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Abstract:
The present paper conducts a meta-analysis of literature on intra-industry spillovers from foreign direct investment, using 97 different outcomes from 67 empirical studies. Apart from the traditional approach, robust meta-regression, random-effects model, and normal probability regression are employed. Results of combined significance analysis are mixed but it is evident that studies published in leading academic journals tend to report rather insignificant results. Our findings suggest that the outcome of an empirical work is, in general, dependent on its design, although this pattern seems to weaken over time. Contrary to previous studies, evidence for publication bias was not detected.

Keywords: meta-analysis, productivity spillovers, technology transfer, foreign direct investment, multinational companies

JEL: D62, F21, F23, O12.

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1 Introduction

Governments all over the world pay fortunes, either in cash or as tax holidays, to attract inward foreign direct investment (FDI) under their jurisdiction. There are plenty of reasons why governments attempt to lure multinational companies (MNCs) but the principal one resides in their expectations of positive productivity externalities spilling over from MNCs to domestic firms (see Blomström & Kokko 2003). There has been a substantial body of empirical literature on productivity spillovers since the 1970s, and many narrative literature reviews have been published (see, *inter alia*, Pack & Saggi 1997). The first quantitative survey, commonly called a meta-analysis, was conducted by Görg & Strobl (2001), followed by Meyer & Sinani (2005), and Wooster & Diebel (2006). For a discussion of the pros and cons of narrative and quantitative literature review methodologies, see Stanley (2001).

Meta-analysis is a rather new method in economics; it has been employed only since the 1980s, and the *meta-regression* approach which we use in this paper, particularly, was developed by Stanley & Jarrell (1989). The recent economic research by means of meta-analysis covers for instance Martins & Yang (2007) studying causal relationship between export and firm's productivity, Gallet (2007) trying to uncover the extent to which study characteristics influence the estimates of tuition and income elasticities, Li *et al.* (2007) investigating systematic variation across environmental Kuznets curve studies, or Fidrmuc & Korhonen (2006) who present a study on business cycle correlation between the Euro area and the Central-East European Economies. Another interesting part of the older literature includes works of Jarrell & Stanley (1990) studying the literature on union-nonunion wage gap, Zelmer (2001) who assesses the impact of different factors on the extent of cooperation in standard linear public goods experiments, Gallet & List (2003) exploring factors that influence variations within and across studies of cigarette demand elasticities or Rose & Stanley (2005) investigating the effect of currency unions on international trade.

A meta-analyst rigorously combines the outcomes of several works that study the same phenomena. A meta-regression analyst, in the concrete, collects a number of statistics from the targeted literature—e.g., correlation coefficients, or t statistics of estimates of the effect in question—and regresses it on several proxies of study design. If any of meta-explanatory variables is found to be significant, it is taken as an evidence that studies' results are *dependent on their design* (for a good introduction to the meta-regression technique, see Stanley 2001). Concerning the meta-analyses of the spillover literature, Görg & Strobl (2001) apply plain ordinary least squares (OLS) meta-regression, Meyer & Sinani (2005) employ panel data methods, and Wooster & Diebel (2006) perform logistic meta-regression. We combine all the three methods and include also robust estimations to get a more stable overall model. The sample of literature used in this meta-analysis is also much broader than in the previous ones, containing 67 original empirical works.

The present paper is structured as follows: Section 2 lists channels of transfers of intra-industry (or horizontal) spillovers from MNCs to domestic firms, and describes the standard design of empirical works on horizontal spillovers. Section 3 discusses in detail the sample selection procedure which was employed, and describes properties of the resulting dataset. Section 4 investigates the combined significance of the collected t statistics. In Section 5, the meta-regression analysis is performed. Section 6 tests for the presence of publication bias in the spillover literature. Section 7 concludes.

2 Channels of Technology Transfer

The history of intra-industry spillover literature dates from 1960, covering works of MacDougall, Corden or Caves, who analyzed the welfare effects of FDI, its impact on optimal tariff policy, industrial level, and international trade openness. A deeper specification is provided in Blomström & Kokko (1996), embodied in the three main channels of technology transfer:

Competition effect As emphasized e.g. in Blomström (1992), the entrance of foreign enterprises contributes to the progression on industrial, technological and managerial level and exports dynamics through the creation of competitive environment. Nevertheless, multinational companies may evoke crowding-out effects as well as *unfair* competition, generating harmful externalities to the domestic firms. MNCs can acquire significant market shares or drain deficient resources. Such unwanted effects are highlighted by several researchers (for instance, Haddad & Harrison 1993, who, in fact, find evidence of *negative* horizontal spillovers).

Demonstration effect Its realization stems from the differences in technology between foreign investors and host-country firms. MNCs enter the host-country market and establish affiliates which possess superior technology compared to local companies. The latter watch and imitate these affiliates in the same industry, thus becoming more productive. Sometimes, only a direct contact with new technologies can overcome conservative attitudes toward the implementation of up-to-date technologies (Blomström & Kokko 1996).

Labor turnover Host country's citizens employed by the foreign investor might benefit from the contact with advanced technologies and production methods. Based on the transfer of human capital, knowledge, and skills toward the host country labor reservoir, this labor exchange phenomena can enhance competitiveness of domestic firms. It does not restrict on horizontal spillovers only since many of MNC's local suppliers use to be established by its former employees. MNCs train local labor force because it is still cheaper than import skilled labor from their home country, even though, in most cases, they cannot prevent the labor turnover (see Görg & Greenaway 2004).

The emergence of widely spread lower level innovations has been significant for economies as much as those of higher order. New products entail interdependencies, calling for the manufacture of further betterments, the future necessities. Generation of externalities happens through local interactions, mobility, information diffusion, international trade or FDI. However, the heterogeneity on local, even on global level seems to cause severe difficulties in implementation and just an extrapolation from experiences, a loan of tools or policies, might be in the specific cases not good enough.

Since it is not possible the measure the above-mentioned effects directly, empirical works on horizontal spillovers are usually performed in the following way: researchers collect data on firms' productivity or output (either on firm or industry level) and regress it on *a measure of foreign presence* in the firms' industries, controlling also for additional variables (capital/output, labor/output ratios, etc.). If the estimate of the parameter for foreign presence is found to be positive and significant, the authors conclude that there is some statistical evidence for the existence of intra-industry spillovers.

3 The Sample of Literature

In the present paper, 97 results from 67 different studies are used, which is a significant increase compared to Görg & Strobl (2001), who used a sample of 21 studies, or Meyer & Sinani (2005) and Wooster & Diebel (2006), who had at their disposal 41 and 32 studies, respectively. We tried to include all relevant papers listed in the previous meta-analyses; additional search was performed in the EconLit and Google Scholar databases using combinations of the keywords "spillovers", "foreign direct investment", "productivity spillovers", and "technology transfer".

We follow the approach of Görg & Strobl (2001) in the selection process, i.e., only those studies are included that do not *diverge significantly* from the standard methodology of productivity-spillovers empirical work as it is described in Section 2, and only English-written papers are considered. What does "diverge significantly" mean? In the first place, we do not use works on vertical (or inter-industry) and R&D spillovers. These categories are qualitatively relative, but the tested models are, in our opinion, too distinct to be pooled together in the framework of a meta-analysis, and it would be much more appropriate to analyze these streams of literature separately. Nevertheless, it should be noted that, for instance, Meyer & Sinani (2005) use both intra- and inter-industry spillovers studies. However, the more distant studies are used, the more heterogeneous the sample becomes and the less reliable are the results drawn from it. Random-effects meta-analysis may provide a remedy for heterogeneity (see, *inter alia*, Hedges 1992), but better advance may be to avoid the problem.

Excluding inter-industry and R&D spillovers, there is still a substantial body of empirical literature dealing with horizontal spillovers. Many papers present multiple models, and thus multiple results. As a rule, we tried to choose the one that was considered the best by the researchers themselves. If the preferred model was not suitable for the analysis—i.e., it diverged too much from the standard methodology—, the model with the highest R-squared (or adjusted R-squared, depending on which one was published) was selected. There are also works that examine different countries with the same methodology, or one country with different specifications which are, nevertheless, consistent with the mainstream approach. For example, Konings (2000) studies spillovers in Bulgaria, Poland, and Romania separately, thus 3 observations were included from his paper. Liu (2008) first presents a purely firm-level model but subsequently adds industry dummies, thus we obtain two observations from this paper, etc. On the other hand, Sadik & Bolbol (2001) apply not industry- or firm-, but country-level aggregation, and Zhu & Tan (2000) uses city-level dataset, therefore we do not include these papers (although Wooster & Diebel (2006) use them). Rattsø & Stokke (2003) employ two proxies for foreign presence at the same time, the share of trade on GDP and FDI on overall investment, none of them belonging to the standard measures in the spillover literature—thus this paper is also excluded from the meta-analysis.

We realize that the selection process is the most vulnerable part of the present work, but the final sample is quite broad and represents works of researchers from dozens of countries and evidence from many economies around the world. Both journal articles and working papers were used. The list of employed studies and some of their characteristics can be found in Table 7 in the Appendix (the column "Result" does not necessarily report researchers' conclusion; the significance of spillover effect is based on simple average of specifications which were included to our analysis from the particular paper).

The first aspect of study design that we include in the meta-analysis is the status of the country for which the data are used. From the whole sample of 97 observations, 41 models are using data for developing countries, 34 models' data are for transition countries, and 22 for advanced economies. Countries are distributed in groups according to the European Economic Association (transition countries list) and the World Bank (developing economies list). The second aspect is the (non)existence of time dimension in the data. Thirty-two models use cross-sectional data, the remaining 65 models rely on panel-data techniques. The third aspect is the definition of MNCs' presence. Thirty-two specifications define foreign presence in the industry as foreign firms' share on employment, 25 use assets, 21 output, and 19 share of sales. The fourth aspect is the level of aggregation. Forty models use purely firm-level data, whereas 35 include also industry dummies and 22 aggregates data on the level of industries. The fifth aspect is the definition of the response variable. Thirty-nine specifications use output growth, 54 models apply labor (or total factor) productivity and the rest employ other measures (for details of different measures, see Görg & Strobl 2001). Exact definitions of all variables and their summary statistics can be found in Table 9 in the Appendix.

4 Combined Significance

Once we have collected a broad sample of empirical studies on intra-industry spillovers, the most natural question appears to be: can we somehow decide whether or not is the general spillover effect significant? The crucial result of every empirical work on productivity spillovers is the (non)significance, polarity, and magnitude of the estimate of the parameter which corresponds to the variable that is used as a proxy for foreign presence in the industry. Since every researcher can (and generally does) use different units, it is not appropriate to take the magnitude of estimates as the representative variable. The t statistic, on the other hand, is a dimension-less variable which is widely employed for the purposes of a meta-analysis (it is also used by all three existing meta-analyzes of the spillover literature Görg & Strobl 2001; Meyer & Sinani 2005; Wooster & Diebel 2006).

The first possible way how to deliver a result is to employ the so-called "vote-counting method" (see, *inter alia*, Hunter & Schmidt 1990). Following this approach, one would count the median value of t statistics in the sample; let us denote it T_M. If the median value was significant, this could be taken as an evidence for existence of the phenomenon in question, and *vice versa*. This method has been criticized, e.g., by Djankov & Murrell (2002). Instead of the vote-counting method, they examine the following statistics:

$$T = \frac{\sum_{k=1}^{K} t_k}{\sqrt{K}}, \tag{1}$$

where K denotes the number of models included in the meta-analysis (i.e., $K = 97$ in our case) and t_k is the t statistic taken from the k-th model. Supposing that all studies have sufficiently large number of degrees of freedom, T is normally distributed and combined significance can be easily tested. Note that, from this point of view, the vote-counting method drastically *under-values* the "real" effect. Djankov & Murrell (2002) also propose another modification of (1):

$$T_W = \frac{\sum_{k=1}^{K} w_k t_k}{\sqrt{\sum_{k=1}^{K} w_k^2}}, \tag{2}$$

where w_k are weights assigned to the k-th model, T_W being normally distributed. Both (1) and (2) are used in productivity-spillovers meta-analyses. Meyer & Sinani (2005) arbitrary assign higher weights to the models that employ "sophisticated econometric methods", Wooster & Diebel (2006) simply use the inversion of the number of models taken from a particular paper (for example, if 3 models from the paper are taken, each has the weight 1/3). We define a combined weight which accounts for *(i)* the number of models from a particular paper as in Wooster & Diebel (2006), and *(ii)* the "quality" of the paper. Quality is simply proxied by the level of publication, i.e., working papers have the lowest weight ($w = 0.25$), articles published in lesser journals have moderate weight ($w = 0.5$), and articles published in the top 60 economics journals according to the list by Kalaitzidakis *et al.* (2003) have the full weight ($w = 1$). It would be possible to take more complicated weights, e.g., some distribution of impact factors, but then there would be a problem with weights for working papers. Nevertheless, even such simple weights have significant impact on the results, as can be seen from Table 1.

Table 1 shows combined significance of the spillover effect in different groups of the sample. Both normally distributed statistics T (1) and T_W (2), and the median value T_M are reported. Values of t_k from our sample vary significantly, from the lowest point of -11.58 to the peak of 27.7. Because such excessive values have rather dramatic effect on the combined significance, we report also T, T_W, and T_M for a narrower sample without these outliers. In the concrete, we employ the restriction $|t_k| \leq 8$, thus the narrower sample contains 87 observations. It is evident at first sight that the weighted value (T_W) is in most cases below the simple measure T, indicating that better-quality papers may report lower t statistics. Nevertheless, for the pooled sample both T and T_W are highly significant, even with an exclusion of outliers. T_M, on the other hand, is not significant. To conclude, the spillover effect is, in general, not significant according to the vote-counting method, but it is significant applying the Djankov & Murrell (2002) methodology.

There are two groups in the sample for which the spillover effect is significant, independently of the methodology in use or spillovers exclusion—these are studies using cross-sectional data and studies with industry-level aggregation. Specifications that measure MNCs' presence as a share of employment are together not significant only when the combined t statistics is measured

Table 1: Aggregated t statistics

Variable	**# of obser.**	**Without outliers**	**All studies** T	T_W	T_M	**Without outliers** T	T_W	T_M
all	97	87	15.5	10.1	0.4	4.41	3.99	0.3
developing	41	38	6.95	2.11	0.9	4.54	3.27	0.811
transition	34	31	9.12	8.13	−0.00423	−0.569	−0.645	−0.193
advanced	22	18	11.8	13.6	1.4	3.85	4.4	0.85
cs	32	28	21.3	16.4	2.77	10.4	9.28	2.41
panel	65	59	4.02	−1.05	0.000265	−1.8	−3.098	0.000185
empl	32	28	13.2	11.9	1.85	6.907	7.9	1.4
sales	19	16	3.102	−3.15	−0.323	−1.03	−1.98	−0.326
assets	25	23	6.81	3.55	0.0507	−0.417	−2.96	0.037
output	21	20	6.64	4.17	0.9	2.4	2.74	0.7
firm	40	35	6.031	0.491	0.312	0.214	−1.28	0.3
industry	22	21	10.8	9.57	2.41	9.22	8.17	2.4
secdum	35	31	10.8	10.4	0.000265	−0.42	0.477	$2.28E-06$
growth	39	33	12.5	6.29	0.4	2.46	−0.358	0.324
prod	58	54	9.82	7.97	0.531	3.68	4.92	0.282
old	46	42	11.3	6.068	1	4.77	4.066	0.75
new	51	45	10.7	8.41	0.324	1.53	1.48	0.051
journal	32	28	17.4	16.2	1.42	6.19	5.64	0.811
wp	42	39	3.69	6.76	0.0258	2.086	4.73	0.000957
topjournal	23	20	6.35	1.43	0.99	−1.029	0.499	0.445

by T_M without outliers. On the other hand, for firm-level specifications, panel data models, studies using sales as a measure of foreign presence, and papers published in the top 60 world economics journals, combined t statistics are positively significant only if they are simply measured as T and outliers are included; the remaining 5 measures are insignificant or even negatively significant. Based on this finding, one could argue that there might be a tendency in the most prestigious journals to publish rather skeptical empirical studies on productivity spillovers, or, perhaps more probably, that *papers of higher quality might be more likely to find no or even negative spillover effects.*

It is also interesting that for transition countries, excluding outliers, all three combined t statistics are insignificant and even negative. This can be surprising since transition countries are usually considered to be likely to benefit from FDI highly as, in their case, the technology gap between domestic firms and MNCs is not so wide (see, e.g., Blomström & Kokko 2003). Furthermore, it seems that newer studies (those published after 2002, dividing the sample approximately to 2 halves) might be more likely to report insignificant results, although the effect of studies' age does not appear to be very strong.

5 Meta-Regression

We have already seen that various aspects of studies' design are likely to influence the result—which is the t statistic for the estimate of the coefficient which belongs to the measure of foreign presence in the industry. In this section, we would like to investigate this pattern more thoroughly, using a different and more advanced approach known as the meta-regression analysis. As a benchmark case, we follow Görg & Strobl (2001) who run a plain OLS regression:

$$Y_k = \alpha + \sum_{l=1}^{L} \beta_l X_{kl} + \epsilon_k, \quad k = 1, 2, \ldots, K, \tag{3}$$

where the meta-response variable Y_k is the t statistic from the k-th specification and meta-explanatory variables X_{kl} reflect different aspects of studies' design according to the 5 main features from Section 3—i.e., those that can be chosen by the researchers *ex ante*. For this reason, we *do not* include a dummy for the level of publication. Because in the absence of publication bias there should be a significant and positive relation between the number of degrees of freedom in the particular model and its reported (absolute) value of t statistic, the logarithm of degrees of freedom makes and additional meta-explanatory variable. Another aspect we would like to control for is the time period for which the study was conducted, thus we include the average year of study period as a meta-explanatory variable. The final model consist of 11 meta-explanatory variables for 97 observations, which gives us much more degrees of freedom than Görg & Strobl (2001) have (25 observations for 9 regressors).

Descriptions of all variables can be found in Table 9 in the Appendix. First, we examine relationships between meta-explanatory variables. The table of correlation coefficients (Table 10) is included in the Appendix, as well—the highest absolute value of all correlation coefficients, 0.63, does not seem to indicate multicollinearity. The condition number is high, but it is sufficient to exclude the average year of study period and it declines to 16. In the regression model, exclusion of this variable do not change estimated signs neither significances of estimates, thus we mostly work with the complete number of meta-explanatory variables. If we regress one meta-explanatory variable in turns on all other meta-explanatory variables and collect the coefficients of determination of such regressions, we obtain the linear redundancy statistics (see Table 2). The highest R-squared reaches 0.67, which is not excessive.

Table 2: Linear and non-linear dependencies

Variable	Linear	Polynomial
Logarithm of degrees of freedom	0.457	0.497
Average year of study period	0.322	0.389
Dummy = 1 if data are for developing country	0.532	0.618
Dummy = 1 if data are for transition country	0.665	0.755
Dummy = 1 if data are cross-section	0.455	0.487
Dummy = 1 if response variable is output growth	0.279	0.330
Dummy = 1 if data are industry-level	0.547	0.699
Dummy = 1 if industry dummies are used	0.308	0.355
Dummy = 1 if MNC presence measured in employment	0.656	0.687
Dummy = 1 if MNC presence measured in assets	0.548	0.570
Dummy = 1 if MNC presence measured in output	0.562	0.595

An important thing—which is, nevertheless, usually omitted—is to test also for non-linear dependencies between explanatory variables (Víšek 1997, pg. 71). Such relationships cannot be discovered by standard correlation and redundancy analysis. Suppose for example that we obtain the following estimate of a regression model:

$$\widehat{Y}_i = X_{i1} + 2X_{i2}, \quad i = 1, 2, \ldots, N. \tag{4}$$

Assume also that there is a latent relationship which would give estimate $\widehat{X}_{i2} = 1 - 10X_{i1}^4$. If one obtains (4) and claims on the basis of it that X_{i1} has positive impact on Y_i, it is obviously not correct. This issue is even more problematic for studies which report significances and polarities of some regression estimates as they key results—and this is the case of empirical works on productivity spillovers. A way how to (try to) discover such non-linear relationships is to use the Weierstrass Approximation Theorem and estimate J following regressions:

$$X_{im} = \alpha + \sum_{j=1}^{J} \sum_{p=1}^{P} \beta_{jp} X_{ij}^p + \vartheta_i, \quad i = 1, \ldots, N, \quad m = 1, \ldots, J, \quad m \neq j, \tag{5}$$

where one must have $JP < N$ to leave a sufficient number of degrees of freedom for the regressions. We performed (5) with $J = 11$ and $P = 6$, the coefficients of determination are listed in Table 2. The highest increase in R-squared compared to simple linear redundancy was detected for variable $INDUSTRY$ and reached 0.15, which is not much taking into account that the new regression has 50 more explanatory variables. Therefore we can conclude that non-linear relationships do not represent a substantial problem in our sample.

All regressions were conducted in Stata 10. Results of the standard meta-regression, using OLS, are reported in Table 11 in the Appendix. We found it necessary to exclude the most obscure observations—with $|t_k| > 8$. There are three main reasons for such selection. Firstly, observations with such a high absolute value of t statistic reach also the largest values of Cook's distance for specification 1 of Table 11 and their predicted residuals are high. Secondly, there is a large gap between the observation with the absolute value of t statistic equal to 5.9 and the next higher one 8.4. Thirdly, it is a similar cut-off level as was used by Görg & Strobl (2001). Nevertheless, we report both families of specifications (with and without outliers) in Table 11.

Performing standard tests of suitability of the model (referring to specification 5 of Table 11), the Ramsey RESET test does not reject the null hypothesis, thus the selected specification is not considered to be wrong. Results of multicollinearity analysis and analysis of non-linear dependences do not change when outliers are excluded. To deal with a possible presence of heteroscedasticity of disturbances, we use heteroscedasticity robust standard errors computed with the Huber-White sandwich estimator, see Huber (1967) and White (1980). To test for normality of disturbances, we employ the Shapiro-Wilk test, which rejects the null hypothesis. Unfortunately, most of the meta-explanatory variables are dummies, which restricts the possibilities for transformations, and executing Box-Cox transformations on the response variable does not bring any substantial improvement. This is one of the reasons for which we decided to employ also other methods, not only plain OLS as Görg & Strobl (2001).

The most obvious choice is to use some of robust estimators, which can also help to assess whether the selected cut-off level for outliers in OLS was the right one. We decided for two alternative estimators, iteratively re-weighted least squares (IRLS) with Huber and Tukey bisquare weight functions tuned for 95% Gaussian efficiency (see Hamilton 2006, pg. 239–256) and median regression[1] from the family of quantile regressions. Results of the robust meta-regression can be found in Table 12 in the Appendix. Concerning the selection of outliers in OLS, we can see that, e.g., IRLS predicts results that are very similar to that of OLS without outliers. Therefore we can conclude that the cut-off $|t_k| \leq 8$ does not seem to be improperly chosen.

Following (Meyer & Sinani 2005), we also perform a pseudo-panel data meta-regression. The cross-sectional dimension is represented by different papers, the other dimension is the order of a model taken from a particular paper. Because we have 97 observations from 67 papers at our disposal, it would not be wise to use the fixed-effects model, as many observations would be dropped and the number of degrees of freedom would diminish significantly, thus it is not even possible to test for fixed effects reliably. Therefore, we will assume that the study-specific effect is normally distributed (nevertheless, this kind of extreme unbalancedness might have an effect on the random effects estimates as well). We will test the following unbalanced panel data model:

$$Y_{ij} = \alpha_i + \sum_{l=1}^{L} \beta_l X_{ijl} + \epsilon_{ij}, \quad i = 1, 2, \ldots, 67, \quad j = 1, 2, \ldots, 8. \tag{6}$$

Results of random-effects meta-regression are reported in Table 13 in the Appendix. It is apparent that, excluding outliers, there is no substantial difference in the predictions of plain OLS and random-effects regression. Testing

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[1] The algorithm minimizes the sum of the absolute deviations about the median.

for random effects, the Breusch-Pagan Lagrange multiplier test does not reject the null hypothesis (it is significant only at the 15% level), thus it might suffice to perform plain OLS in this case. But there is one other advantage of the panel-data method: as Stanley (2001) remarks, if a meta-analyst takes a lot of observations from one paper, a single researcher (or even a single work) can dominate the whole meta-regression. This is not the case of our study since the sample that we use is very diversified, but still, panel-data methods might deliver more "balanced" results.

Another approach is to restrict the meta-response variable to a binary one and employ the probit or logit models (for a related example, see Wooster & Diebel 2006). Therefore, we construct a dummy variable which equals to one when t statistic is positive, and zero otherwise. Moreover, we construct a similar dummy for significance: if the absolute value of t statistic reaches the 5% critical value, the dummy equals one, and zero otherwise. Both models are estimated with normal probability regression and the results can be found in Table 14 in the Appendix. Although there are slight differences between the results of the probit model when the response variable is dummy for positiveness (specification 1 from Table 14) and our benchmark-case OLS, basically it tells the same story in terms of significances and polarities of estimates.

If the dummy for significance is used as the meta-response variable, the only significant meta-explanatory variables are average year of study period and number of degrees of freedom in the study—but the latter only after excluding the most insignificant meta-explanatory variables from the model. Our results suggest that higher number of observations lead to more significant results (either positive or negative), which is something one would expect. Moreover, the reported degree of significance seems to be declining over time—studies using newer data are more likely to find insignificant results.

The results of all methods of meta-regression are summarized in Table 3. We do not prefer any specific model, and rather construct a "representative" one, taking a simple arithmetic average of all t statistics reported by the meta-regressions (or z statistics in the case of probit). Expression (1) is not used here because all specifications from Table 3 use the same data. We argue that the resulting model (t statistics are depicted in Figure 1) is much more stable than any of specifications 1–5 could be *per se*, and since all specifications seem to yield similar results, our conclusions based on the representative model should be robust. There are three meta-explanatory variables which are robustly significant at the 5% level. Our results show that cross-sectional data, industry-level aggregation, and usage of share in employment as a proxy for foreign presence brings, in general, more positively significant outcomes than other specifications. It does not seem to matter, on the other hand, how the response variable is defined.

The significance of *cross-sectional data* confirms the findings of Görg & Strobl (2001), who claim that the bias could be caused by time invariant variables, which are not identified by the explanatory variables in cross-sectional spillover studies. Panel data methods can, on the other hand, uncover these effects, and thus are more reliable. Contrary to Görg & Strobl (2001), we also find the level of aggregation and usage of share in employment as a proxy for foreign presence significant. *Industry-level aggregation*, especially in combination with cross-sectional data, can cause the causality problem—foreign investors may seek efficient and more productive industries for their investments, thus re-

Table 3: Summary of conducted meta-regressions, all studies

Response variable: t statistic; dummy = 1 if positive (probit)	OLS	IRLS	Median reg.	RE	Probit
Logarithm of degrees of freedom	0.0969	0.137	0.100	0.0828	0.0637
	(0.69)	(1.06)	(0.78)	(0.60)	(0.71)
Average year of study period	−0.0119	−0.0216	−0.0239	−0.00560	−0.0422
	(−0.40)	(−0.62)	(−0.71)	(−0.18)	(−1.04)
Dummy = 1 if data are for developing country	−0.124	0.0353	−0.0411	−0.247	0.318
	(−0.23)	(0.05)	(−0.07)	(−0.47)	(0.59)
Dummy = 1 if data are for transition country	0.805	0.833	1.068	0.727	0.701
	(0.99)	(1.03)	(1.37)	(0.89)	(1.08)
Dummy = 1 if data are cross-section	2.023^{**}	1.876^{**}	2.363^{**}	1.993^{**}	0.781
	(3.16)	(2.91)	(3.70)	(3.10)	(1.60)
Dummy = 1 if response variable is output growth	$0.973^{\dagger}$	0.880	0.839	0.756	0.201
	(1.91)	(1.64)	(1.57)	(1.47)	(0.54)
Dummy = 1 if data are industry-level	1.851^{**}	1.884^{*}	0.770	1.787^{**}	1.763^{*}
	(2.85)	(2.37)	(1.03)	(2.74)	(2.37)
Dummy = 1 if industry dummies are used	0.237	0.344	0.468	0.353	0.167
	(0.38)	(0.61)	(0.84)	(0.54)	(0.46)
Dummy = 1 if MNC presence measured in employment	1.510^{*}	$1.436^{\dagger}$	2.216^{**}	1.808^{*}	1.636^{*}
	(2.23)	(1.77)	(2.94)	(2.42)	(2.56)
Dummy = 1 if MNC presence measured in assets	0.329	0.553	1.036	0.577	0.849
	(0.47)	(0.73)	(1.42)	(0.74)	(1.62)
Dummy = 1 if MNC presence measured in output	1.159	1.148	1.856^{*}	1.505	$1.071^{\dagger}$
	(1.39)	(1.40)	(2.25)	(1.60)	(1.91)
Constant	20.85	39.86	44.44	8.379	82.02
	(0.35)	(0.57)	(0.66)	(0.13)	(1.01)
Observations	87	97	97	87	87
R^2 (pseudo R^2 for median reg. and probit)	0.342	0.258	0.128	0.335	0.252

t statistics in parentheses

OLS, RE, and probit computed excluding outliers, using heteroscedasticity robust (Huber-White sandwich est.) t statistics

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

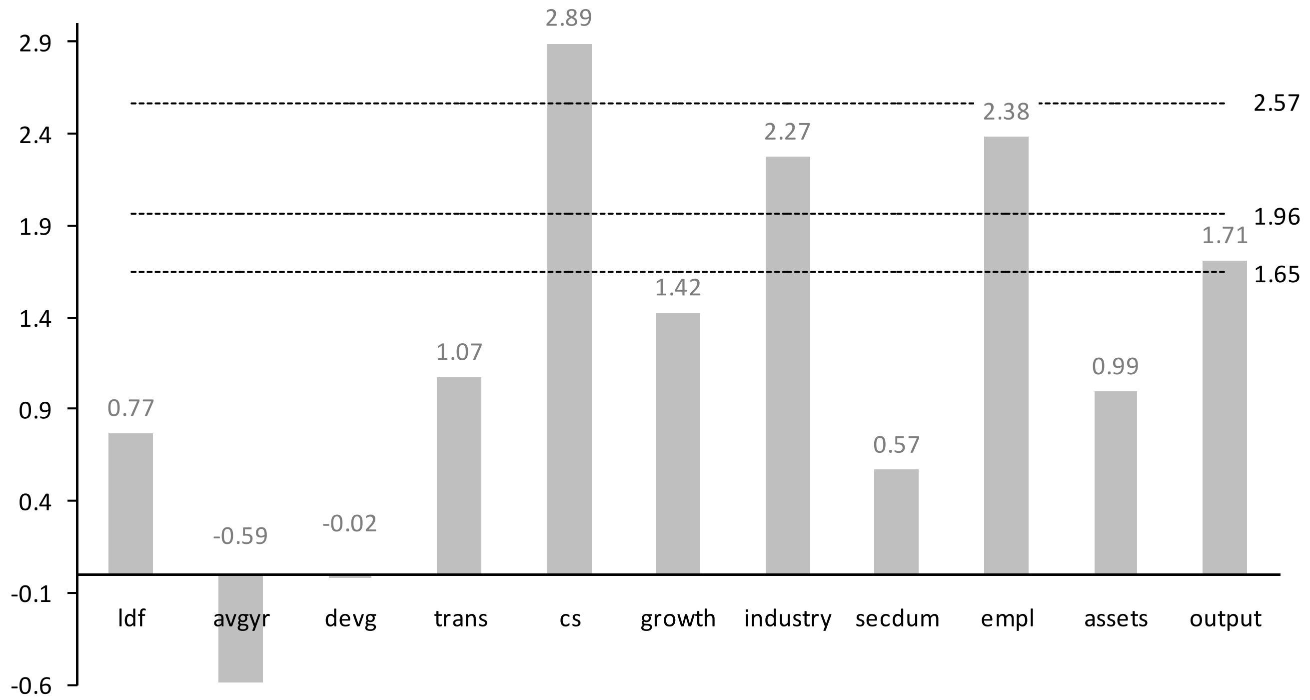

Figure 1: Average t statistics of meta-explanatory variables, all studies

searcher would report a positive spillover effect, even if the particular industry had had high productivity long before MNCs entered it. Additionally, aggregation over heterogeneous firms may generally lead to biased results (Görg & Greenaway 2004). According to Meyer & Sinani (2005), *employment intensive* foreign investments could generate larger spillovers through the labor turnover, contrary to the sales intensive foreign investors who may, on the other hand, be more involved in the competition effect which has ambiguous impacts on host-country firms. This could explain the significant coefficient that was obtained for the variable *EMPL* and might suggest that using share of employment as a proxy for foreign presence is no misspecification. In spite of that, researchers should always check their outcomes on various definitions of proxies and try to explain possibly different outcomes.

It is also evident that the dominant specification of spillovers' testing has been changing over time. Since the first researchers followed the pioneering work of Caves (1974) and used cross-sectional data and industry-level aggregation, a little had changed before Haddad & Harrison (1993) published their study on Morocco, where they—using firm-level panel data—found evidence of negative horizontal spillovers due to the competition effect. Nevertheless, no researcher used panel data again till 1999, where the other highly influential work (Aitken & Harrison 1999) was published. After that, panel-data analysis has become more frequent and has been almost unambiguously dominating the literature since 2003. Because our results suggest that the (non)presence of time dimension in the data is one of the crucial aspects of study design, we decide to split the sample into two halves (studies published in 2002 or before, and *vice versa*), and employ the Chow test to check whether it was appropriate to pool the data together in the first place. The Chow test is significant only at the 23% value, thus the data were probably pooled correctly. Still, it might be benefitial to estimate the model separately for the two time periods.

The results of meta-regressions for older studies are reported in Table 4, more detailed specifications and regressions also with outliers can be found in the Appendix. In the case of probability regression, the dummy for industry-level data had to be omitted since otherwise the probit model would not have converged. The Breusch-Pagan Lagrange multiplier test is significant at the 10% level, thus one might put more weight on random-effects model rather than on plain OLS. Similarly as for the pooled sample of all studies, it seems to matter whether data are cross-sectional, aggregated on the industry level, and whether the share of foreign presence is measured in employment. Contrary to the pooled sample, however, also the fact whether data for transition country are used and whether foreign presence is measured as share in output is significant. In the older studies, firms in transition countries are more likely to benefit from horizontal FDI spillovers.

Results for newer studies can be found in Table 5, detailed estimates of each type of a meta-regression are available in the Appendix. Once again, in the case of probit, one dummy (developing country) had to be dropped so as for the model to converge. The Breusch-Pagan test is not significant at any reasonable level, thus we put more weight on plain OLS. Estimated dependencies are much less apparent now than for the older studies. It is again important whether data are cross-sectional or industry-level, but no other meta-explanatory variable is significant in more than only one specification of Table 5. Thus it appears that the pattern, having basically still the same shape, is getting weaker over time.

Table 4: Summary of conducted meta-regressions, old studies

Response variable: t statistic; dummy = 1 if positive (probit)	OLS	IRLS	Median reg.	RE	Probit
Logarithm of degrees of freedom	0.137	0.163	$0.379^{\dagger}$	0.137	−0.141
	(0.63)	(0.76)	(1.82)	(0.63)	(−1.02)
Average year of study period	0.0265	0.0185	−0.0291	0.0265	−0.0235
	(0.69)	(0.42)	(−0.63)	(0.69)	(−0.43)
Dummy = 1 if data are for developing country	0.804	0.654	−0.547	0.804	0.112
	(1.00)	(0.69)	(−0.63)	(1.00)	(0.11)
Dummy = 1 if data are for transition country	3.018^{**}	2.931^{*}	3.444^{**}	3.018^{**}	0.986
	(2.84)	(2.60)	(3.49)	(2.84)	(1.11)
Dummy = 1 if data are cross-section	$1.382^{\dagger}$	1.326	2.167^{*}	$1.382^{\dagger}$	1.577^{*}
	(1.95)	(1.42)	(2.44)	(1.95)	(2.30)
Dummy = 1 if response variable is output growth	0.527	0.434	−0.0435	0.527	−0.118
	(0.93)	(0.60)	(−0.07)	(0.93)	(−0.19)
Dummy = 1 if data are industry-level	3.057^{**}	3.168^{*}	3.580^{**}	3.057^{**}	
	(3.29)	(2.54)	(3.08)	(3.29)	
Dummy = 1 if industry dummies are used	0.191	0.506	0.787	0.191	−0.800
	(0.16)	(0.47)	(0.84)	(0.16)	(−0.98)
Dummy = 1 if MNC presence measured in employment	2.397^{*}	2.308^{*}	$1.650^{\dagger}$	2.397^{*}	0.858
	(2.30)	(2.04)	(1.71)	(2.30)	(0.94)
Dummy = 1 if MNC presence measured in assets	0.225	0.288	0.0177	0.225	1.121
	(0.21)	(0.29)	(0.02)	(0.21)	(1.48)
Dummy = 1 if MNC presence measured in output	4.433^{**}	4.383^{**}	4.559^{**}	4.433^{**}	$1.763^{\dagger}$
	(3.67)	(3.46)	(3.78)	(3.67)	(1.65)
Constant	−57.65	−41.82	51.75	−57.65	46.46
	(−0.75)	(−0.48)	(0.56)	(−0.75)	(0.42)
Observations	42	45	46	42	42
R^2 (pseudo R^2 for median reg. and probit)	0.626	0.549	0.288	0.626	0.383

t statistics in parentheses

OLS, RE, and probit computed excluding outliers, using heteroscedasticity robust (Huber-White sandwich est.) t statistics

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 5: Summary of conducted meta-regressions, new studies

Response variable: t statistic; dummy = 1 if positive (probit)	OLS	IRLS	Median reg.	RE	Probit
Logarithm of degrees of freedom	0.183	0.248	0.351	0.132	0.0826
	(1.15)	(1.20)	(0.83)	(0.79)	(0.55)
Average year of study period	−0.150	-0.256^{*}	−0.277	−0.119	−0.121
	(−1.26)	(−2.17)	(−0.92)	(−1.07)	(−1.19)
Dummy = 1 if data are for developing country	−0.0703	0.900	1.874	−0.356	
	(−0.04)	(0.61)	(0.46)	(−0.23)	
Dummy = 1 if data are for transition country	1.092	1.881	3.141	0.751	0.344
	(0.56)	(1.12)	(0.69)	(0.39)	(0.52)
Dummy = 1 if data are cross-section	2.687^{*}	3.213^{*}	2.988	2.249^{*}	1.070
	(2.72)	(2.68)	(1.07)	(2.25)	(1.05)
Dummy = 1 if response variable is output growth	1.153	$1.615^{\dagger}$	1.187	0.818	0.561
	(1.21)	(1.77)	(0.46)	(0.91)	(0.78)
Dummy = 1 if data are industry-level	3.438^{*}	4.595^{**}	5.020	3.199^{*}	1.345
	(2.27)	(3.10)	(1.37)	(2.11)	(1.12)
Dummy = 1 if industry dummies are used	0.936	1.579	2.856	1.002	0.765
	(0.84)	(1.60)	(1.05)	(0.97)	(1.16)
Dummy = 1 if MNC presence measured in employment	2.046	2.299	3.765	2.108	2.810^{**}
	(1.66)	(1.54)	(0.87)	(1.28)	(2.63)
Dummy = 1 if MNC presence measured in assets	0.651	1.118	1.537	0.757	$1.994^{\dagger}$
	(0.62)	(0.79)	(0.37)	(0.49)	(1.89)
Dummy = 1 if MNC presence measured in output	0.396	1.057	0.768	0.687	1.353
	(0.33)	(0.79)	(0.20)	(0.39)	(1.46)
Constant	295.9	503.2^{*}	544.2	234.6	237.8
	(1.26)	(2.16)	(0.91)	(1.07)	(1.18)
Observations	45	51	51	45	45
R^2 (pseudo R^2 for median reg. and probit)	0.314	0.348	0.0994	0.302	0.270

t statistics in parentheses

OLS, RE, and probit computed excluding outliers, using heteroscedasticity robust (Huber-White sandwich est.) t statistics

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

This would suggest that, at least recently, researchers have been aware of this dependency of results on study design and they have begun to employ more balanced approaches. Indeed, the empirical literature has been diverging a lot since the work of Görg & Strobl (2001) was published. A significant number of new studies test both for intra-industry and inter-industry spillovers, authors check multiple methodologies and compare the results. Nevertheless, there are still simple cross-sectional and/or industry-level studies, results of those can be mostly easily predicted *ex ante*.

6 Test of Publication Bias

Stanley (2001) highlights the "file drawer" problem that occurs when researchers tend to publish only or mostly the studies that are able to demonstrate significant results, because these are more likely to be accepted for publication in academic journals. It has been shown, e.g., by Card & Krueger (1995) that the "file drawer" problem can be extremely significant in economic publishing. In the concrete, for the literature on minimum wages and employment they find vast evidence for a publication bias. The same phenomena was detected by Görg & Strobl (2001) in the spillover literature and both subsequent meta-analyses (Meyer & Sinani 2005; Wooster & Diebel 2006) also report similar results.

We employ the identical test that was advocated by Card & Krueger (1995) and also performed by Görg & Strobl (2001). The set-up is illustrated in (7)—we regress the absolute value of t statistics reported by the k-th model on the natural logarithm of the square root of number of observations in the k-th model, controlling also for all other meta-explanatory variables which were included in model (1):

$$|t_k| = \alpha + \beta \log(\sqrt{M_k}) + \sum_{l=1}^{L-1} \gamma_l X_{kl} + \epsilon_k, \quad k = 1, 2, \ldots, K, \tag{7}$$

where M_k is the number of observations in the k-th model. The crucial point of this test is the (non)significance and magnitude of the estimated parameter β. Under the null hypothesis of no publication bias, it should hold that $\beta = 1$. In other words, logarithm of square root of number of observations should increase the final model's t statistic for foreign presence proportionally angle-wise 45 degrees.

Results of the publication bias test are reported in Table 6. Specifications 1–4 show plain OLS regression with all observations, specifications 5–8 exclude outliers. The cut-off level for outliers is still the same ($|t_k| \leq 8$). It is a good sign that, under any specification, the estimate of β is significant at least at the 10% level and it is positive, which suggests that more degrees of freedom, *ceteris paribus*, increase results' level of significance as it should be the case of unbiased literature.

Estimated values of β are also very close to 1 for all specifications counted including outliers. Testing the hypothesis $\beta = 1$ with a simple t test, we conclude that there is no sign of publication bias (the corresponding test statistics are available in Table 6, as well). The picture, however, changes significantly when we exclude observations with $|t_k| > 8$. Through all specifications 5–8, the estimated value of β is far from 1 and all conducted t tests result in favor of rejecting the null hypothesis powerfully.

Table 6: Test of publication bias, all studies

	OLS, including outliers				OLS, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lsrdf	1.165^{**}	1.161^{**}	0.865^{*}	1.163^{**}	0.450^{*}	0.390^{*}	$0.299^{\dagger}$	0.397^{*}
	(2.95)	(2.71)	(2.33)	(2.70)	(2.61)	(2.54)	(1.71)	(2.39)
avgyr	−0.0235	−0.0168			-0.0693^{**}	-0.0585^{*}		
	(−0.59)	(−0.46)			(−2.88)	(−2.50)		
devg	−0.564	−0.600			0.361	$0.722^{\dagger}$		
	(−0.31)	(−0.43)			(0.98)	(1.82)		
trans	−0.976	−0.196		−0.463	−0.270	0.0592		−0.794
	(−0.38)	(−0.14)		(−0.27)	(−0.52)	(0.15)		(−1.66)
cs	$3.419^{\dagger}$	2.605		3.403^{*}	0.322	0.474		$0.718^{\dagger}$
	(1.98)	(1.63)		(2.07)	(0.74)	(1.07)		(1.68)
growth	1.620		1.220	1.684	−0.0725		−0.0913	−0.0243
	(1.26)		(0.96)	(1.50)	(−0.21)		(−0.22)	(−0.07)
industry	−0.515		0.597	−0.670	0.357		0.795	0.466
	(−0.42)		(0.67)	(−0.57)	(0.70)		(1.59)	(0.91)
secdum	0.559		−0.534		−0.0194		−0.403	
	(0.58)		(−0.39)		(−0.05)		(−1.03)	
empl	−0.809		0.0417	−0.498	−0.463		0.110	−0.623
	(−0.29)		(0.02)	(−0.28)	(−0.88)		(0.24)	(−1.34)
assets	0.0104		0.388		0.395		0.598	
	(0.01)		(0.21)		(0.75)		(1.18)	
output	−1.532		−0.428	−1.415	−0.107		0.508	−0.174
	(−0.90)		(−0.28)	(−1.14)	(−0.19)		(0.96)	(−0.37)
Constant	45.06	31.81	−0.517	−2.177	138.1^{**}	116.4^{*}	0.336	0.495
	(0.56)	(0.44)	(−0.31)	(−1.09)	(2.87)	(2.50)	(0.39)	(0.58)
Observations	97	97	97	97	87	87	87	87
R^2	0.127	0.083	0.050	0.123	0.274	0.232	0.106	0.168
t ($H_0 : \beta = 1$)	0.170	0.140	0.130	0.140	10.2	15.8	16.1	13.2

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: absolute value of t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

What conclusions should one draw from such irresolute numbers? The present authors would argue that the exclusion of outliers is not entirely appropriate in this case. Model (7) which we test now is different from (1), on the basis of which the cut-off level for outliers was actually determined. The regression model without spillovers possesses higher R-squared, but the levels of significance of meta-explanatory variables are rather worse there. Moreover, such large values of $|t_k|$ can be very important in this regression since they can support or weaken the hypothesis very powerfully, as is in fact shown. All things considered, it seems more suitable to prefer the results of specifications 1–4, i.e., with all observations including outliers.

While all older meta-analyses reject the null hypothesis of no bias powerfully, we conclude that the evidence of publication bias has almost vanished from the spillover literature, and therefore it is becoming more reliable. Nevertheless, the result is quite vulnerable on regression's specification, and exclusion of only a few observations could twist the outcome.

7 Conclusion

This paper presents a meta-analysis of the empirical literature on horizontal productivity spillovers from FDI. We gather a sample of 97 models from 67 studies published either in academic journals or as working papers. Using the vote-counting method, the spillover effect is not significant in general; employing the approach of Djankov & Murrell (2002), on the other hand, there is some evidence that there might exist positive spillovers from FDI. Nevertheless, it is not the case of the narrower sample of studies that were published in the best economics journals—their combined t statistics is insignificant almost in any case. Therefore, the present authors argue that *there is no general persuasive empirical evidence on the intra-industry spillovers.*

We also investigate which study aspects affect the reported significance and polarity of spillovers, using a meta-regression analysis which was elaborated by Stanley & Jarrell (1989). Nevertheless, we use not only the standard ordinary least squares meta-regression (like Görg & Strobl 2001) but we also employ robust methods (iteratively re-weighted least squares and median regression) as well as pseudo-panel data methods (Meyer & Sinani 2005) and probability models (Wooster & Diebel 2006). We find that, in general, *study results are affected by its design*, namely by usage of cross-sectional or panel data, industry- or firm-level aggregation, and specification of the proxy of foreign presence in the industry. Our results suggest that cross-sectional studies tend to report excessively high spillovers, as well as models with industry-level aggregation and employment as a proxy for foreign presence do. However, this pattern appears to become weaker over time, suggesting that newer studies suffer from such a slant less.

Following Card & Krueger (1995), we test for publication bias in the spillover literature. Contrary to Görg & Strobl (2001), *we do not find evidence of publication bias* in the whole sample, suggesting that the bias might have almost vanished from the spillover literature. Nevertheless, our results are quite sensitive since exclusion of a few observations can twist the outcome instantly.

Future research should concentrate on the inter-industry spillovers since they seem to be more promising, the number of empirical works in this field is growing and will soon be sufficient for a meta-regression analysis. Intra-industry spillovers, on the other hand, appear to stay nonexistent or undetectable, at least in the standard research framework following Caves (1974) and Haddad & Harrison (1993).

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A Supplementary Tables

On the following pages, we list a few illustrative tables.

Table 7: Study characteristics

Authors	**Country**	**Years**	**Data**	**Level**	**Presence**	**Depvar**	**Result (5%)**
Caves (1974)	Australia	1966	cs	industry	empl	prod	+
Globerman (1979)	Canada	1972	cs	industry	output	prod	?
Blomström & Persson (1983)	Mexico	1970	cs	industry	empl	prod	+
Blomström (1986)	Mexico	1970/75	cs	industry	empl	other	+
Haddad & Harrison (1993)	Morocco	1985-90	panel	both	assets	prod, growth	-
Blomström & Wolff (1994)	Mexico	1970/75	cs	industry	empl	growth	+
Kokko (1994)	Mexico	1970	cs	industry	empl	prod	+
Kokko (1996)	Mexico	1970	cs	industry	empl	prod	+
Kokko *et al.* (1996)	Uruguay	1970	cs	firm	output	prod	?
Aitken & Harrison (1999)	Venezuela	1976-89	panel	firm	assets	growth	-
Blomström & Sjöholm (1999)	Indonesia	1991	cs	both	output	prod	+
Chuang & Lin (1999)	Taiwan	1991	cs	firm	assets	growth	+
Imbriani & Reganati (1999)	Italy	1992	cs	industry	empl	prod	+
Sjöholm (1999b)	Indonesia	1980-91	cs	firm	output	prod, growth	+
Sjöholm (1999a)	Indonesia	1980-91	cs	firm	output	growth	+
Aslanoglu (2000)	Turkey	1993	cs	industry	sales	prod	?
Barrios (2000)	Spain	1990-94	panel	firm	output	prod	?
Djankov & Hoekman (2000)	Czech Rep.	1993-96	panel	firm	assets	growth	-
Flôres *et al.* (2000)	Portugal	1992-95	panel	firm	output	prod	?
Kathuria (2000)	India	1976-89	panel	firm	sales	other	-
Kinoshita (2000)	Czech Rep.	1995-98	panel	both	empl	growth	?
Konings (2000)	Bulg, Rom, Pol	1993-97	panel	firm	sales	growth	?
Liu *et al.* (2000)	UK	1991-95	panel	industry	empl	prod	+
Yudaeva *et al.* (2000)	Russia	1993-97	panel	both	output	prod	?
Bosco (2001)	Hungary	1993-97	panel	firm	sales	sales	?
Damijan *et al.* (2001)	Trans. countries	1994-98	panel	both	sales	growth	?
Driffield (2001)	UK	1989-92	cs	industry	sales	growth	?
Girma *et al.* (2001)	UK	1991-96	panel	firm	empl	prod, growth	?
Liu *et al.* (2001)	China	1996-97	cs	industry	assets	prod	?
Sgard (2001)	Hungary	1992-99	panel	firm	assets	prod	?
Zemplinerová & Jarolím (2001)	Czech Rep.	1994-98	panel	both	assets	growth	?
Barrios *et al.* (2002)	Gr, Irel, Spain	1992, 97	cs	firm	empl	prod	?
Buckley *et al.* (2002)	China	1995	cs	industry	assets, empl	prod	+

Table 8: Study characteristics—cont.

Authors	**Country**	**Years**	**Data**	**Level**	**Presence**	**Depvar**	**Result (5%)**
Kathuria (2002)	India	1990-96	panel	firm	sales	growth	-
Liu (2002)	China	1993-98	panel	both	assets	prod	?
Schoors & Tol (2002)	Hungary	1997-98	cs	firm	sales	prod	+
Bouoiyour (2003)	Morocco	1987-96	panel	industry	assets	prod	?
Khawar (2003)	Mexico	1990	cs	firm	assets	prod	?
Keller & Yeaple (2003)	USA	1987-96	panel	both	empl	growth	+
Liu & Wang (2003)	China	1995	cs	industry	assets	prod	+
Ruane & Ugur (2003)	Ireland	1991-98	panel	both	empl	growth	+
Wei & Liu (2003)	China	2000	cs	industry	assets	prod	+
Görg & Strobl (2004)	Ireland	1973-95	panel	firm	empl	growth	-
Haskel *et al.* (2004)	UK	1973-92	panel	firm	empl	growth	+
Javorcik (2004)	Lithuania	1996-00	panel	firm	assets	prod	+
Lutz & Talavera (2004)	Ukraine	1998-99	cs	both	assets	prod	?
Marin & Bell (2004)	Argentina	1992-96	panel	firm	empl	growth	?
Sinani & Meyer (2004)	Estonia	1994-99	panel	both	various	growth	+
Torlak (2004)	Trans. countries	1993-00	panel	both	output	prod	?
Vahter (2004)	Est, Slovenia	1994-01	panel	both	assets	prod	?
Blalock & Gertler (2005)	Indonesia	1988-96	panel	firm	output	prod	?
Jordaan (2005)	Mexico	1993	cs	firm	empl	prod	?
Narula & Marin (2005)	Argentina	92-96, 98-01	panel	both	empl	growth	?
Takii (2005)	Indonesia	1990-95	panel	firm	empl	prod	?
Thuy (2005)	Vietnam	1995-02	panel	industry	empl	prod	?
Bwalya (2006)	Zambia	1993-95	panel	firm	empl	growth	?
Kohpaiboon (2006)	Thailand	1996	cs	firm	output	prod	-
Merlevede & Schoors (2006)	Romania	1996-01	panel	firm	output	growth	?
Peri & Urban (2006)	Germany, Italy	1993-99	panel	both	empl	prod	+
Ran *et al.* (2007)	China	2001-03	panel	industry	assets	prod	?
Buckley *et al.* (2007)	China	2001	cs	industry	assets	prod	+
Girma & Wakelin (2007)	UK	1980-92	panel	firm	empl	prod	?
Murakami (2007)	Japan	1994-98	panel	both	empl	growth	?
Sasidharan & Ramanathan (2007)	India	1994-02	panel	both	output	growth	?
Javorcik & Spatareanu (2008)	Romania	1998-03	panel	firm	output	growth	?
Liu (2008)	China	1995-99	panel	both	assets	prod	-
Nguyen (2008)	Vietnam	2000-05	panel	both	output	prod	?

Table 9: Variable Characteristics

Variable	**Definition**	**Summary stat.**
	Response variable	
tstat	t-statistics from literature; meta-response variable	1.576 (5.65)
growth	= 1 if growth is response variable used in literature, = 0 if labor productivity	39
	Foreign Presence Measures	
empl	= 1 if MNC presence measured in employment, = 0 if otherwise (as output, assets, sales)	32
output	= 1 if MNC presence measured in output, = 0 if otherwise (as employment, assets, sales)	21
assets	= 1 if MNC presence measured in assets, = 0 if otherwise (as employment, output, sales)	25
	Data Specification	
cs	= 1 if data are cross-section, = 0 if panel data	32
industry	= 1 if data are industry-level, =0 if firm-level	22
secdum	= 1 if industry dummies are used, = 0 if otherwise	35
trans	= 1 if data are for transition country, = 0 if otherwise (developing, advanced)	34
devg	= 1 if data are for developing country, = 0 if otherwise (transition, advanced)	41
avgyr	Average year of study period	1992.286 (7.835)
ldf	Logarithm of degrees of freedom	7.377 (2.356)

Note: For tstat, avgyr and ldf, the summary statistics is the mean with st. deviation in parenthesis, for all others it is the number of observations for which dummy variable equals 1.

Table 10: Table of correlation coefficients

	ldf	avgyr	devg	trans	cs	growth	industry	secdum	empl	assets	output
ldf	1										
avgyr	.289	1									
devg	-.235	-.245	1								
trans	.153	.383	-.629	1							
cs	-.423	-.431	.376	-.424	1						
growth	.185	.093	-.276	.279	-.352	1					
industry	-.602	-.310	.384	-.398	.510	-.344	1				
secdum	.272	.33	-.295	.438	-.436	.216	-.407	1			
empl	-.0665	-.274	-.0233	-.424	.0673	.006	.196	-.162	1		
assets	-.0259	.207	.212	.0117	.0377	-.147	.131	-.001	-.413	1	
output	.223	-.045	.0569	.0335	.0571	-.176	-.225	.0742	-.369	-.31	1

Table 11: Standard meta-regression, all studies

	OLS, including outliers				OLS, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.340	0.317			0.0969	0.00201		
	(1.26)	(1.28)			(0.69)	(0.02)		
avgyr	0.0635	0.0457			−0.0119	−0.0301		
	(1.29)	(0.98)			(−0.40)	(−0.93)		
devg	−1.323	−1.972			−0.124	−0.461		
	(−0.65)	(−1.26)			(−0.23)	(−0.74)		
trans	1.080	0.338		2.173	0.805	−0.0612		0.824
	(0.40)	(0.21)		(1.17)	(0.99)	(−0.10)		(1.35)
cs	6.106^{**}	5.185^{**}		4.901^{**}	2.023^{**}	2.118^{**}		1.910^{**}
	(3.06)	(3.01)		(2.80)	(3.16)	(2.90)		(3.59)
growth	1.995		1.376	1.682	$0.973^{\dagger}$		0.839	0.923^{*}
	(1.44)		(0.93)	(1.32)	(1.91)		(1.56)	(2.01)
industry	1.153		1.704	−0.535	1.851^{**}		2.333^{**}	1.547^{*}
	(0.83)		(1.61)	(−0.33)	(2.85)		(4.19)	(2.63)
secdum	1.627		0.902		0.237		0.0251	
	(1.46)		(0.57)		(0.38)		(0.04)	
empl	2.376		1.878	1.988	1.510^{*}		1.276^{*}	1.365^{*}
	(0.87)		(0.98)	(1.04)	(2.23)		(2.34)	(2.45)
assets	1.118		1.016		0.329		0.165	
	(0.55)		(0.46)		(0.47)		(0.23)	
output	1.019		1.563	0.501	1.159		$1.390^{\dagger}$	$1.076^{\dagger}$
	(0.55)		(0.86)	(0.37)	(1.39)		(1.95)	(1.69)
Constant	−132.1	−92.86	−0.909	−2.122	20.85	59.93	$-1.191^{\dagger}$	-1.846^{**}
	(−1.35)	(−1.00)	(−0.49)	(−1.49)	(0.35)	(0.93)	(−1.82)	(−2.70)
Observations	97	97	97	97	87	87	87	87
R^2	0.185	0.131	0.031	0.133	0.342	0.222	0.232	0.331

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 12: Robust meta-regression, all studies

	IRLS				Median regression			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.137	0.0387			0.100	0.110		
	(1.06)	(0.35)			(0.78)	(1.13)		
avgyr	−0.0216	−0.0356			−0.0239	−0.0250		
	(−0.62)	(−1.05)			(−0.71)	(−0.84)		
devg	0.0353	−0.0384			−0.0411	−0.183		
	(0.05)	(−0.06)			(−0.07)	(−0.34)		
trans	0.833	0.0195		0.784	1.068	−0.0503		$1.000^{\dagger}$
	(1.03)	(0.03)		(1.33)	(1.37)	(−0.09)		(1.67)
cs	1.876^{**}	1.965^{**}		1.821^{**}	2.363^{**}	2.835^{**}		2.579^{**}
	(2.91)	(3.25)		(3.09)	(3.70)	(5.21)		(4.34)
growth	0.880		0.757	0.849	0.839		0.160	0.360
	(1.64)		(1.38)	(1.66)	(1.57)		(0.27)	(0.68)
industry	1.884^{*}		2.299^{**}	1.552^{*}	0.770		2.120^{**}	0.481
	(2.37)		(3.45)	(2.28)	(1.03)		(2.95)	(0.70)
secdum	0.344		0.126		0.468		0.457	
	(0.61)		(0.23)		(0.84)		(0.80)	
empl	$1.436^{\dagger}$		$1.282^{\dagger}$	1.216^{*}	2.216^{**}		$1.240^{\dagger}$	1.593^{**}
	(1.77)		(1.85)	(2.14)	(2.94)		(1.67)	(2.78)
assets	0.553		0.442		1.036		0.483	
	(0.73)		(0.60)		(1.42)		(0.61)	
output	1.148		$1.334^{\dagger}$	$1.097^{\dagger}$	1.856^{*}		1.280	1.553^{*}
	(1.40)		(1.71)	(1.76)	(2.25)		(1.55)	(2.44)
Constant	39.86	70.61	−1.165	-1.679^{**}	44.44	49.06	−0.940	-1.553^{*}
	(0.57)	(1.05)	(−1.61)	(−2.81)	(0.66)	(0.83)	(−1.21)	(−2.56)
Observations	97	97	97	97	97	97	97	97
R^2	0.258	0.183	0.173	0.248	0.128	0.091	0.073	0.102

t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 13: Panel meta-regression, all studies

	Random effects, including outliers				Random effects, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.351	0.298			0.0828	0.0141		
	(1.29)	(1.17)			(0.60)	(0.12)		
avgyr	0.122*	0.0754			−0.00560	−0.0202		
	(2.02)	(1.49)			(−0.18)	(−0.60)		
devg	−1.752	−2.493			−0.247	−0.662		
	(−0.80)	(−1.50)			(−0.47)	(−1.06)		
trans	0.619	−0.243		2.345	0.727	−0.296		0.874
	(0.20)	(−0.13)		(1.12)	(0.89)	(−0.43)		(1.31)
cs	6.330**	5.452**		4.859*	1.993**	2.182**		1.819**
	(2.68)	(2.95)		(2.46)	(3.10)	(2.89)		(3.47)
growth	0.837		0.284	1.000	0.756		0.582	0.651
	(0.57)		(0.18)	(0.69)	(1.47)		(1.04)	(1.34)
industry	0.898		1.552	−0.747	1.787**		2.313**	1.467*
	(0.55)		(1.32)	(−0.41)	(2.74)		(4.02)	(2.44)
secdum	1.427		1.111		0.353		0.230	
	(1.16)		(0.69)		(0.54)		(0.37)	
empl	2.066		1.446	2.226	1.808*		1.680*	1.492**
	(0.58)		(0.51)	(1.03)	(2.42)		(2.42)	(2.61)
assets	−0.459		−0.255		0.577		0.537	
	(−0.16)		(−0.08)		(0.74)		(0.62)	
output	0.0349		0.596	0.378	1.505		1.829*	1.215†
	(0.01)		(0.23)	(0.22)	(1.60)		(2.13)	(1.77)
Constant	−246.2*	−151.5	0.189	−1.871	8.379	40.39	−1.426†	−1.691*
	(−2.04)	(−1.50)	(0.07)	(−1.21)	(0.13)	(0.60)	(−1.77)	(−2.39)
Observations	97	97	97	97	87	87	87	87
R^2	0.166	0.129	0.021	0.130	0.335	0.220	0.222	0.327

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 14: Probability meta-regression, all studies

	Probit—POSIT, excluding outliers				Probit—SIGNIF, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.0637	0.00533			0.133	0.106		0.121†
	(0.71)	(0.07)			(1.62)	(1.54)		(1.73)
avgyr	−0.0422	−0.0128			−0.0474*	−0.0451*		−0.0492*
	(−1.04)	(−0.49)			(−2.05)	(−2.11)		(−2.26)
devg	0.318	0.0765			0.319	0.278		
	(0.59)	(0.19)			(0.76)	(0.75)		
trans	0.701	−0.344		0.263	0.247	−0.0690		
	(1.08)	(−0.82)		(0.63)	(0.46)	(−0.17)		
cs	0.781	0.922*		0.766†	0.357	0.421		0.354
	(1.60)	(2.17)		(1.72)	(0.86)	(1.08)		(0.94)
growth	0.201		0.157	0.271	0.314		0.297	
	(0.54)		(0.45)	(0.74)	(0.89)		(0.90)	
industry	1.763*		1.597**	1.406*	0.202		0.167	
	(2.37)		(2.81)	(2.27)	(0.42)		(0.44)	
secdum	0.167		0.0137		−0.530		−0.675*	−0.564†
	(0.46)		(0.04)		(−1.50)		(−2.04)	(−1.67)
empl	1.636*		1.335**	1.434*	0.491		0.659	
	(2.56)		(2.74)	(2.51)	(0.90)		(1.49)	
assets	0.849		0.799†	0.912†	0.576		0.694	0.388
	(1.62)		(1.66)	(1.78)	(1.14)		(1.49)	(1.17)
output	1.071†		1.128*	1.136*	0.167		0.564	
	(1.91)		(2.24)	(2.11)	(0.31)		(1.16)	
Constant	82.02	25.69	−0.831†	−1.195*	92.62*	88.75*	−0.617	96.86*
	(1.01)	(0.50)	(−1.69)	(−1.98)	(2.01)	(2.09)	(−1.35)	(2.23)
Observations	87	87	87	87	87	87	87	87
Pseudo R^2	0.252	0.130	0.207	0.234	0.154	0.109	0.081	0.135

t statistics in parentheses

response variable: dummy = 1 if t stat is positive (columns 1–4); dummy = 1 if t stat is significant (columns 5–8)

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 15: Standard meta-regression, old studies

	OLS, including outliers				OLS, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.790	0.831			0.137	0.0156		
	(1.40)	(1.61)			(0.63)	(0.08)		
avgyr	−0.0277	−0.00783			0.0265	−0.0434		
	(−0.27)	(−0.15)			(0.69)	(−1.55)		
devg	−3.265	−2.196			0.804	−0.348		
	(−0.91)	(−0.94)			(1.00)	(−0.45)		
trans	1.328	1.416		2.511	3.018**	1.343		2.602*
	(0.36)	(0.71)		(1.10)	(2.84)	(1.26)		(2.65)
cs	7.859*	7.750**		7.527*	1.382†	3.237**		1.585*
	(2.27)	(3.33)		(2.19)	(1.95)	(2.84)		(2.18)
growth	0.742		0.581		0.527		0.980	
	(0.41)		(0.30)		(0.93)		(1.41)	
industry	0.951		0.754	−2.367	3.057**		2.648**	2.252*
	(0.29)		(0.52)	(−0.66)	(3.29)		(4.10)	(2.68)
secdum	−0.0926		−3.162		0.191		0.0712	
	(−0.05)		(−1.06)		(0.16)		(0.06)	
empl	−0.266		2.350	−0.328	2.397*		1.563*	1.752**
	(−0.09)		(1.18)	(−0.15)	(2.30)		(2.03)	(3.01)
assets	2.840		3.447		0.225		−0.0358	
	(1.18)		(0.91)		(0.21)		(−0.03)	
output	2.450		5.512†	1.013	4.433**		3.503**	3.704**
	(0.62)		(1.96)	(0.25)	(3.67)		(3.30)	(3.40)
Constant	46.98	8.351	−1.118	−2.349	−57.65	85.13	−1.762*	−2.849**
	(0.23)	(0.08)	(−0.52)	(−1.07)	(−0.75)	(1.53)	(−2.08)	(−3.50)
Observations	46	46	46	46	42	42	42	42
R^2	0.403	0.351	0.113	0.289	0.626	0.384	0.482	0.586

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 16: Robust meta-regression, old studies

	IRLS				Median regression			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.163	0.0891			$0.379^{\dagger}$	0.385		
	(0.76)	(0.48)			(1.82)	(1.56)		
avgyr	0.0185	−0.0371			−0.0291	−0.0322		
	(0.42)	(−0.78)			(−0.63)	(−0.52)		
devg	0.654	−0.352			−0.547	−1.248		
	(0.69)	(−0.39)			(−0.63)	(−1.08)		
trans	2.931^{*}	$2.051^{\dagger}$		2.608^{**}	3.444^{**}	1.299		3.390^{**}
	(2.60)	(1.81)		(3.08)	(3.49)	(0.88)		(2.77)
cs	1.326	3.967^{**}		$1.460^{\dagger}$	2.167^{*}	5.262^{**}		1.500
	(1.42)	(4.36)		(1.85)	(2.44)	(4.22)		(1.36)
growth	0.434		0.649		−0.0435		$1.147^{\dagger}$	
	(0.60)		(0.90)		(−0.07)		(1.74)	
industry	3.168^{*}		2.700^{**}	2.417^{**}	3.580^{**}		2.157^{**}	2.837^{*}
	(2.54)		(3.38)	(2.89)	(3.08)		(2.92)	(2.41)
secdum	0.506		0.748		0.787		−1.418	
	(0.47)		(0.71)		(0.84)		(−1.58)	
empl	2.308^{*}		1.470	1.786^{*}	$1.650^{\dagger}$		2.190^{*}	2.363^{*}
	(2.04)		(1.56)	(2.44)	(1.71)		(2.66)	(2.21)
assets	0.288		−0.0869		0.0177		2.098^{*}	
	(0.29)		(−0.09)		(0.02)		(2.29)	
output	4.383^{**}		3.447^{**}	3.914^{**}	4.559^{**}		3.780^{**}	5.300^{**}
	(3.46)		(3.41)	(4.20)	(3.78)		(4.09)	(4.13)
Constant	−41.82	71.56	-1.666^{*}	-2.880^{**}	51.75	60.07	-1.927^{*}	-3.600^{**}
	(−0.48)	(0.76)	(−2.08)	(−4.33)	(0.56)	(0.49)	(−2.59)	(−3.82)
Observations	45	46	46	46	46	46	46	46
R^2	0.549	0.362	0.418	0.534	0.288	0.207	0.179	0.238

t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 17: Panel meta-regression, old studies

	Random effects, including outliers				Random effects, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.494	0.743			0.137	0.0137		
	(0.85)	(1.26)			(0.63)	(0.07)		
avgyr	0.0778	0.0900			0.0265	−0.0376		
	(0.58)	(1.01)			(0.69)	(−1.32)		
devg	−3.559	−3.346			0.804	−0.491		
	(−0.97)	(−1.26)			(1.00)	(−0.63)		
trans	0.0926	−0.0608		2.176	3.018**	1.193		2.602**
	(0.02)	(−0.03)		(0.85)	(2.84)	(1.08)		(2.65)
cs	9.299*	8.654**		8.276*	1.382†	3.345**		1.585*
	(2.41)	(3.14)		(2.14)	(1.95)	(2.88)		(2.18)
growth	−0.222		−0.212		0.527		0.980	
	(−0.12)		(−0.10)		(0.93)		(1.41)	
industry	−1.591		0.522	−3.295	3.057**		2.648**	2.252**
	(−0.40)		(0.30)	(−0.79)	(3.29)		(4.10)	(2.68)
secdum	−0.765		−2.762		0.191		0.0712	
	(−0.41)		(−0.99)		(0.16)		(0.06)	
empl	1.756		2.680	−0.0109	2.397*		1.563*	1.752**
	(0.75)		(1.16)	(−0.01)	(2.30)		(2.03)	(3.01)
assets	3.812		3.821		0.225		−0.0358	
	(1.51)		(0.94)		(0.21)		(−0.03)	
output	1.644		4.419	−0.164	4.433**		3.503**	3.704**
	(0.38)		(1.41)	(−0.04)	(3.67)		(3.30)	(3.40)
Constant	−160.5	−185.0	−0.817	−2.124	−57.65	73.73	−1.762*	−2.849**
	(−0.59)	(−1.03)	(−0.32)	(−0.88)	(−0.75)	(1.30)	(−2.08)	(−3.50)
Observations	46	46	46	46	42	42	42	42
R^2	0.350	0.327	0.102	0.282	0.626	0.383	0.482	0.586

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 18: Probability meta-regression, old studies

	Probit—POSIT, excluding outliers				Probit—SIGNIF, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	−0.141	−0.0863		−0.140	0.131	0.0305		
	(−1.02)	(−0.71)		(−1.03)	(0.87)	(0.28)		
avgyr	−0.0235	−0.0312			−0.0307	−0.0512†		
	(−0.43)	(−0.69)			(−0.94)	(−1.91)		
devg	0.112	−0.148			2.116*	0.790		2.359**
	(0.11)	(−0.23)			(2.31)	(1.55)		(2.70)
trans	0.986	0.387		0.764	1.306	0.383		1.570†
	(1.11)	(0.60)		(1.11)	(1.35)	(0.60)		(1.76)
cs	1.577*	1.701**		1.771**	−1.570	−0.154		−1.507†
	(2.30)	(2.88)		(2.74)	(−1.56)	(−0.27)		(−1.68)
growth	−0.118		−0.292		0.639		0.614	
	(−0.19)		(−0.63)		(1.06)		(1.29)	
secdum	−0.800		−1.100†		−1.100		−0.437	−1.115
	(−0.98)		(−1.68)		(−1.49)		(−0.68)	(−1.60)
empl	0.858		0.949	0.703	1.429		0.597	1.698*
	(0.94)		(1.60)	(0.93)	(1.51)		(0.99)	(2.08)
assets	1.121		0.838	0.819	0.142		0.387	
	(1.48)		(1.29)	(1.17)	(0.20)		(0.60)	
output	1.763†		1.542*	1.605	1.750		0.961	1.807*
	(1.65)		(2.07)	(1.60)	(1.64)		(1.43)	(2.02)
industry					1.803		0.676	1.183
					(1.50)		(1.38)	(1.36)
Constant	46.46	62.15	−0.170	−0.422	58.29	101.3†	−0.814	−1.807*
	(0.42)	(0.70)	(−0.34)	(−0.39)	(0.89)	(1.90)	(−1.46)	(−2.13)
Observations	42	42	42	42	42	42	42	42
Pseudo R^2	0.383	0.307	0.168	0.353	0.305	0.153	0.094	0.257

t statistics in parentheses

response variable: dummy = 1 if t stat is positive (columns 1–4); dummy = 1 if t stat is significant (columns 5–8)

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 19: Standard meta-regression, new studies

	OLS, including outliers				OLS, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.458	−0.317		0.281	0.183	−0.109		0.199†
	(1.16)	(−1.41)		(0.92)	(1.15)	(−0.67)		(1.79)
avgyr	0.0142	0.224		0.0969	−0.150	−0.0201		−0.146†
	(0.05)	(1.24)		(0.41)	(−1.26)	(−0.25)		(−2.00)
devg	2.570	−3.909†			−0.0703	−1.562		
	(0.62)	(−1.94)			(−0.04)	(−1.27)		
trans	6.214	−1.998		3.975	1.092	−1.481		1.107
	(0.98)	(−0.86)		(1.24)	(0.56)	(−1.34)		(0.91)
cs	5.151*	1.902		4.978*	2.687*	1.697		2.674**
	(2.22)	(1.15)		(2.33)	(2.72)	(1.42)		(2.80)
growth	1.857		1.504	1.817	1.153		0.689	1.004
	(0.95)		(0.82)	(1.24)	(1.21)		(0.91)	(1.40)
industry	5.451†		3.947†	5.055*	3.438*		1.748	3.358*
	(1.86)		(1.88)	(2.19)	(2.27)		(1.25)	(2.63)
secdum	3.816†		3.597†	3.228*	0.936		0.272	0.893
	(1.83)		(1.81)	(2.35)	(0.84)		(0.34)	(0.93)
empl	7.267		3.017	6.368	2.046		1.119	1.816†
	(1.08)		(0.79)	(1.56)	(1.66)		(1.37)	(1.70)
assets	0.892		0.830	0.949	0.651		0.500	0.345
	(0.23)		(0.25)	(0.55)	(0.62)		(0.49)	(0.35)
output	−0.305		−0.583		0.396		−0.143	
	(−0.09)		(−0.20)		(0.33)		(−0.16)	
Constant	−41.41	−441.3	−2.847	−202.4	295.9	42.39	−0.866	286.3†
	(−0.08)	(−1.23)	(−0.71)	(−0.43)	(1.26)	(0.26)	(−0.79)	(1.98)
Observations	51	51	51	51	45	45	45	45
R^2	0.255	0.059	0.150	0.245	0.314	0.141	0.148	0.312

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 20: Robust meta-regression, new studies

	IRLS				Median regression			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.248	−0.0681		0.181	0.351	0.00683		$0.381^{\dagger}$
	(1.20)	(−0.42)		(1.13)	(0.83)	(0.04)		(1.91)
avgyr	-0.256^{*}	−0.0333		-0.213^{*}	−0.277	−0.0322		$-0.188^{\dagger}$
	(−2.17)	(−0.34)		(−2.29)	(−0.92)	(−0.30)		(−1.72)
devg	0.900	−1.081			1.874	−1.944		
	(0.61)	(−0.93)			(0.46)	(−1.57)		
trans	1.881	−1.326			3.141	$-2.310^{\dagger}$		
	(1.12)	(−1.21)			(0.69)	(−1.94)		
cs	3.213^{*}	$1.967^{\dagger}$		2.758^{*}	2.988	1.624		1.993
	(2.68)	(1.87)		(2.62)	(1.07)	(1.40)		(1.46)
growth	$1.615^{\dagger}$		0.601	$1.184^{\dagger}$	1.187		0.950	1.443
	(1.77)		(0.65)	(1.70)	(0.46)		(0.52)	(1.45)
industry	4.595^{**}		1.612	3.800^{**}	5.020		1.360	4.339^{*}
	(3.10)		(1.30)	(3.01)	(1.37)		(0.53)	(2.61)
secdum	1.579		0.239	1.143	2.856		1.230	1.966
	(1.60)		(0.28)	(1.42)	(1.05)		(0.73)	(1.63)
empl	2.299		1.121		3.765		2.543	
	(1.54)		(0.97)		(0.87)		(1.07)	
assets	1.118		1.054		1.537		2.343	
	(0.79)		(0.75)		(0.37)		(0.87)	
output	1.057		−0.0835		0.768		0.273	
	(0.79)		(−0.06)		(0.20)		(0.10)	
Constant	503.2^{*}	68.18	−0.771	421.8^{*}	544.2	66.42	−2.503	$370.0^{\dagger}$
	(2.16)	(0.35)	(−0.51)	(2.28)	(0.91)	(0.31)	(−0.85)	(1.70)
Observations	51	51	51	51	51	51	51	51
R^2	0.348	0.136	0.115	0.304	0.099	0.044	0.033	0.064

t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 21: Panel meta-regression, new studies

	Random effects, including outliers				Random effects, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	$0.563^{\dagger}$	−0.317		0.104	0.132	−0.0738		0.130
	(1.78)	(−1.41)		(0.38)	(0.79)	(−0.50)		(0.99)
avgyr	0.188	0.224		0.141	−0.119	−0.00447		$-0.109^{\dagger}$
	(0.59)	(1.24)		(0.61)	(−1.07)	(−0.05)		(−1.66)
devg	3.279	$-3.909^{\dagger}$			−0.356	−1.554		
	(0.82)	(−1.94)			(−0.23)	(−1.32)		
trans	9.272	−1.998			0.751	−1.462		
	(1.37)	(−0.86)			(0.39)	(−1.14)		
cs	6.405^{*}	1.902		$3.101^{\dagger}$	2.249^{*}	1.472		1.811^{*}
	(2.05)	(1.15)		(1.93)	(2.25)	(1.26)		(2.21)
growth	−2.186		−3.186		0.818		0.396	
	(−0.97)		(−1.48)		(0.91)		(0.54)	
industry	$8.366^{\dagger}$		$6.942^{\dagger}$	$3.091^{\dagger}$	3.199^{*}		1.803	2.503^{*}
	(1.90)		(1.89)	(1.70)	(2.11)		(1.31)	(2.21)
secdum	2.045		2.590	3.729^{*}	1.002		0.606	1.114
	(1.46)		(1.54)	(2.26)	(0.97)		(0.72)	(1.25)
empl	4.035		0.604	4.198	2.108		1.445	$1.208^{\dagger}$
	(0.61)		(0.09)	(1.47)	(1.28)		(1.00)	(1.76)
assets	-12.32^{**}		-10.93^{*}		0.757		0.742	
	(−3.20)		(−2.50)		(0.49)		(0.47)	
output	−7.194		−5.250		0.687		0.148	
	(−1.64)		(−1.05)		(0.39)		(0.10)	
Constant	−382.0	−441.3	4.863	−284.7	234.6	11.10	−0.906	$214.6^{\dagger}$
	(−0.61)	(−1.23)	(0.87)	(−0.62)	(1.07)	(0.07)	(−0.58)	(1.65)
Observations	51	51	51	51	45	45	45	45
R^2	0.131	0.059	0.051	0.163	0.302	0.139	0.136	0.233

heteroscedasticity robust (Huber-White sandwich est.) t statistics in parentheses

response variable: t statistic

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 22: Probability meta-regression, new studies

	Probit—POSIT, excluding outliers				Probit—SIGNIF, excluding outliers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ldf	0.0826	−0.00491		0.0225	0.141	0.177		0.126
	(0.55)	(−0.05)		(0.18)	(0.97)	(1.56)		(1.03)
avgyr	−0.121	−0.0688			0.0852	0.0290		0.0793
	(−1.19)	(−0.90)			(1.02)	(0.46)		(1.01)
trans	0.344	−0.774		0.373	−1.137	−1.201†		−1.313†
	(0.52)	(−1.01)		(0.59)	(−0.97)	(−1.68)		(−1.70)
cs	1.070	0.432		0.683	1.100	1.455*		1.250†
	(1.05)	(0.61)		(0.79)	(1.38)	(2.09)		(1.80)
growth	0.561		0.207		−0.0292		0.0777	
	(0.78)		(0.33)		(−0.05)		(0.15)	
industry	1.345		0.419	0.309	−1.000		−0.918	−0.735
	(1.12)		(0.51)	(0.34)	(−0.92)		(−1.29)	(−0.74)
secdum	0.765		0.387		−0.860		−0.702	−0.822
	(1.16)		(0.69)		(−1.36)		(−1.44)	(−1.44)
empl	2.810**		2.434**	2.389**	0.216		0.731	
	(2.63)		(2.74)	(2.61)	(0.19)		(0.94)	
assets	1.994†		1.637†	1.298†	0.487		1.124	
	(1.89)		(1.76)	(1.70)	(0.52)		(1.31)	
output	1.353		0.959	0.704	−0.294		0.252	
	(1.46)		(1.18)	(1.06)	(−0.32)		(0.30)	
devg		−0.0360			−1.252	−0.995		−1.339†
		(−0.04)			(−1.27)	(−1.35)		(−1.68)
Constant	237.8	138.2	−1.268	−1.216	−170.2	−59.00	−0.526	−158.2
	(1.18)	(0.90)	(−1.23)	(−0.90)	(−1.03)	(−0.47)	(−0.56)	(−1.01)
Observations	45	45	45	45	45	45	45	45
Pseudo R^2	0.270	0.109	0.222	0.227	0.233	0.169	0.127	0.206

t statistics in parentheses

response variable: dummy = 1 if t stat is positive (columns 1–4); dummy = 1 if t stat is significant (columns 5–8)

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

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