et al* (2024) by, for instance, aggregating the volumes at the destination country-year level and comparing them with gross FDI inflows data from official sources.

Table 1 summarises the pattern of greenfield FDI over the period between 2003 and 2021 by source and host countries, also broken down by types of activities and by the three broad sectors (primary, industry and services) for illustrative purposes. A few patterns stand out. First, greenfield FDI is predominantly concentrated in the industry sector, even if the share of investment in services has been rising (Figure 1). This tendency holds irrespective of source country or host country income levels. Second, when focusing on the industry sector, Figure 2 reveals that the share of greenfield FDI in non-manufacturing activities is increasing over time. Also, manufacturing FDI is mostly from advanced countries to emerging markets and developing countries (Figure 2a), while the increase of non-manufacturing FDI is largely driven by flows within advanced economies (Figure 2b).

2.2 Cross-border M&As from Refinitiv Eikon

We also explore cross-border M&A data from Refinitiv Eikon to complement the baseline analysis of greenfield FDI. The Refinitiv Eikon database has superseded Thomson Reuter's SDC Platinum database, which has been used extensively in recent academic research such as Erel *et al* (2022) and Bergant *et al* (2023). This dataset also serves as underlying source for cross-border M&As reported in the World Investment Report by UNCTAD. For each cross-border M&A deal, we know the acquiror and target countries as well as the sector associated with the target firm and its purchase value (in USD).

Table 2 summarises the pattern of cross-border M&As over the period between 2003 and 2021 by acquiror and target countries, which is further broken down by the target firms' sector affiliations based on the three broad sectors (primary, industry and services) for illustrative purposes. Unlike greenfield FDI, cross-border M&As in the service sector are as frequent as those in the industry sector. Moreover, North-North flows are predominant in cross-border M&As, almost three times as large as North-South flows. Figure 3 illustrates the rapid catch-up by the service sector cross-border M&As over time. In both industry and service sectors, cross-border M&As have been taking place mostly by investors in advanced countries acquiring target firms in other advanced countries (Figures 4a and 4b).

2.3 World Bank Enterprise Survey

The World Bank Enterprise Surveys (WBES) provide a rich set of standardised firm-level information in a repeated cross-sectional design (with different countries surveyed in different years) for more than 180,000 firms in over 150 countries between 2006 and 2021. Firm-level performance measures in the standardised WBES dataset includes employment, sales, investment, and R&D expenditures. This dataset has been a useful source for cross-country firm-level studies in various contexts, including integration in global value chains, trade and firm productivity (see, among others, Ricci and Trionfetti, 2012; Del Prete *et al,* 2017; Montalbano *et al*, 2018). The current analysis aims to separately estimate inter-industry and intra-industry spillover effects on firm-level labour productivity across an extensive set of host countries, listed in Table A.1.

3 Empirical Strategy

3.1 Baseline approach

The firm-level World Bank Enterprise Surveys (WBES) dataset is merged with the fDi Markets greenfield FDI dataset as well as Refinitiv Eikon's cross-border M&A dataset at the country-sector-year level, with inter-industry linkages incorporated using global input-output matrices from the country-sector-level EORA database based on a common 26-sector classification.

Following the tradition in the literature at least since Javorcik (2004), backward and forward inter-industry linkages are constructed as the weighted sum of FDI

across input or output sectors for a given country-sector, where weights are calculated as the domestic share of inputs from (or outputs to) the relevant sector in total inputs (or outputs). These are expressed as:

$$FDI_{cjt}^{user} = \sum_{s \neq abroad} \left[\left(\frac{\alpha_{cjs}}{\sum_s \alpha_{cjs}} \right) \times FDI_{cst} \right] \quad (1)$$

for forward linkages to domestic users in downstream sectors, and:

$$FDI_{cjt}^{supplier} = \sum_{u \neq abroad} \left[\left(\frac{\alpha_{cuj}}{\sum_u \alpha_{cuj}} \right) \times FDI_{cut} \right] \quad (2)$$

for backward linkages to domestic suppliers in upstream sectors. In the definitions of the forward and backward linkages, a_{cus} is total input supplied by sector s to produce output in sector u, taken from the EORA database for each country c. FDI_{cj} is country-sector level inward FDI measured as the number of new greenfield investments in log from the fDi Markets database, which effectively serves as a measure for intra-industry spillover effects and thus is also denoted as FDI_{cj}^{within}. For the analysis of cross-border M&As, this is simply replaced by the number of cross-border M&As from the Refinitiv Eikon database.2

The baseline regression is then specified as:

$$\Delta \ln LP_{icjt} = \beta_1 \ln\left(FDI_{cjt-3}^{within}\right) + \beta_2 \ln\left(FDI_{cjt-3}^{supplier}\right) + \beta_3 \ln\left(FDI_{cjt-3}^{user}\right) + FE_{cj} + FE_{ct} + FE_{jt} + \varepsilon_{icjt} \quad (3)$$

for estimating both intra-industry and inter-industry spillover effects separately at the same time, where $\Delta \ln LP_{ijct}$ denotes a firm i's labor productivity growth over the previous three years.[3] Potential endogeneity bias is partly corrected by using lagged values of FDI. We further include a various set of fixed effects: FE_{cj}, FE_{ct}, and FE_{jt} that is supposed to capture country-sector, country-year, and sector-year specific effects, respectively. We keep the specification as parsimonious without firm-level control variables because the repeated cross-sectional nature of the firm-level dataset provides only contemporaneous firm-level variables that are supposed to be endogenous to our labour productivity measure. As such, our identification strategy tries to exploit within country-sector variation over time after controlling for country-year-level macroeconomic shocks and sector-year-level supply as well as demand shifts. Remaining concerns about endogeneity are further addressed by the two-step approach introduced below. Standard errors are clustered in multiple dimensions at the country-sector and country-year level.

A set of slight modifications of the baseline specification in equation (3) allows for exploring potential heterogeneity in spillovers in various dimensions. First of all, we can study the heterogeneity by host country income levels by restricting the host country sample to advanced economies (AEs) or to emerging markets and

[2] 1 is added to FDI measures in log to include observations in those country-sectors without new FDI in given year.

[3] Despite the limitation of the data lacking panel structure, the questionnaire includes total sales and number of workers in the last fiscal year and three fiscal years ago so that labor productivity growth over the period can be calculated.

developing economies (EMDEs). Likewise, potential heterogeneity in spillovers by source country income groups can be investigated by aggregating FDI over source countries by their income levels. Moreover, owing to the granularity of the FDI data, grouping greenfield FDI by business functions can shed light on potential difference between spillovers from manufacturing activity and from non-manufacturing activity.[4]

3.2 Two-step approach

To address possible remaining endogeneity issues arising from FDI searching for high growth potential, we consider a two-step approach, where the first step involves a gravity-type regression of actual bilateral FDI to construct *predicted* bilateral FDI measures. In a nutshell, following the idea first developed by Frankel and Romer (1999) for trade flows and recently applied by Panizza *et al* (2022) to FDI flows, this amounts to extracting the exogenous portion of bilateral FDI. Thus, the first step employs geographical as well as geopolitical distance variables that should be less prone to endogeneity concerns.[5] The second step then takes the predicted FDI from the first stage to the otherwise identical spillover estimations specified by equation (3).

Specifically, the Poisson pseudo-maximum likelihood (PPML) estimator *à la* Silva and Tenreyro (2006) is applied to the gravity-type specification below:

$$FDI_{ocjt} = exp\left[\beta_1 IPD_{ojt-1} + \beta_2 GravityControls_{oc} + FE_{ojt} + FE_{cjt}\right]\varepsilon_{ocjt} \quad (4)$$

where FDI_{ocjt} denotes bilateral FDI flows from the source country *o* to the host country *c* in sector *j* and year *t*. IPD_{oct-1} is the lagged value of the ideal point distance between countries *o* and *c*.[6] $GravityControls_{oc}$ is a set of standard gravity variables such as the bilateral geographical distance between the source and host countries (in logs) and dummy variables for common language and legal origins and the presence of colonial relationships.[7] Source country-sector-year fixed effects (FE_{ojt}) and host country-sector-year fixed effects (FE_{cjt}) absorb any time-varying push and pull factors at source country-sector and host country-sector levels, respectively.

[4] The stated *business function* does not necessarily correspond to the *sector classification*. Specifically, business functions are categorised as Manufacturing; Business Services; Customer Contact Centre; Logistics, Distribution & Transportation; Maintenance & Servicing; Retail; Sales, Marketing & Support; Shared Services Centre; Technical Support Centre; Research & Development; ICT & Internet Infrastructure; and Education & Training.

[5] Although geopolitical distance is not as strictly predetermined as geographical distance, it is unlikely to impact labour productivity in a particular country except via the FDI received by that country.

[6] Ideal point distance (IPD) is a measure of geopolitical distance between countries based on voting patterns at the UNGA (Bailey *et al,* 2017). Aiyar *et al* (2024) show that the role of geopolitical alignment in driving the geographical footprint of bilateral FDI has become increasingly more relevant than standard gravity variables.

[7] Standard gravity variables are taken from the CEPII gravity dataset (Conte *et al,* 2022).

The exogenous portion of bilateral FDI flows is extracted as the fitted bilateral FDI flows from the above gravity-type regression, excluding host country-sector-year fixed effects (FE_{cjt}) that are likely to capture the main source of endogeneity we are concerned with (ie growth potential). It is further aggregated across source countries at each host country and sector level. [8] The resulting fitted FDI measure, as opposed to actual FDI measure, is then taken to the baseline estimation exercises.

4 Estimation Results

4.1 Greenfield FDI

4.1.1 Baseline results

Columns (1)-(3) in Table 3 summarise the baseline estimation results, considering FDI, measured as the number of greenfield investment deals, from all sources. Column (1) includes all the host countries in the sample, while columns (2) and (3) include separately AE and EMDE host countries, respectively.

Column (1) shows that spillovers from FDI, in general, tend to occur predominantly across industries: positively through backward linkages, but negatively through forward linkages. By contrast, intra-industry spillover effects are found to be statistically insignificant. However, these results are likely driven by EMDE host countries, as they account for nearly 90 percent of the whole sample observations. Breaking down the sample by host country income levels reveals that intra-industry spillover effects are positive and statistically significant among AEs (column (2)), but insignificant among EMDEs (column (3)). On the other hand, positive and significant backward spillover effects as well as negative and significant forward spillover effects are found exclusively among EMDEs.

These results are consistent with findings from the previous literature. As for intra-industry spillovers, pro-competitive effects and market stealing effects may operate in the opposite direction within an industry: the former is likely to dominate in AEs where local firms are ready to react to fiercer competition from multinational corporations by becoming more productive. On the other hand, the latter may offset the former in EMDEs where local firms are not productive enough to compete against foreign firms with advanced technology (eg Aitken and Harrison, 1999).

Regarding inter-industry spillovers, previous studies tend to find that positive productivity spillovers from FDI take place mainly through contacts between foreign affiliates and local suppliers in upstream sectors rather than through contacts between foreign affiliates and local buyers in downstream sectors (eg Harrison and Rodríguez-Clare, 2010). This is because foreign firms are likely to source inputs locally, and hence increase local demand for inputs produced in the upstream sector.

[8] Although the property of the PPML estimator is such that the aggregate sum of the fitted bilateral values should be always equal to the aggregate sum of the actual bilateral values (ie $\widehat{FDI}_{cjt} = \sum_o \widehat{FDI}_{ocjt} = FDI_{cjt}$; Fally, 2015), the current approach allows deviation between the aggregate sum of the actual and predicted values because host country- sector-year fixed effects (FE_{cjt}) are excluded in deriving predicted values (eg Panizza *et al,* 2022).

As a result, the input sector expands, and the presence of increasing returns to scale could lead to efficiency gains in that sector. At the same time, local suppliers may benefit from learning by doing via direct contacts with foreign buyers with advanced technology. Most importantly, foreign firms will have strong incentive to actively promote backward spillovers.

On the other hand, foreign firms in the upstream sector may mostly sell abroad, limiting the scope for positive technology spillovers via direct contact with local buyers in the downstream sector. Moreover, to the extent that foreign firms crowd out local firms in a given sector, they may exercise market power to charge high mark-ups, with negative consequences for local buyers in the downstream sector. Unlike the case for backward spillovers, foreign firms may have no compelling incentive to actively promote forward spillovers.

Robustness. Table 4 confirms that the baseline results are robust to excluding foreign-owned firms and to an alternative FDI measure comprising investment value rather than number of deals. Columns (1)-(3) repeat the baseline estimation for the sample excluding firms with more than 10 percent foreign ownership, while columns (4)-(6) replace the baseline FDI measure with investment values. Similarly to the baseline results in Table 3, positive backward and negative forward spillovers are statistically significant for the whole sample (columns (1) and (4)) but are mainly driven by EMDE host countries (columns (3) and (6)). Positive and statistically significant intra-industry spillovers are present only among AE host countries (columns (2) and (5)). Given these qualitatively identical results, all the estimations hereafter will include incumbent foreign owned firms and employ the baseline FDI measure.

Heterogeneity by FDI type. Table 5 explores potential heterogeneity in spillovers by the type of FDI activity. Columns (1)-(3) consider FDI for which the business function is categorised as manufacturing, whereas columns (4)-(6) focus on FDI with a non-manufacturing business function. For example, FDI taking place in the manufacturing sector can be categorised as non-manufacturing if its main function involves non-manufacturing activities such as R&D, business services, maintenance, etc. It turns out that both manufacturing and non-manufacturing FDI yield positive and statistically significant intra-industry spillovers in AE host countries (columns (2) and (5)). However, they have contrasting inter-industry spillovers: positive and statistically significant backward spillovers come exclusively from manufacturing FDI in EMDEs, but negative and statistically forward spillovers are found only from non-manufacturing FDI in EMDEs.

These results may reflect that non-manufacturing FDI is not so much associated with local production as manufacturing FDI, and hence there is more limited scope for positive backward linkages via direct contacts with local suppliers upstream.

Heterogeneity by source country income groups. Turning to potential heterogeneity in spillovers by source country income levels, Table 6 reports estimation results by breaking down FDI source countries into AEs and EMDEs. Columns (1)-(3) correspond to estimation results from FDI measures restricted to advanced source countries for all, AE, and EMDE host countries, respectively, while

columns (4)-(6) likewise summarise estimation results from FDI sourced from emerging and developing countries in all, AE, and EMDE host countries.

The baseline result shown in Table 3 that positive and significant backward spillover effects are present only in EMDEs turns out to be driven exclusively by FDI from AEs (columns (3)). To the extent that backward spillovers largely reflect technological transfers from foreign buyers with advanced technology, the result is consistent with the notion that FDI from AEs tends to embody more advanced technology than FDI from EMDEs. Likewise, the negative and significant forward spillover effects in EMDEs are also due entirely to FDI originating from AEs (column (5)). This might reflect the entry of more productive foreign firms that crowd out local firms and exercise market power, thereby squeezing local buyers in the downstream sector. By contrast, the positive and statistically significant intra-industry spillover effects in AEs are associated with FDI from both AEs and EMDEs, possibly because the entry of even less productive foreign firms leads to greater competition.

4.1.2 Two-step approach

Table 7 summarises the estimation results from the gravity-type specification of bilateral greenfield FDI in equation (4) using the PPML estimator. FDI is measured by the total number of greenfield investment deals in column (1) or by total greenfield investment values in column (2). All the estimated coefficients have the expected signs. The greater the geographical distance between a pair of countries, the less greenfield FDI takes place. By contrast, a country pair sharing common legal origins, common language, or colonial relationship tends to have more greenfield FDI deals sourced from each other. Most interestingly, geopolitical distance turns out to affect bilateral greenfield FDI in a similar way to geographical distance (Aiyar *et al,* 2024).

Figure 5 illustrates the results from the gravity-type estimation by comparing actual FDI measures to predicted FDI measures, aggregated by source countries at the host country-sector-year level. Predicted FDI measures are obtained as the fitted bilateral sector-year level values from the gravity-type regression, using either the number of new greenfield investment deals (panel 5a) or the investment size (panel 5b).

Table 8 summarises the second step results that repeat the previous baseline estimation reported in 3 while replacing actual FDI measures with predicted FDI measures from the first step. Columns (1)-(3) confirm the main findings that the positive and significant backward spillover effects are present exclusively in EMDE host countries (column (3)), while positive and significant intra-industry spillover effects are mainly found in AE host countries (column (2)). However, the negative and significant forward spillover effects are present not only in EMDE host countries but also in AE host countries (columns (2) and (3)).

Table 9 reports the second step results on the source country heterogeneity analysis shown in Table 6, replacing the actual FDI measures with the predicted FDI measures from the first step. The results clearly confirm the earlier findings that

positive and significant intra-industry and backward spillovers come exclusively from advanced source countries. The two-step procedure suggests that these results are not simply driven by potential endogeneity between host country growth potential and FDI flows. On the other hand, negative and significant forward spillovers from advanced source countries in EMDE host countries become statistically insignificant. There is also some weak evidence of negative and significant intra-industry spillovers in EMDE host countries from EMDE source countries, suggesting the dominance of market stealing effects from the entrance of competing firms in the same segment of the market.

4.2 Cross-border M&As

4.2.1 Baseline results

Columns (1)-(3) in Table 10 summarise the results considering cross-border M&As from all acquiror countries, measured as the number of cross-border M&A investment deals. Column (1) includes all the target countries in the sample, while column (2) includes AE target countries only and column (3) includes EMDE target countries only.

Column (1) shows that spillovers from FDI, in general, tend to occur predominantly across industries: negatively through backward linkages, but positively through forward linkages. By contrast, intra-industry spillover effects are statistically insignificant. However, as with greenfield FDI, these results are likely driven by EMDE target countries, which account for nearly 90 percent of the full sample observations. As the full sample is broken down by target country income levels, it turns out that negative and significant backward spillover effects as well as positive and significant forward spillover effects are present exclusively among EMDEs. This finding is the exact opposite of the earlier result from greenfield FDI, warranting a further look at the data in what follows.

Robustness. Table 11 reveals that the baseline estimation results from cross-border M&As are not quite robust to excluding foreign-owned firms or an alternative FDI measure in purchase values. Columns (1)-(3) repeat the baseline estimation for the sample excluding firms with more than 10 percent foreign ownership, while columns (4)-(6) replace the baseline cross-border M&A measure in the number of deals with one measured in purchase values. Similarly to the baseline results in Table 3, positive forward spillovers are statistically significant among domestic firms in the whole sample target countries (columns (1)) and are mainly driven by EMDE target countries (columns (3)). By contrast, backward spillovers among domestic firms are statistically insignificant. Moreover, once cross-border M&As are measured in purchase values, none of the spillover channels preserves its statistical significance.

Heterogeneity by acquiror country income groups. Turning to potential heterogeneity in spillovers by acquiror country income levels, Table 12 reports the estimation results by breaking down acquiror countries into AEs and EMDEs. Columns (1)-(3) correspond to estimation results from cross-border M&A measures restricted to advanced acquiror countries for all, AE, and EMDE target countries,

respectively, while columns (4)-(6) likewise summarise estimation results from cross-country M&A by emerging and developing acquiror countries in all, AE, and EMDE target countries. We note that, due to limited observations on cross-border M&A transactions by acquirors from EMDEs into target firms in AEs, intra-industry spillover effects in AE target countries from EMDE acquirors cannot be estimated.

Unlike the baseline result in Table 10, negative backward spillover effects in EMDE target countries become statistically insignificant whether acquiror countries are AEs or EMDEs, while negative intra-industry spillover effects in EMDE target countries become statistically significant when cross-border M&A is driven by AE acquirors. Moreover, the positive and significant forward spillover effects found exclusively among EMDE target countries are driven by cross-border M&As by EMDE acquirors.

4.2.2 Two-step approach

Table 13 summarises gravity-type estimation results of bilateral cross-border M&As using the Poisson pseudo-maximum likelihood estimator. Cross-border M&A is measured by the total number of cross-border M&A deals in column (1) or by total cross-border M&A values in column (2). Although overall gravity-type estimation results from cross-border M&A are similar to those from greenfield FDI, we note that the number of observations is smaller by around one-fourth compared to the case of greenfield FDI reported in Table 7. This is largely due to lower variability within country-sector-year across partner countries, which are thus mostly dropped from the estimation sample.

Figure 6 illustrates the results from the first step by comparing actual cross-border M&A measures to predicted cross-border M&A measures, aggregated by acquiror countries at target country-sector-year level. Predicted cross-border M&A measures are obtained as the fitted bilateral sector-year level values from the gravity-type regression, using either the number of cross-border M&A investment deals (in panel 6a) or the investment size (panel 6b).

Table 14 summarises the second step results that reproduce the baseline results in Table 10 while replacing actual cross-border M&A measures with predicted cross-border M&A measures from the first step. Columns (1)-(3) confirm that the negative and significant backward spillover effects are present exclusively in EMDE target countries. However, the positive and significant forward spillover effects from the baseline estimation results loses statistical significance. Another notable difference is that positive and significant intra-industry spillovers are now detected in AE target countries, suggesting the dominance of the pro-competitive effect from foreign acquisitions in the same segment of the market.

Table 15 reports the second step results on the acquiror country heterogeneity analysis shown in Table 12 but using the predicted cross-border M&A measures from the first step instead of actual measures. The table reveals that both positive and significant intra-industry spillovers in AE target countries and negative and significant backward linkages in EMDE target countries are mainly driven by cross-border M&As from AE acquiror countries. By contrast, positive and significant

forward spillovers from EMDE acquiror countries are found in both AE and EMDE target countries. However, we note that limited observations on cross-border M&A transactions by acquirors from EMDEs into target firms in AEs countries lead to less precisely estimated forward linkages, while preventing the estimation of intra-industry spillover effects in AE target countries from EMDE acquirors.

Overall, although estimation results from cross-border M&As are less robust than those from greenfield FDI, they suggest the presence of negative backward spillovers in EMDE target countries, with possible positive intra-industry spillovers restricted to AE target countries. Since backward spillovers to local suppliers are typically regarded as the main channel—or one of the main channels—for technology transfer to EMDEs, the difference in this regard between greenfield and M&As is noteworthy.

To the best of our knowledge, there is little guidance in the theoretical literature as to why productivity spillovers should differ between greenfield and M&A investment. There are several papers that investigate different motivations for greenfield FDI versus cross-border M&A investment (see Dikova and Brouthers (2016) for a review of the literature). Acquisitions may carry an advantage in terms of speed of establishment, but they can create cross-cultural, technological and organizational mismatches. On the other hand, greenfield investments might preserve valuable corporate culture and resources, but will generally take a longer period to become operational (Dikova *et al,* 2010). Firms seeking to exploit proprietary technology may prefer greenfield investment, because it may enhance the prospect of maintaining firm-specific advantages (Chen and Zeng, 2004). There is also evidence that M&A can sometimes be used by multinational firms to garner tax advantages (Belz *et al.,* 2013). On balance it is unclear whether these different motivations should result in differential productivity in the target / new firm, let alone through what channels they might affect backward or forward productivity spillovers.

While it is beyond the scope of this paper to identify empirically the reason for the difference, future detailed, country-specific work could seek to investigate why M&As do not appear to exhibit the same beneficial upstream impact as greenfield FDI. One reason could be that greenfield investment expands the market for local suppliers by construction, whereas M&A might disrupt existing arrangements with local suppliers, and in some cases, replace local suppliers with purchases from foreign suppliers.

5 Conclusions

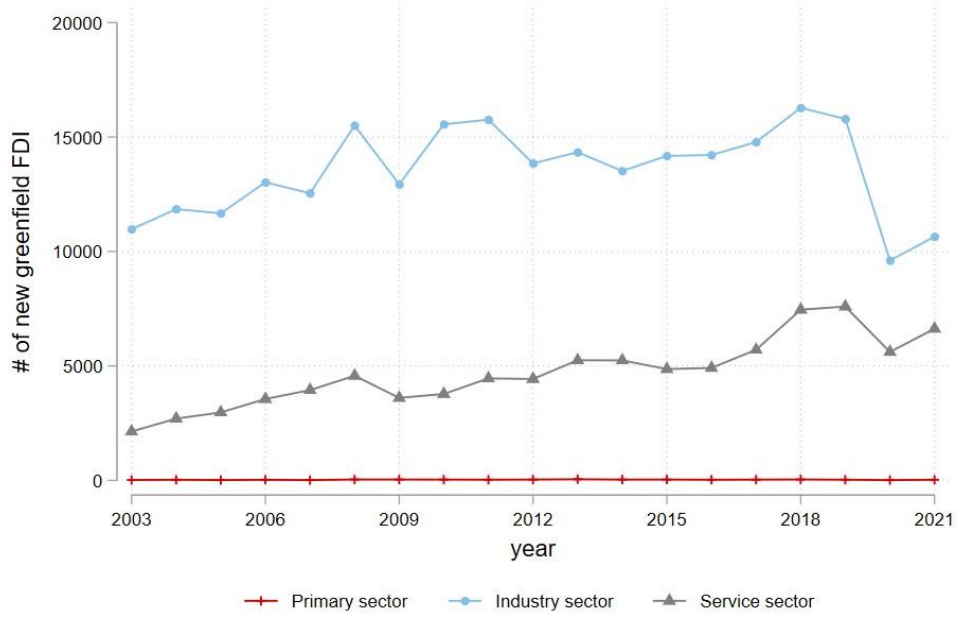
This paper re-evaluates FDI spillover channels by exploring project-level greenfield FDI data as well as deal-level cross-border M&A data matched to cross-country firm-level data at the country-sector level. The granularity of bilateral sector-level FDI datasets helps to mitigate potential endogeneity concerns by allowing a two-step approach whereby an exogenous FDI measure is constructed from a gravity-type regression of bilateral FDI flows. Moreover, the data allow us to identify separately

intra-industry and inter-industry spillover channels, as well as to break them down by source-country and host-country income levels.

Our main findings for greenfield FDI confirm the widely held notion that FDI from advanced countries, by embodying more advanced technology, can have positive spillover effects to domestic firms in emerging and developing economies via backward linkages. Local firms in advanced countries also benefit from the competitive pressure of foreign multinationals in the same sector, as they are likely to be productive enough to compete against foreign entrants. Similar positive intra-industry spillovers are present when considering cross-border M&As in advanced economies, consistent with the observation that advanced countries are open to cross-border M&As. By contrast, firms in emerging and developing countries experience negative backward spillovers from foreign acquisitions, suggesting that there could be important differences between greenfield and M&As from the perspective of externalities in the host country.

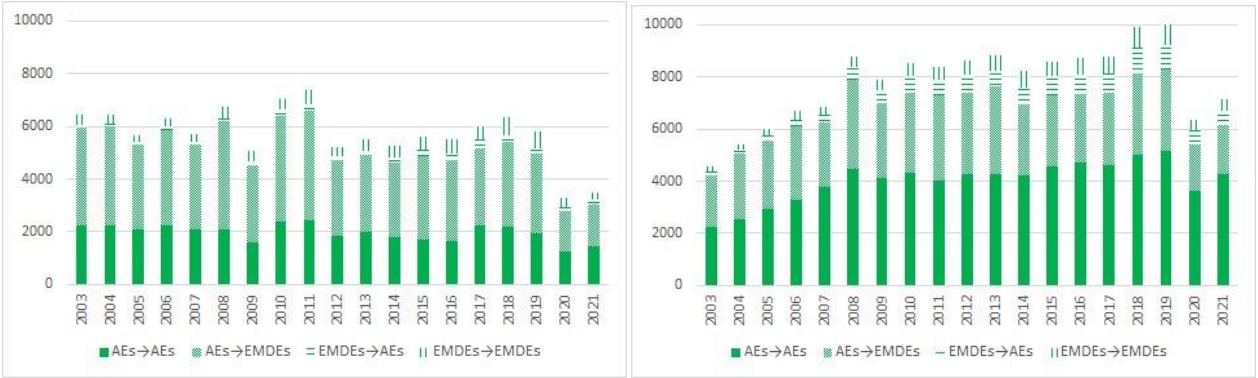
Figures

Figure 1: Greenfield FDI by sectors over time



Notes: This figure illustrates the time-series evolution of greenfield FDI by sector, whereby FDI is classified into one of the three sectors: primary, industry, and services.

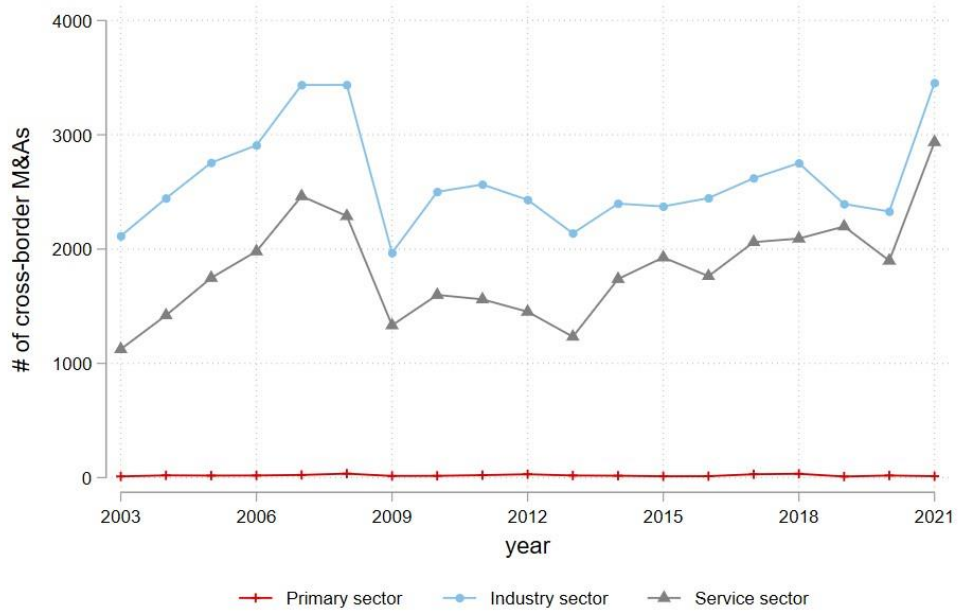
Figure 2: Composition of greenfield FDI in the industry sector over time



(a) Manufacturing FDI (b) Non-manufacturing FDI

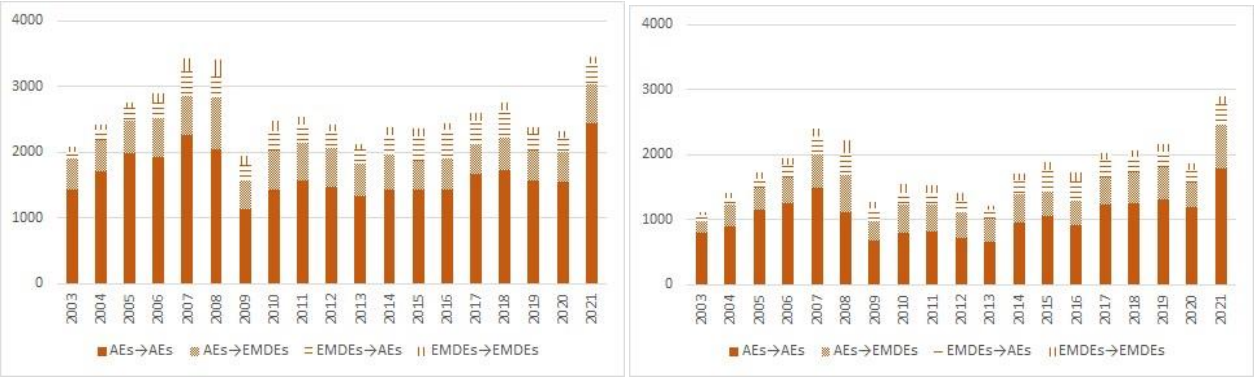
Notes: This figure decomposes greenfield FDI in the industry sector into four categories by source and host country income levels: AEs→AEs; AEs→EMDEs; EMDEs→AEs; EMDEs→EMDEs. Figures 2a and 2b consider manufacturing and non-manufacturing greenfield FDI, respectively.

Figure 3: Cross-border M&As by sectors over time



Notes: This figure illustrates the time-series evolution of cross-border M&As by sector, whereby M&A deals are classified into one of the three sectors: primary, industry, and services.

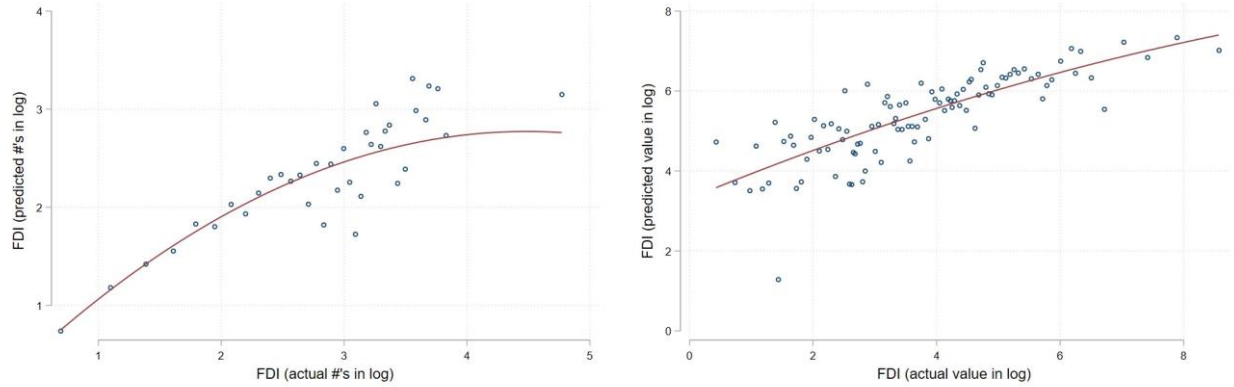
Figure 4: Composition of cross-border M&As over time



(a) M&As in the industry sector (b) M&As in the service sector

Notes: This figure decomposes cross-border M&As into four categories by acquiror and target country income levels: AEs→AEs; AEs→EMDEs; EMDEs→AEs; EMDEs→EMDEs. Figures 4a and 4b consider cross-border M&As in the industry and service sectors, respectively.

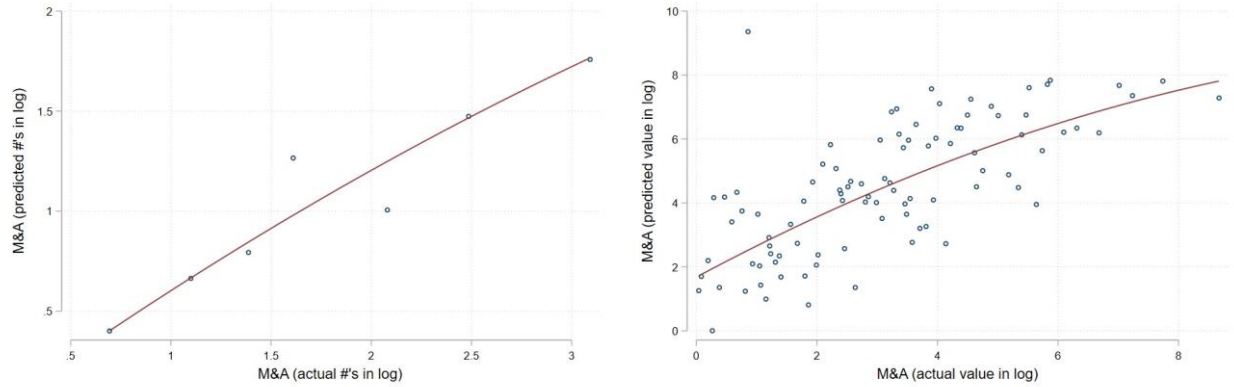
Figure 5: Binned scatters: predicted vs. actual greenfield FDI



(a) # of new deals (b) Size of new investment (million USD)

Notes: This figure presents binned scatter plots for the comparison between actual and predicted FDI measures. Predicted FDI measures are obtained as the fitted bilateral sector-year level values from the gravity-type regression that are further aggregated across source countries. Each observation is at host country-sector-year level covered in the baseline estimation sample. FDI is measured by the number of new greenfield investment deals in panel 5a and by the investment size in panel 5b, both of which are expressed as ln(1 + *FDI*). Fitted values from quadratic regression are in red.

Figure 6: Binned scatters: predicted vs. actual cross-border M&As



(a) # of new deals (b) Purchase value (million USD)

Notes: This figure presents binned scatter plots for the comparison between actual and predicted cross-border M&A measures. Predicted cross-border M&A measures are obtained as the fitted bilateral sector-year level values from the gravity-type regression that are further aggregated across acquiror countries. Each observation is at target country-sector-year level covered in the baseline estimation sample. Cross-border M&A is measured by the number of new cross-border M&A investment deals in panel 6a and by the purchase value in panel 6b, both of which are expressed as ln(1 + *M&A*). Fitted values from quadratic regression are in red.

Tables

Table 1: The pattern of greenfield FDI: 2003-2021

		AEs (Sources)		EMDEs (Sources)	
	Types / Sectors	MFG types	non-MFG types	MFG types	non-MFG types
AEs (Hosts)	Primary	57	190	7	34
	Industry	37,613	76,495	3,334	10,251
	Service	69	52,616	12	5,037
EMDEs (Hosts)	Primary	133	98	36	34
	Industry	59,814	52,275	8,115	9,098
	Service	69	26,442	13	5,144

Notes: This table summarizes the pattern of greenfield FDI over the period between 2003 and 2021 by source and host countries as well as by sector and types of activities. Source and host countries are grouped by income levels (AEs and EMDEs). FDI is classified into one of the three sectors: the primary sector, industry sector, and service sector, and also into one of the two types of activities: manufacturing activity and non-manufacturing activity.

Table 2: The pattern of cross-border M&As: 2003-2021

	Acquirors / Sectors	AEs (Acquirors)	EMDEs (Acquirors)
AEs (Targets)	Primary	157	37
	Industry	31,550	5,337
	Service	20,105	4,104
EMDEs (Targets)	Primary	122	60
	Industry	10,005	2,311
	Service	7,854	2,115

Notes: This table summarizes the pattern of cross-border M&As over the period between 2003 and 2021 by acquiror and target countries as well as by sectors. Acquiror and target countries are grouped by income levels (AEs and EMDEs). Cross-border M&As are classified into one of the three sectors: the primary sector, industry sector, and service sector.

Table 3: Baseline estimation results: Greenfield FDI

	(1)	(2)	(3)
Host country	All	AEs	EMDEs
Intra-industry spillover	0.082	0.623***	0.067
	(0.059)	(0.188)	(0.064)
Backward spillover	0.415***	0.244	0.462***
	(0.127)	(0.393)	(0.139)
Forward spillover	-0.500***	-0.659	-0.515***
	(0.145)	(0.427)	(0.161)
Observations	87141	5206	81809
Adj-R2	0.155	0.187	0.155

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of greenfield investment deals. All columns consider FDI from all source countries; Host country sample in columns (1), (2), and (3) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 4: Alternative sample and FDI measure: Greenfield FDI

	(1)	(2)	(3)	(4)	(5)	(6)
	Domestic			FDI values		
Host country	All	AEs	EMDEs	All	AEs	EMDEs
Intra-industry spillover	0.079	0.514***	0.051	0.024	0.279***	0.016
	(0.064)	(0.179)	(0.067)	(0.022)	(0.075)	(0.023)
Backward spillover	0.486***	0.023	0.575***	0.064*	-0.045	0.068**
	(0.137)	(0.389)	(0.148)	(0.033)	(0.184)	(0.034)
Forward spillover	-0.611***	-0.265	-0.659***	-0.121***	-0.405	-0.126***
	(0.153)	(0.354)	(0.168)	(0.042)	(0.249)	(0.044)
Observations	77740	4345	73282	87141	5206	81809
Adj-R2	0.162	0.201	0.162	0.155	0.188	0.155

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of greenfield investment deals in columns (1)-(3) or total greenfield investment value in columns (4)-(6). Foreign-owned firms are excluded in columns (1)-(3). All columns consider FDI from all source countries; Host country sample in columns (1) and (4), (2) and (5), and (3) and (6) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 5: Estimation results by business types of FDI

	(1)	(2)	(3)	(4)	(5)	(6)
	manufacturing types of FDI			non-manufacturing types of FDI		
Host country	All	AEs	EMDEs	All	AEs	EMDEs
Intra-industry spillover	0.159*	0.890**	0.141	0.090	0.548***	0.077
	(0.090)	(0.406)	(0.092)	(0.068)	(0.191)	(0.073)
Backward spillover	0.340**	0.759	0.372**	0.183	0.392	0.190
	(0.145)	(0.960)	(0.148)	(0.123)	(0.432)	(0.133)
Forward spillover	-0.277	-1.298	-0.288	-0.408***	-0.504	-0.392**
	(0.181)	(1.029)	(0.182)	(0.145)	(0.392)	(0.163)
Observations	87141	5206	81809	87141	5206	81809
Adj-R2	0.155	0.186	0.155	0.155	0.187	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of manufacutring types of greenfield investment deals in columns (1)-(3) and by that of non-manufacturing types of greenfield investment deals in columns (4)-(6). An alternative version of backward- and forward-linkage measures is applied. Columns (1)-(3) and (4)-(6) consider FDI related to manufacturing and non-manufacturing activities, respectively. Host country sample in columns (1) and (4) includes all the sample countries; host country sample in columns (2) and (5) includes advanced countries; host country sample in columns (3) and (6) includes emerging market and developing countries. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 6: Estimation results with source country breakdown: Greenfield FDI

	(1)	(2)	(3)	(4)	(5)	(6)
Source country		AEs			EMDEs	
Host country	All	AEs	EMDEs	All	AEs	EMDEs
Intra-industry spillover	0.106*	0.545**	0.098	-0.071	1.135*	-0.119
	(0.061)	(0.208)	(0.064)	(0.108)	(0.650)	(0.110)
Backward spillover	0.436***	0.369	0.461***	-0.008	-0.177	0.070
	(0.134)	(0.462)	(0.147)	(0.150)	(0.501)	(0.155)
Forward spillover	-0.448***	-0.600	-0.432**	-0.200	-1.080	-0.234
	(0.157)	(0.457)	(0.174)	(0.192)	(0.720)	(0.201)
Observations	87141	5206	81809	87141	5206	81809
Adj-R2	0.155	0.187	0.155	0.155	0.186	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of greenfield investment deals. Columns (1)-(3) and (4)-(6) consider FDI from advanced countries, and emerging market and developing countries, respectively; Host country sample in columns (1) and (4), (2) and (5), and (3) and (6) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 7: Gravity-type estimation results: Greenfield FDI

	(1)	(2)
FDI measures	# of FDIs	FDI values
Ideal point distance	-0.152***	-0.197***
	(0.024)	(0.041)
Geographic distance	-0.427***	-0.493***
	(0.023)	(0.036)
Common legal origins	0.165***	0.006
	(0.046)	(0.058)
Common language	0.523***	0.737***
	(0.062)	(0.094)
Colonial relationship	0.182***	0.146
	(0.058)	(0.115)
Observations	1,704,698	1,704,698

Notes: The table summarizes gravity-type estimation results of bilateral greenfield FDI by Poisson pseudo-maximum likelihood estimator. FDI is measured by a total number of greenfield investment deals in column (1) or total greenfield investment value in column (2). Standard errors in parenthesis are clustered at the source-destination pair level. ***p<0.01, **p<0.05, *p<0.1.

Table 8: Two-step approach estimation results: Greenfield FDI

	(1)	(2)	(3)
Host country	All	AEs	EMDEs
Intra-industry spillover	0.025	0.424***	0.008
	(0.050)	(0.129)	(0.054)
Backward spillover	0.300**	0.168	0.326**
	(0.117)	(0.381)	(0.125)
Forward spillover	-0.272**	-0.631*	-0.217*
	(0.124)	(0.365)	(0.131)
Observations	87141	5206	81809
Adj-R2	0.155	0.187	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of greenfield investment deals and comes from the fitted value from the gravity-type estimation. All columns consider FDI from all source countries; Host country sample in columns (1), (2), and (3) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 9: Two-step approach estimation results with source country breakdown: Greenfield FDI

	(1)	(2)	(3)	(4)	(5)	(6)
Source country		AEs			EMDEs	
Host country	All	AEs	EMDEs	All	AEs	EMDEs
Intra-industry spillover	0.059	0.412***	0.042	-0.241*	1.479	-0.291*
	(0.050)	(0.129)	(0.054)	(0.145)	(1.282)	(0.149)
Backward spillover	0.265**	0.195	0.290**	-0.023	-2.626	0.050
	(0.148)	(0.456)	(0.163)	(0.211)	(1.536)	(0.213)
Forward spillover	-0.212	-0.608	-0.177	-0.029	2.730	-0.059
	(0.159)	(0.489)	(0.177)	(0.235)	(1.947)	(0.240)
Observations	87141	5206	81809	87141	5206	81809
Adj-R2	0.155	0.187	0.154	0.155	0.186	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of greenfield investment deals and comes from the fitted value from the gravity-type estimationColumns (1)-(3) and (4)-(6) consider FDI from advanced countries, and emerging market and developing countries, respectively; Host country sample in columns (1) and (4), (2) and (5), and (3) and (6) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1

Table 10: Baseline estimation results: Cross-border M&As

	(1)	(2)	(3)
Target country	All	AEs	EMDEs
Intra-industry spillover	-0.190	0.535	-0.214
	(0.159)	(0.372)	(0.181)
Backward spillover	-0.335*	-0.933	-0.357*
	(0.202)	(1.213)	(0.207)
Forward spillover	0.609***	0.054	0.577**
	(0.227)	(1.038)	(0.234)
Observations	87141	5206	81809
Adj-R2	0.155	0.186	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of cross-border M&A deals. All columns consider cross-border M&A from all acquiror countries; Target country sample in columns (1), (2), and (3) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 11: Alternative sample and FDI measure: Cross-border M&As

	(1)	(2)	(3)	(4)	(5)	(6)
	Domestic			Cross-border M&A values		
Target country	All	AEs	EMDEs	All	AEs	EMDEs
Intra-industry spillover	-0.113	0.442	-0.131	-0.031	0.037	-0.028
	(0.153)	(0.492)	(0.174)	(0.040)	(0.100)	(0.049)
Backward spillover	-0.295	0.163	-0.353	-0.044	0.025	-0.056
	(0.211)	(1.369)	(0.216)	(0.038)	(0.105)	(0.040)
Forward spillover	0.572**	-0.520	0.587**	0.042	0.056	0.031
	(0.228)	(1.283)	(0.237)	(0.052)	(0.204)	(0.052)
Observations	77740	4345	73282	87141	5206	81809
Adj-R2	0.162	0.200	0.162	0.155	0.186	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of cross-border M&A deals in columns (1)-(3) or total cross-border M&A value in columns (4)-(6). Foreign-owned firms are excluded in columns (1)-(3). All columns consider cross-border M&A from all acquiror countries; Target country sample in columns (1) and (4), (2) and (5), and (3) and (6) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 12: Estimation results with acquiror country breakdown (Cross-border M&As)

	(1)	(2)	(3)	(4)	(5)	(6)
Acquiror country		AEs			EMDEs	
Target country	All	AEs	EMDEs	All	AEs	EMDEs
FDI measure	# deals	# deals	# deals	# deals	# deals	# deals
Intra-industry spillover	-0.292*	0.591	-0.371*	0.175	0	0.182
	(0.173)	(0.358)	(0.208)	(0.184)	(.)	(0.181)
Backward spillover	-0.425	-1.495	-0.453	-0.238	19.29***	-0.246
	(0.276)	(1.116)	(0.292)	(0.303)	(6.105)	(0.301)
Forward spillover	0.579*	0.212	0.509	0.783**	11.02	0.774**
	(0.319)	(0.985)	(0.338)	(0.325)	(14.31)	(0.323)
Observations	87141	5206	81809	87141	5206	81809
Adj-R2	0.155	0.186	0.154	0.155	0.187	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of cross-border M&A investment deals. Columns (1)-(3) and (4)-(6) consider cross-border M&A from advanced countries, and emerging market and developing countries, respectively; Target country sample in columns (1) and (4), (2) and (5), and (3) and (6) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 13: Gravity-type Estimation results: Cross-border M&As

	(1)	(2)
FDI measures	# of M&As	M&A values
Ideal point distance	-0.265***	-0.416***
	(0.037)	(0.044)
Geographic distance	-0.796***	-0.645***
	(0.026)	(0.038)
Common legal origins	0.164***	0.331***
	(0.057)	(0.072)
Common language	0.558***	0.249**
	(0.081)	(0.115)
Colonial relationship	0.159**	0.162*
	(0.070)	(0.098)
Observations	480,380	480,380

Notes: The table summarizes gravity-type estimation results of bilateral M&As by Poisson pseudo-maximum likelihood estimator. M&A is measured by a total number of M&A deals in column (1) or total M&A value in column (2). Standard errors in parenthesis are clustered at the source-destination pair level. ***p<0.01, **p<0.05, *p<0.1.

Table 14: Two-step approach estimation results: Cross-border M&As

	(1)	(2)	(3)
Target country	All	AEs	EMDEs
Intra-industry spillover	-0.236	0.937*	-0.266
	(0.170)	(0.477)	(0.184)
Backward spillover	-0.402*	-1.212	-0.434*
	(0.239)	(0.930)	(0.245)
Forward spillover	0.407	0.411	0.311
	(0.303)	(1.088)	(0.281)
Observations	87141	5206	81809
Adj-R2	0.155	0.186	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of cross-border M&A deals and comes from the fitted value from the gravity-type estimation. All columns consider cross-border M&A from all acquiror countries; Target country sample in columns (1), (2), and (3) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1.

Table 15: Two-step approach estimation results with acquiror country breakdown (Cross-border M&As)

	(1)	(2)	(3)	(4)	(5)	(6)
Acquiror country		AEs			EMDEs	
Target country	All	AEs	EMDEs	All	AEs	EMDEs
FDI measure	# deals	# deals	# deals	# deals	# deals	# deals
Intra-industry spillover	-0.188	1.032**	-0.230	-0.484	0.000	-0.401
	(0.181)	(0.458)	(0.200)	(0.535)	(.)	(0.532)
Backward spillover	-0.578*	-1.678	-0.617*	-0.350	2.246	-0.346
	(0.327)	(0.986)	(0.346)	(0.388)	(5.063)	(0.382)
Forward spillover	0.253	0.379	0.078	1.450***	9.116**	1.190**
	(0.390)	(1.101)	(0.368)	(0.539)	(3.882)	(0.464)
Observations	87141	5206	81809	87141	5206	81809
Adj-R2	0.155	0.186	0.154	0.155	0.187	0.154

Notes: Dependent variable is firm-level labor productivity growth over the previous 3 years. All specifications include country-sector, country-year, and sector-year fixed effects. FDI is measured by a total number of cross-border M&A deals and comes from the fitted value from the gravity-type estimationColumns (1)-(3) and (4)-(6) consider cross-border M&A from advanced countries, and emerging market and developing countries, respectively; Target country sample in columns (1) and (4), (2) and (5), and (3) and (6) includes all the sample countries, advanced countries, and emerging market and developing countries, respectively. Standard errors are clustered at the country-sector and country-year level. ***p<0.01, **p<0.05, *p<0.1

Appendix Table

Table A.1: Baseline sample host countries

Host Country Name	Year	Host Country Name	Year	Host Country Name	Year	Host Country Name	Year
Albania	2007, 2013, 2019	Ecuador	2006, 2010, 2017	Malawi	2009, 2014	Russia	2009, 2012, 2019
Angola	2006, 2010	Egypt	2013, 2016, 2020	Malaysia	2015, 2019	Rwanda	2006, 2011, 2019
Argentina	2006, 2010, 2017	ElSalvador	2006, 2010, 2016	Mali	2007, 2010, 2016	Senegal	2007, 2014
Armenia	2009, 2013, 2020	Estonia	2009., 2013, 2019	Mauritania	2006, 2014	Serbia	2009, 2013, 2019
Azerbaijan	2009, 2013, 2019	Eswatini	2006, 2016	Mexico	2006, 2010	Slovak Republic	2009, 2013, 2019
Bangladesh	2007, 2013	Ethiopia	2011, 2015	Moldova	2009, 2013, 2019	Slovenia	2009, 2013, 2019
Belarus	2008, 2013, 2018	Gambia	2006, 2018	Mongolia	2009, 2013, 2019	SouthAfrica	2007, 2020
Benin	2009, 2016	Georgia	2008, 2013, 2019	Montenegro	2009, 2013, 2019	Suriname	2010, 2018
Bhutan	2009, 2015	Ghana	2007, 2013	Morocco	2013, 2019	Sweden	2014, 2020
Bolivia	2006, 2010, 2017	Guatemala	2006, 2010, 2017	Mozambique	2007, 2018	Tajikistan	2008, 2013, 2019
Bosnia and Herzegovina	2009, 2013, 2019	Guinea	2006, 2016	Myanmar	2014, 2016	Tanzania	2006, 2013
Botswana	2006, 2010	Honduras	2006, 2010, 2016	Namibia	2006, 2014	Timor-Leste	2009, 2015, 2021
Bulgaria	2007, 2009, 2013, 2019	Hungary	2009, 2013, 2019	Nepal	2009, 2013	Togo	2009, 2016
Burundi	2006, 2014	Indonesia	2009, 2015	Nicaragua	2006, 2010, 2016	Tunisia	2013, 2020
Cameroon	2009, 2016	Jordan	2013, 2019	Niger	2009, 2017	Türkiye	2008, 2013, 2019
Chad	2009, 2018	Kazakhstan	2009, 2013, 2019	Nigeria	2007, 2014	Uganda	2006, 2013
Chile	2006, 2010	Kenya	2007, 2013, 2018	North Macedonia	2009, 2013, 2019	Ukraine	2008, 2013, 2019
Colombia	2006, 2010, 2017	Kosovo	2009, 2013, 2019	Panama	2006, 2010	Uruguay	2006, 2010, 2017
Croatia	2007, 2013, 2019	Kyrgyz Republic	2009, 2013, 2019	Paraguay	2006, 2010, 2017	Uzbekistan	2008, 2013, 2019
Czech Republic	2009, 2013, 2019	LaoPDR	2009., 2012, 2016, 2018	Peru	2006, 2010, 2017	Vietnam	2009, 2015
Côte d'Ivoire	2009, 2016	Latvia	2009, 2013, 2019	Philippines	2009, 2015	Yemen	2010, 2013
DRC	2006, 2010, 2013	Lebanon	2013, 2019	Poland	2009, 2013, 2019	Zambia	2007, 2013
DominicanRepublic	2010, 2016	Lithuania	2009. 2013, 2019	Romania	2009, 2013, 2019	Zimbabwe	2011, 2016