Does Investor Protection Increase Foreign Direct Investment? A Large Meta-Analysis

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ABSTRACT

We undertake a meta-analysis of the effects of international agreements for the protection of foreign investors (IIAs) on foreign direct investment using 1099 estimates drawn from of 41 studies. Random-effects or WAAP estimates of the partial correlation coefficients of these studies show that all types of international treaties (bilateral investment treaties, multilateral investment treaties, bilateral trade agreements and multilateral trade agreements) have a positive impact on FDI. However, an analysis of publication-selection bias found a genuine effect on FDI of all treaties except multilateral investment treaties. Moreover, our analysis shows that the major source of heterogeneity in the reviewed studies stems from differences in the source countries of FDI used by researchers and in the ability of researchers to appropriately model the dynamic effects of IIAs.

Key Words: meta-analysis, foreign direct investment, investor protection, bilateral investment treaty

JEL Classification Nos.: F21, F23, F53, G38, K33, O24

1. Introduction

Since the middle of the 20th century, foreign direct investment (FDI) has been the most dynamic and, arguably, the most transformative aspect of globalization. For multinational corporations (MNCs), FDI has served as means of expanding sales in foreign markets, of exploiting firm-specific competitive advantages, of obtaining access to foreign resources and of creating cross-country supply chains to reduce costs at multiple stages of the production and distribution process (Baldwin and Lopez-Gonzales, 2015). For host countries, FDI is seen as a means of accelerating economic growth and exports through increases in the capital stock, better access to advanced technology, and improvements in the skills of host-country workers and managers (Borensztein et al., 1998). Moreover, FDI is widely seen as promoting higher productivity through spillovers in productivity to upstream and downstream host-country firms (Havranek and Irsova, 2011; Newman et al., 2015).

FDI also carries costs and risks for both foreign investors and for host countries. The risks to investors include expropriation (Kobrin, 1979; Hajzler, 2010), host-country restrictions on FDI, often accompanied by conditions such as local sourcing and corporate governance requirements that reduce profits, regulatory interference with the MNC's activities by host-county authorities, discrimination in favor of local firms, limits on profit repatriation (Vandervelde, 2009), etc. In host countries where the rule of law is weak and where government predation against foreign firms is common, foreign investors are not likely to find redress for these injuries from the host-country's legal system. Disadvantages of FDI from the standpoint of host countries include the possibility that MNCs can use their market power in the host country to harm local firms and the local economy, to keep wages low, to encourage corrupt behavior, and to reap excessive profits. Thus, home-country oversight of foreign firms is seen as necessary and justified. These conflicts between investor interests and home-country sovereignty can reduce FDI inflows unless host countries can credibly commit to restrain their exercise of arbitrary or predatory behavior while balancing this commitment with their legitimate sovereign regulatory and oversight duties.

To encourage FDI by reducing the risks of arbitrary host-country actions that harm foreign investors, home and host countries have developed arrangements for protecting foreign investors. Perhaps the most numerous of such arrangements are bilateral investment treaties (BITs) of which more than 3000 have been negotiated. Under the terms of these treaties, MNCs that believe they have been treated unfairly by the host country can file for arbitration by a neutral arbitral body. The arbitrators decide whether the MNC's claim is legitimate and, if so, what damages are to be paid to the MNC by the host country. In addition to BITs, protection for foreign investors is also provided through multilateral investment treaties (MITs), which include provisions similar to those of BITs but cover several home and/or host countries. Bilateral trade treaties (BTTs) and multilateral trade treaties (MTTs) sometimes also include protection for FDI between the signatories (Büthe and Milner, 2008). For the sake of brevity, we refer to all these arrangements as International Investment Agreements (IIAs).

Host countries can benefit from investment protection treaties if FDI provides economic benefits to the host country and if investor protection treaties can attract sufficient amounts of FDI. If these two conditions are met, the restrictions imposed on the sovereignty of the host country and the risk of having to make payments to foreign investors in case of unfavorable arbitral decisions may be offset by the economic benefits of greater FDI inflows. As for the first condition, the existing literature on the economic benefits of FDI suggests that FDI has broadly positive economic effects on the host country's economy (Meyer and Sinani, 2009; Wooster and Diebel, 2010). However, the literature on whether and to what extend investor protection treaties increase FDI inflows is quite controversial, with some studies finding large positive effects, others insignificant effects and yet others negative effects. Reasons for this lack of agreement stem in part from the difficulties in conceptualizing and measuring FDI flows and stocks (Pohl, 2018) and in part from the fact that the measurement of the effect of investment treaties on FDI has engaged the interest of scholars from the fields of economics, the law and political science. Each of these disciplines tends to apply different theoretical frameworks and empirical strategies and to emphasize different aspects of the relationship between investment treaties and FDI. This lack of a common framework makes it difficult to evaluate the many studies of the effect of investment protection on FDI.

In this paper we conduct a meta-analysis to synthesize the empirical findings in a large sample of the literature that examines the relationship between IIAs and FDI. We also examine which study conditions generate heterogeneity in the empirical evidence and look for sources of bias in the results reported in the literature by performing a multivariate meta-regression analysis. In addition, we test for the presence of publication-selection bias and genuine empirical evidence in the literature using a funnel plot and meta-regression models designed for this purpose. In Section 2 we briefly survey previous literature that has sought to synthesize the empirical research on this topic. In Section 3, we describe how we selected the studies used in our meta-analysis and present the basic results on the effects reported in the literature. The meta-synthesis of the reported results is carried out in Section 4, and we find that, after adjusting for heterogeneity and possible bias, the results how that all types of IIAs promote FDI although the effect is relatively small. In Section 5 we use meta-regression analysis to explore the causes of heterogeneity among the studies analyzed, and we identify the nature of the home countries and the specification of the dynamic effects of IIAs as the most important sources of heterogeneity. The possibility of publication-selection bias in the published results is examined in Section 6. Using the FAT-PET-PEESE approach advocated by Stanley and Doucouliagos (2012), we conclude that the existing literature contains genuine empirical evidence of positive effects of IIAs on FDI except in the case of multilateral trade agreements. Section 7 concludes.

2. Literature survey

Given the policy relevance of the effect of investment protection treaties on FDI and the considerable differences in methodologies and conclusions used to study the topic, scholars have sought to gain clarity on what conclusions the literature throws up in two ways. One is through critical surveys of the numerous studies available in the literature. Recent surveys of the literature include Jacobs (2017) and Pohl (2018). Jacobs (2017) categorizes studies of the effect of BITs on FDI as either monadic or didactic. In broad terms, monadic studies relate a host country's BIT activity, usually measured by the number of BITs it has signed, to total FDI inflows, measured either by FDI inflows over a given period or by the stock of FDI in the country. Jacobs criticizes such studies on the grounds that they do not account for the economic characteristics of the countries with which the host country has signed BITs, nor do they effectively account for other host country policies toward FDI that may have effects as, or more, important as the signing of BITs. Didactic studies overcome some of these criticisms by examining the effect of BITs on bilateral FDI flows or stocks between countries that have signed BITs. Jacobs faults the results of these studies as well, arguing that the protection afforded by BITs between countries depends critically on the terms incorporated in the BIT; studies that do not account for these differences in BITs may lead to faulty conclusions about their effect on FDI. He thus concludes that available studies and the conflicting conclusions they offer need further methodological improvement before a firm conclusion on the effectiveness of BITs can be reached.

Pohl (2018) presents a more extensive survey in which he examines over 30 studies. He concludes that:

> "…the vast majority of the existing studies do not offer a satisfying answer to the question whether IIAs influence capital allocation in treaty partners. This is due to conceptual problems regarding the notions of FDI on the one hand, and IIA-based investment protection on the other, which are common to all reviewed studies. Many of these problems are likely to be nonrandomly associated with variables of interest, thus leading to important bias and invalid results for the research question." (Pohl, 2018, p.19)

Pohl is critical of FDI data because of their shortcomings in reflecting the economic activity of MNCs in host countries due to the mingling of FDI with other forms of more liquid investments and with MNC borrowing in host countries to finance their affiliates. He also points out that FDI data do not always reflect the true origin of such investments due to roundtripping and treaty shopping.[1] Finally, he notes the failure of many studies to account for protection afforded investors by international agreements other than BITs. While Pohl is to some extent correct in the criticisms that he makes of the data and the conceptualization of the studies he reviews, the conclusion that it is these data and conceptual shortcomings that lead to conflicting results remains unsubstantiated because there is no way to measure how or if such errors affect the results.[2] Looking at the wide variety of approaches in the studies surveyed by Pohl in terms of the specification of the dependent variable, the

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[1] Roundtripping refers to host country residents who move funds off shore to be invested back in the country of origin but with the added protection or anonymity of being classified as FDI rather than domestic investment. In treaty shopping, an MNC from country A wishing to invest in country B will first establish an affiliate in country C, whose BIT with country B provides greater protection for the foreign investor than does the BIT between countries A and B. The affiliate in country C then undertakes the investment (Lee, 2015).

[2] For example, Brada *et al.* (2019) show that accounting for roundtripping does not change the parameters of a gravity equation for estimating bilateral FDI stocks among a large sample of countries.

correlates used, the sample of countries and time period covered, and the estimation techniques employed, it is at least as likely, if not more so, that the conflicting results stem from these latter factors rather than from shortcomings in the data. Moreover, it is not uncommon in empirical work that, over time, studies come to embody new data, new theoretical insights, new specifications of regressions and new estimation techniques, all of which improve our understanding of the phenomenon of interest, even if the new results disagree with or overturn the findings of previous research. Finally, not all studies are of equal quality or validity due to differences in the resources and the skills and care brought to bear by the researcher.

In the face of such heterogeneous estimates, meta-analysis offers a less subjective and more rigorous approach to the evaluation of the effect of IIAs on FDI. The only meta-analysis of which we are aware is that of Bellak (2015 a, b).[3] Bellak examines 40 studies of the effect of BITs on FDI using a sample of 40 studies, 23 of which were published in journals, 4 in books and 13 as working and conference papers, etc. With the exception of one publication from 2014, one from 2013 and 6 from 2012 and 2011, the remaining studies were published in the preceding decade or earlier. Bellak uses only studies that allow him to calculate the semi-elasticity of FDI with respect to the presence of BITs. This focus on semi-elasticity is attractive in the sense that calculating the semi-elasticity of FDI with respect to the existence of a BIT addresses directly the question of how large the effect of BITs on FDI is. However, the use of the semi-elasticity as the variable of interest imposes some severe restrictions on the studies that can be used for the meta-analysis and thus reduces the number of studies that can be covered by the meta-analysis. For example, studies that are missing standard errors or the mean values of variables cannot be used. Similarly, studies that use interaction effects between BITs and other covariates as well as other specifications that make it impossible to calculate the effect of the BIT dummy must also be excluded. Moreover, the focus on the semi-elasticity forces Bellak to analyze studies that use the stock of FDI separately from those that use FDI flows as the dependent variable, and, for the former, there are only 11 studies, rendering

[3] The first cited publication, 2105a, is a summary of the second, 2015b, which contains considerably more detail.

hypothesis testing of dubious value for studies using the stock of FDI.[4] These restrictions reduce the total number of semi-elasticities calculated to 309, and, for analytical purposes, these have to be further subdivided based on the way in which FDI is measured in the various studies. Bellak finds a strong publication bias in favor of studies that find a positive effect of BITs on FDI, and, once the results are adjusted for this bias, the mean values of the semi-elasticities, ranging from 4 to 13%, are sharply reduced so that, for FDI flows, the semi-elasticity falls to 2.3%, which, while statistically significant, leads Bellak to conclude that "… the empirical evidence on the basis of a meta-analysis suggests that the FDI promotion effect of BITs seems to be economically and statistically negligible" (Bellak, 2015, p. 76).

The meta-analysis presented in this paper differs in sample, methodology and findings from those of Bellak. First, we focus on more recent studies, and this newer evidence on the effects of BITs on FDI may account for some of the difference in findings. Of the 41 studies included in our meta-analysis and listed in Table 1, 18 were published in 2015 or later, and thus were not available to Bellak. These more recent studies, in addition to potentially providing longer time spans over which to measure the effects of BITs, address many of the shortcomings of previous studies mentioned in the literature surveys referenced above and thus yield more precise estimates of the effect of IIAs on FDI.[5] There are also methodological differences; we take advantage of advances in meta-analysis techniques that enable us to analyze studies with different dependent variables within a single framework. By using the partial correlation coefficient (PCC) of each study's results rather than the semi-elasticity we can analyze within a single framework all available studies on the effects of IIAs on FDI regardless of the specification or measure of FDI used. As a result, we are able examine simultaneously studies that use stocks or flows of FDI or its ratio to GDP, studies that make use of interactions between covariates and the IIA dummy, and studies that use dynamic specifications that seek to uncover the long-term effects of IIAs. Thus, our study analyzes 1099 separate estimates of the effects of BITs and other IIAs on FDI. Moreover, we analyze not only

[4] Bellak also uses other criteria to eliminate studies from the meta-analysis, such as requiring that studies included in the analysis use only ratified BITs as the explanatory variable.

[5] Nevertheless, 17 of the studies used by Bellak are also included in our sample.

the effect of BITs but also the effects of other types of investor protection treaties, and we are able to test the importance of the effects of differences in correlates and in specifications on the results reported by the studies surveyed. Finally, we take advantage of recent innovations in meta-analyses techniques to better analyze the PCCs and to examine publication selection bias.

3. Literature selection and data characteristics

To find studies suitable for meta-analysis in this paper, we searched the EconLit, Web of Science, Scopus, and Google Scholar databases for studies that empirically examined the effect of BITs on FDI. We searched for relevant literature using the full keywords "foreign direct investment bilateral investment treaties" and the abbreviated version "FDI BIT" as well as possible combinations of these full and abbreviated keywords. We also carried out a literature search separately using the keywords, i.e., "bilateral investment treaties", "BIT", "foreign direct investment" and "FDI". Restricting our sample to journal articles, book chapters and academic working papers in English, we identified 86 studies on the subject of BIT effects on FDI. Of these 86 studies, 51 yielded quantitative results that could be used in our meta-analysis, but closer analysis revealed some duplication between working papers that were subsequently published as journal articles. We dropped the former and retained the latter in our sample. This left us with 41 studies, whose main characteristics are reported in Table 1. As shown in this Table, most of the studies use either developed countries or the US or the EU as the sources of FDI, although some use a broader sample of home countries. The host countries are often either developing countries or a larger sample of hosts including developed countries. Although most studies use either stocks or flows of FDI, a minority use the ratio of FDI to host-country GDP. While the time period covered varies from study to study, many studies cover time periods of 20 to 30 years. Finally, many studies distinguish between the effects of bilateral investment treaties and other types of IIAs. The majority of the studies, 29, were published in scholarly journals, three were published in books and nine were working papers. These studies yielded 1099 separate estimates of the effects of investment protection on FDI.[6] We take estimates in a paper as differing from one another if they differ in terms

[6] As can be seen from Table 1, most studies yielded more than one estimate.

of at least one of the following elements: the dependent variable, the explanatory variables, the time period or countries covered, specification of the regression equation, and method of estimation.

A closer examination of the studies showed that some authors had taken care to identify, separately, estimates of the effects of bilateral investment treaties (BIT), multilateral investment treaties (MIT), bilateral trade agreements (BTA) and regional trade agreements (RTA), the latter two of which often contain some provisions for FDI protection. The rationale for this is, as, for example, Hallward-Driemeier (2003) argues, that some investor protection is included in broader international treaties such as NAFTA that also liberalize trade among participating countries. Thus, there would be two effects of NAFTA on FDI, one due to the increase in bilateral trade resulting from the reduction in trade barriers and the other due to the increased protection of foreign investors.[7] Consequently, to attribute the entire change in bilateral FDI among NAFTA members to investor protection alone would be erroneous, and, thus, the effects on FDI of arrangements such as NAFTA should be evaluated separately from those of simple BITs. While the focus of our analysis is on the literature dealing with the effects of BITs, we take the opportunity to analyze the effects of these other types of arrangements as well, to the extent that they are addressed by our sample of studies.

Taking K as the number of independent estimates provided by the analyzed studies, we calculated the partial correlation coefficient (PCC) of each of the K estimates. The PCC is a measure of the association between the dependent variable and the independent variable of interest, the existence of some form of IIA, when all other explanatory variables are held constant. Letting t_k and df_k be the t-value and the degrees of freedom of the k-th estimate, r_k, the PCC of the k-th estimate is calculated as:

$$r_k = \frac{t_k}{\sqrt{t_k^2 + df_k}}, \quad k = 1, 2, \dots, K \qquad (1)$$

and the standard error, SE_k, of r_k is given by:

[7] Note that the effect of reduced trade barriers on bilateral FDI flows is ambiguous. On the one hand, lower tariffs and other trade barriers reduce the need for FDI to serve the foreign market, but greater bilateral trade can also be a stimulus for greater FDI, particularly of the vertical, resource-seeking type, as was evident in the automobile sectors in Canada, Mexico and the US after the implementation of NAFTA.

$$SE_k = \sqrt{(1 - r_k^2)/df_k} \quad (2)$$

Figure 1 displays the individual kernel densities of the PCCs for each of the four types of IIAs as well as for all IIAs taken together. The kernels all display positive skewness and appreciable kurtosis. Table 2 confirms what is visible in Figure 1 regarding skewness and kurtosis. The means of the PCCs the four different international agreement differ from each other and these differences are statistically significant according to the ANOVA and the Kruskal-Wallis tests. Thus, according to these unadjusted means and *t*-tests of the null hypothesis that the mean is zero, all types of IIAs except for RTAs have a positive effect on FDI, although the magnitude of the effect differs among IIAs. There are more estimates of PCCs for BITs than for the other forms of investment protection, and the mean of the PCCs of BITs is greater than the means of other IIAs. Since BITs are signed for the express purpose of promoting FDI between the signatories while bilateral and multilateral trade agreements have a multitude of objectives and thus may embody less robust protection for investors, it is not surprising that the PCCs of the latter two are smaller. Moreover, BITs are mainly designed to promote capital flows from developed to developing countries while multilateral investment treaties often cover investments among a group of closely-related countries that are similar in economic terms. It may be that multilateral investment protection treaties have the smallest PCCs because they may involve either groupings of wealthy well-governed countries and FDI among these countries does not require additional investor protection, or groups of countries with low incomes and little FDI activity among them or because their investment protections are rather weak.[8]

While the means of the PCCs are positive and, excluding RTAs, statistically significant, a more important question is whether these means signify an important effect of IIAs on FDI. Doucouliagos (2011) examines 22,141 empirical studies in economics and finds that, for all studies, the 25th percentile PCC is 0.07. Studies with

[8] Note that there are only two studies that estimate the effects of MITs. One of them, Dixon and Haslam (2016), focuses explicitly on the effect of MITs on South-South FDI in the context of Latin America.

PCCs less than this value can be considered as reporting "very small" effects in Doucouliagos' terminology.[9] In this sense, our results are consistent with Bellak's (2015) conclusion that the effect of BITs is small but statically significant. It now remains to adjust the mean PCCs presented in Table 2 through meta-synthesis.

4. Meta-synthesis

If we assume that the PCC of the k-th estimate, r_k, is characterized by a mean and standard deviation given by θ_k and s_k respectively and that $\theta_1 = \theta_2 = \ldots = \theta_K = \theta$, then each study included in our meta-analysis estimates the common underlying population effect and the estimates differ only by random sampling errors. An asymptotically efficient estimator of the unknown true population parameter θ is the mean of the estimates of all K of the r_k weighted by the inverse variance of each estimate:

$$\bar{R} = \sum_{k=1}^{K} w_k r_k \Big/ \sum_{k=1}^{K} w_k , \qquad (3)$$

where $w_k = 1/v_k$ and $v_k = s_k^2$. The variance of the synthesized partial correlation, $\bar{R}$, is thus given by $1/\sum_{k=1}^{K} w_k$. This is called the meta-fixed-effect model, and we denote estimates of the fixed-effect model by $\overline{R_f}$. Estimates are reported in Column 2 of Table 3. In order to utilize this method to synthesize the PCCs, it is necessary to confirm that the estimates are homogeneous by means of a test statistic that has a Chi-square distribution with K-1 degrees of freedom as given by Equation 4:

$$Q_r = \sum_{k=1}^{K} w_k \left(r_k - \overline{R_f}\right)^2 \sim \chi^2(K-1). \qquad (4)$$

The null hypothesis is rejected if Q_r exceeds the critical value as the results reported in Column 4 of Table 3 indicate.

Because we reject this null hypothesis, heterogeneity exists among the studies, and we adopt as more appropriate a random-effects model that incorporates sampling variation resulting from an underlying population

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[9] However, Doucouliagos also reports that the distribution of PCCs varies by subfields of economics. While he provides no results for studies dealing with IIAs, the lowest cutoffs for "small" effects are 0.020 for studies of "intergovernmental competition" and 0.015 for "politics and taxes". By the standards of these studies our results report PCCs that would be seen as moderate for all IIAs and especially for BITs.

of differing effect sizes as well as the study-level sampling error. If the deviation between estimates is expressed as δ_θ^2, the unconditional variance of the k-th estimate is given by $v_k^u = (v_k + \delta_\theta^2)$. In this meta-random-effects model, the population parameter θ is estimated by replacing the weight w_k with the weight $w_k^u = 1/v_k^u$ in Eq. (3).[10] For the between-studies variance component, we use the method of moments estimator computed by Equation 5 using the value of the homogeneity test value Q_r obtained from Eq. (4):

$$\hat{\delta}_\theta^2 = \frac{Q_r - (K-1)}{\sum_{k=1}^{K} w_k^u - \left(\sum_{k=1}^{K} w_k^{u^2} / \sum_{k-1}^{K} w_k^u\right)}. \qquad (5)$$

Hereafter, we denote the estimates of the meta-random-effects model as $\overline{R_r}$.

In addition to this traditional approach to meta-synthesis method described above, we also utilize the unrestricted weighted least squares weighted average (UWA) method proposed by Stanley and Doucouliagos (2017). They argue that, compared to the fixed-effect and random-effects models, UWA is less subject to influence from excess heterogeneity and thus from publication-selection bias. The UWA takes as the synthesized effect size a point estimate obtained from a regression where the standardized effect size is the dependent variable and the estimation precision is the independent variable. Thus, we estimate Eq. (6), in which there is no intercept term, and the coefficient α is the synthesized value of the PCCs:

$$t_k = \alpha(1/SE_k) + \varepsilon_k, \qquad (6)$$

where ε_k is the residual term. These estimates of α in Equation (6) have the same values as the estimated value of $\overline{R_f}$, but the standard error is more robust to publication selection bias.

In a related article, Stanley et al. (2017) argue for computing a UWA of only those estimates whose statistical power exceeds a threshold of 0.8, and they call this estimation method the weighted average of the adequately powered estimates (WAAP). According to Stanley *et al*. (2017), the WAAP estimate is more robust against publication selection bias than is the random-effects estimate of $\overline{R_r}$, and, thus, when the number of high-

[10] This means that the meta-fixed-effects model is a special case based on the assumption that $\delta_\theta^2 = 0$.

and low-powered studies is large, as it is in the case in this paper, "…WAAP clearly dominates all other weighted averages…" including fixed-effects, random-effects and UWA (Stanley et al., 2017, p. 1583).[11]

The results of meta-synthesis of the collected estimates are reported in Table 3. The tests for homogeneity, reported in Column 4, reject the null hypothesis in all five cases. Note that the fixed-effect estimates in Column 2 are smaller than the unweighted estimates reported in Table 2, which reflects the former's greater susceptibility to the effects of bias. Therefore, we consider the synthesized effect size $\overline{R_r}$ of the random-effects model reported in Column 3 of Table 3 as the more appropriate estimate of the effect of IIAs on FDI although the random-effects model will yield more biased estimates in the presence of publication bias or if small sample studies yield large effect estimates.

Note that, relative to the mean values of the PCCs reported in Table 2, the synthesized random-effects values for the PCCs for All International Agreements and BITs decline, although they retain their levels of statistical significance. This decline in the values of these estimates is evidence of the importance of the lack of homogeneity of the PCCs for a proper interpretation of the effects of IIAs on FDI. The estimates for the other types of investor protection and their significance generally mirror the values reported in Table 2.

Table 3 also provides synthesis results based on the UWA methodology proposed by Stanley and Doucouliagos (2017). Even though the UWA method produces the same estimate of the means as does the fixed-effects model, the evaluation of the statistical significance of the synthesized effect size is more severe, yielding lower, but still highly significant, *t*-values for all estimates except those for RTAs, whose level of significance drops from the 1% level to the 10% level.

Finally, WAAP, the UWA of adequately-powered estimates, generates synthesized effect sizes smaller than those obtained from both the fixed-effect and the random-effects estimation in all cases, although differences between the WAAP and FE estimates are largest for All International Agreements and for BITs. It is worth noting that the number of adequately powered estimates represents 16% of all estimates used in our meta-analysis. This corresponds to the incidence of adequately powered estimates in much empirical economics research (Ioannidis

[11] For the appropriateness of WAAP for economic research, see Ioannidis & et al. (2017).

et al., 2017).

To sum up, the meta-synthesis of the PCCs shows that there is a small but significant effect of IIA on FDI and that this effect varies by type of investor protection scheme. The analysis also suggests the presence of heterogeneity and possible bias in the results, and it is to these issues that we now turn.

5. Meta-regression analysis

We undertake a meta-regression analysis (MRA) to explore the factors causing heterogeneity among the studies analyzed. We estimate a meta-regression model:

$$r_k = \beta_0 + \sum_{n=1}^{N} \beta_n x_{kn} + e_k\,, \;\; k = 1, \cdots, K \qquad (7)$$

where x_{kn} is the *n*-th meta-independent variable that captures a relevant characteristic of the *k*-th PCC and explains its systematic variation from other PCCs in the sample; β_n denotes the meta-regression coefficient to be estimated; *N* is the number of meta-independent variables; and e_k is the meta-regression disturbance term. To check the statistical robustness of coefficient β_n, we perform our MRA using the following seven estimators: (1) the cluster-robust ordinary least squares (OLS) estimator, which clusters the collected estimates by study and computes robust standard errors; (2) the cluster-robust weighted least squares (WLS) estimator using the number of observations (*N*); (3) the squared value of degrees of freedom ($\sqrt{d.f.}$); (4) the inverse of the standard error (1/*SE*); (5) the inverse of the number of estimates reported per study (1/*EST*) as an analytical weight; (6) the multi-level mixed effects RLM estimator; and (7) the cluster-robust random-effect panel GLS estimator following Stanley and Doucouliagos (2012) and other meta-analyses in economics. For our purposes, we accept β_n as being significantly different from zero if at least four of the estimates of β_n obtained by the above seven estimation methods are statistically significant.

In view of the wide variety of approaches to measuring the effect of IIAs on FDI in terms of model specification, type of data on FDI, IIAs covered, country coverage and control variables considered relevant by researchers, we identified 37 meta-independent variables for inclusion. These are the variables that we judged as most likely to lead to differences in results among the studies in our sample, and they also reflect many of the criticisms found in the literature of one or another type of study. We group these variables into 16 categories that collect the variables by the nature of the source of heterogeneity such as econometric methodology, data type, etc. The variables and their coding are reported in Table 4.

The estimation results are reported in Table 5. In the first category, "International agreement variable type", we take one type of study as the baseline. Here, the estimate for BITs is taken as the baseline estimate and the next three rows report on whether estimates of coefficients for the three other types of IIAs differ from those obtained for BITs using the significance criterion mentioned above. The coefficient for the category of MIT shows a positive estimate in four out of seven models. Hence the effect size of MITs is by our criterion significantly larger than that of BITs. BTA's and RTA's coefficients are not significantly different from zero. Thus, there is no difference in effect size between BITs, BTAs and RTAs, *ceteris paribus*.

The second category relates to the definition of the IIA variable. The baseline is represented by studies that use a zero-one dummy to indicate the presence of an IIA. Other studies, however, look at the cumulative number of IIAs that a country has signed and estimate the effects of the cumulative number, usually on aggregate inward FDI. The reported estimates show that this difference in modelling approach does not lead to any systematic differences in the estimates of the effect of IIAs. The similar effect of a single IIA on FDI from one country compared to that of a set of IIAs with a number of countries points to a certain degree of commonality among different IIAs. This does not necessarily mean that all IIAs are the same or that they contain identical rules. Nevertheless, it appears that the IIA provisions embodied in different agreements tend to affect FDI in a similar fashion.

The third category deals with the treatment of the existence of IIAs. Some authors do not specify whether the IIAs used in their estimations are ratified or signed or they use both categories. Other authors prefer to use signed agreements as the explanatory variable on the assumption that signed agreements are likely to be ratified in due course, and thus they serve as a signal to foreign investors that they will have greater protection in the host country in the future for investments that they may undertake now. Yet other authors, however, choose to use only ratified agreements as these are the only agreements that do confer tangible protection to investors. Again, the reported results show that there is no systematic difference in the estimates obtained using these various measures of the existence of IIAs.

Category 4 covers specific aspects of the specification used by researchers to measure the effect of IIAs. The coefficients of dummies for studies that explicitly model the long-term effects (Long-term effect) of IIAs on FDI are significant, positive and relatively large in six of the seven regressions reported in Table 5. Because the decision by an MNC to undertake FDI in a host country that has just signed an IIA with the MNC's home country requires some time to plan and execute, whether the investment takes the form of an acquisition in the host country or a greenfield investment, it is not surprising that the long-term effect of the IIA is larger than is the short-term effect. Moreover, many IIA are signed as part of a package of economic policy reforms. For various reasons, the signing and ratification of such IIAs may sometimes precede other reforms in the policy package. Since FDI flows depend not only on the level of investment protection, the key policy instrument of IIA, it is obviously quite possible and indeed likely that that the positive effect of IIA may only appear in the long-run. Paradoxically, lagging the measure of IIAs that authors use in their regressions yields a negative, significant and large, coefficient. Lagging the IIA measure is usually justified by the assumption that doing so accounts for the time required for IIAs to affect FDI. The conflicting results for these two coefficient estimates for meta-independent variables related to the effects of time on the impact of IIAs on FDI suggest that a better modelling of the dynamics of these effects should be an important task for future research. Finally, the inclusion of interaction terms, usually between the measure of IIAs and host- or home-country characteristics does not yield a significant difference in the effects reported.

In category 5, we consider the effect of how FDI is measured. The default option is the use the log of FDI flows or stocks. This can be a problem, especially in in dyadic models, because FDI may be zero or even negative, which forces researchers to drop observations or to insert arbitrarily small positive values for non-positive observations.[12] Other authors use the monetary value of FDI or the ratio of FDI to host-country GDP. However, none of these choices lead to a significantly different estimates of the effects of IIAs.

Categories 6 through 9 deal with the potential effects of the type of countries included in the study on the results obtained. Category 6 examines the effect of the number of home countries in the sample on the effect estimates. The number of home countries included in a study has a positive and significant coefficient in six of seven cases, but the average of the six significant coefficients is less than 0.001, meaning that the effect is rather unimportant in practical terms. The largest significant coefficients in the meta-regression analysis relate to Category 7, the composition of the home countries in the studies. Compared to studies that use both advanced and emerging-market countries, which we take as the baseline, we find that studies that use advanced countries or the US as the home country result in positive and significantly larger estimated effects. If the home countries are advanced economies (Advanced home country) the average of the significant coefficients is 0.054, and, if the study uses the United States as the home country, then the average of the coefficients is 0.079. These home country effects are not surprising. IIAs are largely designed to facilitate investments from developed countries that are the major sources of FDI to emerging-market counties. Thus, focusing on the effects of this subset of IIAs and on flows from wealthy to developing countries should show a greater effect of IIAs. The even larger coefficient for the United States as the country from which FDI originates is likely due to two factors. The first is that the US is the home to many more MNCs that undertake FDI than are other developed countries and the US is also the largest source of outward FDI during the period covered by the studies analyzed. A second reason for the larger effects found in studies using the US as the home country is that BITs and other investor protection treaties negotiated by the United States are considered by observers to provide US investors considerably greater protection and also easier entry into the economies of treaty partners than is true in the case of IIAs negotiated by other developed countries (Salacuse and Sullivan 2005; Berger et al. 2010). This greater protection for US investors should result, *ceteris paribus*, in a greater effect of US agreements on FDI from the United States than

[12] Silva and Tenreyro (2006) discuss some of the econometric problems that this practice creates.

would be the case for other home countries. These results also suggest that IIAs among developed countries may be intended more to promote reciprocal market access rather than to increase FDI flows. Thus, the choice of home countries critically influences the results obtained by studies of the IIA-FDI relationship.

The number of host countries in a study, category 8, has no significant effect on the estimated effect of IIAs. Moreover, the nature of the host countries, category 9, also does not affect the results systematically. Whether a study uses a mixture of developed or developing countries, which is the baseline, or whether host countries in the sample are limited to either developed or developing countries, has no systematic effects on the estimates. Categories 10 and 11 relate to the nature of the data used in studies. Category 10 shows that there is no significant difference between studies that use panel data, cross-section data or time series data. This is somewhat surprising in that panel estimates using fixed effects to control for unobservable country differences that do not vary with time should lead to more robust estimates. Neither the first year covered by a study nor the length of the time covered by a study have any systematic effect on the reported effect.

Categories 12 through 15 investigate the effects of econometric choices researchers make in seeking to estimate the effects of IIAs on FDI. In category 12, we take the gravity equation as the baseline specification since is it a widely used model not only for bilateral trade but also for bilateral FDI (Blonigen and Piger, 2010). Any specification that has as covariates the level or logs of the GDPs of the two countries and the distance between them falls into this category. However, the results show that there are no significant differences between the results obtained by the gravity equation and by other specifications. Likewise, the studies using OLS estimator do not differ from those obtained by other means (category 14) nor does controlling for the potential endogeneity of investment protection effect the size of reported PCCs. Finally, in category 16 a number of covariates often found in gravity specifications as well as in other models of FDI are shown not to affect the reported results. These include institutional quality in the host country, since IIAs can be a substitute for poor host-country institutions because they remove some decision-making power from the host government and cede it to an impartial arbitral body. However, some researchers argue that IIAs and the quality of host-country institutions are complements and not substitutes. Similar considerations apply to the polity measure as well as to corruption. Economic characteristics include inflation, trade openness, the exchange rate regime of the stability of the exchange rate and cultural similarities between home and host countries. Finally, in category 16 we account for the degrees of freedom in each study as well as the quality of the outlet in which it was published. None of these factors influence the size of the reported effect.

The results of the meta-regression analysis thus lead to several conclusions. The first is that many aspects of the large variety of models and data used to measure the effect of IIAs on FDI do not affect the findings of these studies in a systematic way despite frequent criticism in the literature of different modelling choices made by researchers. Thus, one may conclude that this variety of approaches can be seen as an extensive robustness test in that the results of numerous and quite different approaches lead to similar conclusions regarding the effects of IIAs. The second conclusion is that the results also identify two issues for further research. The first is a need for a better modelling of the dynamics of the effect of IIAs on FDI in view of the opposing effects found in studies that explicitly address these dynamics and those that use lagged IAAs to address this issue. The second is a somewhat broader issue, which is what should be the objective of studies seeking to identify the effects of IIAs. In view of the fact that there are over 3000 BITs in existence, it follows that these BITs and other IIAs encompass very different sorts of provisions among pairs of countries with differing institutions, legal systems, levels of economic development and objectives in entering into IIAs. Thus, focusing on broad country coverage requires that researchers include in their specifications covariates that appropriately capture these differences, which may be a tall order. Thus, as the coefficients for studies dealing with the US and other advanced economies suggest, it may be more appropriate to look for large effects of IIAs among samples of countries where the home countries have similar economic characteristics and as do the host countries, although the characteristics of the home countries should differ from those of the host countries. Although for many IIAs the effects are small, if the research covered in this meta-analysis is to be of any policy relevance, it is not the average effect of all IIAs but rather the effect expected by a specific home and host country pair that matters and therefore a more focused selection of home and host countries may be more relevant for policy makers.

6. Assessment of publication selection bias

To conclude our analysis, in this section we examine whether the studies in our sample are influenced by publication selection bias, which can occur because papers that produce results with the "expected" sign or conclusion are more likely to be accepted for publication by journals. We first address this issue by using funnel plots of the reported PCCs and then by estimating a set of meta-regression models that are designed to identify publication bias.

The funnel plot is a scatter plot with the effect size, the PCC, on the horizontal axis and the precision of the estimate, measured by $1/SE$, on the vertical axis. In the absence of publication selection bias, effect sizes reported by independent studies should vary randomly and symmetrically around the true effect. Moreover, statistical theory suggests that the dispersion of effect sizes is negatively correlated with the precision of the estimate. Therefore, the shape of the plot should have the appearance of an inverted funnel. If the funnel plot is not bilaterally symmetrical around the true effect and is skewed to one side, then publication bias is suspected in the sense that estimates in favor of a specific conclusion, i.e., estimates with the expected sign, are published more frequently.

Figure 2 shows the funnel plot of the estimates for all studies of all IIA as well as plots of the PCCs by type of investor protection regime. In Panels (a), (b), (d) and (e) of Figure 2, the WAAP reference value is represented by a solid line. In Panel (c), the UWA estimate of all studies is used as a reference value. There is also a dotted line, which shows the value of zero. The panels representing all studies and studies of BITs show the expected funnel shape. Since the WAAP estimate of the effect is close to zero, any skewing that is observable relative to the zero-effect vertical line will not differ much if we assume that the WAAP estimate is correct. In the case of all IIAs as well as in the case of BITs, the distribution of PCCs appears skewed to the right, suggesting the predominance of positive results in the literature. In Panel (d), the PCCs for bilateral trade treaties also display a funnel shape. Here, the distribution appears skewed only if we assume a true effect of zero, but if we accept the WAAP estimate as true, then there appears to be no publication bias in favor of positive effects of BITs. For the other types of IIAs, the Panels do not show a funnel shape, in part because of the limited number of studies of these types of agreements.[13] Thus, inferences drawn from visual inspection of these latter two Panels about possible publication bias cannot be made with much certainty.

To further clarify the results presented in Figure 2, we perform univariate tests of publication selection bias for all IIAs and by IIA type, the results of which are reported in Table 7. These tests confirm the impression gained from visual inspection of Figure 2. According to this Table, if the true effect is assumed to be zero, the goodness-of-fit test rejects, at a 1% level, the null hypothesis that the number of positive and negative estimates is equal for all studies of IIAs except those dealing with RTAs. Under the assumption that the true effect size takes the WAAP value, the null hypothesis is also rejected in all cases, but, in the cases of MITs, BTAs, and RTAs, it is negative estimates of effects that predominate. This may be due to the small number of studies that deal with these types of arrangements, as Figure 2 suggests.

To examine publication selection bias in a more rigorous manner, Stanley and Doucouliagos (2012) propose estimating Equation 8 and testing for the null hypothesis that the coefficient β_0 is equal to zero where

$$t_k = \beta_0 + \beta_1(1/SE_k) + \epsilon_{k,} \quad (8)$$

and ϵ_k is the error term. If the intercept term β_0 is not zero, the distribution of the effect sizes is asymmetric, suggesting the possibility of publication bias. For this reason, this test is called the funnel-asymmetry test (FAT). The rejection of the null hypothesis implies the presence of a genuine (i.e., statistically significant non-zero) effect. As Panel (a) of Table 7 shows, the results of the FAT test depend on the estimation method adopted. OLS and cluster-robust OLS yield non-zero estimates for β_0, but the other three estimation techniques fail to reject the hypothesis that β_0=0. Thus, we judge that the FAT test does not provide definite evidence of the existence of publication selection bias.

The existence of publication selection bias does not rule out the possibility that a genuine effect exists in the literature. Stanley and Doucouliagos (2012) propose a way of identifying such a true effect by testing the null

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[13] In some cases, there are only a few independent studies, each of which produces a number of estimates of PCCs. It is not surprising that even if single study uses somewhat different specifications, data, etc. its basic design will lead to similar levels of precision, which is evident in Panels c and e of Figure 2.

hypothesis that the coefficient β_1 in Equation 8 is equal to zero. The rejection of the null hypothesis suggests the existence of a genuine effect. They call this test the precision-effect test (PET). To test the robustness of the regression coefficients obtained for the PET test, we estimate Equation (8) using not only the OLS estimator, but also the cluster-robust OLS estimator, the multi-level mixed effects RML estimator, the cluster-robust random-effects panel estimator and the cluster-robust fixed-effects panel estimator to account for possible heterogeneity among the studies.[14] As can be seen in Panel (a) of Table 7, the PET test leads to the rejection of the null hypothesis regardless of which estimation technique is used. Thus, we conclude that the studies covered by our meta-analysis demonstrate a true positive effect of IIAs on FDI. Moreover, Stanley and Doucouliagos (2012) also note that an estimate of the publication-selection-bias-adjusted effect size can be obtained by estimating Eq. (9), which has no intercept. If the null hypothesis of $\gamma_1 = 0$ is rejected, then a non-zero true effect does exist in the literature, and the coefficient γ_1 can be regarded as its estimate where

$$t_k = \gamma_0 SE_k + \gamma_1(1/SE_k) + \epsilon_k. \tag{9}$$

Stanley and Doucouliagos (2012) call the hypothesis test for Eq. (9) the precision-effect estimate with standard error (PEESE) approach.[15] As reported in Panel (b) of Table 7, the PEESE result shows that the coefficient γ_1 in Eq. (9) is statistically significantly different from zero for all five estimation techniques. Therefore, we conclude that the true value of the effect of IIAs on FDI is in the range of 0.0146 and 0.0174.

We also carried out the FAT-PET-PEESE procedure by agreement type. The results are summarized in Table 8. As this Table shows, the FAT test detected publication selection bias only in the case of studies of RTAs, suggesting that the likelihood of publication selection bias is generally low in this research field. The PET tests suggested the presence of genuine empirical evidence in three of four cases, and the PEESE method generated statistically significant non-zero publication selection bias-adjusted effect sizes for all IIAs, BITs, BTAs and RTAs, which is largely consistent with the results of the meta-synthesis reported in Table 3 except for studies of

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[14] To estimate Eq. (8), we use the cluster-robust random-effects estimator and the cluster-robust fixed-effects estimator.

[15] For Eq. (9), which does not have an intercept term, we report the random-effects model estimated by the maximum likelihood method and the population averaged GEE model in place of the last two estimation methods used for Equation 8. .

regional trade agreements, which show a larger bias-corrected effect size than the WAAP estimate. Only in the case of MITs do the test results suggest that they have no true effect on FDI in the selected studies. It is noteworthy that the estimated true effects provided by the PEESE approach are very near to the WAAP estimates reported in Table 3, as Stanley's simulation test predicts. Overall, our assessment of publication selection bias in this section indicates that the possibility of publication selection bias does not invalidate the existence of a positive relationship between IIAs and FDI and that the existing literature does contain empirical evidence of a positive effect of international agreements on FDI.

7. Conclusions

In this paper we have carried out a meta-analysis of 41 studies, yielding 1099 estimates, of the effects of international investment treaties on foreign direct investment. Our meta-synthesis, presented in Table 3, indicates that, based on either random-effects or WAAP estimates of the partial correlation coefficients of these studies, all types of international treaties, bilateral investment treaties, multilateral investment treaties, bilateral trade agreements and multilateral trade agreements, have a positive impact on FDI. Moreover, the FAT-PET-PEESE approach to publication-selection bias revealed that the existing literature does provide genuine empirical evidence of the positive effect of IIAs on FDI except for the case of MITs.

Our analysis also shows that the major source of heterogeneity in the reviewed studies stems from differences in the source countries of FDI used by different researchers and in the ability of researchers to appropriately model the dynamic effects of investment treaties. These findings suggest that further research is needed to address these issues by better controlling for the makeup of the countries that are the sources and recipients of FDI. Our understanding of how investment treaties influence FDI over time is also needed. One potential approach would be to use matched-pair models to better estimate the temporal effects of investment treaty protection. Finally, our analysis also suggests that different types of investment protection treaties have different effects on FDI. However, the existing literature is heavily weighted toward the study of bilateral investment treaties and other types of arrangements for protecting foreign investments are studied only infrequently. Finally, our analysis of the sources of heterogeneity of results in the literature shows that differences in specification, definition of FDI, and choice of explanatory variables are not a major cause of differences in results among studies, which suggests that many of the methodological disagreements among researchers do not matter as much as is often claimed.

Our meta-analysis also has some policy implications. The largest significant coefficients in the meta-regression analysis relate to the composition of the home countries in the studies. When the home countries are advanced economies and especially the United States, the effects of investment treaties are significantly larger. Thus, policy makes seeking to attract more FDI for their countries would be well-advised to focus on signing treaties with the largest sources of FDI rather than maximizing the number of investment treaties that they sign. Our findings also suggest that the effect of IIA should be seen in a longer-run perspective, which would also require signatories to seek greater stability in the conduct of their domestic policies. In addition, our findings suggest that the differences among various IIAs are outweighed by the similarities in their effects on FDI. This could go a long way in helping policy makers to harmonize investment rules in future negotiations of IIAs. There is a message in our results for researchers as well. With over 3000 bilateral investment treaties in existence, should the focus of research be on the effects of all these treaties or should the focus be on the effect of treaties signed with the main sources of foreign direct investments? While the former question may be more interesting from a scientific standpoint, the latter is of greater practical importance.

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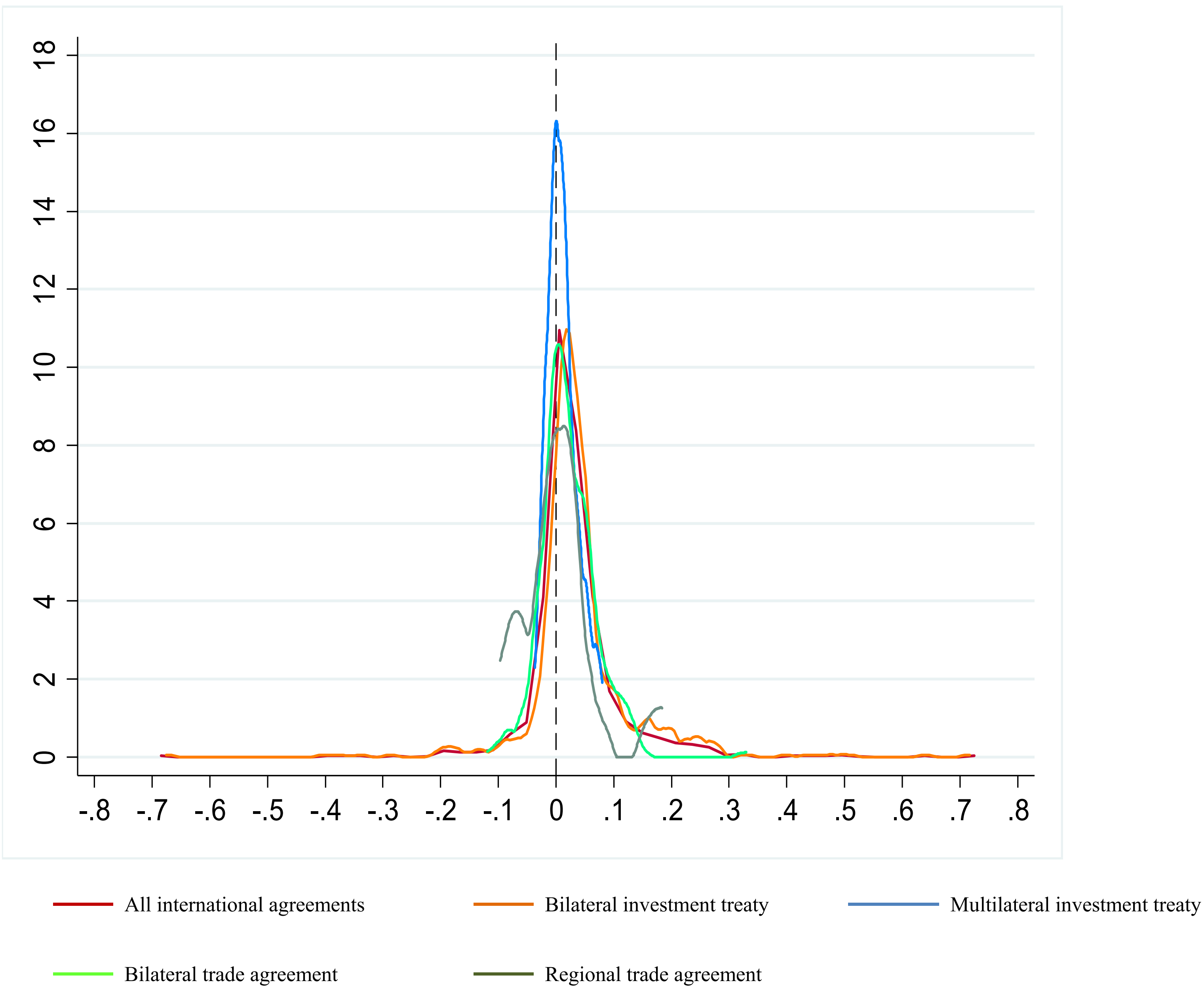
APPENDIX 1

Method for Evaluating the Quality Level of a Study

To determine the quality level of the studies subjected to our meta-analysis, we used the ranking of publications found in IDEAS and the Thomson Reuters Impact Factor. IDEAS, the largest bibliographic database, provides a ranking of economics journals and working papers. The list is freely available at http://ideas.repec.org. For our meta-study, we divided journals into 20 clusters and assigned each of these journal clusters a score or weight from 1 for the lowest journal cluster to 20 for the highest cluster. Thomson Reuters Impact Factor was used for academic journals not ranked by IDEAS. We referred to the Thomson Reuters Impact Factor and to other journal rankings and identified the same level of IDEAS ranking-listed journals that correspond to these non-listed journals; we assigned each of them the same score as its ranked counterparts. For academic books and book chapters, we assigned a score of 1 unless at least one of three conditions was met: (1) the book or book chapter clearly states that it has been peer reviewed; (2) its publisher is a leading academic publisher who undertakes external evaluations carried out by experts; or (3) we evaluated the research level of the study to be high. If one of these conditions was met, the book or chapter received a score of 10, which is the median value of the scores assigned to the above-mentioned IDEAS ranking-listed economics journals.

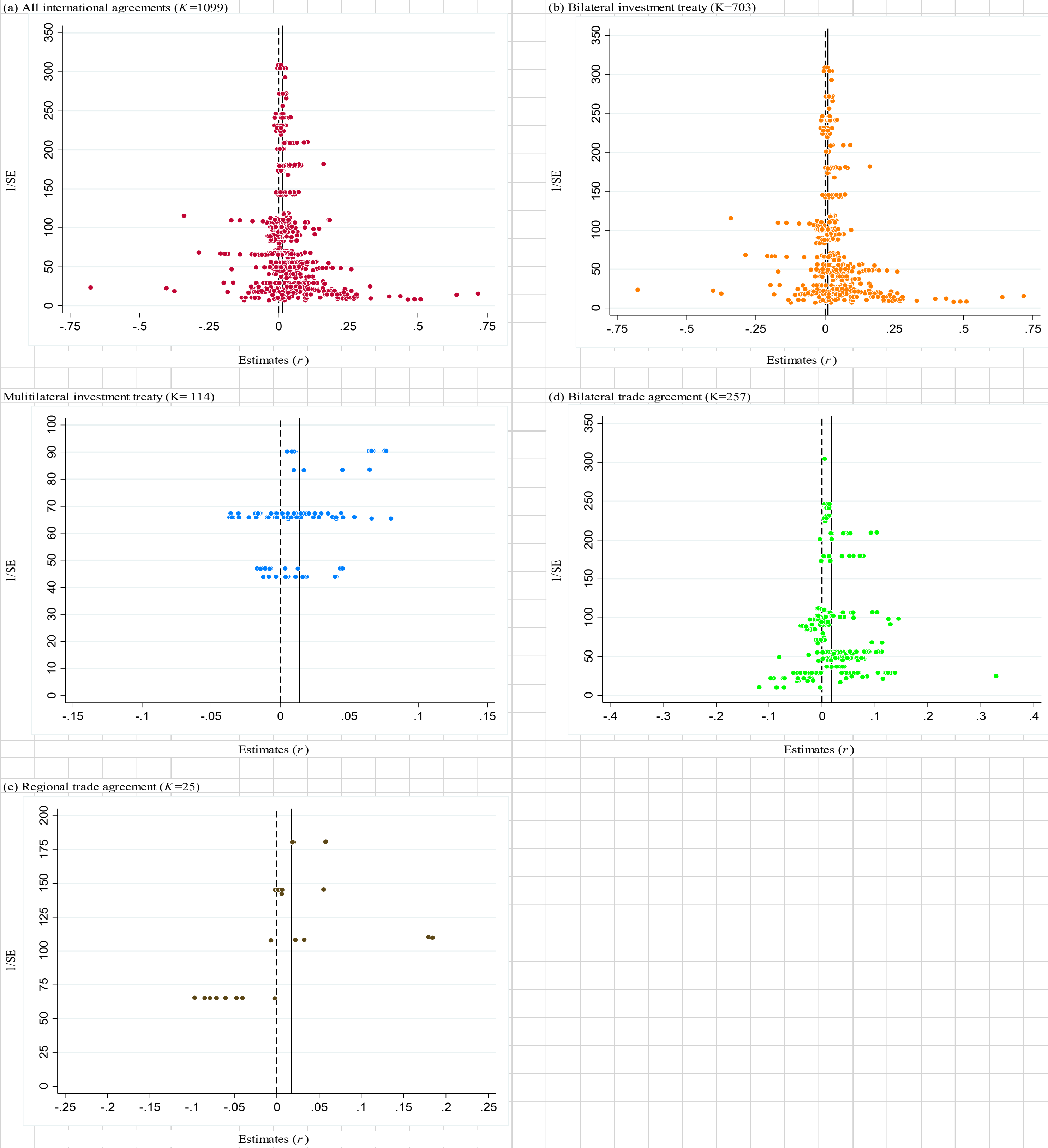
Figure 1. Kernel density estimation of partial correlation coefficients by type of international investment protection agreement



Note: Vertical axis is kernel density. Horizontal axis is variable value.

Source: Authors' illustration.

Figure 2. Funnel plot of patial correlation coefficients by international agreement type



Note: Solid line indicates the sythesized effect size of WAAP reported in Table 3. In Panel (c), the UWA of all estimates is used because the WAAP is not available for multilateral investment treaty.
Source: Authors' illustration.

Table 1. List of selected studies for meta-analysis
(by date of publication)

Author(s) (publication year)	Target home countries [a]	Target host countries [a]	Estimation period	FDI variable type (independent variable) [c]	International agreement variable type (dependent variable) [d]	Number of collected estimates (*K*)
Hallward-Driemeier (2003)	AC	DC	1980-2000	II, III	BIT, MIT	42
Egger and Pfaffermayr (2004)	AC	GL	1982-1997	I	BIT	40
Grosse and Trevino (2005)	GL	GL	1990-1999	II	BIT	3
Neumayer and Spess (2005)	GL	DC	1970-2001	II	BIT, BTA	20
Swnson (2005)	GL, US	DC	1990-1999	II	BIT	6
Tobin and Rose-Ackerman (2005)	US	DC	1980-2000	II	BIT	4
Gallagher and Birch (2006)	GL, US	DC	1980-2003	II	BIT	6
Aisbett (2007)	AC	DC	1980-1999	II	BIT, BTA	16
Egger and Merlo (2007)	AC	AC	1980-2001	I	BIT	32
Coupe at al. (2008)	AC	GL	1990-2001	II	BIT	13
Yackee (2008)	AC	GL	1971-2003	II	BIT	8
Buthe and Milner (2009)	GL	DC	1970-2000	II	BIT	14
Desbordes and Vicard (2009)	AC	DC	1991-2000	I	BIT	9
Kerner (2009)	AC	DC	1982-2001	II	BIT	28
Busse et al. (2010)	GL	DC	1978-2004	II	BIT	12
Haftel (2010)	US	DC	1977-2004	III	BIT	12
Tobin and Rose-Ackerman (2011)	GL	GL	1984-2007	II	BIT	34
Jang (2011)	AC	GL, AC, DC	1982-2005	II	BIT, BTA	18
Egger and Merlo (2012)	AC	GL	1996-2005	I	BIT	2
Kerner and Lawrence (2012)	US	DC	1997-2007	I	BIT	3
Bankole and Adewuyi (2013)	EU	CD	1980-2010	I	BIT, BTA	21
Buge (2014)	AC	GL, AC	1993-2006	I	BIT, BTA	180
Colen et al. (2014)	GL	GL	1994-2009	I	BIT	10
Lejour and Salfi (2015)	AC	GL	1985-2011	I	BIT	33
Aisbett et al. (2016)	GL	GL	1980-2010	II	BIT	40
Bhasin and Manocha (2016)	AC	DC	2001-2012	II	BIT	3
Colen et al. (2016)	GL	GL	1994-2009	I	BIT	9
Danzman (2016)	GL	GL	1984-2014	I	BIT, BTA	16
Dixon and Haslam (2016)	AC, DC	DC	1990-2008	II	BIT, MIT	100
Lee and Johston (2016)	GL	DC	1971-2006	II	BIT, BTA	24

Reed et al. (2016)	AC	GL, AC, DC	1990-2006	I, II	BTA	36
Zeng and Lu (2016)	GL	DC	1997-2011	II	BIT, RTA	37
Agrawal et al. (2017)	GL	CD	1970-2014	II	BIT	2
Falvey and Foster-McGregor (2017)	AC	DC	1985-2011	II	BIT, BTA	40
Frenkel and Walter (2017)	GL	Gl, DC	2001-2012	I, II	BIT	20
Oh and Fratianni (2017)	AC	GL	1980-2005	II	BIT, RTA	57
Simumba (2017)	GL	DC	2007-2014	I	BIT	14
Sirr et al. (2017)	US	GL	1999-2008	II	BIT	12
Aisbett et al. (2018)	GL	DC	1980-2010	II	BIT, BTA	47
Falvey and Foster-McGregor (2018)	AC	DC	1990-2006	II	BIT, BTA	50
Brada et al. (2019)	GL	GL	2005-2009	I	BIT, RTA	26

[a] GL: Global; AC: Advanced countries; DC: Developing countries; EU: European Union; US: The United States

[b] I: FDI stock; II: FDI inflow; III: FDI inflow to GDP

[c] BIT: Bilateral investment treaty; MIT: Multilateral investment treaty; BTA: Bilateral trade agreement; RTA: Regional trade agreement

Source: Compiled by the authors.

Table 2. Descriptive statistics of the partial correlation coefficients (PCCs), t-test and Shapiro–Wilk normality test of collected estimates by international agreement type and univariate comparative analysis between four types of international agreements

	K	Mean [a]	Median [b]	S.D.	S.E.	Max.	Min.	Kurtosis	Skewness	t test [c]		Shapiro-Wilk normality test (W) [d]
All international agreements	1099	0.032	0.021	0.081	0.002	0.717	-0.676	21.170	1.058	13.306	***	0.768†††
Bilateral investment treaty	703	0.041	0.027	0.094	0.004	0.717	-0.676	17.398	0.766	11.525	***	0.772†††
Multilateral investment treaty	114	0.011	0.008	0.027	0.002	0.080	-0.037	2.962	0.627	4.487	***	0.957†††
Bilateral trade agreement	257	0.021	0.013	0.049	0.003	0.329	-0.119	8.754	1.107	7.068	***	0.937†††
Regional trade agreement	25	0.004	0.002	0.068	0.014	0.184	-0.097	4.718	1.136	0.304		0.862†††

Notes:

[a] ANOVA: F=8.000, p=0.000; Bartlett's test: χ^2= 284.229, p= 0.000

[b] Kruskal-Wallis rank-sum test: χ^2=51.823, p=0.0001

[c] ***: Null hypothesis that mean is zero is rejected at the 1% level.

[d] †††: Null hypothesis of normal distribution is rejected at the 1% level.

Source: Authors' calculation.

Table 3. Synthesis of estimates

International agreement variable type	Number of estimates (K) (1)	(a) Traditional synthesis method: Fixed-effects model (z value) [a] (2)		Random-effects model (z value) [a] (3)		Homogeneity Test [b] (4)		(b) Unrestricted weighted least squares average (UWA): UWA of all estimates [c] (t value) [a] (5)		Number of adequately powered estimates [e] (6)	WAAP (weighted average of the adequately powered tests.) (t value) [a] (7)		Median S.E. of estimates (8)	Median statistical power (9)
All international agreements	1099	0.016 (60.22)	***	0.023 (20.83)	***	15000	***	0.016 (16.23)	***	181	0.014 (9.58)	***	0.015	0.177
Bilateral investment treaty	703	0.015 (47.40)	***	0.026 (18.40)	***	11000	***	0.015 (12.06)	***	113	0.011 (7.94)	***	0.015	0.159
Multilateral investment treaty	114	0.014 (10.03)	***	0.012 (4.30)	***	410	***	0.014 (5.27)	***	0	- (-)		0.015	0.151
Bilateral trade agreement	257	0.019 (34.31)	***	0.023 (10.96)	***	2797	***	0.019 (10.38)	***	51	0.018 (5.59)	***	0.018	0.187
Regional trade agreement	25	0.020 (12.50)	***	0.005 (0.49)		1013	***	0.020 (1.92)	*	12	0.017 (2.72)	**	0.009	0.607

Notes:

[a] Null hypothesis: The synthesized effect size is zero.

[b] Null hypothesis: Effect sizes are homogeneous.

[c] Synthesis method advocated by Stanley and Doucouliagos (2015) and Stanley et al. (2017).

[d] Denotes number of estimates with statistical power of 0.80 or more which is computed with reference to the UWA of all collected estimates.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Name, definition, and descriptive statistics of meta-independent variables

Variable name	Definition	Descriptive statistics		
		Mean	Median	S.D.
Multilateral investment treaty	1 = if estimate captures the effect of multilateral investment treaty on FDI, 0 = otherwise	0.104	0	0.305
Bilateral trade agreement	1 = if estimate captures the effect of bilateral trade agreement on FDI, 0 = otherwise	0.234	0	0.423
Regional trade agreement	1 = if estimate captures the effect of regional trade agreement on FDI, 0 = otherwise	0.023	0	0.149
Cumulative number	1 = if international agreement variable represents the cumulative number of concluded agreements, 0 = otherwise	0.353	0	0.478
Ratified agreement	1 = if international agreement variable covers ratified agreements, 0 = otherwise	0.369	0	0.483
Signed agreement	1 = if international agreement variable covers signed agreements, 0 = otherwise	0.151	0	0.358
Long-term effect	1 = if estimate captures the long-term effect of international agreement on FDI, 0 = otherwise	0.009	0	0.095
Lagged variable	1 = if a lagged international agreement variable is used for estimation, 0 = otherwise	0.033	0	0.178
With an interaction term(s)	1 = if estimation is carried out with an interaction term(s) of international agreement variable, 0 = otherwise	0.144	0	0.351
Total amount	1 = if the measure of the FDI variable is the monetary value of FDI, 0 = otherwise	0.222	0	0.416
To GDP	1 = if the measure of the FDI variable is the ratio of FDI to GDP, 0 = otherwise	0.030	0	0.171
Number of home countries	Total number of FDI home countries	51.557	30	58.481
Advanced home country	1 = if target home country limited to advanced countries, 0 = otherwise	0.603	1	0.489
Developing home country	1 = if target home country limited to developing countries, 0 = otherwise	0.040	0	0.196

United States	1 = if target home country limited to the United States, 0 = otherwise	0.033	0	0.178
EU	1 = if target home country limited to the EU member countries, 0 = otherwise	0.019	0	0.137
Number of host countries	Total number of FDI host countries	72.905	65	52.219
Advanced host countries	1 = if target host country limited to advanced countries, 0 = otherwise	0.146	0	0.353
Developing host countries	1 = if target host country limited to developing countries, 0 = otherwise	0.481	0	0.500
Cross-section data	1 = if cross-section data is employed for empirical analysis, 0 = otherwise	0.138	0	0.345
Time-series data	1 = if time-series data is employed for empirical analysis, 0 = otherwise	0.031	0	0.173
First year of estimation	First year of estimation period	1988.081	1985	9.155
Length of estimation	Years of estimation period	18.735	19	9.348
Aggregate model	1 = if aggregate FDI is used for estimation, 0 = otherwise	0.167	0	0.374
Dyadic model	1 = if dyadic model is used for estimation, 0 = otherwise	0.437	0	0.496
Other models	1 = if a model other than gravity, aggregate, and dyadic models is used for estimation, 0 = otherwise	0.003	0	0.052
OLS	1 = if OLS estimator is used for estimation, 0 = otherwise	0.266	0	0.442
Control for endogeneity	1 = if endogeneity between FDI and conclusion of international agreement is controlled for, 0 = otherwise	0.055	0	0.227
Institutional condition	1 = if estimation simultaneously controls for institutional quality in the host countries, 0 = otherwise	0.134	0	0.341
Polity	1 = if estimation simultaneously controls for political conditions in the host countries, 0 = otherwise	0.279	0	0.449
Corruption	1 = if estimation simultaneously controls for the degree of corruption in the host countries, 0 = otherwise	0.044	0	0.204

Inflation	1 = if estimation simultaneously controls for inflation in the host countries, 0 = otherwise	0.146	0	0.354
Trade openness	1 = if estimation simultaneously controls for trade openness in the host countries, 0 = otherwise	0.400	0	0.490
Exchange rate	1 = if estimation simultaneously controls for exchange rate/regime between the home and host countries, 0 = otherwise	0.116	0	0.320
Cultural similarity	1 = if estimation simultaneously controls for cultural similarity between the home and host countries, 0 = otherwise	0.348	0	0.476
√Degree of freedom	Root of degree of freedom of the estimated model	87.855	65.031	73.304
Quality level	Twenty-point scale of the study's quality level [a]	10.932	15	8.120

Notes:

[a] See the Appendix 1 for more details.

Source: Authors' calculations

Table 5. Meta-regression analysis

Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Multilevel mixed-effects RML	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default option in parentheses)	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
(1) International agreement variable type (bilateral investment treaty)							
Multilateral investment treaty	-0.01976	0.05210 *	0.01598	0.00956	0.03772 ***	0.03021 **	0.04131 ***
	(0.0227)	(0.0273)	(0.0144)	(0.0141)	(0.0134)	(0.0141)	(0.0131)
Bilateral trade agreement	-0.02286	-0.03215	-0.00097	-0.00770	-0.03032 *	-0.02931 *	-0.03006 *
	(0.0155)	(0.0200)	(0.0040)	(0.0057)	(0.0178)	(0.0176)	(0.0182)
Regional trade agreement	0.01038	0.04973	0.02357	0.02808	0.05392	0.04629	0.05755
	(0.0605)	(0.0543)	(0.0389)	(0.0500)	(0.0567)	(0.0571)	(0.0578)
(2) Definition of international agreement variable (binary dummy)							
Cumulative number	-0.00378	0.00109	0.01258 *	0.00843	-0.00437	-0.00337	-0.00441
	(0.0132)	(0.0183)	(0.0073)	(0.0087)	(0.0153)	(0.0151)	(0.0156)
(3) Nature of international agreement (unspecified)							
Ratified agreement	0.01026	-0.00471	-0.00101	0.00090	-0.01834	-0.01294	-0.01907
	(0.0142)	(0.0209)	(0.0039)	(0.0056)	(0.0148)	(0.0147)	(0.0154)
Signed agreement	-0.01718	-0.02160	-0.00153	-0.00306	-0.01785	-0.01800	-0.01676
	(0.0202)	(0.0235)	(0.0044)	(0.0077)	(0.0181)	(0.0182)	(0.0190)
(4) Other characteristics of international agreement variable							
Long-term effect (unspecified)	0.00993	0.01456 **	0.04594 ***	0.03564 **	0.01290 ***	0.01358 ***	0.01234 ***
	(0.0145)	(0.0062)	(0.0121)	(0.0137)	(0.0015)	(0.0028)	(0.0014)
Lagged variable	-0.02620	-0.00554	-0.02468 *	-0.02038	-0.02970 **	-0.03153 **	-0.02574 *
	(0.0237)	(0.0211)	(0.0144)	(0.0159)	(0.0138)	(0.0159)	(0.0140)
With an interaction term(s)	-0.01542	0.00929	-0.00083	-0.00540	0.01198	0.00586	0.01511 *
	(0.0121)	(0.0111)	(0.0050)	(0.0069)	(0.0084)	(0.0088)	(0.0086)
(5) FDI variable type (log transformed)							
Total amount	0.02696	0.03588	-0.01682 **	-0.01089	0.01812	0.03737	0.02037 ***

	(0.0237)		(0.0245)		(0.0068)		(0.0108)		(0.0448)		(0.0362)		(0.0002)	
Ratio to GDP	0.00207		0.03063		-0.04493	***	-0.04243	***	-0.00145		0.02109		dropped	
	(0.0367)		(0.0595)		(0.0090)		(0.0139)		(0.0450)		(0.0402)			
(6) Number of home countries														
Number of home countries	0.00043	*	0.00017		0.00021	*	0.00031	**	0.00106	***	0.00084	***	0.00113	***
	(0.0002)		(0.0002)		(0.0001)		(0.0001)		(0.0002)		(0.0002)		(0.0001)	
(7) Target home countries (global)														
Advanced home country	0.04711		0.05038	*	0.00525		0.01815		0.07578	**	0.07586	**	0.01382	***
	(0.0321)		(0.0295)		(0.0084)		(0.0136)		(0.0346)		(0.0351)		(0.0019)	
Developing home country	0.04105		0.04515		-0.00944		0.00827		0.05825	*	0.06141	*	dropped	
	(0.0291)		(0.0277)		(0.0122)		(0.0151)		(0.0336)		(0.0326)			
United States	0.08223	*	0.05606		0.08568	***	0.10265	***	0.07004	**	0.07872	**	0.05397	***
	(0.0481)		(0.0472)		(0.0208)		(0.0281)		(0.0295)		(0.0400)		(0.0133)	
EU	0.00614		-0.11329		0.09921	***	0.09073	**	0.09014		0.03992		dropped	
	(0.0728)		(0.0985)		(0.0263)		(0.0362)		(0.0763)		(0.0757)			
(8) Number of host countries														
Number of host countries	-0.00038		-0.00082	**	0.00001		-0.00012		0.00040		-0.00017		0.00117	***
	(0.0003)		(0.0003)		(0.0001)		(0.0001)		(0.0005)		(0.0004)		(0.0003)	
(9) Target host countries (global)														
Advanced host countries	-0.01406		-0.05223	**	0.00642	*	0.00276		0.00086		-0.02299		0.03562	**
	(0.0123)		(0.0214)		(0.0033)		(0.0061)		(0.0262)		(0.0217)		(0.0175)	
Developing host countries	0.00649		0.00231		0.01610	**	0.01209		0.03508		0.00459		0.08476	***
	(0.0138)		(0.0135)		(0.0072)		(0.0079)		(0.0344)		(0.0278)		(0.0313)	
(10) Data type (Panel data)														
Cross-section data	0.06449		0.10349	*	0.01517		0.02480		0.00272		0.02102		0.00627	
	(0.0408)		(0.0523)		(0.0098)		(0.0190)		(0.0413)		(0.0414)		(0.0447)	
Time-series data	0.01348		0.02608		0.02993	**	0.02699		-0.07074	*	-0.02405		dropped	
	(0.0338)		(0.0395)		(0.0146)		(0.0184)		(0.0425)		(0.0460)			
(11) Estimation period														
First year of estimation	-0.00294	*	-0.00294		-0.00318	***	-0.00348	***	0.00060		-0.00159		0.00375	
	(0.0015)		(0.0018)		(0.0006)		(0.0010)		(0.0028)		(0.0023)		(0.0047)	

Length of estimation	-0.00044	0.00131	-0.00270 ***	-0.00205 *	0.00023	-0.00054	0.00344
	(0.0019)	(0.0020)	(0.0008)	(0.0011)	(0.0032)	(0.0027)	(0.0050)
(12) Specification type (gravity model)							
Aggregate FDI model	0.07225 *	0.07087 *	0.00771	0.01428	0.00206	0.01964	-0.00044
	(0.0361)	(0.0403)	(0.0127)	(0.0151)	(0.0108)	(0.0175)	(0.0063)
Dyadic model	-0.00367	0.00917	-0.02312 ***	-0.02397 ***	-0.00841	-0.00791	0.00314
	(0.0172)	(0.0185)	(0.0070)	(0.0079)	(0.0115)	(0.0168)	(0.0060)
Other models	0.11159 *	0.16227 **	-0.01160	0.00108	0.06175	0.10228	dropped
	(0.0566)	(0.0803)	(0.0128)	(0.0244)	(0.0607)	(0.0664)	
(13) Estimator (estimators other than OLS)							
OLS	0.01658	0.03427	0.01391	0.02242 *	-0.00383	-0.00314	-0.00069
	(0.0235)	(0.0284)	(0.0111)	(0.0130)	(0.0364)	(0.0334)	(0.0389)
(14) Control for endogeneity							
Control for endogeneity	-0.01181	0.01421	-0.00217	-0.00852	-0.00072	-0.00011	-0.00184
	(0.0120)	(0.0125)	(0.0087)	(0.0109)	(0.0102)	(0.0110)	(0.0100)
(15) Control variable							
Institutional quality	0.03833 *	0.03274 *	-0.00802	0.00453	0.00630	0.02916	-0.01708
	(0.0203)	(0.0175)	(0.0058)	(0.0120)	(0.0148)	(0.0203)	(0.0125)
Polity	-0.01399	0.00237	-0.01868 ***	-0.01823 ***	-0.01069	-0.00300	-0.02095
	(0.0120)	(0.0131)	(0.0043)	(0.0053)	(0.0249)	(0.0231)	(0.0244)
Corruption	-0.02399	-0.00020	-0.03814 **	-0.02963	-0.02780	-0.01683	-0.04108
	(0.0283)	(0.0412)	(0.0165)	(0.0181)	(0.0259)	(0.0288)	(0.0258)
Inflation	0.00662	0.00387	0.01831 **	0.02130	-0.01999	0.00153	-0.01992
	(0.0265)	(0.0293)	(0.0086)	(0.0133)	(0.0320)	(0.0346)	(0.0133)
Trade openness	-0.01360	-0.03359 *	0.00638	0.00297	-0.00928	-0.02731	0.02109
	(0.0188)	(0.0190)	(0.0075)	(0.0107)	(0.0202)	(0.0242)	(0.0130)
Exchange rate	0.00821	0.05278	-0.01852 ***	-0.01564	0.03034	0.04272	-0.03142
	(0.0419)	(0.0478)	(0.0066)	(0.0141)	(0.0454)	(0.0485)	(0.0204)
Cultural similarity	0.03932 *	0.02539	-0.00578	0.00042	0.01088	0.01883	0.00653 *
	(0.0197)	(0.0170)	(0.0069)	(0.0105)	(0.0079)	(0.0154)	(0.0038)
(16) Degree of freedom and research quality							

√ Degree of freedom	0.000103	-0.000103	0.000078	0.000093	-0.000070	-0.000034	-0.000101
	(0.00010)	(0.00010)	(0.00007)	(0.00007)	(0.00006)	(0.00008)	(0.00006)
Quality level	0.001422		-0.001534 ***	-0.001037	0.001929	0.001778	dropped
	(0.00127)		(0.00042)	(0.00066)	(0.00232)	(0.00172)	
Intercept	5.81187 *	5.85758	6.39045 ***	6.96766 ***	-1.30232	3.11570	-7.66411
	(3.0189)	(3.6357)	(1.2778)	(1.9179)	(5.6480)	(4.6998)	(9.4721)
K	1099	1099	1099	1099	1099	1099	1099
R^2	0.303	0.387	0.287	0.263	-	0.163	0.012

Notes: [a] Breusch–Pagan test: χ^2=20.43, *p*=0.0000

[b] Hausman test: χ^2=138.54, *p*=0.0000

Figures in parentheses beneath the regression coefficients are robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimation. See Table 4 for the definition and descriptive statistics of meta-independent variables.

Table 6. Univariate test of publication selection bias by international agreement variable type

	Number of estimates (K)	Under the assumption that the true effect size is zero				Under the assumption that the true effect size is the WAAP estimate (x)[a]			
		Number of estimates		Goodness-of-fit test (z)[b]		Number of estimates		Goodness-of-fit test (z)[c]	
		$PCC_k < 0$	$PCC_k > 0$			$PCC_k < x$	$PCC_k > x$		
All international agreements	1099	271	828	16.8018 (0.000)	***	732	637	5.2788 (0.000)	***
Bilateral investment treaty	703	142	561	15.8029 (0.000)	***	212	491	10.5227 (0.000)	***
Multilateral investment treaty	114	41	73	2.9971 (0.003)	***	72	42	-2.8098 (0.005)	***
Bilateral trade agreement	257	78	179	6.3002 (0.000)	***	142	115	-1.6842 (0.092)	*
Regional trade agreement	25	10	15	1.0000 (0.317)		17	8	-1.8000 (0.072)	*

Notes:

[a] For multilateral investment treaty, the UWA of all estimates is used instead of the WAAP.

[b] Null hypothesis: The ratio of the positive versus negative values is 50:50.

[c] Null hypothesis: The ratio of estimates below x versus those over x is 50:50.

Figures in parentheses are p values. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Authors' calculations.

Table 7. Meta-regression analysis of publication selection

(a) FAT-PET test (Equation: $t = \beta_0+\beta_1(1/SE)+v$)

Estimator	OLS		Cluster-robust OLS		Multi-level mixed effects RML		Cluster-robust random-effects panel GLS		Cluster-robust fixed-effects panel LSDV	
Model	[1]		[2]		[3]		[4] [a]		[5] [b]	
Intercept (FAT: H_0: $\beta_0 = 0$)	0.8828	***	0.8828	**	0.3990		0.4530		-0.0820	
	(0.135)		(0.354)		(0.611)		(0.589)		(0.807)	
$1/SE$ (PET: H_0: $\beta_1 = 0$)	0.0099	***	0.0099	**	0.0159	**	0.0149	**	0.0209	**
	(0.001)		(0.004)		(0.008)		(0.008)		(0.009)	
K	1099		1099		1099		1099		1099	
R^2	0.0380		0.0380		-		0.0380		0.0380	

(b) PEESE approach (Equation: $t = \gamma_0 SE+\gamma_1(1/SE)+v$)

Estimator	OLS		Cluster-robust OLS		Multi-level mixed effects RML		Random-effects panel ML		Population-averaged panel GEE	
Model	[6]		[7]		[8]		[9]		[10]	
SE	16.5996	***	16.5996	***	7.5368		7.5368		7.9429	
	(2.262)		(5.321)		(7.532)		(6.036)		(7.423)	
$1/SE$ (H_0: $\beta_1 = 0$)	0.0146	***	0.0146	***	0.0174	***	0.0174	***	0.0172	***
	(0.001)		(0.004)		(0.006)		(0.002)		(0.006)	
K	1099		1099		1099		1099		1099	
R^2	0.2097		0.2097		-		-		-	

Notes:

[a] Breusch-Pagan test: χ^2=1107.22, p=0.000

[b] Hausman test: χ^2=12.44, p=0.0004

Figures in parentheses beneath the regression coefficients are standard errors. Except for Model [9], robust standard errors are estimated. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8 . Summary of publication selection bias test

International agreement variable type [a]	Number of estimates (K)	Test results [a]		
		Funnel asymmetry test (FAT) (H_0: β_0=0)	Precision-effect test (PET) (H_0: β_1=0)	Precision-effect estimate with standard error (PEESE) (H_0: β_1=0) [b]
All international agreements	1099	Not rejected	Rejected	Rejected (0.0146/0.0174)
Bilateral investment treaty	703	Not rejected	Rejected	Rejected (0.0120/0.0134)
Multilateral investment treaty	114	Not rejected	Not rejected	Not rejected
Bilateral trade agreement	257	Not rejected	Rejected	Rejected (0.0188/0.0208)
Regional trade agreement	25	Rejected	Rejected	Rejected (0.0444/0.1043)

Notes:

[a] The null hypothesis is rejected when more than three of five models show a statistically significant estimate. Otherwise not rejected.

[b] Figures in parentheses are PSB-adjusted estimates. If two estimates are reported, the left and right figures denote the minimum and maximum estimate, respectively.

Source: Authors' estimation.