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Spillover versus Ownership: A Meta-Analysis of Transition Literature[†]

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Abstract: In this paper, we conduct a meta-analysis of the literature that empirically examines the microeconomic impacts of foreign direct investment (FDI) in Central and Eastern Europe and the former Soviet Union. The meta-synthesis of estimates collected from relevant studies shows that both the effect size and the statistical significance of the indirect effect of FDI, namely the productivity spillover effect, are obviously lower than those of the direct effect caused by foreign participation in company management through ownership. Moreover, the meta-regression analysis reveals that, probably due to the presence of publication selection bias, previous studies have not yet provided empirical evidence of a non-zero productivity spillover effect in the region. Further research efforts are required to capture the true effect.

JEL classification numbers: D22, F21, F23, F61, P33

Key words: foreign direct investment (FDI), technology spillover, foreign ownership, meta-analysis, publication selection bias, Central and Eastern Europe, former Soviet Union

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1. Introduction

The impact of foreign direct investment (FDI) on the transformation process toward a market economy in the post-communist states is regarded as one of the hot empirical issues in the field of "transition economics" (Turley and Luke, 2010; Myant and Drahokoupil, 2011; Roland, 2012). As suggested in **Figure 1**, it is very likely that a close relationship will emerge between the scale of FDI inflow and the progress in corporate governance reform and enterprise restructuring in Central and Eastern Europe (CEE) as well as in the former Soviet Union (FSU). Thus, economists have been and are still now paying careful attention to the impact of FDI on firm behavior and performance in these countries.

A key research area attracting interest among researchers of transition economies from this viewpoint is the "foreign ownership effect," which questions how foreign participation in company management through ownership influences production efficiency and financial performance in the relevant company. Another key area is the "productivity spillover effect," which explores how the new entry and subsequent business expansion by multinational enterprises with excellent management know-how and production technology externally affect domestic firms in the host country. Reflecting the substantial difference between the two in their respective routes to the manifestation of the FDI effects, the former is also called the "direct effect," while the latter is called the "indirect effect" (Hanousek et al., 2011).

A large number of empirical studies have repeatedly verified a positive correlation between foreign ownership and the ex-post performance of the firm across different countries and periods. As Brown et al. (2006) and many other studies have demonstrated, this positive correlation is also true in studies of transition economies. In fact, previous systematic reviews and meta-analyses in this research field strongly support such an affirmative relationship between the two (Djankov and Murrell, 2002; Iwasaki, 2007; Estrin et al., 2009). Thus, it is not an exaggeration to state that, two decades after the collapse of the Communist Bloc, there is almost nothing left to argue about the positive direct effect of FDI in the region.

In contrast, debates over the indirect effect of FDI show no sign of a convergence, although we now have a certain number of empirical studies on this topic. Hence, there is great significance in conducting a meta-analysis of the related literature. More specifically, in this paper, we attempt to clarify the achievements and limits in this study area by performing a synthesis of estimates collected from previous studies that empirically examined the indirect effect of FDI in the CEE and FSU countries, a meta-regression analysis to explore the factors that cause the heterogeneity among relevant studies, as well as a test of publication selection bias in the literature. In this regard, we notice that some of the studies subject to the meta-analysis in this paper estimate not only the indirect effect but also the direct effect. Thus, in addition to the above research objectives, we compare the estimates of the indirect effect with those of the direct effect to identify how the effect size, the statistical significance, and other aspects of the former are different from those of the latter.

Hanousek et al. (2011) is one of the rare meta-studies in transition economics, and it shares common research interests with this paper. We have a high respect for their pioneering efforts. There are, however, some substantial differences between their research work and ours. Firstly, Hanousek et al. (2011) employed 21 studies for their meta-analysis, while the meta-analysis in this paper deals with a total of 30 studies centering on relatively new studies published in the late 2000s. In addition, only nine of the studies are quoted by both papers in an overlapping manner. Secondly, when collecting empirical evidence, Hanousek et al. (2011) confined their subject studies to those that treat the firm-level heterogeneity and the sample selection bias by means of the instrumental variables (IV) method or the fixed-effects estimation method. In contrast, as explained later, this paper does not make any particular selection criteria, except for one condition that limits the studies' subject to our meta-analysis of the published manuscripts. Instead, we examine the potential influence upon estimates due to the between-study divergence in their empirical approach by meta-regression analysis (MRA). Thirdly, this paper gives considerable attention to possible publication selection bias in the literature and tries to examine this issue in accordance with the methodology advocated by Stanley and Doucouliagos (2012). From these perspectives, this paper complements Hanousek et al. (2011) to provide a full picture of the studies on transition economies that concern the microeconomic effects of FDI.

Before starting the meta-analysis, let us briefly discuss the indirect effect of FDI or, more specifically, how the productivity spillover effect may occur in multinational enterprises (MNEs) to domestic firms. According to Iwasaki et al. (2012), domestic firms in recipient countries gain positive externalities from FDI via the four main routes that follow: The first route is imitation of the management system and production of MNEs. One transmission mechanism often reported in this regard is reverse engineering. Today, industrial espionage is considered to be an extreme form of imitation. The second route is the intermediate input of goods and services supplied by MNEs, which contributes to quality improvement and cost reductions in in-house products. The third route is the feedback of marketing information and the transfer of techniques for quality control, inventory, and standardization through the provision of goods and services to MNEs. These foreign customers tend to actively encourage local suppliers in the form of sending experts to the latter, implementing joint research projects, and holding joint drills. The fourth route is the acquisition of human capital in the form of the movement of experienced managers, engineers, and other skilled workers from MNEs to domestic firms, including not only voluntary career changes but also the active recruitment and headhunting of talent by local competitors that is quite common, particularly in countries with poor markets for skilled labor. Now that the role of intangible assets and tacit knowledge is becoming increasingly important, the latter two routes have the same degree of significance as the former two in order for FDI to cause positive productivity spillovers to domestic firms.

On the other hand, researchers have unanimously asserted that FDI can also have a negative impact on domestic firms in the recipient countries, specifically through the crowding-out effect, which may surpass its positive competitive effect by breaking down ineffective, monopolized domestic markets and improving the managerial discipline of indigenous companies. This is especially true when MNEs strategically make an all-out effort to gain a significant share in the production markets of host countries with relatively closed economies, where the level of management skills and the production technology of domestic firms is significantly poorer by international standards. In this way, FDI has pros and cons for domestic firms. Thus, substantial direct capital inflows from abroad do not necessarily guarantee positive spillover effects for domestic companies.

As mentioned above, the same conclusions have not been reached in previous studies regarding the indirect impacts of FDI on the restructuring process of domestic firms, probably because, in many transition economies, former socialist enterprises experience an enormous amount of damage from fierce competition with foreign companies and, consequently, positive externalities that domestic firms gain from MNEs through the above four routes are considerably offset by the negative effects of market competition between the two. However, we can also assume that the direction and extent of the indirect effect of FDI on a net basis vary substantially depending on the target countries/regions, the industrial sectors, and the estimation periods. Accordingly, in our meta-analysis, we give attention to the mutual relationship between these study conditions and the empirical results reported in the relevant studies, in addition to identifying the magnitude and statistical significance of the indirect effect of FDI in the literature as a whole.

The remainder of this paper is structured as follows: The next section describes our methodology of literature selection and meta-analysis. Section 3 overviews selected studies for meta-analysis. Section 4 demonstrates the synthesis of collected estimates. Section 5 performs meta-regression analysis to explore the observed heterogeneity between studies. Section 6 tests publication selection bias. Section 7 summarizes the major findings and concludes the paper.

2. Methodology of Literature Selection and Meta-Analysis

In this section, we describe our methods of selecting and coding of relevant studies and for meta-analysis based on the empirical evidence collected.

In order to identify studies related to FDI in the CEE and FSU countries as a base collection, we first searched the Econ-Lit and Web of Science databases for research works that had been registered in the 24 years from 1989 to 2012 that contained a combination of two terms consisting of one from "*foreign direct investment*," "*FDI*," or "*multinational enterprise*" and another one from "*transition economies*," "*Central Europe*," "*Eastern Europe*," "*former Soviet Union*," or the respective names of each CEE and FSU country. Among about 500 studies that we found at this stage, we actually obtained more than 350 studies, or about 70%, of the total. We also searched the references in these 350 or more studies and obtained about 50 additional papers. As a result, we collected nearly 400 studies.

Next, we closely examined the contents of these approximately 400 studies and narrowed the literature list to those containing estimates that could be subjected to meta-analysis in this paper. In the next section, we report its results in detail. During this process, we decided to exclude all unpublished research works. According to Doucouliagos et al. (2012), unpublished working papers might present estimates that cannot be said to be final, and, moreover, these manuscripts are more likely to be insufficient since they had not yet gone through the peer review process. In our judgment, the same concerns can be applied also to the unpublished works obtained by us for this study, to a great extent. Another reason to exclude unpublished works is that we use the quality level of each paper that is evaluated on the basis of external indicators as a weight for a combination of statistical significance levels and as an analytical weight or a meta-independent variable for the MRA. In addition, the following facts also motivate us to take this measure: First, the number of working papers is not very large in our case. Second, these unpublished works are not heavily concentrated in recent years. The latter fact led us to decide that there is no particular concern about overlooking the latest research results due to their exclusion.

In this study, we adopt an eclectic coding rule to simultaneously mitigate the following two selection problems: One is the arbitrary-selection problem caused by data collection in which the meta-analyst selects only one estimate per study. The second is over-representation caused by data collection in which all estimates are taken from every study without any conditions. More specifically, we do not necessarily limit the selection to one estimate per study, but multiple estimations are collected if and only if we can recognize notable differences from the viewpoint of empirical methodology in at least one item of the target regions/countries, data type, regression equation, estimation period, and estimator. Hereafter, K denotes the total number of collected estimates (k=1, 2, …, K).

Next, we outline the meta-analysis to be conducted in the following sections. In this study, we employ the partial correlation coefficient (PCC) and the t value to synthesize the collected estimates. The PCC is a measure of association of a dependent variable and the independent variable in question when other variables are held constant. The PCC is calculated in the following equation:

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

where t_k and df_k denote the t value and the degree of freedom of the k-th estimate, respectively.

The standard error (SE) of r_k is given by $\sqrt{(1-r_k^2)/df_k}$.[1]

The following method is applied for synthesizing PCCs. Suppose there are K estimates. Here, the PCC of the k-th estimate is labeled as r_k, and the corresponding population and standard deviation are labeled as θ_k and S_k, respectively. We assume that $\theta_1 = \theta_2 = \ldots = \theta_K = \theta$, implying that each study in a meta-analysis estimates the common underlying population effect and that the estimates differ only by random sampling errors. An asymptotically efficient estimator of the unknown true population parameter θ is a weighted mean by the inverse variance of each estimate:

$$\bar{R} = \sum_{k=1}^{K} w_k r_k \Big/ \sum_{k=1}^{K} w_k, \quad (2)$$

where $w_k = 1/v_k$ and $v_k = s_k^2$. The variance of the synthesized partial correlation $\bar{R}$ is given by: $1/\sum_{k=1}^{K} w_k$.

This is the meta fixed-effect model. Hereafter, we denote the estimates of the meta fixed-effect model using $\overline{R_f}$. In order to utilize this method to synthesize PCCs, we need to confirm that the estimates are homogeneous. A homogeneity test uses the statistic:

$$Q_r = \sum_{k=1}^{K} w_k \left(r_k - \overline{R_f}\right)^2 \sim \chi^2(K-1), \quad (3)$$

which has a Chi-square distribution with N-1 degrees of freedom. The null hypothesis is rejected if Q_r exceeds the critical value. In this case, we assume that heterogeneity exists among the studies and adapt a random-effects model that incorporates the sampling variation due to an underlying population of 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 $v_k^u = \left(v_k + \delta_\theta^2\right)$. In the meta random-effects model, the population θ is estimated by replacing the weight w_k with the weight $w_k^u = 1/v_k^u$ in Eq. (2).[2] For the between-studies variance component, we use the method of moment estimator computed by the next equation

[1] A benefit of the PCC is that its use makes comparing and synthesizing collected estimates easier concerning independent variables of which the definitions or units differ. On the other hand, a flaw of the PCC is that its distribution is not normal when the coefficient is close to -1 and +1 (Stanley and Doucouliagos, 2012, p. 25). Fisher's z-transformation $\left(z = \frac{1}{2}\ln\left(\frac{1+r}{1-r}\right)\right)$ is the most well-known solution to this problem. As in overall economic studies, the PCC of each estimate to be used for our meta-analysis is rarely observed to be close to the upper or lower limit, and thus we used the PCC calculated in Eq. (1). Nevertheless we have confirmed that even if a z-transformed PCC is used, the results of meta-analysis in this paper are not greatly different.

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

using the value of the homogeneity test statistic Q_r obtained from Eq. (3):

$$\hat{\delta}_{\theta}^{2} = \frac{Q_r - (K-1)}{\sum_{k=1}^{K} w_k^u - \left(\sum_{k=1}^{K} w_k^{u^2} / \sum_{k-1}^{K} w_k^u\right)} . \quad (4)$$

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

Following Djankov and Murrell (2002), we combine t values using the next equation:[3]

$$\overline{T_w} = \sum_{k=1}^{K} w_k t_k \Bigg/ \sqrt{\sum_{k=1}^{K} w_k^2} \quad \sim \quad N(0,1). \quad (5)$$

Here, w_k is the weight assigned to the t value of the k-th estimate. As the weight w_k in Eq. (5), we utilize a 10-point scale to mirror the quality level of each relevant study($1 \leq w_k \leq 10$). More concretely, if the concerned study is a journal article, the quality level is determined on the basis of the economic journal's ranking and the impact factor. If it is either a book or a book chapter, the quality level is determined on the basis of the presence or absence of a peer review process and literature information, such as the publisher.[4] Moreover, we report not only the combined t value $\overline{T_w}$ weighted by the quality level of the study, but also the unweighted combined t value $\overline{T_u}$ that is obtained according to the following equation:

$$\overline{T_u} = \sum_{k=1}^{K} t_k \Big/ \sqrt{K} \sim N(0,1). \quad (6)$$

By comparing these weighted and unweighted combined t values, we examine the relationship between the quality level and the level of statistical significance reported by each study.

As a supplemental statistic for evaluating the reliability of the above-mentioned combined t value, we also report Rosenthal's fail-safe N (*fsN*) as computed by the next formula:

$$fsN\ (p = 0.05) = \left(\frac{\sum_{k=1}^{K} t_k}{1.645}\right)^2 - K. \quad (7)^5$$

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[3] Iwasaki (2007) and Wooster and Diebel (2010) also adopt this combination method of the t value.

[4] For more details on the evaluation method of the quality level, see Appendix of this paper.

[5] Rosenthal's fail-safe N denotes the number of studies when the average effect size, which needs to be added in order to bring the combined probability level of the entire studies to the standard significance level to determine the presence or absence of effect, becomes equal to zero. The larger value of *fsN* in Eq. (7) denotes the more reliable estimation of the combined t value. For

Following the synthesis of collected estimates, we conduct MRA to explore the factors causing heterogeneity between selected studies. To this end, we estimate the meta-regression model:

$$y_k = \beta_0 + \sum_{n=1}^{N} \beta_n x_{kn} + e_k\,, \quad k = 1, 2, \cdots, K, \quad (8)$$

where y_k is the PCC or the t value of the k-th estimate; x_{kn} denotes a meta-independent variable that captures relevant characteristics of an empirical study and explains its systematic variation from other empirical results in the literature; β_n denotes the meta-regression coefficient to be estimated; and e_k is the meta-regression disturbance term (Stanley and Jarrell, 2005).

When selecting an estimator for meta-regression models, we should pay most attention to heterogeneity among selected studies. It is especially true for our case where multiple estimates are to be collected from one study. Therefore, we perform MRA using the following 6 estimators: the cluster-robust ordinary least squares (OLS) estimator that clusters the collected estimates by study and computes robust standard errors; the cluster-robust weighted least squares (WLS) estimator that uses either the above-mentioned quality level of the study, the number of observations, or the inverse of the standard error (1/*SE*) as an analytical weight; the multilevel mixed effects restricted maximum likelihood (RML) estimator; and the unbalanced panel estimator.[6] In this way, we check the statistical robustness of coefficient β_n.

Testing for publication selection bias is an important issue on par with the synthesis of estimates and meta-regression of between-study heterogeneity. In this paper, we examine this problem by using the funnel plot and the Galbraith plot as well as by estimating the meta-regression model that is designed especially for this purpose.

The funnel plot is a scatter plot with the effect size (in the case of this paper, the PCC) on the horizontal axis and the precision of the estimate (in this case, 1/SE) on the vertical axis. In the absence of publication selection, effect sizes reported by independent studies vary

more details, see Mullen (1989) and Stanley and Doucouliagos (2012).

[6] This refers to the random-effects and fixed-effects estimators. The unbalanced panel estimator is selected on the basis of the Hausman test of the random-effects assumption. We also report the result of the Breusch-Pagan test to test the null hypothesis that the variance of the individual effects is zero in order to question whether the panel estimation itself is appropriate. We set the critical value for both of these model specification tests at a 10% level of significance.

randomly and symmetrically around the true effect. Moreover, according to the statistical theory, the dispersion of effect sizes is negatively correlated with the precision of the estimate. Therefore, the shape of the plot must look like an inverted funnel. This means that if the funnel plot is not bilaterally symmetrical but is deflected to one side, then it is suspected that there is an arbitrary manipulation in the study area in question in the sense that estimates in favor of a specific conclusion (i.e., estimates with an expected sign) are more frequently published (type I publication selection bias).

Meanwhile, the Galbraith plot is a scatter plot with the precision of the estimate (in the case of this paper, 1/SE) on the horizontal axis and the statistical significance (in this case, the t value) on the vertical axis. We use this plot for testing another arbitrary manipulation in the sense that estimates with higher statistical significance are more frequently published, irrespective of their sign (type II publication selection bias). In general, the statistic, $|(\text{the } k - \text{th estimation} - \text{the true effect})/SE_k|$, should not exceed the critical value of ±1.96 by more than 5% of the total estimates. In other words, when the true effect does not exist and there is no publication selection, the reported t values should vary randomly around zero, and 95% of them should be within the range of ±1.96. The Galbraith plot tests whether the above relationship can be observed in the statistical significance of the collected estimates, and thereby identifies the presence of type II publication selection bias. In addition, for the above reasons, the Galbraith plot is also used as a tool to test the presence of a non-zero effect.[7]

In addition to the two scatter plots, we also report estimates of the meta-regression models, which are developed to examine the two types of publication selection bias and the presence of the true effect in a more rigorous manner.

We can test for type I publication selection bias by regressing the t value of the k-th estimate on the inverse of the standard error (1/SE) using the following equation:

$$t_k = \beta_0 + \beta_1(1/SE_k) + v_k, \quad (9)$$

and thereby testing the null hypothesis that the intercept term β_0 is equal to zero.[8] In Eq. (9), v_k

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[7] For more details, see Stanley (2005) and Stanley and Doucouliagos (2009).

[8] Eq. (9) is an alternative model to the following meta-regression model that takes the effect size as the dependent variable and the standard error as the independent variable:

$$\text{effect size}_k = \beta_0 SE_k + \beta_1 + \varepsilon_k. \quad (9b)$$

More specifically, Eq. (9) is obtained by dividing both sides of the above equation by the is the error term. When the intercept term β_0 is statistically significantly different from zero, we can interpret that the distribution of the effect sizes is asymmetric. For this reason, this test is called the funnel-asymmetry test (FAT). Meanwhile, type II publication selection bias can be tested by estimating the next equation, where the left side of Eq. (9) is replaced with the absolute *t* value:

$$|t_k| = \beta_0 + \beta_1(1/SE_k) + v_k \quad (10)$$

thereby testing the null hypothesis of $\beta_0 = 0$ in the same way as the FAT.

Even if there is a publication selection bias, a genuine effect may exist in the available empirical evidence. Stanley and Doucouliagos (2012) propose examining this possibility by testing the null hypothesis that the coefficient β_1 is equal to zero in Eq. (9). The rejection of the null hypothesis implies the presence of a genuine effect. They call this test the precision-effect test (PET). Moreover, they also state that an estimate of the publication-bias-adjusted effect size can be obtained by estimating the following equation that has no intercept:

$$t_k = \beta_0 SE_k + \beta_1(1/SE_k) + v_k, \quad (11)$$

thereby obtaining the coefficient β_1. This means that if the null hypothesis of $\beta_1 = 0$ is rejected, then the non-zero effect does actually exist in the literature, and that the coefficient β_1 can be regarded as its estimate. Stanley and Doucouliagos (2012) call this procedure the precision-effect estimate with standard error (PEESE) approach.[9] To test the robustness of the regression coefficient, we estimate Eq. (9) to (11) above using not only the OLS estimator, but also the cluster-robust OLS estimator and the unbalanced panel estimator, [10] both of which

standard error. The error term ε_k in Eq. (9b) does not often satisfy the assumption of being i.i.d. (independent and identically distributed). In contrast, the error term in Eq. (9), $v_k = \varepsilon_k/SE_k$, is normally distributed, and thus it can be estimated by OLS. Type I publication selection bias can also be detected by estimating Eq. (9b) using the WLS estimator with the inverse of the squared standard error $(1/SE_k^2)$ as the analytical weight and, thereby, testing the null hypothesis of $\beta_0 = 0$ (Stanley, 2008; Stanley and Doucouliagos, 2012, pp. 60–61).

9 You can see that the coefficient β_1 in Eq. (11) may become the estimate of the publication-bias-adjusted effect size in light of the fact that the following equation is obtained when both sides of Eq. (11) are multiplied by the standard error:

$$\text{Effect size}_k = \beta_0 SE_k^2 + \beta_1 + \varepsilon_k. \quad (11b)$$

When directly estimating Eq. (11b), the WLS method, with $1/SE_k^2$ as the analytical weight, is used (Stanley and Doucouliagos, 2012, pp. 65–67).

10 To estimate Eqs. (9) and (10), we use either the random-effects estimator or the fixed-effects estimator according to the results of the Hausman test of the random-effects assumption. With

treat possible heterogeneity among the studies.

To sum up, for testing publication selection bias and the presence of a genuine empirical effect, we take the following four steps: First, we test the type I publication selection bias by estimating Eq. (9) to examine the FAT and the type II publication selection bias by estimating Eq. (10). Second, regardless of the outcome from the tests of publication selection bias, we conduct PET to test the existence of a genuine effect in the collected estimates beyond possible contamination from publication bias. Third, in cases where the null hypothesis of the PET is rejected, we obtain an estimate of β_1 in Eq. (11) using the PEESE approach. Finally, if β_1 in Eq. (11) is statistically significantly different from zero, we report β_1 as the estimate of the publication-selection-bias-adjusted effect size. In cases where the null hypothesis of PET is accepted, we judge that the literature in question fails to provide sufficient evidence to capture the genuine effect.[11]

3. Overview of Selected Studies for Meta-Analysis

As mentioned in the Introduction, we selected a total of 30 studies that contain estimates suitable for meta-analysis in this paper in accordance with the method of literature selection described in the previous section. **Table 1** shows an outline of these studies. In this research field, Djankov and Hoekman (2000) is a pioneering study. Using a dataset of 513 listed companies on the Prague Stock Exchange, they empirically examined both the direct and indirect effects of FDI in the Czech Republic during the early 1990s. Since its publication, several empirical works have been published almost every year, with Iwasaki et al. (2012) being the latest one published in December, 2012.

The accumulation of these studies has not resulted in the broadening of the target countries. In fact, as **Table 1** shows, their composition is strongly biased toward EU member countries, and the non-EU country studies limited only to Yudaeva et al. (2003), Sabirianova et

regard to Eq. (11), which does not have an intercept term, we report the random-effects model estimated by the maximum likelihood method.

[11] As mentioned above, we basically followed the FAT-PET-PEESE approach advocated by Stanley and Doucouliagos (2012, pp. 78–79) as the test procedures for publication selection. However, we also included the test of type II publication selection bias using Eq. (10) as our first step as this kind of bias is very likely in the literature regarding FDI in transition economies.

al. (2005), and Tytell and Yudaeva (2007), which deal with Russia and/or Ukraine. No single study has ever covered the other FSU states as well as non-EU member countries in CEE. Meanwhile, among the EU member countries, Estonia and Hungary are each treated by nine studies. Following these two countries, Poland is treated by eight studies, Romania by seven studies, and the Czech Republic by six studies.

Looking at the breakdown by the target industries, 23 out of the 30 studies investigate the mining and manufacturing industry, while seven studies cover a broad range of industries. Furthermore, five studies touch not only on the manufacturing industry, but also on the service industry. The manufacturing industry is attracting the greatest interest among economists involved in studies on international technology transfer. **Table 1** indicates that researchers of transition economies follow this tradition.

Empirical analysis in the above 30 studies covers the 14 years from 1992 to 2005 as a whole. The average estimation period of collected estimates concerning the indirect effect of FDI is 5.4 years (median: 5; standard deviation: 1.9).[12] Only five studies, more specifically, Pawlik (2006), Muraközy (2007), Békés et al. (2009), Görg et al. (2009), and Vahter (2011), have conducted empirical analysis in which the estimation period exceeds 10 years. All 30 studies utilized panel data, and only Tytell and Yudaeva (2007) concurrently reported estimates based on cross-sectional data.

As reported in **Table 1**, these preceding studies adopted a total of seven types of indices as the firm performance variable to be introduced in the left-hand side of their respective regression models. Among the collected estimates with regard to the indirect effect of FDI, estimates of the effect on the total factor productivity (TFP) account for 35.5%, followed by the sales revenue accounting for 18.2%, and the labor productivity for 12.2%. The production volume, the value added, and the export market entry record account for slightly less than 10% each. The remaining price-cost margin accounts for 2.9%.[13]

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[12] As for the direct effect of FDI, the average estimation period of collected estimates is 4.8 years (median: 4; standard deviation 2.4).

[13] Meanwhile, with regard to the estimates concerning the direct effect of FDI, estimates that examined the effect on production volume account for the largest share of 24.4%, followed by value added for 23.0%, TFP for 20.0%, labor productivity for 14.8%, and sales revenue for 11.9%. The remaining 5.9% is accounted for by the estimates of the effect on export market entry.

The most important factor in this research field is how to design the FDI variable to be introduced in the right-hand side of the regression equation for measuring the indirect effect. The basic empirical strategy for this sort of analysis is to test the correlation between the performance of a domestic firm and the market presence of firms with foreign ownership surrounding this firm. In this regard, researchers have come to a consensus that the market share of foreign firms should be the proxy for the latter when the former is represented by the above-mentioned firm performance variable. However, just as in the case of determining what is to be adopted as the firm performance variable, the decision as to what kind of index should be used to measure the market share of foreign firms largely depends on the discretion of the individual researchers based on their data constraints. Actually, the preceding studies listed in **Table 1** use a total of eight benchmark indices to represent the market share of foreign firms. In this connection, it is noteworthy that only five out of the 30 studies simultaneously adopted different indices to estimate the indirect effect, and, accordingly, it seems that researchers of transition economies place less emphasis on the statistical robustness of their estimates from the viewpoint of the differences in the benchmark indices of the FDI variable. However, according to Iwasaki et al. (2012), which employed five different indices in order to examine the relationship between the difference in FDI variable types and the estimation results, the selection of the benchmark index is one of the causes that substantially affect the estimates. Therefore, we will test this issue through our meta-analysis.

Another issue to be considered in terms of the design of the FDI variable for estimating the indirect effect concerns how to capture its range and scope. The indirect effect of FDI can be divided into the following types: (1) the "horizontal effect" that spills over from foreign firms operating in an identical industry; and (2) the "vertical effect" that comes from foreign firms in any other industrial sector(s) through the supplier-client relationship. The latter can be further divided into the following two sub-types: (2a) the "vertical forward effect" that takes place from upstream industries; and (2b) the "vertical backward effect" that emerges from downstream industries. Therefore, in order to empirically detect these three types of indirect effect of FDI via different spillover routes, it is necessary to measure the market presence of foreign firms in each of the horizontal, upstream, and the downstream industries. To this end, almost all researchers utilize the following calculation method: Suppose the *i*-th domestic firm belongs to industrial sector *P*. Then the market presence of foreign firms for the i-th domestic firm in sector *P* can be computed by the following equation:

$$Horizontal\ FDI_i = \frac{\sum_{p \text{ for all } p \in P} x_p \cdot FS_p - x_i \cdot FS_i}{\sum_{p \text{ for all } p \in P} x_p - x_i}, \qquad (12)$$

where x denotes the business scale at the firm level and FS stands for the foreign ownership share. As Eq. (12) shows, if the i-th domestic firm is operating as a foreign joint-venture company, the business scale of the firm weighted by its foreign ownership share is subtracted from the numerator on the right-hand side.

In this regard, it is important to notice that the definition of foreign firms operating in "an identical industry," which the i-th domestic firm belongs to, varies depending on the study. In other words, there is a large gap among studies in the scope of the industrial sector to which Eq. (12) is to be applied. Actually, among the 30 studies listed in **Table 1**, many of them adopt the two-digit NACE classification as the boundary of the horizontal industry, but some studies extend the scope to the one-digit classification, while quite a few others narrow the scope to the three-digit or even the four-digit classification. Furthermore, four studies pay attention to the potential relationship between the geographical constraints and the likeliness of the indirect effect to emerge and conduct empirical analyses in which the scope of aggregation is confined to regional markets where the subject firms are located. Moreover, Iwasaki et al. (2011; 2012) gave attention to the multi-layered structure of the NACE classification and proposed to estimate a set of the FDI variables that have a nested structure in response to the depth of the industry classification, aiming to identify the horizontal effect by the industrial sector, each of which has a different level of aggregation. As a result, they detected a horizontal spillover effect that cannot be captured by the conventional model that has a single horizontal variable. We will examine whether or not the above differences in the horizontal FDI variable types affect the collected estimates in the course of MRA.

The market presence of foreign firms in upstream industries can be computed using the following equation, in which the market presence of foreign firms in each upstream industrial sector is weighted by the relevant upstream industrial sector share as a percentage of the total input into sector *P*:

$$Forward\ FDI_i = \sum_{Q \text{ if } Q \neq P} \alpha_{QP} \cdot \left[\frac{\sum_{q \text{ for all } q \in Q} x_q \cdot FS_q}{\sum_{q \text{ for all } q \in Q} x_q} \right], \quad (13)$$

where α_{QP} denotes the proportion of sector Q in the total input into sector P. In the same way, the market presence of foreign firms in downstream industries can be obtained by the following equation, in which the market presence of foreign firms in each downstream industrial sector is weighted by the relevant downstream industrial sector share as a percentage of the total input from sector P:

$$Backward\ FDI_i = \sum_{R \text{ if } R \neq P} \alpha_{RP} \cdot \left[\frac{\sum_{r \text{ for all } r \in R} x_r \cdot FS_r}{\sum_{r \text{ for all } r \in R} x_r} \right], \quad (14)$$

where α_{RP} denotes the proportion of sector R in the total input from sector P.

As explained above, the empirical test of the vertical effect of FDI requires both a firm-level dataset that covers a broad range of industries and a detailed input-output table. This is the reason why many researchers limit the scope of their empirical analysis to the horizontal effect. In fact, as shown in **Table 1**, while all 30 of the studies examine the horizontal effect, only 12 look at the vertical effect as well.

From the 30 studies outlined above, we collected a total of 625 estimates of the indirect effect of FDI (20.8 per study, on average). They consist of 444 estimates of the horizontal effect, 64 of the vertical forward effect, and 117 of the vertical backward effect. In addition, as stated in the Introduction, we also collected 135 estimates of the direct effect of FDI from 14 studies (9.6 per relevant study, on average) to compare the empirical results on the indirect effect of FDI with those in terms of the direct effect. The breakdown of the collected estimates of the direct effect is shown in the right column of **Table 1**.[14]

With regard to the estimation results on the direct effect, ten of 14 studies reported a statistically significant and positive effect, revealing strong support for the foreign ownership effect. In contrast, the empirical evidence is rather mixed with respect to the indirect effect. Indeed, concerning the horizontal effect, only seven of 30 studies reported a significant and positive effect, while four studies showed a significant and negative effect. The remaining 19

[14] Interaction terms with an FDI variable are not included at all in the collected estimates because they do not indicate any pure effect of the FDI itself. However, in the course of MRA, we examined how the simultaneous estimation with an interaction term(s) affects the estimates of the FDI variable.

studies either detected no significant effect or concluded that their estimates were not statistically robust. Regarding the vertical effect, Yudaeva et al. (2003) presented significant and negative estimates in terms of both the forward effect and the backward effect, while five studies reported significant and positive estimates of the backward effect. In the following sections, we will further scrutinize the disparities in the estimates and their causes using meta-analytic techniques.

4. Synthesis of Estimates

Figure 2 illustrates a frequency distribution of the PCC of the 625 estimates of the indirect effect of FDI collected from the 30 studies listed in **Table 1** and the corresponding frequency distribution by effect type. As Panel (a) of this figure shows, the PCC has a sharp distribution with the mode of -0.005, and 74.2% (464 estimates) of the total concentrate in the range of -0.02 to 0.02. Therefore, the goodness-of-fit test for a normal distribution rejects the null hypothesis at the 1% level of statistical significance (χ^2=443.440, p=0.000). All the estimates stay in a range between -0.12 and 0.11; hence, according to Cohen's (1988) guidelines, no estimates report a "medium" or "large" effect ($0.3<|r|$), and only three manage to report a "small" effect ($0.1\leq|r|\leq0.3$) at best in terms of the indirect impact of FDI on the performance of domestic firms. Accordingly, we can say that almost none of the studies have succeeded in detecting any remarkable indirect effect of FDI in transition economies.[15] As Panel (b) of **Figure 2** indicates, this finding holds true even when evaluation is limited to the horizontal effect. With regard to the vertical effect, as Panels (c) and (d) of the same table show, the forward effect shows a negatively skewed distribution, while the backward effect has a

[15] Doucouliagos (2011) argues, in this regard, that Cohen's guidelines for zero-order correlations are too restrictive when applied to economics and proposes to use the 25th percentile, 50th percentile (median), and 75th percentile of a total of 22141 PCCs collected by himself as alternative criteria. According to his new guidelines, for general purposes, 0.070, 0.173, and 0.327 are considered to be the lower threshold for small, medium, and large effects, respectively. In addition, Doucouliagos (2011) also presents field-specific guidelines, in which 0.024, 0.154, and 0.245 are recommended for use as corresponding criteria for the FDI spillover effect. Although his new guidelines give more positive evaluation to the estimates we have collected than those in accordance with Cohen's, our conclusion still holds that, as a whole, studies on transition economies report a very small indirect effect of FDI.

distribution with a long tail in the positive direction. Nevertheless, no matter which type it is, the fact remains that the vertical FDI also has a weak correlation with the firm performance of domestic companies.

Figure 3 shows a frequency distribution of the *t* value of the above 625 estimates and the corresponding frequency distribution by effect type. Panel (a) of the table draws a sharp distribution with long tails in both the positive and negative directions with the mode of -0.50. As in the case of the PCC, the goodness-of-fit test strongly rejects the null hypothesis again (χ^2=95313273.055, p=0.000). There are 193 estimates in which the *t* value is equal to or exceeds the threshold of 2.0 in terms of the absolute value, indicating that 30.9% of the regression estimations performed in the preceding studies demonstrate a statistically significant indirect effect of FDI in the general sense. According to Panels (b) through (d) of **Figure 3**, the corresponding rates for the horizontal effect, the vertical forward effect, and the vertical backward effect are 29.7% (132 of the 444 estimates), 20.3% (13 of 64), and 41.0% (48 of 117), respectively. In other words, the probability of the vertical backward effect being detected with a statistical significance at the 5% level exceeds not only that of the vertical forward effect (test for equality of proportions: z=2.819, p=0.005), but also that of the horizontal effect (z=2.329, p=0.020). This result endorses the statement by Javorcik and Spatareanu (2005; 2008), who underlined the role of MNEs as clients of domestic firms in that they function as an important route for the transfer of technology from advanced nations to post-communist countries, focusing on the Czech Republic and Romania.

With respect to the estimates of the direct effect of FDI, as shown in **Figure 4**, the PCC and *t* value are also concentrated in a range between 0.00 and 0.02 and a range between -2.0 and 2.0, respectively, showing a tendency similar to that of the indirect effect. However, both Panels (a) and (b) in this figure show an extremely skewed distribution with a very long tail in the positive direction, which is substantially different from those of the indirect effect. According to Cohen's (1988) guidelines, 20.0% of the collected estimates, or more specifically 27 out of the 135 estimates, indicate a significantly positive and small or more direct effect of FDI ($0.1<r$; $2.0\leq t$). This result contrasts sharply with that of the indirect effect, where only one estimate shows a small positive effect with a statistical significance at the 5% level, demonstrating the greater difficulty in empirically verifying the indirect effect than the direct

effect.

Figures 5 and **6** illustrate the chronological order of the PCC and the *t* value of the estimates of the indirect effect of FDI, respectively. As indicated in Panel (a) of **Figure 5**, the PCC of all the estimates shows an upward trend along with the average year of estimation period. The approximate straight line drawn in the figure shows that, when there is a one-year extension of the average estimation period, the PCC increases by 0.001. According to Panels (b) and (d) of the same figure, this trend can be observed in the horizontal effect, while the vertical backward effect instead shows a downward trend. Meanwhile, **Figure 6** shows that only the estimates of the vertical forward effect indicate an upward time trend from the viewpoint of statistical significance. More precisely, when the average estimation period extends by one year, the *t* value of the vertical forward effect improves by 0.24. These complex relationships between the estimation period and the magnitude or statistical significance of the indirect effect are difficult to interpret. It is possible that the empirical evidence regarding the indirect effect is strongly affected by uncontrolled factors in the simple regression models drawn in these figures.

As seen in **Figure 7**, in the case of the direct effect, both the PCC and the *t* value show a clear downward trend in chronological order. This result may suggest that the performance gaps between domestic and foreign-owned firms gradually dissolve in tandem with progress toward a market economy. In fact, the approximate straight lines in this figure indicate that, when the average year of estimation period extends by one year, the PCC and the *t* value decline by 0.01 and 0.41, respectively. However, it is likely that the downward trends revealed in **Figure 7** might have been caused by factors other than the estimation period, as in the case of the indirect effect. We examine this issue by MRA in the next section.

Table 2 provides a synthesis of the collected estimates. The overall synthesis results are reported on the top line. **Table 2** also shows results focusing on the differences in the target countries/industries, the firm performance variable, and the type of FDI variable as well as the testing effects in light of the discussion in the previous section. As shown in Column (a) of the table, which reports the synthesis results of the PCC, the homogeneity test rejects the null hypothesis in every case, and, hence, we adopt the synthesized effect size $\overline{R_r}$ of the random-effects model as the reference value. According to this column, the synthesized PCC of all the estimates of the indirect effect is 0.002 and statistically significant at the 1% level, suggesting that the empirical analyses conducted in the 30 studies listed in **Table 1** have found a weak but significant and positive indirect effect of FDI in transition economies as a whole. However, similar evaluations do not hold true when studies subject to the meta-synthesis are limited to the following cases: studies on Russia or Ukraine; studies on the service industry; studies in which either the sales revenue, the production volume, or the TFP is adopted as the benchmark index for the firm performance variable; and studies in which either the company's equity/assets, the sales revenue, or the production volume is used as the benchmark index for the FDI variable. Moreover, while the horizontal effect and the vertical backward effect show a significant and positive synthesized effect size, the same value of the vertical forward effect is negative at the 5% significance level. In summation, the above findings strongly suggest that the empirical results of the indirect effect of FDI in transition economies greatly vary, depending on the study conditions, the estimation methods, and the effect type tested.

Column (b) of **Table 2** reports the combined *t* value. Here, we can confirm that the unconditionally combined *t* value $\overline{T_u}$ is significant at the 5% or less level in all cases except for the studies on the service industry and the studies in which the company's equity or assets is adopted as the benchmark index for the FDI variable. In contrast, the combined *t* value $\overline{T_w}$ that is weighted according to the quality level of the study is not only substantially lower than the unconditionally combined *t* value $\overline{T_u}$, but also below the 10% significance level except for only four cases. This result implies that there may be a strongly negative correlation between the statistical significance of the estimates and the study quality.

At the bottom of **Table 2**, the meta-synthesis results of the estimates regarding the direct effect of FDI are reported. The synthesized effect size $\overline{R_r}$ is 0.048 and 24 times as large as the corresponding synthesized value of the indirect effect (0.002). In terms of both the combined *t* value and the fail-safe N (*fsN*), the direct effect is also far superior to the indirect effect. These results repeatedly emphasize that the indirect effect is smaller and more difficult to empirically detect as compared to the direct effect.

5. Meta-Regression Analysis of Heterogeneity among Studies

As pointed out in the previous section, there are remarkable differences in the estimates of the indirect effect of FDI among the studies listed in **Table 1**, and these differences may be attributable to various study conditions. Aiming to explore this issue more rigidly, in this section, we estimate a meta-regression model designed to simultaneously control factors that may cause heterogeneity among the preceding studies. We introduce the PCC or the *t* value into the left-hand side of the regression equation defined in Eq. (8), while in its right-hand side, we adopt a total of 63 meta-independent variables. **Table 3** lists their names, definitions, and descriptive statistics. As this table shows, in the course of MRA, we take into consideration not only the differences in the target countries/industries, the estimation period, the benchmark index of the firm performance variable, the type of FDI variable, and the effect type tested that we mentioned in the previous section, but also the differences in the type of data used for estimation, basic information sources, the scope of domestic firms to be analyzed, equation types, control variables that may strongly influence the estimation results, estimators, the aggregation level of FDI variables (namely the market share of foreign firms), the scope of foreign firms to be covered by the FDI variables, and other characteristics of FDI variables as well as the degree of freedom and the quality level of the study.

Table 4 reports the estimation results. With regard to unbalanced panel regression models [6] and [12], the null hypothesis is not rejected by the Hausman test in both cases, and, hence, we report the random-effects models. At the same time, however, the Breusch-Pagan test accepts the null hypothesis that the variance of the individual effects is zero. Therefore, the estimation results of the random-effects model are rarely different from those of the OLS model. The WLS models are sensitive to the choice of analytical weights. Nevertheless, many variables are significantly estimated uniformly. The coefficient of determination (R^2), which indicates the explanatory power of an entire model, ranges from 0.268 (Models [7] and [12]) to 0.598 (Model [9]). This level is higher than that of the meta-regression models estimated by Hanousek et al. (2011).[16]

[16] In their MRA, Hanousek et al. (2011) regressed the *t* value of a total of 933 estimates of the FDI spillover effect onto a series of meta-independent variables, and, as a result, in Table 5 (p. 318), they reported four models in which the adjusted coefficient of determination is within the range

From **Table 4**, we can confirm the following relationships between the estimates of the indirect effects of FDI and the methodological differences among studies: First, if other conditions are the same, the difference in the target countries does not significantly affect the estimation results, except for one possibility that, as Panel (b) of the table shows, studies on Russia may lead to lower statistical significance of the estimates than those concerning other countries. In contrast, the difference in the target industries is one cause that greatly influences the empirical evaluation of the indirect effect. Actually, as Panel (a) of **Table 4** indicates, the size of the indirect effect expressed in the PCC is smaller, on average, in studies on the mining and manufacturing industry and those on the service industry by around 0.020 and 0.025, respectively, in comparison with studies covering a broad range of industrial sectors. In addition, according to Panel (b) of the same table, the *t* value of the FDI variable is lower in studies on the service industry by a range of 2.5 to 3.4 on average than in studies on all the industries and those on the mining and manufacturing industry. Although it is a fact that most FDI designated for the CEE and FSU region has been invested into the mining and manufacturing industry, excessive emphasis on this industrial sector as a target for study of the productivity spillover effect is not desirable for grasping the overall role of MNEs operating in transition economies.

Second, the differences in the estimation period and the data type (i.e., panel versus cross-section) do not cause a noteworthy difference in the collected estimates, but the difference in basic information sources of the data affects them to a great extent. In fact, as Panel (a) of **Table 4** shows, the use of commercial databases and original enterprise survey results is obviously more disadvantageous as compared to the use of official statistics to detect the remarkable indirect effect of FDI on the real world. In addition, Panel (b) of the same table indicates that empirical analyses based on commercial databases are also inferior to those utilizing official statistics in terms of the statistical significance of the estimates. The most important factor causing these differences in the estimates may be the overwhelming volume of information in official statistics. The official statistics are usually produced from census

of 0.105 to 0.135. Although not specifically explained in Hanousek et al. (2011), we suppose that they estimated their meta-regression models by OLS and, thus, they might not have given special attention to the possible heterogeneity between studies.

data and, thus, contain a huge amount of observations. It is easy to imagine that this superiority of official statistics is of great utility to capture the market share of foreign firms more accurately and to estimate the parameter of the FDI variable with higher precision as compared with commercial databases and the results of original enterprise surveys.

Third, among elements that determine the basic structure of the regression model, including the scope of the firms subject to the analysis, equation type, and control variables as well as estimators, the difference in equation types is a particularly influential factor in explaining the heterogeneity between studies in terms of both the effect size and the statistical significance of the estimates. More specifically, studies that adopt the difference model or the translog model have a strong tendency to present more conservative results on the indirect effect of FDI as compared to studies that use other type of regression model. Moreover, based on Panel (a) of **Table 4**, it is possible to state that the control of time fixed effects, the use of the GLS estimator, and the treatment of endogeneity by the instrumental variables (IV) method are also important factors in explaining the differences among studies.

Fourth, the design and selection of the firm performance variables and the FDI variables also bring about a decisive impact on the estimates of the indirect effect. More specifically, as compared to studies that adopt value added and export market entry records as the proxy for the firm performance of domestic firms, studies that use other indices tend to present a more negative evaluation of the role of FDI in the transfer of technology; it is especially true when the firm performance variables are measured based on TFP.[17] Furthermore, the estimates of the meta-independent variables related to the FDI variable suggest that the choice of the benchmark index, the industrial and geographical aggregation level, and the scope of foreign firms to compute the FDI variables are also factors that cause heterogeneity between studies. However, it is also a fact that there is a large disparity in the combination of statistically robust meta-independent variables between the PCC and the *t* value.

Fifth, when controlling a series of factors that show a significant estimate in our MRA,

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[17] In this regard, our supplemental regression confirmed that there is no noteworthy difference found between studies that estimate the TFP by the OLS method and those that use the semi-parametric method first contrived by Olley and Pakes (1996) and then further developed by Levinsohn and Petrin (2003) to measure TFP, taking into consideration possible endogeneity between factor inputs and productivity.

the difference in the route of the technology transfer from MNEs to domestic firms does not greatly affect the empirical evaluation on the indirect effect of FDI in the existing literature. Indeed, the two kinds of meta-independent variables that capture the estimates of the vertical effect by 1 are insignificant both in Panels (a) and (b) of **Table 4**. This result shows a clear contrast with the result of the MRA conducted by Hanousek et al. (2011), according to which, as compared with the horizontal effect, the *t* value of the vertical forward effect is lower at the 1% significance level, while that of the vertical backward effect is higher at the 1% significance level. This interesting finding may infer that the further accumulation of research works concerning the FDI spillover effect throughout the latter half of the 2000s has resulted in great changes in empirical evaluations of the indirect effect. It is also possible that the discrepancy in the composition of the selected studies for meta-analysis and/or the methodological gap in MRA leads to the contradictory conclusions between the two papers. It is difficult to make a definitive judgment on this point at this stage, and, hence, we must leave the decision up to a future meta-study that will embrace similar studies to be published in the future.

Sixth, the result of our MRA reveals that the degree of freedom and the quality level of the study are not closely related to the observed heterogeneity in the literature. We conjecture that because all 30 studies listed in **Table 1** use a large sample far exceeding 300 observations (27,466 per estimate, on average), the sample constraints are not a serious matter in this study area and do not cause the low explanatory power of the degree of freedom. Meanwhile, the divergence in the study quality may be sufficiently explained by the factors represented by other meta-independent variables, and, thus, the quality gap measured by external standards consisting of the journal rankings and the presence of a peer-review system is no longer an important factor in causing the between-study heterogeneity.

Table 5 provides an estimation of the meta-regression model that takes the PCC or the *t* value of the estimates of the direct effect of FDI as a dependent variable. This table suggests that, as opposed to the above findings with respect to the indirect effect, the choice of target countries, the use of cross-section data, the control for the market competition and industry fixed effects, and the simultaneous estimation of the interacted terms substantially affect the estimates of the direct effect. Meanwhile, the variation in information sources of the data and in the estimators cause no significant differences among the estimates. Another point contrasting with the indirect effect is that, on average, a higher effect size is more likely to be detected in studies that use the difference model and/or the translog model and in studies that adopt the TFP or the export market entry record as the firm performance variable as compared with the other studies. Incidentally, the estimation period has no statistically robust influence on the empirical evaluation of the direct effects as well as the indirect effects. We conclude from this result that the chronological trends observed in **Figures 5** to **7** are highly likely to be generated by factors other than the estimation period.

6. Assessment of Publication Selection Bias

In this section, we test the publication selection bias and the presence of genuine empirical evidence in this research field following the methodology explained in Section 2.

First, **Figure 8** illustrates a funnel plot of the PCC of all estimates of the indirect effect of FDI against the respective inverse of the standard errors and corresponding plots by the effect type. Panel (a) of this figure shows a bilaterally symmetric and inverted funnel-shaped distribution in both cases if either zero or the mean value of the top 10 percent most-precise estimates (0.001) is used as an approximate value of the true effect. Similar characteristics can be confirmed in Panel (b) of **Figure 8**, which is based on the estimates of the horizontal effect. In contrast, as shown in Panels (c) and (d) of the same figure, which use the estimates of the vertical forward effect and those of the vertical backward effect, respectively, the shape of the funnel plots is rather unclear, possibly due to an insufficient quantity of empirical evidence.

The ratio of the positive versus negative values in all 625 estimates of the indirect effect is 314:292, excluding 19 estimates with a zero value. This result accepts the null hypothesis that the ratio is 50:50 (z=0.894, p=0.372). When the estimates are divided into two with the value of 0.001 being the threshold, the ratio becomes 314:311, which also does not reject the null hypothesis (z=0.120, p=0.905). Therefore, we extrapolate that type I publication selection bias is not likely to exist in the literature. We can obtain similar results when the scope is limited to the horizontal effect and the vertical forward effect.[18] Regarding the vertical

[18] The ratio of the positive versus negative estimates of the horizontal effect (the vertical forward

backward effect, the null hypothesis, that the ratio is even, is rejected at the 5% significance level in both cases when either zero or the mean value of the top 10% of the most-precise estimates is used as an approximate value of the true effect.[19] Accordingly, we strongly suspect that type I publication selection bias occurs among the estimates of the vertical backward effect.

Next, looking at the Galbraith plot in Panel (a) of **Figure 9**, which is based on the *t* value and the inverse of the standard error of all the estimates of the indirect effect, we can confirm that far more than 5% of the estimates are out of the range of ±1.96 or the two-sided critical values of the 5% significance level. In fact, the number of estimates in which the respective absolute *t* values are equal to or exceed 1.96 amounts to 197 of 625 estimates, accounting for 31.5% of the total. This result strongly rejects the null hypothesis that the rate is 5% (z=30.421, p=0.000). In addition, according to Panels (b) through (d) of the figure, the corresponding rate for the horizontal effect, the vertical forward effect, and the vertical backward effect are 30.0%, 20.3%, and 43.6%, respectively, and in all of these cases, the null hypothesis is repeatedly rejected at the 1% level. Moreover, even if we assume that the mean value of the top 10 percent most-precise estimates stands at the true effect, we can still find a clear excess of estimates of which the statistic $|(\text{the } k \text{ th estimations} - \text{true effect})/SE_k|$ transcends the critical value of 1.96. In fact, the rate based on the all estimates accounts for 29.9%, and the corresponding rates by effect type are 27.9% for the horizontal effect, 20.3% for the vertical forward effect, and 42.7% for the vertical backward effect. Here again, the null hypothesis that the rate is 5% is strongly rejected in all cases. Therefore, irrespective of the difference in the effect type, the likelihood of type II publication selection bias occurring in this study area is considered to be very high.

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effect) is 222:210 (24:36), and the z-value and the p-value of the test for equality of proportions are 0.577 and 0.564 (1.549 and 0.121), respectively. When the estimates are divided into two using the mean of the top 10% of the most-precise estimates as the threshold, the ratio of the above-mean values and the below-mean values is 206:238 (37:27), and the z-value and the p-value in this case are 1.519 and 0.129 (or 1.250 and 0.211), respectively.

[19] The ratio of the positive versus negative estimates of the vertical backward effect is 68:46, and the z-value and the p-value of the test for equality of proportions are 2.061 and 0.039, respectively. When the estimates are divided into two with the mean of the top 10% most-precise estimates being the threshold, the ratio of the above-mean values and the below-mean values becomes 25:92, and the z-value and the p-value in this case are 6.194 and 0.000, respectively.

In **Figure 10**, both funnel and Galbraith plots using the estimates of the direct effect of FDI are represented. As is obvious from this figure, both type I and type II publication selection biases are highly likely in this study area.[20]

Table 6 reports the estimation results of the meta-regression models that are specially designed to examine publication selection bias and the presence of genuine empirical evidence in terms of the indirect effect of FDI. As the table shows, in all the cases, the Breusch-Pagan test rejects the null hypothesis that the variance of the individual effects is zero. Therefore, in reference to the results of the random-effects model or the fixed-effects model, we confirm that the null hypothesis that the intercept term (β_0) is zero in Eq. (9) is not rejected in Models [3], [6], [9], and [12], while the null hypothesis that the intercept term (β_0) is equal to zero in Eq. (10) is rejected in Models [15], [18], [21], and [24] at the 1% significance level. Accordingly, we are assured of the existence of type II publication selection bias across the study area regarding the indirect effect of FDI in transition economies.

Further, according to Panel (c) of **Table 6**, the coefficient of the inverse of the standard error (β_1) in Eq. (11) is estimated to be positive in Model [36] with statistical significance at the 5% level, suggesting that the existing literature listed in **Table 1** may include genuine evidence concerning the vertical backward effect. However, in Panel (a) of the same table, Model [12] does not reject the null hypothesis that the coefficient of the inverse of the standard error (β_1) is zero in Eq. (9), as in the case of Models [3], [6], and [9] that are estimated using all the estimates and those on the horizontal effect and the vertical forward effect, respectively. Therefore, we cannot adopt the coefficient β_1 obtained from the estimation of Model [36] as the publication-bias-adjusted effect size.

In the case of studies on the direct effect, as indicated in **Table 7**, the likelihood of both type I and type II publication selection biases is significantly high. However, it is possible that genuine evidence may exist in the collected estimates beyond publication selection and,

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[20] The ratio of the positive-versus-negative PCCs for all estimates of the direct effect, excluding one estimate with a zero value, is 117:17 (z=8.521, p=0.000). When the estimates are divided into two with the mean of the top 10% most-precise estimates being the threshold, the ratio of the above-mean values and the below-mean values is 55:80 (z=2.152, p=0.031). Moreover, estimates in which the respective absolute t values exceed 1.96 account for 48.9% of the total (z=23.398, p=0.000). As statistics in parentheses report, the hypothesis is rejected at the 5% or less significance level, as in the case of the indirect effect.

according to the coefficient of β_1 in Model [9], the true effect is near to a value of 0.012.

In summary, judging from the above test results, we conclude that the existing literature that examines the microeconomic impacts of FDI in transition economies fails to provide sufficient empirical evidence to prove the emergence of the non-zero productivity spillover effect in the region as a whole; this may be due to the type II publication selection bias caused by excessive reporting of statistically significant estimates in the previous studies.

7. Conclusions

In this paper, we conducted a meta-analysis of the literature that empirically examines the microeconomic impacts of FDI in the CEE and FSU countries. More specifically, using a total of 760 estimates obtained from 30 studies published during the period from 2000 to 2012, we first performed a meta-synthesis of the collected estimates, then identified the factors that cause the observed heterogeneity among studies by MRA, and, finally, relying on the methodology advocated by Stanley (2005) and Stanley and Doucouliagos (2012), we tested the publication selection bias and the presence of a genuine empirical effect in the literature.

The results revealed that both the effect size and the statistical significance of the indirect effect of FDI, namely the productivity spillover effect, are obviously lower than those of the direct effect caused by foreign participation in company management through ownership. In fact, the random-effects model indicates that the synthesized PCC of the indirect effect is 0.002, which is one twenty-fourth of the corresponding value of the direct effect. Moreover, the combined *t* value weighted by the quality level of the study also makes a sharp contrast between the two. Indeed, while the value of the direct effect is 8.054, that of the indirect effect shows a mere 1.101.[21]

As pointed out in Section 4, about 30% of the regression results reported in the preceding studies verify the statistically significant indirect effect of FDI in transition economies. Nevertheless, taking the sample size into consideration, their synthesized effect size in terms of PCC is deemed to be small because, overall, the statistical significance of estimates used for

[21] In this regard, however, we note a statement made by Doucouliagos (2011): “The finding of a small effect does not mean that the research topic is trivial. Perhaps it becomes important to find out why the effect is small and how it can be made larger” (p. 10).

the meta-synthesis is not sufficiently high. As indicated by Eq. (1) in Section 2, the PCC is a function of the *t* value and the degree of freedom. Most studies of the microeconomic effects of FDI in transition economies utilize a very large sample in which the number of observations amounts to several tens of thousands. Suppose that the degree of freedom is 10,000. In this case, even when the *t* value of an estimate is 5.0, the PCC is as small as 0.050, or far below the threshold of 0.10, by which a "small" effect is recognized in accordance with Cohen's (1988) guideline. In essence, the empirical results so far obtained from studies on the CEE and FSU countries are all at modest levels in terms of the statistical significance of the estimates, although researchers in this study area employ a large-scale dataset for their empirical analysis. Whether this revelation correctly reflects the reality or whether it derives from the reliability of the data may become a controversial issue.

Furthermore, the results of MRA in Section 5 has demonstrated that empirical evidence with respect to the microeconomic effects of FDI largely depends on the study conditions. In this regard, however, there is a substantial difference between the PCC and the *t* value in terms of the combination of meta-independent variables that take a statistically significant coefficient. Moreover, we also found that the estimation results of the meta-regression model have a noticeable distinction between the indirect and direct effects.

In addition, according to the test results regarding the publication selection bias reported in Section 6, type II publication selection bias, which places excessive emphasis on empirical evidence with a high level of statistical significance, is likely to exist in the research field of the indirect effect of FDI in transition economies. Probably due to the negative influence of this problem, researchers have not yet provided empirical evidence of the non-zero productivity spillover effect in the CEE and FSU states. Further research efforts are required to capture the true effect. In this sense, studies on transition economies may never come to an end.

Appendix

Method for Evaluating the Quality Level of a Study

This appendix describes the evaluation method used to determine the quality level of the studies subjected to our meta-analysis.

For journal articles, we used the ranking of economics journals that had been published as of November 1, 2012, by IDEAS—the largest bibliographic database dedicated to economics and available freely on the Internet (http://ideas.repec.org/)—as the most basic information source for our evaluation of quality level. IDEAS provides the world's most comprehensive ranking of economics journals, and, as of November, 2012, 1173 academic journals were ranked.

We divided these 1173 journals into 10 clusters by a cluster analysis based on overall evaluation scores, and have assigned each of these journal clusters a score (weight) from 1 (the lowest journal cluster) to 10 (the highest).

The following table shows a list of 12 academic journals that are representative of the study field of transition economies along with their IDEAS economics journal ranking [1], their overall scores [2], and the scores that we assigned in accordance with the above-mentioned procedures [3].

	[1]	[2]	[3]
Journal of Comparative Economics	129	129.98	8
Economics of Transition	138	137.84	8
Emerging Markets Review	162	160.99	7
Economic Systems	230	216.02	7
Economic Change and Restructuring	362	338.54	5
Comparative Economic Studies	397	370.99	5
Emerging Markets Finance and Trade	419	393.71	5
European Journal of Comparative Economics	443	421.53	5
Post-Communist Economies	449	425.82	5
Eastern European Economics	483	456.52	4

Problems of Economic Transition	626	590.06	4
Transition Studies Review	663	625.18	3

For academic journals that are not ranked by IDEAS, we referred to the Thomson Reuters Impact Factor and other journal rankings and identified the same level of IDEAS ranking-listed journals that correspond to these non-listed journals; we have assigned each of them the same score as its counterparts.

Meanwhile, for academic books and book chapters, we have assigned a score of 1 in principle, but if at least one of the following conditions is met, each of the relevant books or chapters has uniformly received a score of 4, which is the median value of the scores assigned to the above-mentioned IDEAS ranking-listed economics journals: (1) The academic book or book chapter clearly states that it has gone through the peer review process; (2) its publisher is a leading academic publisher that has external evaluations carried out by experts; or (3) the research level of the study has been evaluated by the authors to be obviously high.

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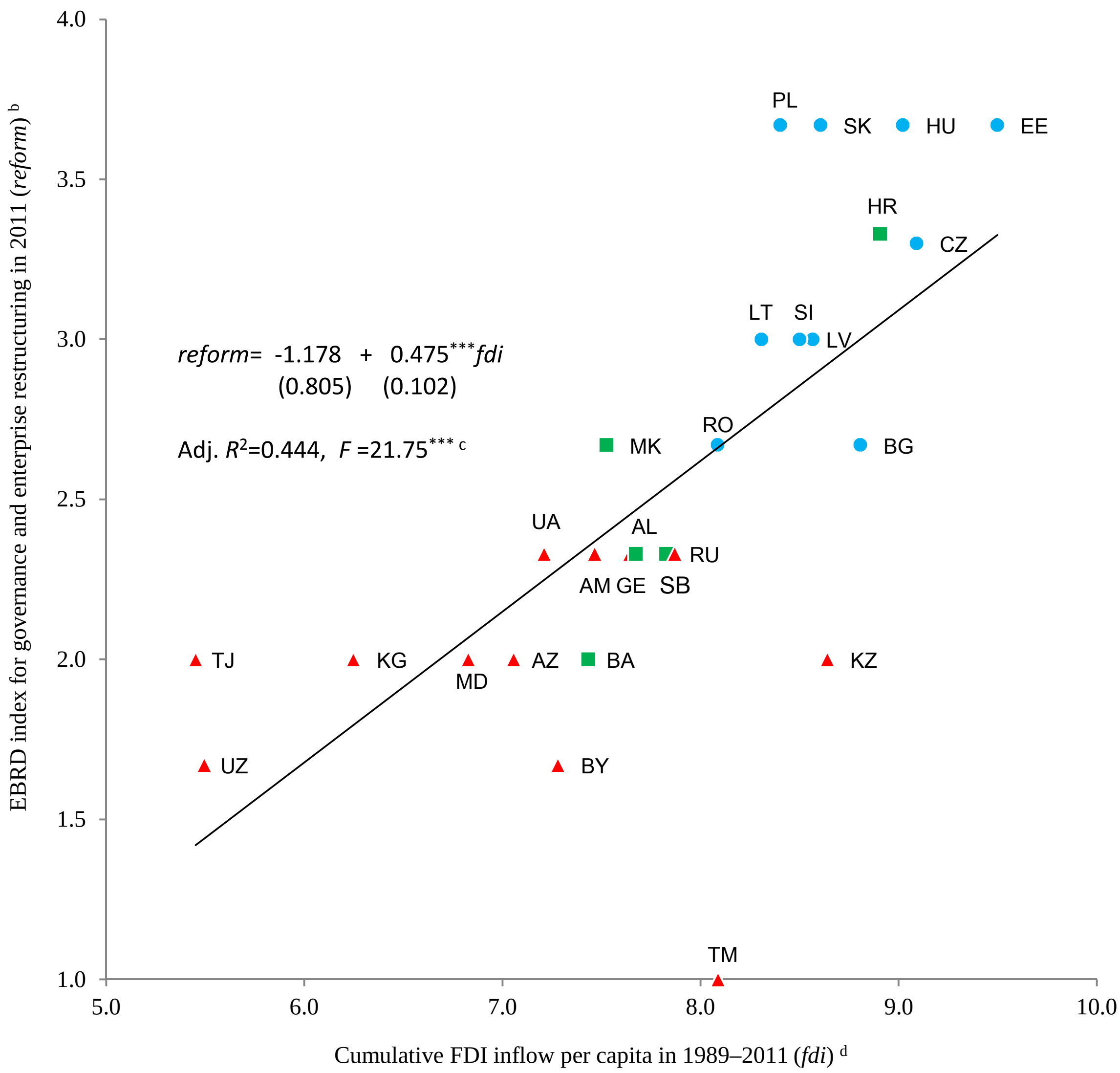
Figure 1. Relationship between the scale of FDI inflow and enterprise reform in the CEE and FSU countries [a]



Notes:

[a] Country abbreviations: AL — Albania; AM — Armenia; AZ — Azerbaijan; BA — Bosnia and Herzegovina; BG — Bulgaria; BY — Belarus; CZ — Czech Republic; EE — Estonia; GE — Georgia; HR — Croatia; HU — Hungary; KG — Kyrgyzstan; KZ — Kazakhstan; LT — Lithuania; LV — Latvia; MD — Moldova; MK — FYR Macedonia; PL — Poland; RO — Romania; RU — Russia; SB — Serbia and Montenegro; SI — Slovenia; SK — Slovakia; TJ — Tajikistan; TM — Turkmenistan; UA — Ukraine; UZ — Uzbekistan. ●, ■, and ▲ represent CEE EU member countries, CEE non-EU member countries, and FSU states, respectively.

[b] The index takes the range between 1.00 (representing little or no change from a rigid centrally planned economy) and 4.33 (representing the standards of an industrialized market economy). The figure for the Czech republic is in 2007. The figure for Serbia and Montenegro takes the average of two countries.

[c] Figures in parentheses beneath the regression coefficients of the approximate straight line are standard errors. *** denotes statistical significance at the 1% level.

[d] In natural logarithm.

Source: Author's illustration based on the data obtained from EBRD (http://www.ebrd.com/pages/homepage.shtml), EUROSTAT(http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home), and UNCTAD (http://unctadstat.unctad.org/) websites.

Table 1. List of selected studies on the microeconomic effects of FDI in transition economies for meta-analysis

Author (Publication year)	Target country [a]	Target industry	Estimation period [b]	Data type	Firm performance variable [c]	Study on the indirect effect of FDI: FDI variable (Market share of foreign firms) [d]	Study on the indirect effect of FDI: Effect type to test: Horizontal effect	Study on the indirect effect of FDI: Effect type to test: Vertical effect: Forward effect	Study on the indirect effect of FDI: Effect type to test: Vertical effect: Backward effect	Study on the indirect effect of FDI: Number of corrected estimates	Study on the indirect effect of FDI: Average precision (AP) [e]	Study on the direct effect of FDI: Relevant study	Study on the direct effect of FDI: FDI variable [f]	Study on the direct effect of FDI: Number of corrected estimates	Study on the direct effect of FDI: Average precision (AP) [e]
Djankov and Hoekman (2000)	CZ	All industries	1992–1996	Panel	III	B	✓			3	15.636	✓	a, b	4	129.132
Bosco (2001)	HU	All industries	1993–1997	Panel	II	C	✓			20	11.146	✓	a	8	35.028
UNECE (2001)	EE, SI	Manufacturing industry	1994–1998	Panel	V	C, E	✓			4	268.265	✓	a	4	16.093
Konings (2001)	BG, PL, RO	All industries	1993–1997	Panel	III	D	✓			12	4.212	✓	a	9	72.165
Damijan et al. (2003)	BG, CZ, EE, HU, PL, RO, SI, SK	Manufacturing industry	1994–1998	Panel	III	C, E	✓			3	288.821	✓	b	16	12.149
Yudaeva et al. (2003)	RU	Mining and manufacturing industry	1993–1997	Panel	I	D	✓	✓	✓	32	5.535	✓	b	16	19.039
Javorcik (2004)	LT	Manufacturing industry	1996–2000	Panel	III, V	D	✓	✓	✓	35	274.165				
Jensen (2004)	PL	Food industry	1995–2000	Panel	II, IV	C	✓			3	31.348				
Sinani and Meyer (2004)	EE	All industries	1994–1999	Panel	II	A	✓			1	11.882				
Damijan and Knell (2005)	EE, SI	Manufacturing industry	1994–1999	Panel	III	D	✓	✓	✓	11	124.854	✓	b	4	24.061
Javorcik and Spatareanu (2005)	CZ, RO	All industries	1998–2000	Panel	I, V	D	✓		✓	8	347.075				
Sabirianova et al. (2005)	CZ, RU	Mining and manufacturing industry	1993–2000	Panel	II	C	✓			8	25.579				
Pawlik (2006)	PL	Manufacturing industry	1993–2002	Panel	IV	A, C, G, H	✓			7	6.957	✓	a	8	9.349
Vahter (2006)	EE, SI	Manufacturing industry	1994–2001	Panel	IV	B	✓			4	10.241	✓	b	4	12.229
Halpern and Muraközy (2007)	HU	Manufacturing industry	1996–2003	Panel	I, V	C	✓	✓	✓	18	6.092	✓	a	2	4.729
Muraközy (2007)	HU	Manufacturing industry	1993–2003	Panel	VI	C	✓	✓	✓	18	25.313				
Tytell and Yudaeva (2007)	PL, RO, RU, UA	Manufacturing industry	1998–2003	Panel/cross-section	I, V	G	✓			14	7.857	✓	a	4	12.352
Vahter and Masso (2007a)	EE	Manufacturing and service industries	1995–2002	Panel	I, V	B, G	✓			28	20.120	✓	b	24	27.235
Vahter and Masso (2007b)	EE	Manufacturing and service industries	1995–2002	Panel	V	B	✓			4	21.967				
Gersl et al. (2008)	BG, CZ, EE, HU, LT, LV, PL, SI, SK, RO	Manufacturing industry	2000–2005	Panel	V	C	✓	✓	✓	30	4.052				
Javorcik and Spatareanu (2008)	RO	Manufacturing industry	1998–2003	Panel	V	D	✓		✓	24	4.244				
Marcin (2008)	PL	Manufacturing and service industries	1996–2003	Panel	III	D	✓	✓	✓	10	28.373				
Békés et al. (2009)	HU	Manufacturing industry	1993–2003	Panel	V	D	✓	✓	✓	3	38.373				
Görg et al. (2009)	HU	Manufacturing industry	1992–2003	Panel	I, V	F	✓			13	27.900				
Kosová (2010)	CZ	All industries	1994–2001	Panel	II	G	✓			8	8.119				
Nicolini and Resmini (2010)	BG, PL, RO	Manufacturing industry	1998–2003	Panel	V	G	✓	✓	✓	35	90.948				
Iwasaki et al. (2011)	HU	Manufacturing and service industries	2002–2005	Panel	VII	E	✓			64	8.674	✓	a	8	8.054
Monastiriotis and Alegria (2011)	BG	All industries	2002–2005	Panel	II	G	✓			11	18.389				
Vahter (2011)	EE	Manufacturing industry	1995–2004	Panel	V	G	✓			2	1.676				
Iwasaki et al. (2012)	HU	Manufacturing and service industries	2002–2005	Panel	II, IV, V	A, B, C, F, G	✓	✓	✓	192	55.385	✓	a	24	59.286

Notes:

[a] Country abbreviations correspond with those in Figure 1.

[b] Estimation period may differ depending on the target country.

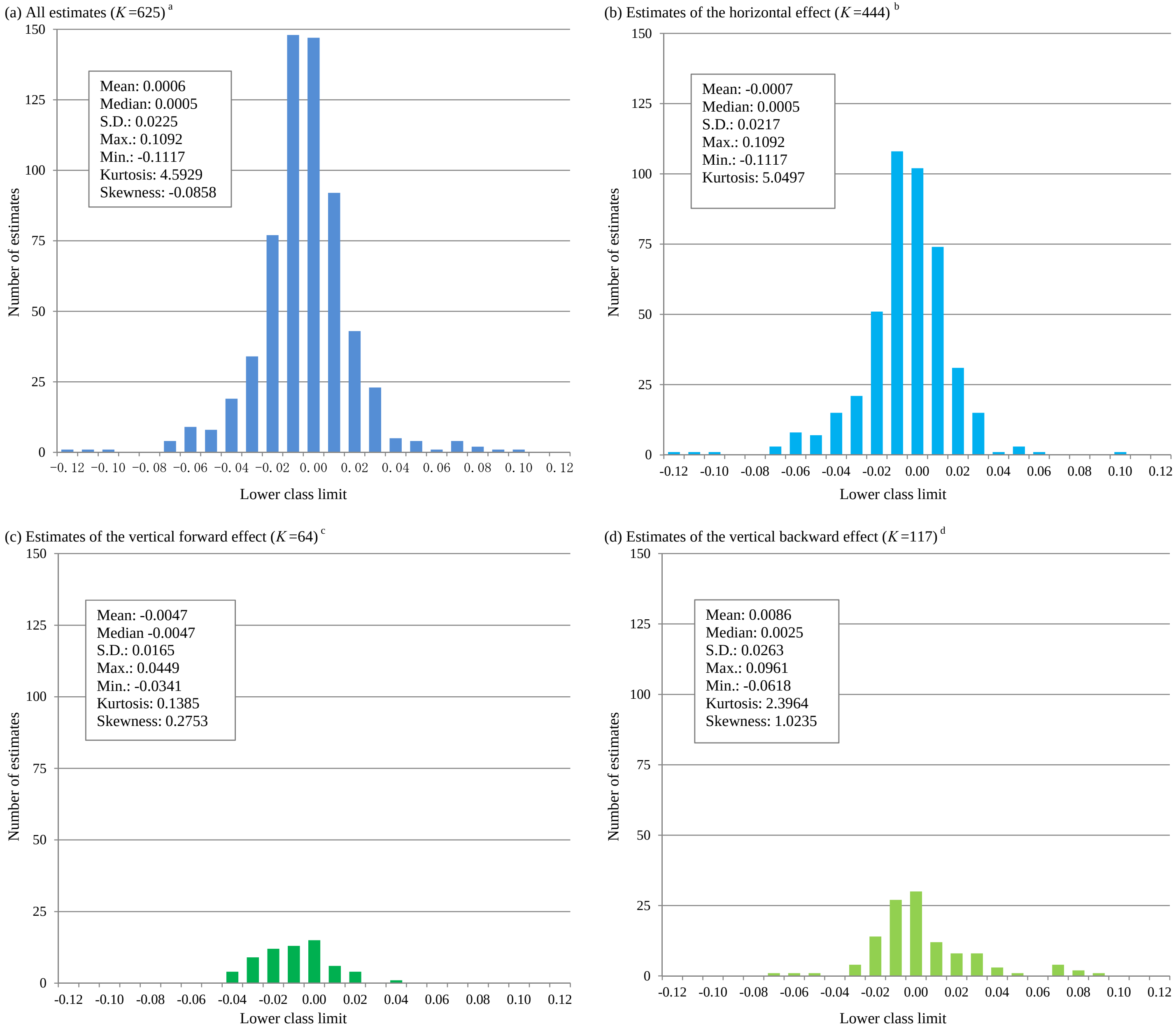
[c] I: Added value; II: Sales revenue; III: Production volume; IV: Labor productivity; V: Total factor productivity (TFP); VI: Price-cost margin; VII: Export market entry record

[d] A: Share of equity; B: Share of assets; C: Share of sales revenue; D: Share of production volume; E: Share of export volume; F: Share of value added; G: Share of employment; H: Share of gross investment

[e] AP is defined as the mean of the inverse of standard errors of estimates collected from the study.

[f] a: Foreign ownership share; b: dummy for foreign-owned firms

Figure 2. Distribution of partial correlation coefficients of estimates of the indirect effect of FDI



Notes:

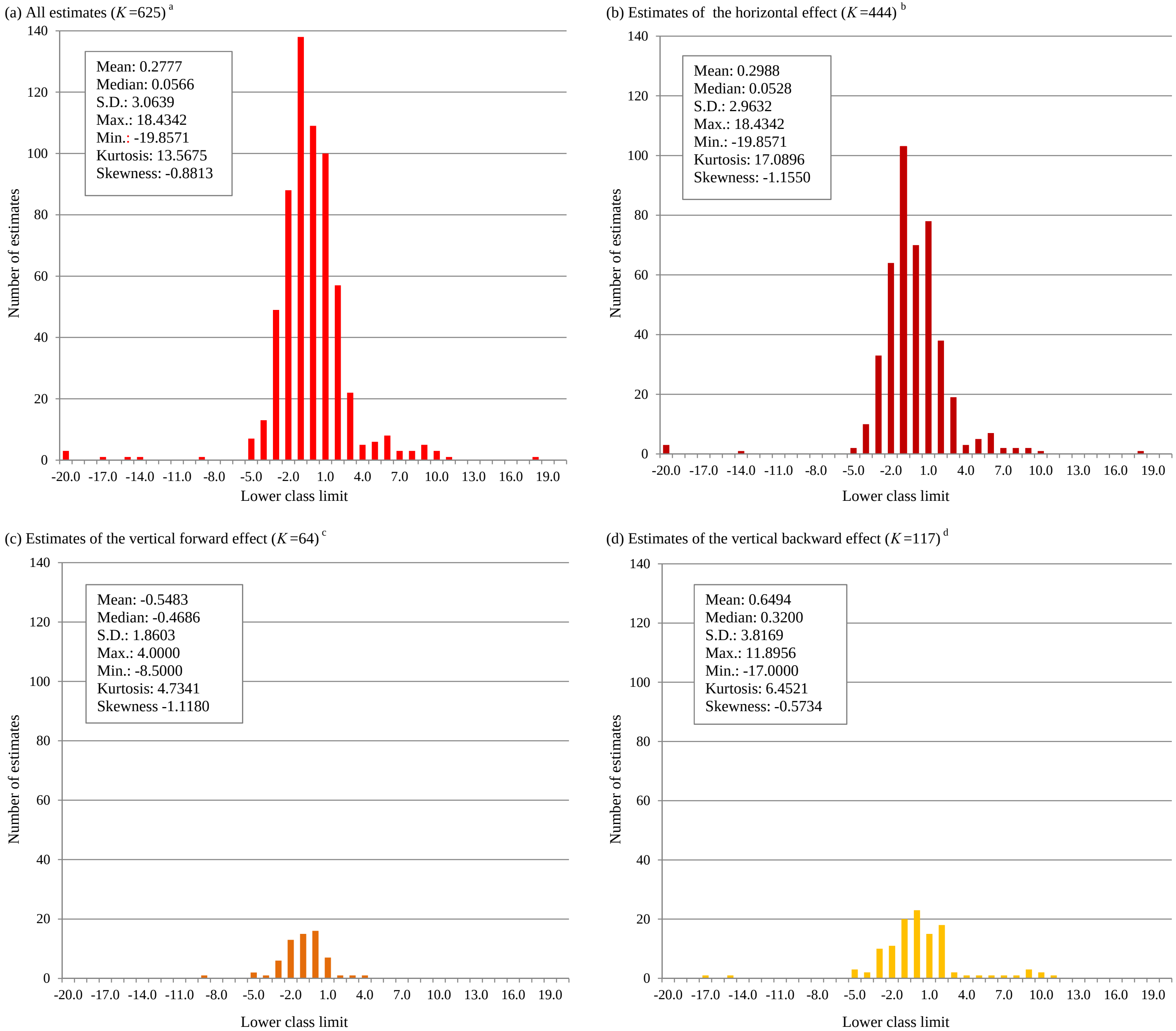
[a] Goodness-of-fit test: χ^2 =443.440, p =0.000

[b] Goodness-of-fit test: χ^2 =1332.631, p =0.000

[c] Goodness-of-fit test: χ^2 =6.615, p =0.358

[d] Goodness-of-fit test: χ^2 =37.770, p =0.000

Figure 3. Distribution of *t* values of estimates of the indirect effect of FDI



Notes:

[a] Goodness-of-fit test: χ^2 =95313273.055, p =0.000

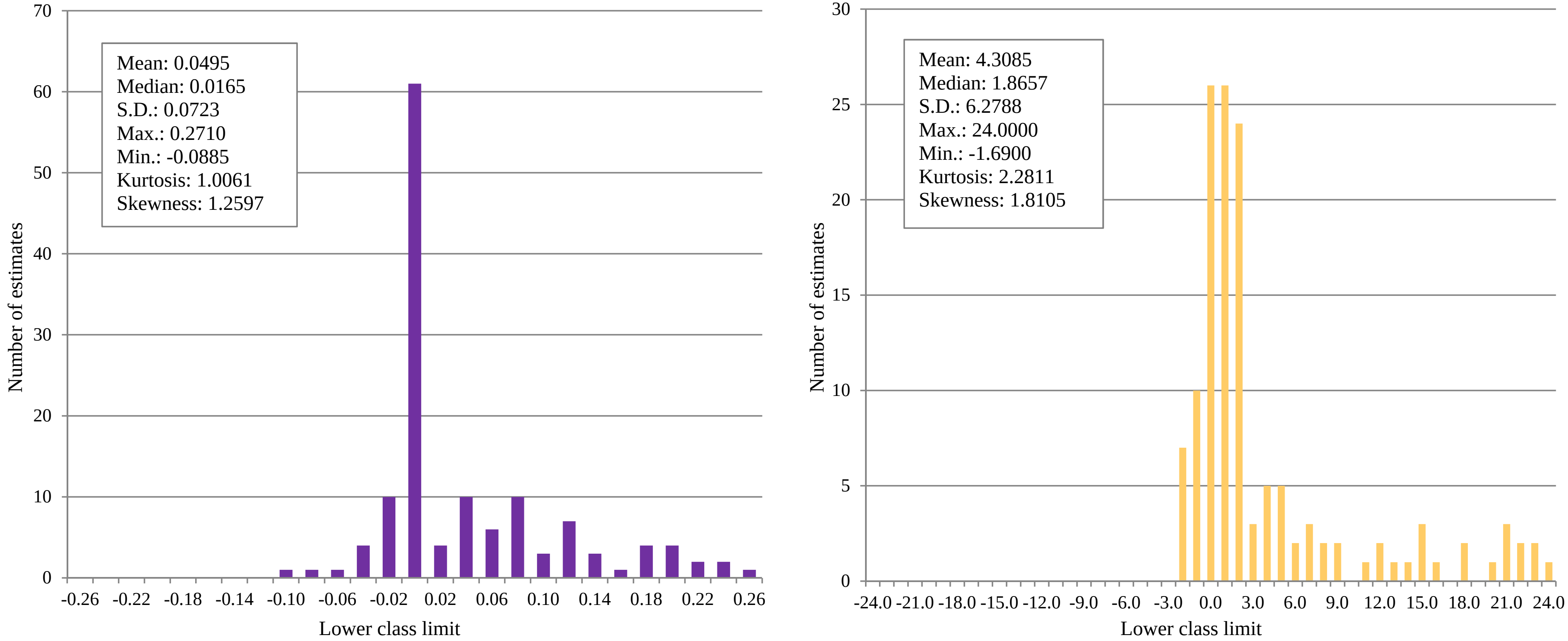
[b] Goodness-of-fit test: χ^2 =578968677.907, p =0.000

[c] Goodness-of-fit test: χ^2 =638.470, p =0.000

[d] Goodness-of-fit test: χ^2 =2313.261, p =0.000

Figure 4. Distribution of partial correlation coefficients and t values of estimates of direct effect of FDI (K =135)

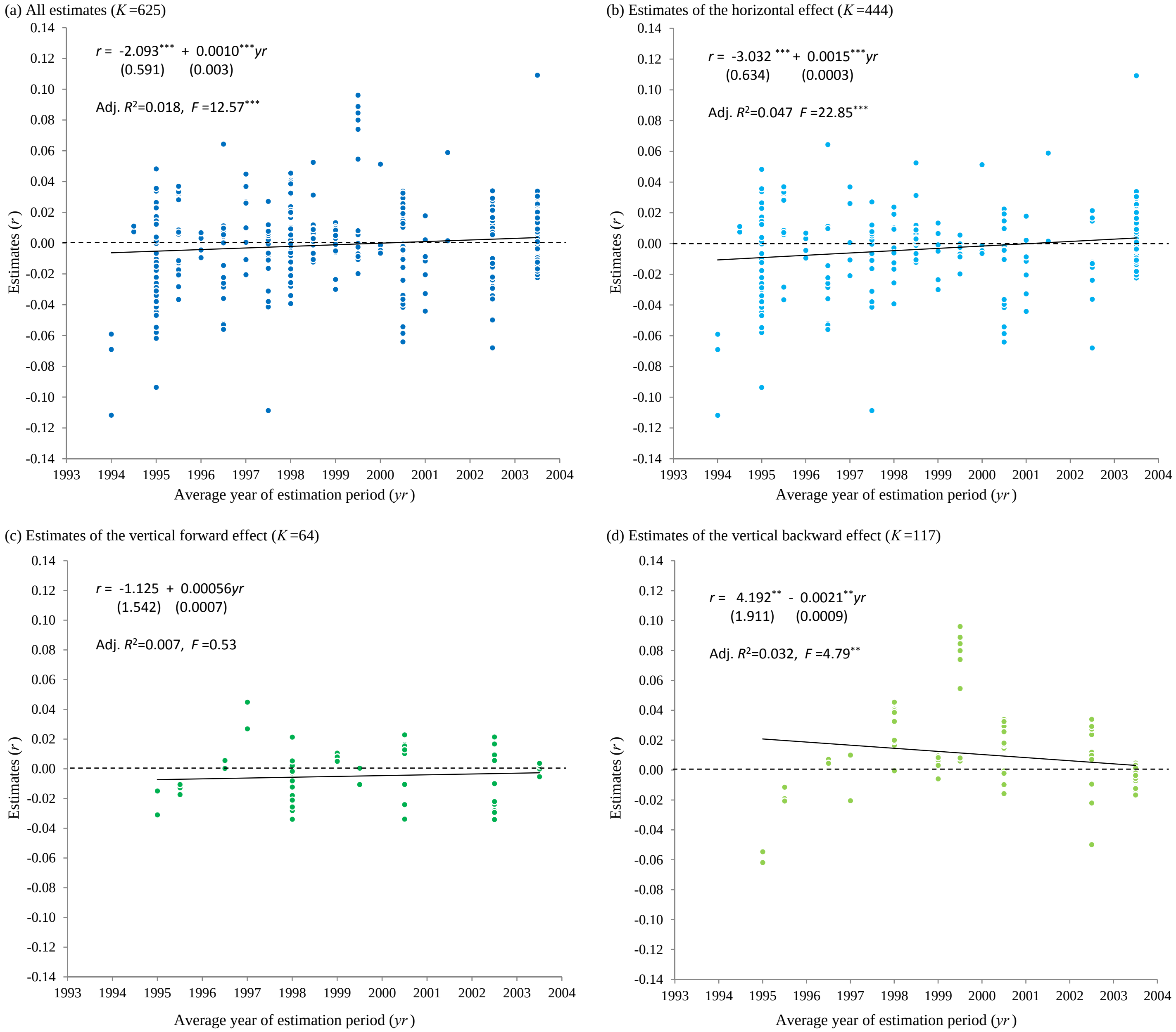
(a) PCC [a] (b) t value [b]



[a] Goodness-of-fit test: χ^2 =236.829, p =0.000

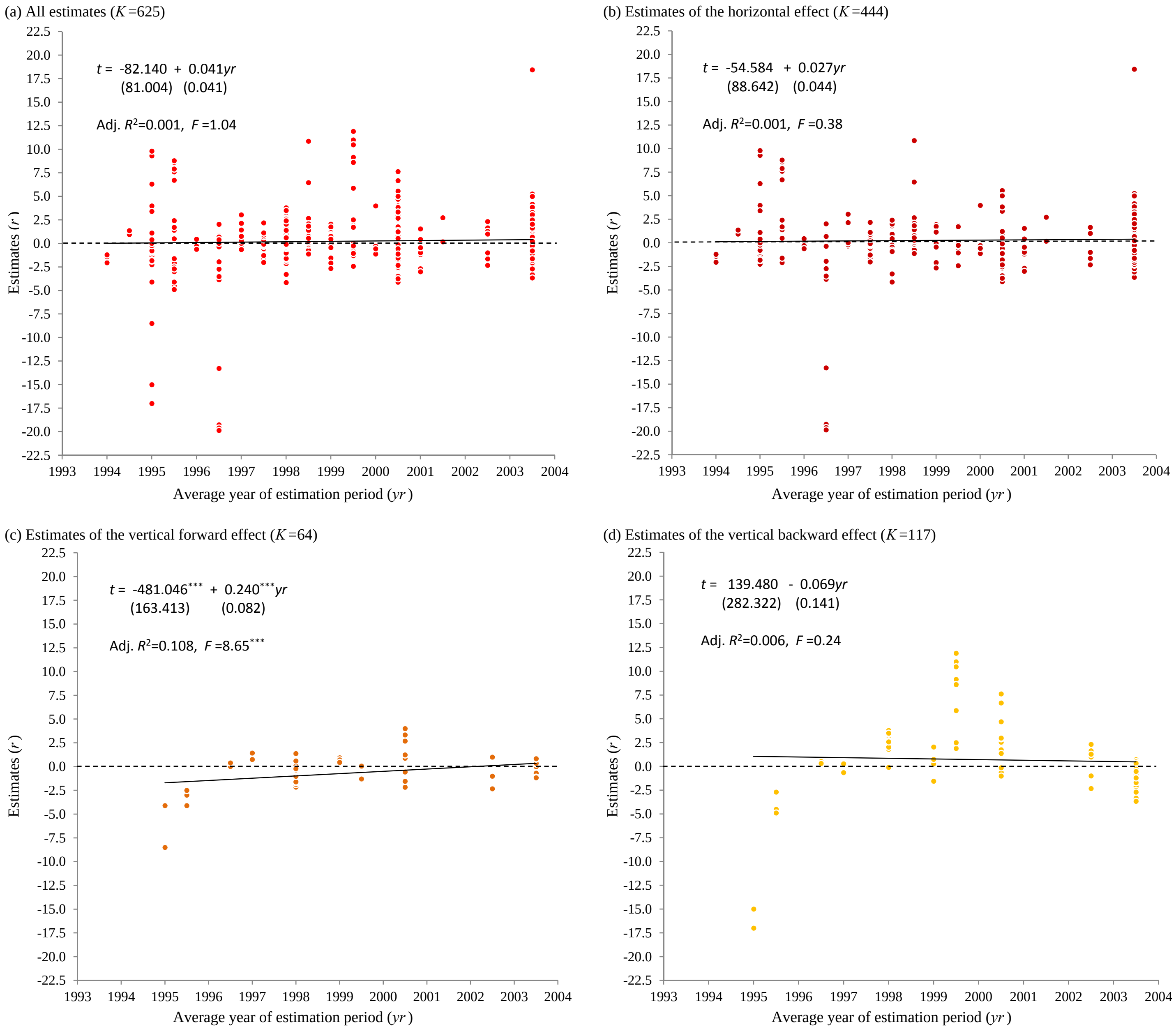
[b] Goodness-of-fit test: χ^2 =304.815, p =0.000

Figure 5. Chronological order of partial correlation coefficients of estimates of the indirect effect of FDI



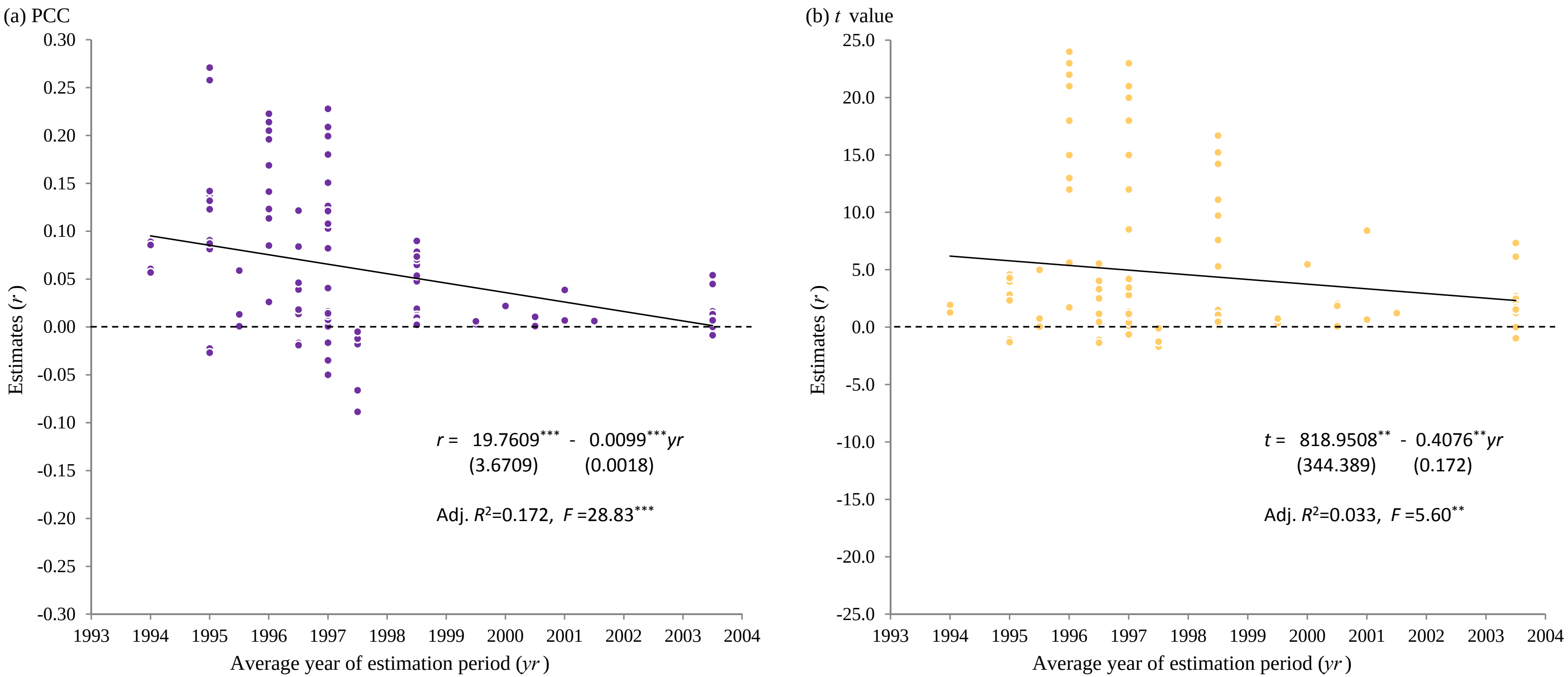
Note: Figures in parentheses beneath the regression coefficients of the approximate straight line are standard errors. *** and ** denote statistical significance at the 1% and 5% levels, respectively.

Figure 6. Chronological order of *t* values of estimates of the indirect effect of FDI



Note: Figures in parentheses beneath the regression coefficients of the approximate straight line are standard errors. *** denotes statistical significance at the 1% level.

Figure 7. Chronological order of partial correlation coefficients and *t* values of estimates of the direct effect of FDI (*K* =135)



Note: Figures in parentheses beneath the regression coefficients of the approximate straight line are standard errors. *** and ** denote statistical significance at the 1% and 5% levels, respectively.

Table 2. Synthesis of collected estimates

	Number of estimates (*K*)	(a) Synthesis of PCCs			(b) Combination of *t* values			
		Fixed-effect model (*z* value)[a]	Random-effects model (*z* value)[a]	Test of homogeneity[b]	Unweighted combination (*p* value)	Weighted combination (*p* value)	Median of *t* values	Failsafe *N* (*fsN*)
All studies on indirect effect of FDI	625	0.002 ***	0.002 ***	5481.640 ***	6.944 ***	1.101	0.057	10512
		(7.00)	(2.97)		(0.00)	(0.14)		
(a) Comparison in terms of target country								
Studies of CEE EU member countries	582	0.003 ***	0.003 ***	2848.769 ***	8.475 ***	1.369 *	0.044	14866
		(11.11)	(4.19)		(0.00)	(0.09)		
Studies of Russia or Ukraine	43	-0.005 ***	0.001	2499.587 ***	-4.706 ***	-0.610	0.400	309
		(-7.67)	(0.13)		(0.00)	(0.27)		
(b) Comparison in terms of target industry								
Studies that cover all industries	73	0.007 ***	0.004 *	411.665 ***	4.364 ***	0.598	0.410	441
		(9.35)	(1.85)		(0.00)	(0.27)		
Studies of mining and manufacturing industry [e]	408	0.002 ***	0.003 ***	4435.850 ***	7.012 ***	1.055	0.203	7006
		(5.23)	(2.63)		(0.00)	(0.15)		
Studies of service industry	144	0.000	0.000	568.354 ***	-0.444	-0.098	-0.389	-134
		(-0.13)	(0.17)		(0.33)	(0.46)		
(c) Comparison in terms of firm performance variable								
Studies that adopt the value added	68	0.006 ***	0.008 **	1700.943 ***	10.243 ***	1.475 *	0.667	2569
		(9.71)	(2.53)		(0.00)	(0.07)		
Studies that adopt the sales revenue or production volume	177	-0.003 ***	-0.001	1820.430 ***	-3.478 ***	-0.474	-0.002	614
		(-6.51)	(-0.33)		(0.00)	(0.32)		
Studies that adopt the labor productivity	76	0.001 *	0.001 *	104.713 **	1.747 **	0.355	-0.085	10
		(1.77)	(1.68)		(0.04)	(0.36)		
Studies that adopt the total factor productivity (TFP)	222	0.003 ***	0.002	1280.252 ***	3.783 ***	0.578	-0.121	952
		(5.88)	(1.44)		(0.00)	(0.28)		
Studies that adopt other benchmark indices to measure firm performance	82	0.006 ***	0.006 ***	396.792 ***	7.047 ***	2.391 ***	0.830	1423
		(7.30)	(3.16)		(0.00)	(0.01)		
(d) Comparison in terms of FDI variable								
Studies that use the equity or assets	155	0.000	0.000	337.365 ***	-0.012	-0.002	-0.124	-155
		(-0.40)	(0.40)		(0.50)	(0.50)		
Studies that use the sales revenue or production volume	263	0.000	0.002	3816.461 ***	1.746 **	0.230	-0.085	33
		(0.68)	(0.91)		(0.04)	(0.41)		
Studies that use employment	102	0.007 ***	0.004 *	811.027 ***	7.337 ***	1.072	0.474	1927
		(10.82)	(1.85)		(0.00)	(0.14)		
Studies that use other benchmark indices to compute market share of foreign firms	105	0.004 ***	0.005 ***	408.451 ***	6.962 ***	2.675 ***	0.490	1776
		(6.30)	(3.74)		(0.00)	(0.00)		
(e) Comparison in terms of effect type tested								
Studies that examine the horizontal effect	444	0.003 ***	0.002 **	3574.066 ***	6.297 ***	1.060	0.050	6062
		(8.47)	(2.17)		(0.00)	(0.14)		
Studies that examine the vertical forward effect	64	-0.004 ***	-0.005 **	198.981 ***	-4.385 ***	-0.591	-0.469	391
		(-4.96)	(-2.50)		(0.00)	(0.28)		
Studies that examine the vertical backward effect	117	0.002 ***	0.008 ***	1653.583 ***	7.025 ***	1.010	0.320	2017
		(2.76)	(3.60)		(0.00)	(0.16)		
(f) All studies on the direct effect of FDI	135	0.035 ***	0.048 ***	5639.740 ***	50.062 ***	8.054 ***	1.866	124894
		(49.26)	(9.81)		(0.00)	(0.00)		

Notes:

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

[b] Null hypothesis: Effect sizes are homogeneous.

[c] Including studies of food industry (Jensen, 2004).

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

Table 3. Name, definition, and descriptive statistics of meta-independent variables

Variable name	Definition	Descriptive statistics		
		Mean	Median	S.D.
Czech Republic	1 = if target country is the Czech Republic, 0 = otherwise	0.035	0	0.184
Estonia	1 = if target country is Estonia, 0 = otherwise	0.072	0	0.259
Hungary	1 = if target country is Hungary, 0 = otherwise	0.531	1	0.499
Latvia	1 = if target country is Latvia, 0 = otherwise	0.005	0	0.069
Lithuania	1 = if target country is Lithuania, 0 = otherwise	0.061	0	0.239
Poland	1 = if target country is Poland, 0 = otherwise	0.067	0	0.251
Romania	1 = if target country is Romania, 0 = otherwise	0.080	0	0.272
Russia	1 = if target country is the Russian Federation, 0 = otherwise	0.064	0	0.245
Slovakia	1 = if target country is Slovakia, 0 = otherwise	0.008	0	0.089
Slovenia	1 = if target country is Slovenia, 0 = otherwise	0.024	0	0.153
Ukraine	1 = if target country is Ukraine, 0 = otherwise	0.005	0	0.069
Mining and manufacturing industry	1 = if target industry is mining and manufacturing industry, 0 = otherwise	0.653	1	0.476
Service industry	1 = if target industry is service industry, 0 = otherwise	0.230	0	0.421
First year of estimation	First year of estimation period	1998.402	1998	3.570
Length of estimation	Years of estimation period	5.382	5	1.912
Cross-section data	1 = if cross-section data is employed for empirical analysis, 0 = otherwise	0.006	0	0.080
Commercial database	1 = if data employed for empirical analysis is based on a commercial database, 0 = otherwise	0.258	0	0.438
Original enterprise survey	1 = if data employed for empirical analysis is based on an original enterprise survey, 0 = otherwise	0.005	0	0.069
Fully domestically owned firm	1 = if observations are limited to fully domestically owned firms, 0 = otherwise	0.298	0	0.458
Domestically owned firm	1 = if observations are limited to fully domestically owned firms and joint venture firms, 0 = otherwise	0.440	0	0.497
Difference model	1 = if difference model is used for estimation, 0 = otherwise	0.182	0	0.386
Translog model	1 = if translog model is used for estimation, 0 = otherwise	0.555	1	0.497
Absorption capacity of domestic firms	1 = if estimation simultaneously controls for absorption capacity of domestic firms, 0 = otherwise	0.184	0	0.388
Market competition	1 = if estimation simultaneously controls for the degree of market competition, 0 = otherwise	0.294	0	0.456
Location fixed effects	1 = if estimation simultaneously controls for location fixed effects, 0 = otherwise	0.638	1	0.481
Industry fixed effects	1 = if estimation simultaneously controls for industry fixed effects, 0 = otherwise	0.370	0	0.483
Time fixed effects	1 = if estimation simultaneously controls for time fixed effects, 0 = otherwise	0.958	1	0.200
GLS	1 = if generalized least squares estimator is used for estimation, 0 = otherwise	0.002	0	0.040
FE	1 = if fixed-effects panel estimator is used for estimation, 0 = otherwise	0.677	1	0.468
RE	1 = if random-effects panel estimator is used for estimation, 0 = otherwise	0.034	0	0.180
GEE	1 = if generalized estimating equation estimator is used for estimation, 0 = otherwise	0.002	0	0.040
Tobit	1 = if tobit estimator is used for estimation, 0 = otherwise	0.008	0	0.089
IV	1 = if instrumental variable method is used for estimation, 0 = otherwise	0.035	0	0.184

(continued)

Variable name	Definition	Descriptive statistics		
		Mean	Median	S.D.
Sales revenue	1 = if sales revenue is adopted as the benchmark index of firm performance variables, 0 = otherwise	0.182	0	0.386
Production volume	1 = if production volume is adopted as the benchmark index of firm performance variables, 0 = otherwise	0.101	0	0.301
Labor productivity	1 = if labor productivity is adopted as the benchmark index of firm performance variables, 0 = otherwise	0.122	0	0.327
TFP	1 = if total factor productivity is adopted as the benchmark index of firm performance variables, 0 = otherwise	0.355	0	0.479
Price-cost margin	1 = if price-cost margin is adopted as the benchmark index of firm performance variables, 0 = otherwise	0.029	0	0.167
Export market entry	1 = if export market entry record is adopted as the benchmark index of firm performance variables, 0 = otherwise	0.102	0	0.303
Share of assets	1 = if market share of foreign firms is measured in terms of assets, 0 = otherwise	0.206	0	0.405
Share of sales revenue	1 = if market share of foreign firms is measured in terms of sales revenue, 0 = otherwise	0.205	0	0.404
Share of production volume	1 = if market share of foreign firms is measured in terms of production volume, 0 = otherwise	0.216	0	0.412
Share of export volume	1 = if market share of foreign firms is measured in terms of export volume, 0 = otherwise	0.106	0	0.308
Share of value added	1 = if market share of foreign firms is measured in terms of value added, 0 = otherwise	0.059	0	0.236
Share of employment	1 = if market share of foreign firms is measured in terms of number of employed, 0 = otherwise	0.163	0	0.370
Share of gross investment	1 = if market share of foreign firms is measured in terms of gross investment, 0 = otherwise	0.003	0	0.057
2-digit level	1 = if market share of foreign firms is aggregated at 2-digit level of industrial classification, 0 = otherwise	0.606	1	0.489
3-digit level	1 = if market share of foreign firms is aggregated at 3-digit level of industrial classification, 0 = otherwise	0.147	0	0.355
4-digit level	1 = if market share of foreign firms is aggregated at 4-digit level of industrial classification, 0 = otherwise	0.150	0	0.358
Regional market level	1 = if market share of foreign firms is aggregated at regional market level, 0 = otherwise	0.070	0	0.256
High-tech foreign firm	1 = if market share of foreign firms is limited to that of high-tech foreign firms, 0 = otherwise	0.027	0	0.163
Low-tech foreign firm	1 = if market share of foreign firms is limited to that of low-tech foreign firms, 0 = otherwise	0.019	0	0.137
Foreign joint venture firm	1 = if market share of foreign firms is limited to that of foreign joint venture firms, 0 = otherwise	0.032	0	0.176
Fully foreign-owned firm	1 = if market share of foreign firms is limited to that of fully foreign-owned firms, 0 = otherwise	0.032	0	0.176
Large-scale foreign firm	1 = if market share of foreign firms is limited to that of large-scale foreign firms, 0 = otherwise	0.032	0	0.176
Small and medium-sized foreign firm	1 = if market share of foreign firms is limited to that of small and medium-sized foreign firms, 0 = otherwise	0.032	0	0.176
Nested FDI variable	1 = if a nested FDI variable(s) is used for estimation, 0 = otherwise [a]	0.346	0	0.476
Lagged FDI variable	1 = if a lagged FDI variable(s) is used for estimation, 0 = otherwise	0.600	1	0.490
Dummy variable	1 = if FDI variable is a dummy variable for foreign-owned firms, 0 = otherwise	0.084	0	0.278
With an interaction term(s)	1 = if estimation is carried out with an interaction term(s) of FDI variables, 0 = otherwise	0.208	0	0.406
Vertical forward effect	1 = if effect type tested is vertical forward effect, 0 = otherwise	0.102	0	0.303
Vertical backward effect	1 = if effect type tested is vertical backward effect, 0 = otherwise	0.187	0	0.390
$\sqrt{}$ Degree of freedom	Root of degree of freedom of the estimated model	146.861	150.542	73.310
Quality level	Ten-point scale of the quality level of the study [b]	5.754	5	2.587

Notes:

[a] For details of the nested FDI variable model, see Iwasaki et al. (2011; 2012).

[b] See Appendix for more details.

Table 4. Meta-regression analysis of heterogeneity among studies of the indirect effect of FDI

(a) Dependent variable — PCC

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[1]	[2]	[3]	[4]	[5]	[6] [a]
Target country (Bulgaria)						
Czech Republic	-0.0041	-0.0069	-0.0164	0.0001	0.0014	-0.0041
	(0.010)	(0.011)	(0.012)	(0.007)	(0.010)	(0.010)
Estonia	0.0092	0.0027	-0.0091	-0.0096	0.0110	0.0092
	(0.013)	(0.014)	(0.016)	(0.014)	(0.014)	(0.013)
Hungary	0.0052	0.0031	-0.0032	-0.0044	0.0029	0.0052
	(0.013)	(0.014)	(0.016)	(0.016)	(0.013)	(0.013)
Latvia	0.0010	-0.0034	-0.0100	0.0103	0.0024	0.0010
	(0.010)	(0.011)	(0.009)	(0.010)	(0.010)	(0.010)
Lithuania	-0.0027	0.0035	0.0053	-0.0044	-0.0082	-0.0027
	(0.013)	(0.015)	(0.021)	(0.014)	(0.012)	(0.013)
Poland	-0.0216	-0.0266	-0.0220	-0.0434 ***	-0.0214	-0.0216
	(0.017)	(0.016)	(0.018)	(0.012)	(0.018)	(0.017)
Romania	0.0055	0.0077	0.0218	0.0274	0.0023	0.0055
	(0.010)	(0.010)	(0.015)	(0.028)	(0.011)	(0.010)
Russia	-0.0134	-0.0187	-0.0121	-0.0008	-0.0156	-0.0134
	(0.018)	(0.019)	(0.016)	(0.032)	(0.017)	(0.018)
Slovakia	0.0019	0.0028	-0.0120	0.0039	0.0017	0.0019
	(0.011)	(0.013)	(0.010)	(0.017)	(0.010)	(0.011)
Slovenia	0.0140	0.0057	-0.0059	-0.0078	0.0147	0.0140
	(0.014)	(0.014)	(0.016)	(0.014)	(0.013)	(0.014)
Ukraine	-0.0005	-0.0063	-0.0163	0.0068	-0.0025	-0.0005
	(0.013)	(0.015)	(0.014)	(0.014)	(0.013)	(0.013)
Target industry (All industries)						
Mining and manufacturing industry	-0.0204 **	-0.0213 ***	-0.0275 **	-0.0301	-0.0150 **	-0.0204 **
	(0.008)	(0.008)	(0.011)	(0.021)	(0.007)	(0.008)
Service industry	-0.0245 ***	-0.0255 ***	-0.0233 ***	-0.0257 **	-0.0206 ***	-0.0245 ***
	(0.006)	(0.006)	(0.008)	(0.012)	(0.006)	(0.006)
Estimation period						
First year of estimation	0.0023	0.0024	0.0021	0.0017	0.0015	0.0023
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Length of estimation	-0.0004	-0.0010	0.0004	0.0001	-0.0015	-0.0004
	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)
Data type (Panel data)						
Cross-section data	0.0021	0.0056	-0.0027	-0.0201	0.0049	0.0021
	(0.009)	(0.010)	(0.014)	(0.016)	(0.007)	(0.009)
Data source (Official statistics)						
Commercial database	-0.0213 ***	-0.0273 ***	-0.0345 ***	-0.0321 **	-0.0194 ***	-0.0213 ***
	(0.005)	(0.007)	(0.012)	(0.015)	(0.006)	(0.005)
Original enterprise survey	-0.0713 ***	-0.0684 ***	-0.0541 **	-0.1061 ***	-0.0806 ***	-0.0713 ***
	(0.012)	(0.013)	(0.023)	(0.030)	(0.011)	(0.012)
Type of observations (All domestic firms)						
Fully domestically owned firm	0.0026	0.0035	0.0079 *	-0.0009	0.0010	0.0026
	(0.003)	(0.003)	(0.004)	(0.001)	(0.002)	(0.003)
Domestically owned firm	-0.0005	0.0026	0.0053	-0.0012	-0.0002	-0.0005
	(0.003)	(0.004)	(0.005)	(0.002)	(0.003)	(0.003)
Equation type (Models other than listed below)						
Difference model	-0.0171 **	-0.0178 **	-0.0320 **	-0.0233 **	-0.0161 **	-0.0171 **
	(0.007)	(0.007)	(0.014)	(0.009)	(0.006)	(0.007)
Translog model	-0.0070	-0.0109 **	-0.0086 *	-0.0025	-0.0061 *	-0.0070 *
	(0.004)	(0.005)	(0.005)	(0.006)	(0.003)	(0.004)
Control variable						
Absorption capacity of domestic firms	-0.0004	0.0034	0.0207 *	0.0031	0.0004	-0.0004
	(0.006)	(0.005)	(0.011)	(0.004)	(0.005)	(0.006)
Market competition	0.0065	0.0063	0.0116	0.0095	0.0101	0.0065
	(0.005)	(0.005)	(0.008)	(0.008)	(0.006)	(0.005)
Location fixed effects	-0.0017	-0.0067	-0.0085	-0.0076	0.0028	-0.0017
	(0.009)	(0.009)	(0.014)	(0.010)	(0.009)	(0.009)
Industry fixed effects	0.0042	0.0028	0.0014	-0.0011	-0.0030	0.0042
	(0.011)	(0.011)	(0.013)	(0.017)	(0.011)	(0.011)
Time fixed effects	0.0102 *	0.0073	-0.0016	0.0108	0.0121 **	0.0102 *
	(0.005)	(0.005)	(0.018)	(0.010)	(0.005)	(0.005)
Estimator (Estimators other than listed below)						
GLS	0.0294 *	0.0282 *	-0.0214	0.0113	0.0282 *	0.0294 *
	(0.017)	(0.016)	(0.029)	(0.032)	(0.017)	(0.017)
FE	-0.0015	-0.0044	-0.0097	0.0016	-0.0065	-0.0015
	(0.009)	(0.012)	(0.013)	(0.009)	(0.010)	(0.009)
RE	0.0036	0.0015	0.0038	0.0075	-0.0011	0.0036
	(0.008)	(0.009)	(0.015)	(0.010)	(0.008)	(0.008)
GEE	0.0093	0.0099	-0.0018	0.0105	0.0023	0.0093
	(0.010)	(0.009)	(0.012)	(0.013)	(0.008)	(0.010)
Tobit	0.0074	0.0082	-0.0068	0.0068	-0.0018	0.0074
	(0.010)	(0.010)	(0.015)	(0.013)	(0.009)	(0.010)
IV	-0.0126 **	-0.0113 *	-0.0073	-0.0226 **	-0.0092 *	-0.0126 **
	(0.006)	(0.006)	(0.007)	(0.008)	(0.005)	(0.006)

(continued)

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[1]	[2]	[3]	[4]	[5]	[6] [a]
Type of firm performance variable (Value added)						
Sales revenue	-0.0152 **	-0.0129 **	-0.0095 **	-0.0058	-0.0072	-0.0152 ***
	(0.006)	(0.005)	(0.004)	(0.006)	(0.004)	(0.006)
Production volume	-0.0143 **	-0.0153 **	-0.0227 *	0.0008	-0.0057	-0.0143 **
	(0.006)	(0.007)	(0.013)	(0.003)	(0.005)	(0.006)
Labor productivity	-0.0124 **	-0.0111 *	-0.0058 *	-0.0040	-0.0050	-0.0124 **
	(0.006)	(0.005)	(0.003)	(0.006)	(0.005)	(0.006)
TFP	-0.0176 ***	-0.0197 **	-0.0158 ***	-0.0079 ***	-0.0115 ***	-0.0176 ***
	(0.006)	(0.008)	(0.005)	(0.002)	(0.004)	(0.006)
Price-cost margin	-0.0181	-0.0257 *	-0.0378 **	-0.0195	-0.0095	-0.0181
	(0.012)	(0.014)	(0.018)	(0.015)	(0.013)	(0.012)
Export market entry	-0.0042	-0.0215	-0.0471	-0.0041	-0.0053	-0.0042
	(0.021)	(0.026)	(0.028)	(0.015)	(0.016)	(0.021)
Type of FDI variable (Share of equity)						
Share of assets	0.0003	0.0006	0.0017	0.0012	0.0014	0.0003
	(0.003)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)
Share of sales revenue	0.0030	0.0061	0.0054 **	0.0022	0.0012	0.0030
	(0.004)	(0.004)	(0.002)	(0.001)	(0.004)	(0.004)
Share of production volume	0.0079	0.0123	0.0270 **	0.0144	0.0068	0.0079
	(0.011)	(0.010)	(0.012)	(0.011)	(0.011)	(0.011)
Share of export volume	-0.0070	-0.0084	-0.0105	-0.0144 ***	-0.0104 *	-0.0070
	(0.008)	(0.011)	(0.012)	(0.002)	(0.006)	(0.008)
Share of value added	0.0025	0.0017	0.0044 ***	0.0005	0.0021	0.0025
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Share of employment	0.0048 *	0.0061 *	0.0054 **	0.0021	0.0034 **	0.0048 *
	(0.003)	(0.003)	(0.002)	(0.001)	(0.002)	(0.003)
Share of gross investment	0.0264 ***	0.0205	-0.0177	0.0256 **	0.0291 ***	0.0264 ***
	(0.007)	(0.013)	(0.022)	(0.012)	(0.003)	(0.007)
Aggregate level of FDI variable (1-digit level)						
2-digit level	0.0012	0.0015	0.0128 ***	0.0012	0.0012	0.0012
	(0.007)	(0.006)	(0.004)	(0.008)	(0.007)	(0.007)
3-digit level	-0.0030	0.0043	0.0094 **	-0.0039	-0.0042	-0.0030
	(0.009)	(0.008)	(0.004)	(0.009)	(0.009)	(0.009)
4-digit level	0.0097	0.0153 *	0.0165 ***	0.0050	0.0086	0.0097
	(0.009)	(0.008)	(0.003)	(0.009)	(0.009)	(0.009)
Regional market level	0.0109	0.0170 **	-0.0008	0.0194 **	0.0124 *	0.0109
	(0.008)	(0.008)	(0.009)	(0.009)	(0.007)	(0.008)
Coverage of FDI variable (All foreign firms)						
High-tech foreign firm	-0.0075 **	-0.0072 **	-0.0096 *	-0.0106 ***	-0.0065 **	-0.0075 **
	(0.003)	(0.003)	(0.005)	(0.002)	(0.003)	(0.003)
Low-tech foreign firm	-0.0008	-0.0003	0.0000	-0.0016 *	0.0002	-0.0008
	(0.003)	(0.003)	(0.003)	(0.001)	(0.002)	(0.003)
Foreign joint venture firm	0.0048	0.0120 **	0.0102 ***	0.0083	0.0065 *	0.0048
	(0.004)	(0.006)	(0.004)	(0.008)	(0.003)	(0.004)
Fully foreign owned firm	0.0021	0.0080	0.0064 *	0.0037	0.0039	0.0021
	(0.004)	(0.006)	(0.003)	(0.006)	(0.003)	(0.004)
Large-scale foreign firm	0.0031	0.0104 *	0.0091 **	0.0015	0.0049	0.0031
	(0.004)	(0.006)	(0.004)	(0.006)	(0.003)	(0.004)
Small and medium-sized foreign firm	0.0004	0.0064	0.0076 **	0.0059	0.0022	0.0004
	(0.004)	(0.006)	(0.003)	(0.007)	(0.003)	(0.004)
Other characteristics of FDI variable						
Nested FDI variable	-0.0075	-0.0140	-0.0038	-0.0034	-0.0036	-0.0075
	(0.006)	(0.009)	(0.004)	(0.004)	(0.004)	(0.006)
Lagged FDI variable	-0.0061	-0.0050	-0.0028	0.0004	-0.0019	-0.0061
	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)
With an interaction term(s)	0.0006	0.0013	0.0083 **	0.0055	0.0014	0.0006
	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Effect type to test (Horizontal effect)						
Vertical forward effect	-0.0054	-0.0056	-0.0056	-0.0129	-0.0059	-0.0054
	(0.006)	(0.008)	(0.005)	(0.011)	(0.006)	(0.006)
Vertical backward effect	0.0087	0.0130	-0.0022	0.0075	0.0079	0.0087
	(0.010)	(0.010)	(0.008)	(0.007)	(0.009)	(0.010)
Degree of freedom and research quality						
√Degree of freedom	0.0000	0.0000	-0.0002 **	-0.0001	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Quality level	0.0018	-	-0.0012	-0.0014	0.0009	0.0018
	(0.001)	(-)	(0.001)	(0.001)	(0.001)	(0.001)
Intercept	-4.5619	-4.8249	-4.0470	-3.2848	-3.0600	-4.5619
	(3.079)	(3.552)	(3.042)	(4.908)	(2.975)	(3.079)
K	625	625	625	625	625	625
R^2	0.327	0.385	0.396	0.470	-	0.327

(continued)

(b) Dependent variable — t value

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[7]	[8]	[9]	[10]	[11]	[12] [b]
Target country (Bulgaria)						
Czech Republic	-0.1904	0.0793	-2.2437	0.9130	1.9805 *	-0.1904
	(1.213)	(1.467)	(3.133)	(1.845)	(1.132)	(1.213)
Estonia	0.4053	-0.0740	-4.4794	-1.8436	0.6097	0.4053
	(1.178)	(1.383)	(3.693)	(2.239)	(0.938)	(1.178)
Hungary	0.8825	1.0830	-3.4289	0.2392	0.3367	0.8825
	(1.333)	(1.532)	(4.237)	(1.964)	(0.997)	(1.333)
Latvia	0.2606	0.3225	-2.6023	0.0449	0.7402	0.2606
	(0.968)	(1.153)	(2.937)	(2.079)	(0.471)	(0.968)
Lithuania	1.0160	0.7343	-0.2254	0.5501	0.0315	1.0160
	(1.836)	(2.040)	(5.381)	(2.889)	(0.740)	(1.836)
Poland	-1.5063	-1.6720	-3.5872	-3.5744 ***	-1.2348	-1.5063
	(1.207)	(1.201)	(2.241)	(1.244)	(1.252)	(1.207)
Romania	2.1498	2.4694	5.4643	3.8274	1.7884	2.1498
	(1.456)	(1.658)	(3.542)	(2.555)	(1.191)	(1.456)
Russia	-4.6732	-7.3239 *	-5.0915	-6.6726 *	-6.4883 **	-4.6732
	(3.383)	(4.050)	(3.263)	(3.808)	(3.103)	(3.383)
Slovakia	1.5377	2.2147	-1.7171	1.0973	1.1328	1.5377
	(1.629)	(1.824)	(3.173)	(2.120)	(0.791)	(1.629)
Slovenia	0.8151	0.5627	-3.7760	-1.4668	1.1049	0.8151
	(1.144)	(1.407)	(4.124)	(2.075)	(0.739)	(1.144)
Ukraine	-1.7011	-2.7925	-5.2225	-1.1750	-3.6977 **	-1.7011
	(1.895)	(2.619)	(3.758)	(2.107)	(1.766)	(1.895)
Target industry (All industries)						
Mining and manufacturing industry	-2.3504	-2.1648	-5.1138 **	-1.6584	-1.8899	-2.3504
	(1.526)	(1.756)	(2.199)	(1.941)	(1.387)	(1.526)
Service industry	-2.6041 **	-2.6920 **	-3.2472 *	-1.9802	-2.5317 **	-2.6041 **
	(1.189)	(1.310)	(1.780)	(1.594)	(1.188)	(1.189)
Estimation period						
First year of estimation	-0.0426	-0.1235	0.1692	-0.3090	-0.0779	-0.0426
	(0.230)	(0.294)	(0.275)	(0.306)	(0.224)	(0.230)
Length of estimation	-0.3741	-0.7432	-0.1004	-0.6332	-0.4787	-0.3741
	(0.322)	(0.453)	(0.318)	(0.442)	(0.302)	(0.322)
Data type (Panel data)						
Cross-section data	0.3027	1.2728	-3.5889	-0.2179	0.3693	0.3027
	(1.679)	(2.128)	(3.298)	(1.973)	(1.094)	(1.679)
Data source (Official statistics)						
Commercial database	-2.8402 *	-3.5604 *	-8.6261 ***	-2.6659	-4.1003 ***	-2.8402 **
	(1.431)	(1.852)	(2.730)	(1.613)	(1.590)	(1.431)
Original enterprise survey	-1.0929	-0.8295	2.1249	-6.1557	-4.8054 **	-1.0929
	(2.307)	(2.701)	(4.921)	(3.717)	(2.288)	(2.307)
Type of observations (All domestic firms)						
Fully domestically owned firm	1.4509 *	1.5193 *	2.1925 **	0.1364	0.4194	1.4509 *
	(0.755)	(0.851)	(1.002)	(0.280)	(0.409)	(0.755)
Domestically owned firm	0.5568	0.5363	1.3691	-0.0823	0.1629	0.5568
	(0.608)	(0.848)	(0.990)	(0.402)	(0.470)	(0.608)
Equation type (Models other than listed below)						
Difference model	-3.0689 *	-3.5696 **	-7.2197 **	-3.1142 *	-2.1749 *	-3.0689 **
	(1.535)	(1.702)	(3.321)	(1.536)	(1.144)	(1.535)
Translog model	-1.4156 **	-1.8304 ***	-2.0687 **	-0.0367	-1.0451 **	-1.4156 **
	(0.582)	(0.667)	(0.935)	(0.975)	(0.423)	(0.582)
Control variable						
Absorption capacity of domestic firms	0.4157	0.0987	4.4826 *	0.7488	0.1776	0.4157
	(1.104)	(1.017)	(2.350)	(0.901)	(0.670)	(1.104)
Market competition	1.3220	1.4939	2.8321 *	1.8795	1.4390 *	1.3220
	(0.839)	(0.942)	(1.599)	(1.238)	(0.816)	(0.839)
Location fixed effects	0.2810	0.1590	-0.0307	-0.3854	1.5654	0.2810
	(0.880)	(0.947)	(2.607)	(1.191)	(0.986)	(0.880)
Industry fixed effects	-2.0436	-2.2985	-2.3686	-2.8787	-3.0586 *	-2.0436
	(1.536)	(1.632)	(2.545)	(2.138)	(1.591)	(1.536)
Time fixed effects	0.5504	0.5930	-5.7677	1.2947	1.3687 *	0.5504
	(0.717)	(0.675)	(4.107)	(1.096)	(0.756)	(0.717)
Estimator (Estimators other than listed below)						
GLS	-3.1962	-2.9776	-14.8909 **	-2.2473	-3.1428	-3.1962
	(2.971)	(3.323)	(5.927)	(3.215)	(2.175)	(2.971)
FE	-0.9862	-0.8759	-2.3313	0.2992	-2.1998	-0.9862
	(1.586)	(1.976)	(2.543)	(1.377)	(2.178)	(1.586)
RE	0.8742	0.3334	-0.0004	1.5496	-0.2771	0.8742
	(1.588)	(1.800)	(3.755)	(1.925)	(1.440)	(1.588)
GEE	1.0752	0.7017	-1.4262	1.2945	-0.7114	1.0752
	(1.384)	(1.358)	(3.202)	(2.355)	(1.122)	(1.384)
Tobit	0.5273	0.0506	-2.8803	0.4147	-1.3294	0.5273
	(1.485)	(1.678)	(3.836)	(2.415)	(1.351)	(1.485)
IV	-1.3306	-1.0186	-1.1455	-2.0150 **	-0.6943	-1.3306
	(0.886)	(0.909)	(1.349)	(0.933)	(0.915)	(0.886)

(continued)

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[7]	[8]	[9]	[10]	[11]	[12] [b]
Type of firm performance variable (Value added)						
Sales revenue	-2.4020 **	-2.4710 **	-1.9334 **	-1.6259	-0.5619	-2.4020 **
	(0.960)	(0.989)	(0.868)	(1.040)	(0.637)	(0.960)
Production volume	-3.1170 **	-3.6706 **	-6.0449 **	-0.9236 *	-1.0435	-3.1170 **
	(1.411)	(1.570)	(2.586)	(0.512)	(0.803)	(1.411)
Labor productivity	-1.8133 *	-1.7874 *	-1.2503	-1.1722	-0.0632	-1.8133 *
	(0.990)	(0.964)	(0.837)	(1.069)	(0.654)	(0.990)
TFP	-3.0461 **	-3.2943 **	-3.6860 ***	-1.6122 ***	-1.5123 ***	-3.0461 ***
	(1.138)	(1.391)	(1.096)	(0.308)	(0.539)	(1.138)
Price-cost margin	-4.5050 **	-4.6232 **	-12.6163 ***	-2.9568 *	-2.3636	-4.5050 ***
	(1.700)	(1.976)	(3.992)	(1.591)	(1.784)	(1.700)
Export market entry	-2.3745	-2.7291	-12.7015 *	0.0031	-3.2207	-2.3745
	(3.274)	(4.203)	(6.367)	(2.254)	(2.872)	(3.274)
Type of FDI variable (Share of equity)						
Share of assets	0.1028	-0.0548	0.2159	0.2493	0.4611 ***	0.1028
	(0.318)	(0.419)	(0.344)	(0.201)	(0.171)	(0.318)
Share of sales revenue	0.7125 *	0.7737 *	0.9599 **	0.2275	0.5194 ***	0.7125 **
	(0.358)	(0.429)	(0.380)	(0.217)	(0.191)	(0.358)
Share of production volume	2.6103	2.8095	7.3458 **	2.2819	1.8132	2.6103
	(1.895)	(1.998)	(2.892)	(2.011)	(2.103)	(1.895)
Share of export volume	-0.4321	0.0669	-0.4439	-1.0136 ***	-0.7809 *	-0.4321
	(1.020)	(1.699)	(2.450)	(0.368)	(0.462)	(1.020)
Share of value added	0.6181 **	0.5889 **	1.1184 ***	0.3497 ***	0.6218 ***	0.6181 ***
	(0.230)	(0.216)	(0.162)	(0.080)	(0.123)	(0.230)
Share of employment	1.4526 **	1.6086 **	1.3955 **	1.0561 *	0.8424 ***	1.4526 **
	(0.705)	(0.711)	(0.596)	(0.532)	(0.285)	(0.705)
Share of gross investment	1.2233	1.5302	-7.0459	3.4664 **	1.1196 ***	1.2233
	(0.866)	(1.134)	(4.615)	(1.624)	(0.337)	(0.866)
Aggregate level of FDI variable (1-digit level)						
2-digit level	1.1341	0.9292	3.4381 ***	-0.1220	1.7272	1.1341
	(1.145)	(0.802)	(0.890)	(0.841)	(1.263)	(1.145)
3-digit level	0.6435	1.3292	3.0243 ***	-0.6658	0.8766	0.6435
	(1.262)	(0.983)	(0.933)	(1.000)	(1.345)	(1.262)
4-digit level	2.5996 *	3.4480 **	4.1233 ***	0.6283	2.7580 **	2.5996 *
	(1.418)	(1.334)	(0.548)	(1.082)	(1.394)	(1.418)
Regional market level	0.6438	0.5785	1.1585	1.7318	1.9604 **	0.6438
	(0.922)	(1.148)	(1.896)	(1.801)	(0.888)	(0.922)
Coverage of FDI variable (All foreign firms)						
High-tech foreign firm	-0.6794	-0.6855	-2.4526 *	-2.6545 ***	-1.1197 ***	-0.6794
	(0.610)	(0.630)	(1.308)	(0.475)	(0.432)	(0.610)
Low-tech foreign firm	0.3002	0.2847	-0.0995	-0.4491	-0.0374	0.3002
	(0.444)	(0.460)	(0.916)	(0.323)	(0.266)	(0.444)
Foreign joint venture firm	1.2947 *	1.5094	2.3648 ***	1.0331	1.5374 **	1.2947 **
	(0.645)	(1.147)	(0.827)	(1.163)	(0.670)	(0.645)
Fully foreign owned firm	0.7647	0.7190	1.6723 **	0.8634	1.0075 *	0.7647
	(0.616)	(1.148)	(0.769)	(0.977)	(0.517)	(0.616)
Large-scale foreign firm	1.0909	1.3057	2.2350 **	0.4724	1.3337 **	1.0909 *
	(0.645)	(1.147)	(0.827)	(0.868)	(0.670)	(0.645)
Small and medium-sized foreign firm	0.7710	0.7252	2.0464 **	1.1024	1.0138 **	0.7710
	(0.616)	(1.148)	(0.769)	(1.311)	(0.517)	(0.616)
Other characteristics of FDI variable						
Nested FDI variable	-1.3121	-2.5951	-0.9363	-0.6885	-0.1943	-1.3121
	(1.030)	(1.679)	(0.995)	(0.848)	(0.420)	(1.030)
Lagged FDI variable	-0.7448	-0.8795	-0.5466	-0.0248	0.1583	-0.7448
	(0.693)	(0.743)	(0.864)	(0.576)	(0.601)	(0.693)
With an interaction term(s)	1.0940	1.4888	2.3504 **	2.4497 ***	0.9896	1.0940
	(0.697)	(1.034)	(0.938)	(0.843)	(0.742)	(0.697)
Effect type to test (Horizontal effect)						
Vertical forward effect	-0.6598	-0.6176	-1.1965	-1.2446	-0.7640	-0.6598
	(0.759)	(0.942)	(1.313)	(0.921)	(0.729)	(0.759)
Vertical backward effect	0.4166	0.9496	-1.1426	0.4747	0.2647	0.4166
	(1.312)	(1.521)	(1.767)	(0.904)	(1.252)	(1.312)
Degree of freedom and research quality						
$\sqrt{\text{Degree of freedom}}$	-0.0091	-0.0080	-0.0430 ***	-0.0097	-0.0010	-0.0091
	(0.011)	(0.011)	(0.015)	(0.012)	(0.009)	(0.011)
Quality level	-0.0404	-	-0.6082 **	-0.2770	-0.1138	-0.0404
	(0.185)	(-)	(0.274)	(0.248)	(0.225)	(0.185)
Intercept	93.1499	257.3312	-311.8691	626.6749	162.1665	93.1499
	(459.654)	(586.742)	(545.165)	(611.613)	(446.197)	(459.654)
K	625	625	625	625	625	625
R^2	0.268	0.367	0.598	0.537	-	0.268

Notes:

[a] Breusch-Pagan test: χ^2=0.00, p=1.000; Hausman test: χ^2=16.47, p=1.000

[b] Breusch-Pagan test: χ^2=0.00, p=1.000; Hausman test: χ^2=10.41, p=1.000

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 3 for definition and descriptive statistics of meta-independent variables.

Table 5. Meta-regression analysis of heterogeneity among studies of the direct effect of FDI

(a) Dependent variable — PCC

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[1]	[2]	[3]	[4]	[5]	[6] [a]
Target country (Bulgaria)						
Czech Republic	0.0386	0.0431 *	0.0264 ***	0.0482 *	0.0386 *	0.0386 *
	(0.023)	(0.022)	(0.005)	(0.027)	(0.020)	(0.023)
Estonia	0.0961 **	0.1035 **	0.0493 **	0.0912 *	0.0961 ***	0.0961 **
	(0.043)	(0.042)	(0.020)	(0.048)	(0.037)	(0.043)
Hungary	0.0317	0.0327	0.0256	0.0634	0.0317	0.0317
	(0.055)	(0.051)	(0.040)	(0.059)	(0.047)	(0.055)
Poland	0.1751 *	0.1938 *	0.0621	0.1879 *	0.1751 **	0.1751 *
	(0.092)	(0.094)	(0.039)	(0.100)	(0.080)	(0.092)
Romania	0.0582 ***	0.0494 ***	0.0555 ***	0.0510 ***	0.0582 ***	0.0582 ***
	(0.010)	(0.006)	(0.006)	(0.011)	(0.008)	(0.010)
Russia	0.0949 **	0.0746 *	0.0482 ***	0.0517 ***	0.0949 ***	0.0949 **
	(0.038)	(0.036)	(0.014)	(0.014)	(0.033)	(0.038)
Slovakia	0.0304	0.0373	-0.0109	0.0520	0.0304	0.0304
	(0.043)	(0.043)	(0.011)	(0.048)	(0.037)	(0.043)
Slovenia	0.0674 *	0.0651 *	0.0327 *	0.0631	0.0674 **	0.0674 *
	(0.036)	(0.033)	(0.016)	(0.039)	(0.032)	(0.036)
Ukraine	0.0790	0.0621	0.0201	0.0419	0.0790 *	0.0790
	(0.048)	(0.048)	(0.015)	(0.032)	(0.042)	(0.048)
Target industry (All industries)						
Mining and manufacturing industry	-0.1277 ***	-0.1235 ***	-0.0849 ***	-0.1409 ***	-0.1277 ***	-0.1277 ***
	(0.027)	(0.022)	(0.016)	(0.027)	(0.024)	(0.027)
Service industry	-0.1462 ***	-0.1555 ***	-0.0982 ***	-0.1675 ***	-0.1462 ***	-0.1462 ***
	(0.047)	(0.046)	(0.025)	(0.048)	(0.041)	(0.047)
Estimation period						
First year of estimation	0.0146	0.0158	0.0154 **	0.0099	0.0146	0.0146
	(0.013)	(0.011)	(0.006)	(0.013)	(0.011)	(0.013)
Length of estimation	0.0195	0.0182	0.0137 **	0.0126	0.0195	0.0195
	(0.016)	(0.011)	(0.006)	(0.016)	(0.013)	(0.016)
Data type (Panel data)						
Cross-section data	0.2369 ***	0.2258 ***	0.1453 ***	0.2421 ***	0.2369 ***	0.2369 ***
	(0.052)	(0.025)	(0.008)	(0.050)	(0.045)	(0.052)
Data source (Official statistics)						
Commercial database	0.0048	0.0039	-0.0064	0.0086	0.0048	0.0048
	(0.012)	(0.016)	(0.011)	(0.013)	(0.010)	(0.012)
Type of observations (All domestic firms)						
Domestically owned firm	0.0135	0.0105	0.0001	0.0054	0.0135	0.0135
	(0.016)	(0.011)	(0.002)	(0.010)	(0.014)	(0.016)
Equation type (Models other than listed below)						
Difference model	0.0837 **	0.0846 **	0.0721	0.0278	0.0837 ***	0.0837 **
	(0.037)	(0.031)	(0.051)	(0.049)	(0.032)	(0.037)
Translog model	0.1726 **	0.1606 **	0.0401	0.1472 ***	0.1726 ***	0.1726 **
	(0.075)	(0.060)	(0.034)	(0.047)	(0.065)	(0.075)
Control variable						
Market competition	-0.0428 *	-0.0457 **	-0.0398 *	-0.0237	-0.0428 **	-0.0428 *
	(0.022)	(0.020)	(0.019)	(0.021)	(0.019)	(0.022)
Location fixed effects	-0.0196	-0.0284	-0.0311	-0.0149	-0.0196	-0.0196
	(0.033)	(0.029)	(0.041)	(0.030)	(0.029)	(0.033)
Industry fixed effects	0.0183 ***	0.0163 ***	0.0159 **	0.0225 ***	0.0183 ***	0.0183 ***
	(0.006)	(0.005)	(0.007)	(0.005)	(0.005)	(0.006)
Time fixed effects	-0.0284	-0.0318	-0.0362	-0.0155	-0.0284	-0.0284
	(0.026)	(0.022)	(0.023)	(0.024)	(0.022)	(0.026)
Estimator (Estimators other than listed below)						
FE	-0.0163	-0.0310	-0.0467	-0.0417	-0.0163	-0.0163
	(0.036)	(0.035)	(0.055)	(0.030)	(0.031)	(0.036)
RE	0.0229	0.0216	0.0302	0.0018	0.0229	0.0229
	(0.030)	(0.027)	(0.020)	(0.008)	(0.026)	(0.030)

(continued)

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[1]	[2]	[3]	[4]	[5]	[6] [a]
Type of firm performance variable (Value added)						
Sales revenue	0.0188	0.0199	0.0017	0.0098	0.0188	0.0188
	(0.013)	(0.015)	(0.003)	(0.012)	(0.012)	(0.013)
Production volume	-0.0144	-0.0275	-0.0677	-0.0129	-0.0144	-0.0144
	(0.035)	(0.028)	(0.053)	(0.036)	(0.031)	(0.035)
Labor productivity	0.0190	0.0228	-0.0002	0.0101	0.0190	0.0190
	(0.014)	(0.019)	(0.003)	(0.012)	(0.012)	(0.014)
TFP	0.1839 **	0.1733 **	0.0392	0.1538 **	0.1839 ***	0.1839 **
	(0.080)	(0.062)	(0.034)	(0.054)	(0.070)	(0.080)
Export market entry	0.1853 **	0.1858 **	0.0212	0.1132 *	0.1853 ***	0.1853 **
	(0.073)	(0.080)	(0.093)	(0.062)	(0.063)	(0.073)
Type of FDI variable						
Dummy variable (Foreign ownership share)	0.0157	0.0150	0.0350 ***	0.0214	0.0157	0.0157
	(0.015)	(0.010)	(0.004)	(0.015)	(0.013)	(0.015)
With an interaction term(s)	-0.0428 ***	-0.0393 ***	-0.0381 ***	-0.0374 **	-0.0428 ***	-0.0428 ***
	(0.011)	(0.012)	(0.006)	(0.014)	(0.010)	(0.011)
Degree of freedom and research quality						
√ Degree of freedom	0.0002	0.0003	0.0001	0.0003	0.0002	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Quality level	-0.0042	-	0.0006	-0.0071	-0.0042	-0.0042
	(0.008)	(-)	(0.008)	(0.005)	(0.007)	(0.008)
Intercept	-29.3305	-31.8291	-30.7797 **	-19.9108	-29.3305	-29.3305
	(25.647)	(21.717)	(11.420)	(26.886)	(22.265)	(25.647)
K	135	135	135	135	135	135
R^2	0.813	0.826	0.921	0.872	-	0.813

(continued)

(b) Dependent variable — t value

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[7]	[8]	[9]	[10]	[11]	[12] [b]
Target country (Bulgaria)						
Czech Republic	0.3426	0.7636	0.7405	1.2497	0.3426	0.3426
	(0.888)	(0.720)	(0.814)	(1.154)	(0.771)	(0.888)
Estonia	3.1928 **	4.2405 **	5.0026 **	5.4344 **	3.1928 ***	3.1928 **
	(1.427)	(1.799)	(2.153)	(1.870)	(1.239)	(1.427)
Hungary	1.3335	2.5271 *	3.1170	5.8423 *	1.3335	1.3335
	(1.491)	(1.295)	(4.914)	(3.165)	(1.294)	(1.491)
Poland	2.7513 *	4.1623 **	0.7556	4.5143 **	2.7513 **	2.7513 *
	(1.518)	(1.400)	(2.728)	(1.825)	(1.318)	(1.518)
Romania	3.1779 ***	2.2656 **	2.8373 **	2.2584 **	3.1779 ***	3.1779 ***
	(1.064)	(0.972)	(1.313)	(0.797)	(0.923)	(1.064)
Russia	0.3618	-3.6945	2.4977	-6.1798	0.3618	0.3618
	(3.527)	(3.112)	(2.335)	(4.315)	(3.062)	(3.527)
Slovakia	0.7700	2.1403 *	0.4060	4.1470 **	0.7700	0.7700
	(1.357)	(1.090)	(1.607)	(1.609)	(1.178)	(1.357)
Slovenia	2.2647 **	1.8562	4.5772 ***	2.6345	2.2647 **	2.2647 **
	(1.040)	(1.207)	(1.343)	(1.689)	(0.903)	(1.040)
Ukraine	-2.0693	-4.7632	-0.6822	-5.8901	-2.0693	-2.0693
	(2.651)	(3.087)	(1.383)	(3.822)	(2.301)	(2.651)
Target industry (All industries)						
Mining and manufacturing industry	-4.8739	-4.7716 *	-6.3955 **	-6.2329	-4.8739 *	-4.8739
	(3.011)	(2.583)	(2.622)	(4.350)	(2.614)	(3.011)
Service industry	-6.8163	-9.2870 **	-9.1884 **	-11.6805 **	-6.8163 *	-6.8163 *
	(4.102)	(4.295)	(3.911)	(5.026)	(3.561)	(4.102)
Estimation period						
First year of estimation	0.1115	0.0524	0.6216	-0.8527	0.1115	0.1115
	(1.282)	(1.011)	(0.932)	(1.718)	(1.113)	(1.282)
Length of estimation	0.2061	-0.0534	0.1351	-1.0881	0.2061	0.2061
	(1.429)	(0.872)	(1.031)	(1.976)	(1.241)	(1.429)
Data type (Panel data)						
Cross-section data	18.8646 ***	19.4463 ***	15.1179 ***	21.6480 ***	18.8646 ***	18.8646 ***
	(3.052)	(1.525)	(1.442)	(4.318)	(2.650)	(3.052)
Data source (Official statistics)						
Commercial database	0.7262	0.1386	3.2367 **	0.1919	0.7262	0.7262
	(0.903)	(1.166)	(1.240)	(1.107)	(0.784)	(0.903)
Type of observations (All domestic firms)						
Domestically owned firm	0.8358	0.6962	0.2991	0.5550	0.8358	0.8358
	(0.855)	(0.656)	(0.474)	(1.033)	(0.742)	(0.855)
Equation type (Models other than listed below)						
Difference model	-2.1348	-2.1123	-5.3756	-6.7659	-2.1348	-2.1348
	(2.759)	(2.607)	(6.787)	(4.185)	(2.395)	(2.759)
Translog model	-0.6218	-3.5456	-8.2675 *	-7.2677	-0.6218	-0.6218
	(4.921)	(3.593)	(4.611)	(4.839)	(4.273)	(4.921)
Control variable						
Market competition	-0.8447	-1.1231	-1.7667	0.9251	-0.8447	-0.8447
	(1.607)	(1.920)	(2.173)	(2.481)	(1.395)	(1.607)
Location fixed effects	0.1273	-1.2550	-2.3403	0.5393	0.1273	0.1273
	(4.199)	(3.945)	(5.852)	(4.145)	(3.646)	(4.199)
Industry fixed effects	2.1991 ***	1.8728 ***	1.9635 *	2.5569 ***	2.1991 ***	2.1991 ***
	(0.698)	(0.576)	(1.021)	(0.586)	(0.606)	(0.698)
Time fixed effects	-0.2011	-0.9928	-1.6122	0.9752	-0.2011	-0.2011
	(2.756)	(2.667)	(2.911)	(3.118)	(2.393)	(2.756)
Estimator (Estimators other than listed below)						
FE	-4.2400	-6.1028	-5.5719	-6.0661	-4.2400	-4.2400
	(4.220)	(4.109)	(8.013)	(4.368)	(3.664)	(4.220)
RE	1.6421	1.6579	6.9292 **	0.6370	1.6421	1.6421
	(2.207)	(2.028)	(3.063)	(0.940)	(1.916)	(2.207)

(continued)

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	Random-effects panel GLS
Meta-independent variable (Default) / Model	[7]	[8]	[9]	[10]	[11]	[12] [b]
Type of firm performance variable (Value added)						
Sales revenue	1.0635	1.2826	0.0830	0.9897	1.0635	1.0635
	(0.766)	(0.905)	(0.356)	(1.074)	(0.665)	(0.766)
Production volume	0.2514	0.3684	1.3045	3.0592	0.2514	0.2514
	(1.703)	(1.202)	(7.017)	(2.442)	(1.478)	(1.703)
Labor productivity	0.9024	1.1571	-0.3121	0.9555	0.9024	0.9024
	(0.803)	(1.041)	(0.354)	(1.083)	(0.697)	(0.803)
TFP	-0.1907	-2.8687	-8.5190 *	-6.7215	-0.1907	-0.1907
	(5.275)	(3.873)	(4.393)	(5.678)	(4.580)	(5.275)
Export market entry	-1.2885	-4.1171	-8.4723	-8.5730	-1.2885	-1.2885
	(5.772)	(5.894)	(12.001)	(7.186)	(5.011)	(5.772)
Type of FDI variable						
Dummy variable (Foreign ownership share)	0.6731	0.8331	0.6775	0.4602	0.6731	0.6731
	(1.270)	(0.845)	(0.661)	(1.866)	(1.102)	(1.270)
With an interaction term(s)	-3.2856 *	-2.4513 *	-4.5273 ***	-1.8032	-3.2856 **	-3.2856 **
	(1.584)	(1.227)	(1.360)	(1.499)	(1.375)	(1.584)
Degree of freedom and research quality						
$\sqrt{}$Degree of freedom	0.0345	0.0627 **	0.0409	0.0736 ***	0.0345	0.0345
	(0.027)	(0.023)	(0.036)	(0.022)	(0.024)	(0.027)
Quality level	-0.0689	-	0.2072	-0.3218	-0.0689	-0.0689
	(0.606)	(-)	(1.154)	(0.575)	(0.526)	(0.606)
Intercept	-220.3666	-99.7437	-1229.4110	1715.0280	-220.3666	-220.3666
	(2,557.708)	(2,015.838)	(1,850.002)	(3,430.360)	(2,220.536)	(2,557.708)
K	135	135	135	135	135	135
R^2	0.890	0.905	0.917	0.909	-	0.890

Notes:

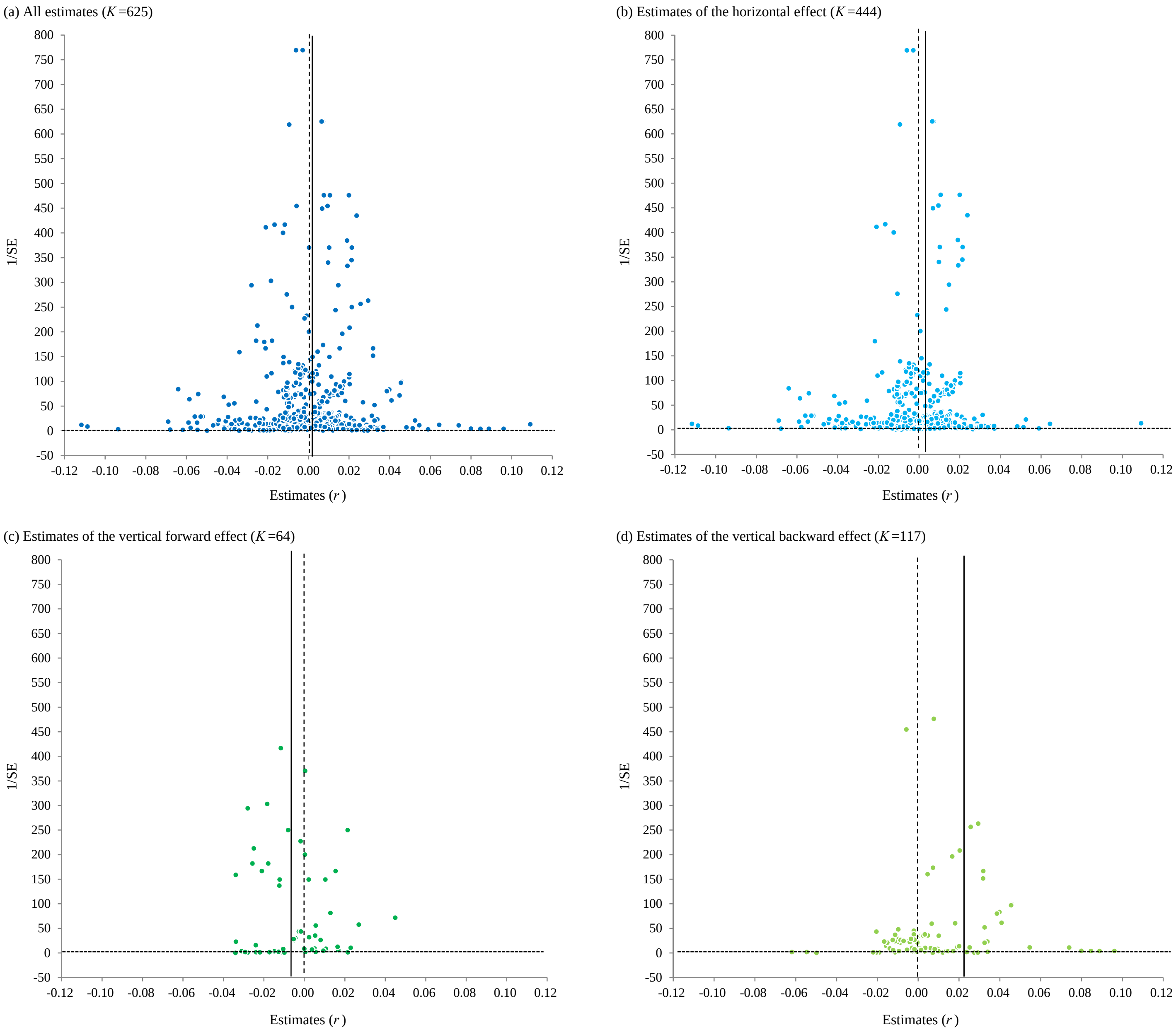
[a] Breusch-Pagan test: χ^2 =0.00, p =1.000; Hausman test: χ^2 =5.56, p =0.999

[b] Breusch-Pagan test: χ^2 =0.00, p =1.000; Hausman test: χ^2 =2.66, p =1.000

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 3 for definition and descriptive statistics of meta-independent variables.

Figure 8. Funnel plot of estimates of the indirect effect of FDI

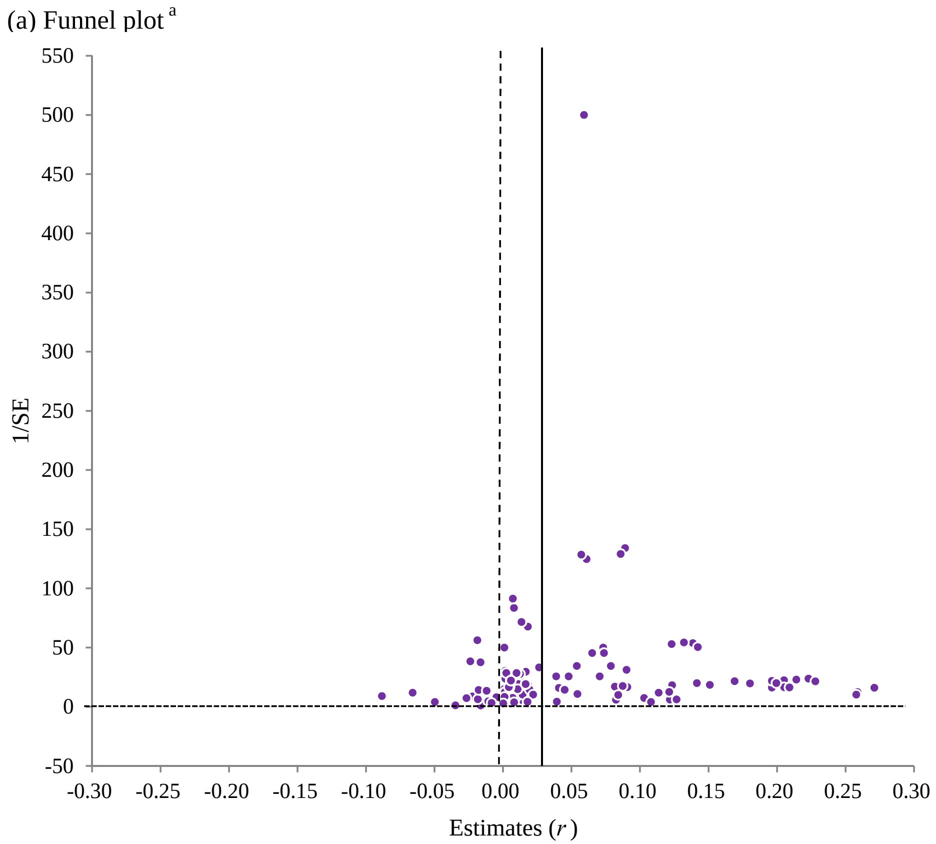


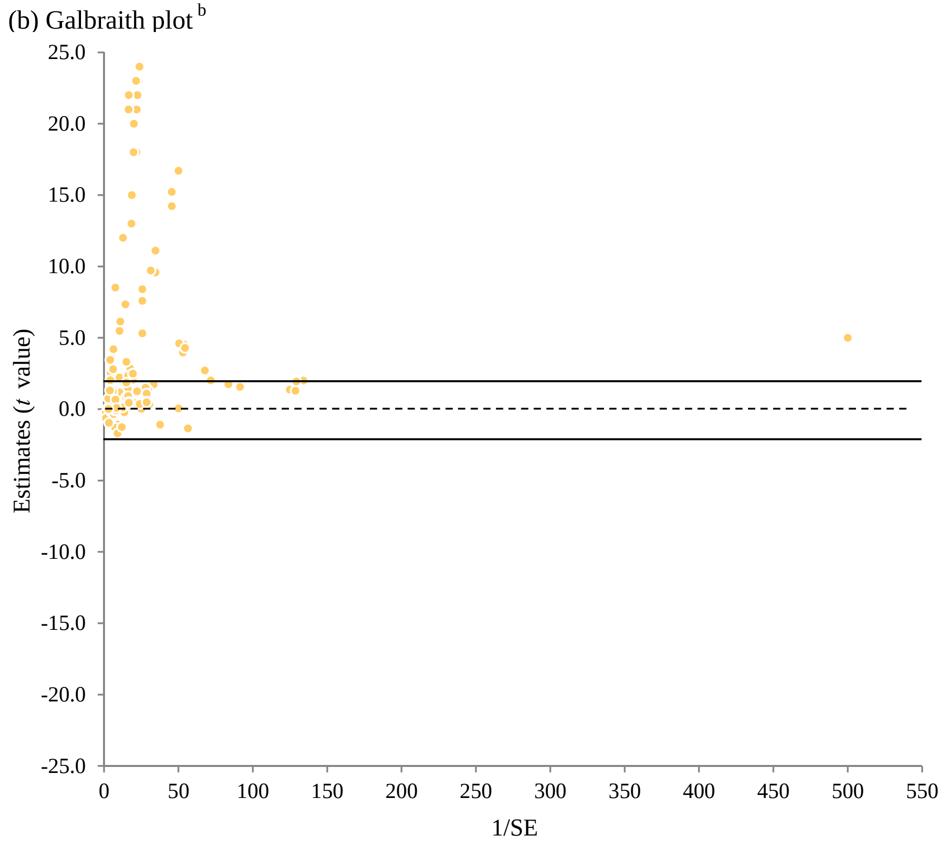
Note: Solid line indicates the mean of the top 10% most-precise estimates. The values for all estimates, the horizontal effect, the vertical forward effect, and the vertical backward effect are 0.001, 0.002, -0.007, and 0.022, respectively.

Figure 9. Galbraith plot of estimates of the indirect effect of FDI

Note: Solid lines indicate the thresholds of two-sided critical values at the 5% significance level ±1.96.

Figure 10. Funnel plot and Galbraith plot of estimates of the direct effect of FDI (K =135)





Notes:

[a] Solid line indicates the mean of the top 10% most-precise estimates, 0.03.

[b] Solid lines indicate the thresholds of two-sided critical values at the 5% significance level ±1.96.

Table 6. Meta-regression analysis of publication selection in studies on the indirect effect of FDI

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

Estimates to test	All estimates			Estimates of the horizontal effect			Estimates of the vertical forward effect			Estimates of the vertical backward effect		
Estimator	OLS	Cluster-robust OLS	Random-effects panel GLS	OLS	Cluster-robust OLS	Random-effects panel GLS	OLS	Cluster-robust OLS	Random-effects panel GLS	OLS	Cluster-robust OLS	Random-effects panel GLS
Model	[1]	[2]	[3] [a]	[4]	[5]	[6] [b]	[7]	[8]	[9] [c]	[10]	[11]	[12] [d]
Intercept (FAT: H_0: β_0=0)	0.2275	0.2275	0.0341	0.2750 *	0.2750	-0.2026	-0.6481 **	-0.6481	-0.6528	0.3858	0.3858	0.5697
	(0.145)	(0.293)	(0.456)	(0.163)	(0.437)	(0.552)	(0.308)	(0.618)	(0.566)	(0.426)	(1.176)	(1.179)
1/SE (PET: H_0: β_1=0)	0.0009	0.0009	0.0020	0.0004	0.0004	0.0025	0.0013	0.0013	0.0041	0.0068	0.0068	0.0070
	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.002)	(0.004)	(0.006)	(0.005)	(0.008)	(0.007)
K	625	625	625	444	444	444	64	64	64	117	117	117
R^2	0.0009	0.0009	0.0009	0.0002	0.0002	0.0002	0.0053	0.0053	0.0053	0.0181	0.0181	0.0181

(b) Test of type II PSB (Equation: $|t|=\beta_0+\beta_1(1/SE)+v$)

Estimates to test	All estimates			Estimates of the horizontal effect			Estimates of the vertical forward effect			Estimates of the vertical backward effect		
Estimator	OLS	Cluster-robust OLS	Random-effects panel GLS	OLS	Cluster-robust OLS	Fixed-effects panel LSDV	OLS	Cluster-robust OLS	Random-effects panel GLS	OLS	Cluster-robust OLS	Fixed-effects panel LSDV
Model	[13]	[14]	[15] [e]	[16]	[17]	[18] [f]	[19]	[20]	[21] [g]	[22]	[23]	[24] [h]
Intercept (H_0: β_0=0)	1.9785 ***	1.9785 ***	1.8254 ***	1.9156 ***	1.9156 ***	1.6580 ***	1.4758 ***	1.4758 ***	1.2915 ***	2.4071 ***	2.4071 **	2.0925 ***
	(0.115)	(0.378)	(0.409)	(0.129)	(0.332)	(0.125)	(0.236)	(0.512)	(0.435)	(0.334)	(0.918)	(0.222)
1/SE	-0.0016 **	-0.0016	0.0013	-0.0015 **	-0.0015	0.0032	-0.0016	-0.0016	0.0022	0.0001	0.0001	0.0082
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.005)	(0.006)
K	625	625	625	444	444	444	64	64	64	117	117	117
R^2	0.0042	0.0042	0.0042	0.0043	0.0043	0.0043	0.0136	0.0136	0.0136	0.0000	0.0000	0.0000

(c) PEESE approach (Equation: $t=\beta_0 SE+\beta_1(1/SE)+v$)

Estimates to test	All estimates			Estimates of the horizontal effect			Estimates of the vertical forward effect			Estimates of the vertical backward effect		
Estimator	OLS	Cluster-robust OLS	Random-effects panel ML	OLS	Cluster-robust OLS	Random-effects panel ML	OLS	Cluster-robust OLS	Random-effects panel ML	OLS	Cluster-robust OLS	Random-effects panel ML
Model	[25]	[26]	[27]	[28]	[29]	[30]	[31]	[32]	[33]	[34]	[35]	[36]
SE	-0.0004	-0.0004	0.0014	0.0002	0.0002	0.0024	-0.3820 ***	-0.3820 **	-0.2919 **	-0.4111	-0.4111	-0.1655
	(0.001)	(0.001)	(0.009)	(0.000)	(0.000)	(0.008)	(0.139)	(0.146)	(0.144)	(0.393)	(0.875)	(0.438)
1/SE (H_0: β_1=0)	0.0019 ***	0.0019	0.0020	0.0015 **	0.0015	0.0023	-0.0017	-0.0017	0.0030	0.0089 **	0.0089	0.0073 **
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.004)	(0.006)	(0.003)
K	625	625	625	444	444	444	64	64	64	117	117	117
R^2	0.0048	0.0048	-	0.0037	0.0037	-	0.0780	0.0780	-	0.0427	0.0427	-

Notes:

[a] Breusch-Pagan test: χ^2=37.92, p=0.000; Hausman test: χ^2=0.10, p=0.746

[b] Breusch-Pagan test: χ^2=106.71, p=0.000; Hausman test: χ^2=0.13, p=0.721

[c] Breusch-Pagan test: χ^2= 25.95, p=0.000; Hausman test: χ^2=0.02, p=0.888

[d] Breusch-Pagan test: χ^2=125.26, p=0.000; Hausman test: χ^2=0.11, p=0.743

[e] Breusch-Pagan test: χ^2=382.79, p=0.000; Hausman test: χ^2=2.54, p=0.111

[f] Breusch-Pagan test: χ^2= 117.24, p=0.000; Hausman test: χ^2=3.86, p=0.049

[g] Breusch-Pagan test: χ^2= 30.48, p=0.000; Hausman test: χ^2=1.37, p=0.242

[h] Breusch-Pagan test: χ^2=109.35, p=0.000; Hausman test: χ^2= 2.83, p=0.093

Figures in parentheses beneath the regression coefficients are standard errors. Except for Model [27], [30], [33], and [36], robust standard errors are estimated. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7. Meta-regression analysis of publication selection in studies on the direct effect of FDI

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

Estimator	OLS	Cluster-robust OLS	Random-effects panel GLS
Model	[1]	[2]	[3] [a]
Intercept (FAT: H_0: $\beta_0=0$)	4.425 ***	4.425 *	2.955 ***
	(0.63)	(2.23)	(1.06)
1/SE (PET: H_0: $\beta_1=0$)	-0.004	-0.004	0.012 ***
	(0.01)	(0.01)	(0.00)
K	135	135	135
R^2	0.001	0.001	0.001

(b) Test of type II PSB (Equation: $|t|=\beta_0+\beta_1(1/SE)+v$)

Estimator	OLS	Cluster-robust OLS	Random-effects panel GLS
Model	[4]	[5]	[6] [b]
Intercept (H_0: $\beta_0=0$)	4.652 ***	4.652 **	3.216 ***
	(0.62)	(2.19)	(1.01)
1/SE	-0.005	-0.005	0.011 ***
	(0.01)	(0.01)	(0.00)
K	135	135	135
R^2	0.001	0.001	0.001

(c) PEESE approach (Equation: $t=\beta_0 SE+\beta_1(1/SE)+v$)

Estimator	OLS	Cluster-robust OLS	Random-effects panel ML
Model	[7]	[8]	[9]
SE	8.974 **	8.974	-4.108
	(3.91)	(7.13)	(2.77)
1/SE (H_0: $\beta_1=0$)	0.035 **	0.035 *	0.012 *
	(0.01)	(0.02)	(0.01)
K	135	135	135
R^2	0.116	0.116	-

Notes:

[a] Breusch-Pagan test: χ^2 = 536.47, p=0.000; Hausman test: χ^2=0.60, p=0.438

[b] Breusch-Pagan test: χ^2=550.23, p=0.000; Hausman test: χ^2=0.61, p=0.435

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.