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Multinational Companies and Productivity Spillovers: A Meta-Analysis with a Test for Publication Bias

by

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Abstract

This paper presents the results of a meta-analysis of the literature on multinational companies and productivity spillovers. Studies in this literature examine spillovers usually within the framework of an econometric analysis in which labour productivity in domestic firms is regressed on a number of covariates assumed to have an effect on productivity, one of which is the presence of foreign firms. A positive and statistically significant coefficient on the foreign presence variable is then taken as evidence that spillovers exist. For a sample of published and unpublished studies, we collect the different coefficients on the foreign presence variable reported in the different studies, and their associated values of the *t*-statistic. We then regress the value of the *t*-statistics on a number of study characteristics, such as sample size, variable definitions used, etc. Some of these characteristics, namely, variable definitions, and whether it is a cross-section or panel analysis, have an effect on the size of the coefficient found in the productivity studies. Using a similar regression approach, we also find evidence that there may be publication bias in the literature on productivity spillovers.

Outline

1. Introduction
2. Description of the Sample
3. Meta-Analysis
4. Testing for Publication Bias
5. Conclusion

Non-Technical Summary

One of the most frequently referred to positive effect of multinational companies (MNCs) on the host country is the presence of technological externalities, which can lead to productivity spillovers from MNCs to domestic firms in the host country. Productivity spillovers enable domestic firms to increase productivity allowing them to become more efficient. The empirical evidence on productivity spillovers is mixed with some studies finding positive spillover effects, while others find negative effects or no spillovers at all. Arguably, differences in research design, methodology and data may have an impact on the results obtained. In this paper we try to shed some light on this issue by performing a meta-analysis on a sample of published and unpublished studies of productivity spillovers. Meta-analysis can be used to summarise, and to explain variations in results of a number of similar empirical studies concerned with one research topic. Meta-analysis can also be used to test for publication bias in the literature, that is the tendency in academic journals to publish results which are statistically significant. Our analysis suggests that the research design is crucial for a proper analysis of productivity spillovers. Panel data studies appear to be more appropriate as they allow a researcher to follow the development of domestic firms' productivity over a longer time period, rather than studying only one data point in time in cross sectional data. We also find that the definition of the foreign presence variable included in the studies seems to affect the results obtained. We would also suggest that host country characteristics, such as the technological capability of domestic firms, impact on the potential spillovers which can benefit domestic firms. In an extension of our analysis, we also find that there seems to be evidence of publication bias in the studies of productivity spillovers included in our sample.

1 Introduction

The increasing importance of multinational companies (MNCs) and associated foreign direct investment (FDI) for international production has prompted considerable interest into the effects of MNCs on host countries.[1] One of the most frequently referred to positive effect is the presence of technological externalities, which can lead to productivity spillovers from MNCs to domestic firms in the host country. Productivity spillovers enable domestic firms to increase productivity allowing them to become more efficient.[2]

Such spillovers can occur through three main channels (Blomström and Kokko, 1998).[3] Firstly, if there are movements of highly skilled staff from MNCs to domestic firms, these employees may take with them knowledge which may be usefully applied in the domestic firm. Secondly, there may be so-called "demonstration effects" if there are arm's-length-relationships between MNCs and domestic firms and domestic firms learn superior production technologies from multinationals. Thirdly, competition from multinationals may force domestic rivals to up-date production technologies and techniques to become more productive. This is frequently referred to as a "competition effect". As Aitken and Harrison (1999) point out, however, this competition effect may also reduce productivity in domestic firms, if MNCs attract away demand from their domestic competitors.

Productivity spillovers are difficult to measure, since, as Krugman (1991, p. 53) points out, "knowledge flows […] leave no paper trail by which they may be measured and tracked". The approach adopted in the empirical literature therefore largely avoids the (arguably difficult to answer) question as to how productivity spillovers actually take place, but focuses on the simpler issue of whether or not the presence of multinationals affects productivity in domestic firms. This is usually done in the framework of an econometric analysis in which labour productivity or total factor productivity in domestic firms is regressed on a number of covariates assumed to have an effect on productivity, one of which is the presence of foreign

[1] There is also a literature concerned with examining the effects of MNCs on home countries, see, for example Blomström and Kokko (1994), Blomström et al. (1997). As this is not the focus of our paper, however, we do not review these issues herein.

[2] See Blomström and Kokko (1998) and Pack and Saggi (1997) for recent concise reviews of the literature on host country effects, in particular, productivity spillovers and technology flows, of MNCs.

[3] These different channels open up various options for government policy to encourage technology inflows from multinationals. See Kokko and Blomström (1995) for a discussion.

firms. If the estimate of the coefficient on the foreign presence variable turns out to have a positive and statistically significant sign, this is taken as evidence that spillovers have taken place from MNCs to domestic firms.[4]

The empirical results on the presence of spillovers are mixed. Table 1 lists a number of studies which analyse productivity spillovers in manufacturing industries in different developed and developing countries. Inspection shows that Djankov and Hoekman (2000), Kathuria (2000), Aitken and Harrison (1999) and Haddad and Harrison (1993) find negative effects of the presence of multinationals on domestic firms, using firm level panel data for manufacturing industries in the Czech Republic, India, Venezuela and Morocco respectively. Kokko et al. (1996), Girma et al. (1999), Barrios (2000) and Flores et al. (2000) do not find any statistically significant effects in their studies of Uruguayan, UK, Spanish and Portuguese manufacturing industries respectively, while the other studies listed in the table find positive and statistically significant positive effects which support the hypothesis of productivity spillovers. The magnitude of the coefficients also differs across studies.

Table 1 here

Various explanations are put forward to explain statistically insignificant or negative results. For example, the presence of foreign firms can reduce productivity of domestic firms, as pointed out by Aitken and Harrison (1999). Since foreign firms can frequently be assumed to posses some sort of firm-specific assets (Caves, 1996) which allow them to use a superior production technology, they have lower marginal cost than a domestic competitor and can attract demand away from domestic firms. Thus, productivity in domestic firms falls, at least in the short run, because of competition with multinational companies.

It is also argued in the literature that positive spillovers only affect a certain group of firms and aggregate studies may, therefore, underestimate the true significance of such effects. Kokko et al. (1996) find evidence for productivity spillovers only to domestic firms with moderate

[4] Görg and Strobl (2000) present a different way of examining technology spillovers. They postulate that, if firms benefit from technology spillovers they are able to produce more efficiently, i.e., at lower costs which will, ceteris paribus, increase their probability of survival. They also present empirical results that the presence of foreign firms (which are arguably the source for technology spillovers) increases firms' probability of survival in Irish manufacturing industries, which they take as evidence for the existence of spillovers. The present paper is, however, only concerned with papers of productivity studies.

technology gaps *vis-à-vis* foreign firms, i.e., domestic firms with at least some capability of being able to make use of the spillover effects, while they do not find evidence for spillovers from MNCs to domestic firms which use considerably lower levels of technology. Aitken and Harrison (1999) find that productivity in small Venezuelan firms (with less than 50 employees) has increased following the presence of MNCs, while there does not appear to be a similar effect on large domestic firms.

The question remains unanswered, however, as to why some studies find positive, while others find negative or no spillover effects from multinationals, and why the magnitude of regression coefficients differs across studies. Arguably, differences in research design, methodology and data may have an impact on the results obtained. In this paper we try to shed some light on this issue by performing a meta-analysis of the literature on productivity spillovers. Meta-analysis can be used to summarise, and to explain variations in results of a number of similar empirical studies concerned with one research topic (Stanley and Jarrell, 1989).[5] Meta-analysis can also be used to test for publication bias in the literature, that is the tendency in academic journals to publish results which are statistically significant (Card and Krueger, 1995).

For a sample of studies of productivity spillovers, we collect the different coefficients on the foreign presence variable found in the different studies, and their associated values of the *t*-statistic. We then regress the *t*-statistics on a number of meta-independent study characteristics, such as sample size, variable definitions used, etc. Some of these characteristics, namely, whether it is a cross-section or panel analysis, and variable definitions have an effect on the size of the coefficient found in the productivity studies. We also find evidence that there may be publication bias in the literature on productivity spillovers.

Our analysis suggests that the research design is crucial for a proper analysis of productivity spillovers. Panel data studies appear to be more appropriate as they allow a researcher to follow the development of domestic firms' productivity over a longer time period, rather than studying only one data point in time in cross sectional data. We would also suggest that host country characteristics, such as the technological capability of domestic firms, impact on the potential spillovers which can benefit domestic firms.

The remainder of the paper is structured as follows. Section 2 presents the sample of studies used and Section 3 provides the results of the meta-analysis. In Section 4 we describe the results of an analysis of publication bias, and Section 5 summarises our main results and presents some concluding comments.

2 Description of the Sample

The sample of papers from the productivity spillovers literature analysed in our paper consists of 21 studies, 16 of which are published in academic journals, two are forthcoming in journals and three of which are unpublished manuscripts (see Table 1 for a listing of studies included). The papers were obtained from inspection of the recent concise survey of the literature of the wider area of technology spillovers by Blomström and Kokko (1998) as well as an EconLit search for the key words "productivity spillovers".[6] Furthermore, we searched through recent issues of appropriate journals and conducted internet searches for unpublished papers. There may, no doubt, be further published and unpublished papers, and especially dissertations which we were not able to take account of in this study. Of the papers included, only seven are concerned with measuring productivity spillovers in developed countries (two for the UK, one for Australia, Canada, Taiwan, Spain, and Portugal) while of the others five examine the Mexican case. All studies relate to manufacturing industries.

In terms of the research design, most studies analyse data for one year, or one specified time period, using one particular definition of the dependent variable and varying the number and definition of explanatory variables reported in the regression results. For such studies, we included in our sample the most preferred specification, either by examining the highest R-squared value or by the comparability of the variable definitions to the other studies included. There are, however, three papers for which we include more than one regression result in the sample. From Sjöholm (1999a) we include three results, since he looks at different time periods and uses different definitions of the dependent variable, and from Haddad and Harrison (1993) and Girma et al. (1999) we include two results each to account for their different

[5] See Phillips (1994), Phillips and Gross (1995), Smith and Huang (1995) and Stanley (1998) for recent applications of meta-analysis in the economics literature.

[6] The EconLit search produced 171 references, most of which, however, were concerned with the related, yet distinct, issue of R&D spillovers and growth. See, for example, Griliches (1998) for a discussion. Also, we only included papers written in English in our meta analysis.

dependent variable definition. This leads to a total of twenty-five observations to be used in our meta-analysis.

Fourteen observations (from twelve papers) are obtained from studies which used plant level data, while eleven observations relate to industry level data (at varying levels of aggregation). Panel data were only used in eight papers, from which we obtained ten observations, while the remaining studies are based on cross-section data. In terms of the variable definitions, nine observations relate to foreign presence being measured as employment share in foreign owned firms, nine measure foreign presence as output (or value added) share while the other seven use other related measures. Haddad and Harrison (1993), Chuang and Lin (1999) and Djankov and Hoekman (2000) measure foreign presence as the share of assets held by foreign firms, Aitken and Harrison (1999) use the share of foreign equity participation, while Kathuria (2000) uses the share of sales of foreign firms. Driffield (2000) calculates the growth of sales in foreign-owned firms as a measure of foreign presence.

Of the observations included in our sample, 14 out of the 25 cases define the dependent variable as labour productivity (i.e., output or value added per worker), while output growth is used in nine cases. Blomström (1986) calculates a different measure, namely, an efficiency index $e_i = \overline{y_i} / y_i^+$ where y_i^+ is value added per employee in firms in a size class with the highest value added per employee within an industry *i*, and $\overline{y_i}$ is the industry average. Thus, this index calculates the distance of the industry average from the "best practice" or "efficiency frontier" in the industry. Kathuria (2000) uses a similar measure in his study of productivity spillovers in India.[7]

3 Meta-Analysis

In order to attempt an explanation of the variations in results across the sample of studies of productivity spillovers, we follow Stanley and Jarrell (1989) who suggest estimating an equation as follows:

[7] In some of their specifications, Aitken and Harrison (1999) also use a different dependent variable definition, namely the log of output. In that case, however, both the dependent and the foreign presence variable are defined differently and we therefore do not include this result in our meta-analysis.

$$Y_j = \beta_0 + \sum_{k=1}^{K} \beta_k Z_{jk} + e_j, \qquad j=1,2,\ldots N \tag{1}$$

where Y_j is the reported estimate in study j from a total of N studies, and Z_{jk} are meta-independent variables which proxy characteristics of the empirical studies in the sample in order to explain the variation in Y_js across studies. Our choice of explanatory variables is provided in Table 2.

First of all, it must be pointed out that an analysis of the differences in the effect of spillovers across studies is hampered by the fact that the foreign presence variable is measured in different units in the different studies; for example, Globerman (1974) measures value-added per worker in thousands of Canadian dollars, while Flores et al. (2000) measurement is in millions of Portuguese escudos. Of course, these differences in measurement will affect the magnitude of the coefficients on foreign presence. We, therefore, decided to use a dimensionless variable, namely the *t*-statistic as the dependent variable in our meta-analysis, as suggested by Stanley and Jarrell (1989). The *t*-statistic provides us with a standardised measure of the effect of the foreign presence variable on the dependent variable which allows a cross-study comparison.

In terms of the explanatory variables, there are a number of characteristics of individual studies which may impact on the size of the *t*-statistic. For example, results may differ because of differences in numbers of observations used in the papers. In our sample, the smallest number of observations was available to Blomström and Wolff (1994) with only 20 observations, while Aitken and Harrison (1999), on the other side of the scale, can avail of 32,521 observations. All other things being equal, an increase in the sample size should raise the absolute value of the *t*-ratio. To take account of differing sample sizes we include the square root of the degrees of freedom in our meta-analysis, as in Card and Krueger (1995). As we discuss in more detail below, this variable also allows us to conduct a simple test for publication bias in the studies on productivity spillovers.

As can be seen from Table 2, we also control for differences in the time of study and the nature of the data (industry or plant; cross-section or panel), the status of the host economy (developing or developed), the nature of the foreign presence variable, and differences in the

definition of the dependent variable. Ideally, we would also like to include a variable to control for the nature of the different explanatory variables included in the different studies. The small size of our sample poses the problem of only few degrees of freedom, however, which prevents the inclusion of additional dummy variables to control for this. Suffice it to say that most studies include additional sectoral characteristics as explanatory variables, such as, measures of market concentration (Blomström, 1986), average capital-labour ratio in domestic firms (Kokko et al., 1996), measures of labour quality (Globerman, 1979), or measures of labour and capital inputs in estimations of total output growth (Haddad and Harrison, 1993).

Table 2 here

The results of the meta regression, using OLS are reported in Table 3. As Stanley and Jarrell (1989) point out, since the dependent variables are drawn from studies with widely different characteristics, it is highly likely that the error terms of the meta-regression are not homoskedastic. We therefore calculate heteroskedasticity consistent standard errors using the White (1980) estimator. We have eliminated two observations, namely one of the results reported by Sjöholm (1999a) and the result by Chuang and Lin (1999), from our sample as they have excessively high *t*-statistics, which leaves us with 22 observations in the meta-regression.[8]

Table 3 here

Our results suggest that studies which use cross-sectional data tend to have, on average, higher *t*-ratios than panel studies. In other words, the effect of productivity spillovers appears to be higher in cross-sectional studies. This difference across data set types may arise because of the problems associated with unobserved time invariant effects. Specifically, if there are time invariant effects across the individual units (either industry or firms) that are not captured in the explanatory variables but are correlated with the foreign presence variable then the cross-sectional studies may produce biased and inconsistent estimates of the effect arising from spillovers. Such time invariant effects may, however, be purged from panel data studies if, for example, a fixed or random effects estimation technique is used (see Baltagi, 1995).

[8] We also re-estimated the meta-regression including these outliers. In that case, the coefficient on *cs* is qualitatively and quantitatively similar to the results reported here, while the coefficient on *x3* is statistically insignificant.

In terms of variable definitions, it does not appear to make a difference how the dependent variable is defined; whether it is output per worker, output growth, or another measure. Our results suggest, however, that the choice of foreign presence proxy may be an important determinant of differences across studies. Including separate dummy variables for whether a study used foreign output share or some other variable to proxy foreign presence, we find that these two proxies produce lower results relative to our base-line category of foreign employment share (although the coefficient on the output share dummy is statistically insignificant). This may suggest that a proper definition of the variable which is supposed to capture the spillover effect is crucial. As pointed out above, most studies use either the share of employment in foreign-owned firms, or the share of output produced by these firms, as a proxy to capture this effect. Some studies, however, use other measures and our results show that these studies find lower spillover effects than others, ceteris paribus.

Our findings suggest that it does not appear to matter whether a study uses industry or plant level data, whether a study is concerned with a developing or developed country, and whether or not the data are recent. In a correlation analysis we do, however, find statistically significant (at the five and ten percent level respectively) negative correlations between *year* and *cs* (-0.52) and *year* and *ind* (-0.35). This suggests that studies using older data tend to be those which use cross-section and industry level data, which may be due to the availability of better and more disaggregated data for more recent research.

4 Testing for Publication Bias

At least since De Long and Lang (1992) have economists recognised that there may be a tendency among editors of academic journals to publish papers preferably if they reject their null hypothesis, i.e., if they produce statistically significant results. This is frequently referred to as publication bias and has attracted growing interest in the recent academic literature (see, Card and Krueger, 1995, Neumark and Washer, 1996, Ashenfelter et al., 1999). As these papers argue, a meta-analysis provides an opportunity to test for publication bias using the results available from the literature.

Card and Krueger (1995) propose a simple yet intuitive test of publication bias. Basic sample theory suggests that, loosely speaking, studies with larger numbers of observations should also

produce higher *t*-ratios. More precisely, the coefficient of a regression of the log of the absolute value of the *t*-ratio on the log of the square root of the degrees of freedom should be equal to 1. This suggests a straightforward test for publication bias, namely, estimate the said regression and examine the size of the coefficient. This is what we set out to do in this section.

We use the same data set as used for the meta-analysis in Section 3, including the three unpublished studies. Of course, one may argue that a study of publication bias, for obvious reasons, should not include studies which are not published yet and which, therefore, may not be subject to such bias. However, one could also argue that, if publication bias exists, researchers may take this into account while conducting research and may only be willing to circulate papers which show statistically significant results. In other words, publication bias does not only prevail because editors may prefer statistically significant results, but also because there is "peer pressure" to circulate papers only if results conform to this standard. Given that the three unpublished studies included in our sample have only been recently circulated, they may be subject to this (pre)publication bias. A brief look back at Table 1, however, shows that all three unpublished studies find statistically insignificant results, which may suggest that publication bias has not influenced the research. We also undertook the following analysis for the sample excluding the three unpublished studies, and the results, which are available from the authors upon request, are qualitatively and quantitatively similar to the ones reported herein.

Figure 1 shows the relationship between the absolute value of the estimated *t*-statistics and the square root of degrees of freedom in the included studies. Note that this graph clearly shows the outliers, as pointed out above, which we deleted from our regressions. We would expect a positive relationship between the estimated *t*-statistics and degrees of freedom which does not appear to hold for the data displayed in the graph. It is clearly not obvious from Figure 1 whether there is any relationship, the scatter of points appears to be most closely fitted by a horizontal line.

Figure 1 here

To examine this issue in more detail we regress the log of the absolute value of the *t*-statistics on the log of the square root of degrees of freedom (*lsrdf*), controlling for other meta-

independent characteristics as above. We then perform a simple *t*-test on the coefficient on *lsrdf* to check whether the hypothesis that the coefficient is equal to 1 can be rejected. The results of different specifications of this regression are reported in Table 4.

Table 4 here

Inspection of the *t*-statistics reported in the table shows that we can reject the hypothesis of the coefficient on *lsrdf* being equal to 1 for all specifications of the estimation, reported in columns (1) to (4). Thus, our analysis provides evidence that publication bias may be present, i.e., that studies of productivity spillovers are more likely to become published if they report statistically significant effects of foreign presence on productivity in domestic firms.

Card and Krueger (1995) also suggest that a regression of the coefficient in question on its standard error may provide evidence as to whether publication bias is present. In theory, one would expect no systematic relationship between these two variables but if publication bias is present, a *t*-ratio will have to exceed (roughly) 2 in absolute value, in which case there may be a positive relationship between the coefficient and the standard error (since $t=b/\text{SE}$). Performing this regression on the data in our sample yields the following regression (standard errors in parentheses):[9]

$$Y_j = -0.079 + 2.376SE_j \qquad (2)$$

$$(0.066) \quad (0.553)$$

where the coefficient on *SE* is statistically significant at the 1 percent level and the R-squared equals 0.84. This result lends further credence to the claim that there is indeed evidence of publication bias in the literature on productivity spillovers which we have included in our sample.

5 Conclusion

A substantial body of literature analysing whether or not there are productivity spillovers from the presence of multinational companies to domestic firms in developed or developing countries has developed over the past 25 years, but these studies produce mixed results. Our

meta-analysis of the results published or circulated in a number of studies in this area shows that some aspects of the research design may affect the results of that study. We find that, on average, cross-sectional studies report higher coefficients of the effect of foreign presence than panel data studies, and that the definition of the foreign presence variable included in the studies seems to affect the results obtained. We also find some evidence that suggests there they may be publication bias in the studies that we reviewed.

Over and above our meta-analysis, a careful reading of the literature on productivity spillovers reveals that spillovers are far from being a "catch-all" concept but that different firms may benefit or suffer from the presence of foreign firms. Aitken and Harrison (1999) show that small firms benefit more from multinational firms than large firms, while Kokko et al. (1996) find evidence that only firms with a moderate technology gap relative to multinationals benefit, whereas domestic firms with drastically lower levels of productivity can not reap any positive effects from the presence of foreign firms.

Also, in terms of research design, Aitken and Harrison (1999) argue that if foreign multinationals gravitate towards more productive sectors there may be a positive association between sectoral productivity and the presence of foreign firms even without spillovers taking place. They find in their study of a panel of Venezuelan firms that including industry dummies changes a positive and statistically significant coefficient to be negative and significant.[10] This provides further evidence that a careful research design is crucial for the analysis of productivity spillovers. Clearly, these and our findings indicate that the question of spillovers arising from foreign multinationals can as of yet not be considered a resolved issue.

[9] Again, exclusion of the three unpublished studies yields qualitatively and quantitatively similar results.
[10] However, this lack of industry dummies cannot explain the differences in results for the sample of observations we use, as we have collected results for econometric specifications without dummies for all but one (Blomström and Sjöholm, 1999) study.

Table 1: Papers on productivity spillovers included in the meta-analysis

Author(s)	Country	Year	Data	Aggregation	Result
Caves (1974)	Australia	1966	Cs	Industry	+
Globerman (1979)	Canada	1972	Cs	Industry	+
Blomström and Persson (1983)	Mexico	1970	Cs	Industry	+
Blomström (1986)	Mexico	1970/1975	Cs	Industry	+
Haddad and Harrison (1993)	Morocco	1985-1989	Panel	Firm & Ind.	-
Blomström and Wolff (1994)	Mexico	1970/1975	Cs	Industry	+
Kokko (1994)	Mexico	1970	Cs	Industry	+
Kokko (1996)	Mexico	1970	Cs	Industry	+
Kokko et al. (1996)	Uruguay	1990	Cs	Firm	insignificant
Aitken and Harrison (1999)	Venezuela	1976-1989	Panel	Firm	-
Blomström and Sjöholm (1999)	Indonesia	1991	Cs	Firm	+
Chuang and Lin (1999)	Taiwan	1991	Cs	Firm	+
Sjöholm (1999a)	Indonesia	1980-1991	Cs	Firm	+
Sjöholm (1999b)	Indonesia	1980-1991	Cs	Firm	+
Girma et al. (1999) (unpubl.)	UK	1991-1996	Panel	Firm	insignificant
Djankov and Hoekman (2000)	Czech Re.	1993-1996	Panel	Firm	-
Driffield (2000)	UK	1989-1992	Cs	Industry	+
Kathuria (2000)	India	1976-1989	Panel	Firm	-
Liu et al. (2000)	UK	1991-1995	Panel	Industry	+
Barrios (2000) (unpubl.)	Spain	1990-1994	Panel	Firm	insignificant
Flores et al. (2000) (unpubl.)	Portugal	1992-1995	Panel	Firm	insignificant

Table 2: Independent variables included in the meta-regression

Variable	Description
srdf	Square root of the degrees of freedom
year	Average year of the data used in the study
Ind	Dummy equal to 1 if data are at industry level
Cs	Dummy equal to 1 if data are cross-section
Dev	Dummy equal to 1 if data are for developing country
Y1	Dummy equal to 1 if dependent variable is output per worker
Y2	Dummy equal to 1 if dependent variable is growth of output
Y3	Dummy equal to 1 if dependent variable is another definition
X1	Dummy equal to 1 if foreign presence variable is foreign employment share
X2	Dummy equal to 1 if foreign presence variable is foreign output share
X3	Dummy equal to 1 if foreign presence variable is another definition

Table 3: Results of meta-regression
Dependent variable: *t*-statistic

Variable	(1)	(2)	(3)	(4)
srdf	-0.014(0.012)	0.002 (0.016)	-0.011 (0.012)	-0.004 (0.019)
ind	-	-0.306 (1.998)	-	-0.896 (2.248)
cs	-	5.036 (1.625)***	-	4.052 (1.534)**
dev	-	-1.892 (1.340)	-	-0.907 (1.139)
year	-	0.045 (0.089)	-	0.066 (0.063)
y2	-	-	1.251 (1.366)	0.580 (1.041)
y3	-	-	-1.082 (1.675)	-0.983 (1.574)
x2	-	-	-0.363 (0.984)	-1.627 (1.330)
x3	-	-	-4.389 (1.692)**	-3.129 (1.320)**
constant	2.009 (0.750)**	-89.142 (176.826)	2.735 (0.534)***	-129.976 (125.048)
# of obs.	23	23	23	23
F	1.32	3.25	5.53	5.53
R^2	0.05	0.54	0.49	0.69

Note: heteroskedasticity-adjusted standard errors in parentheses.

***, **, * denote statistical significance at the 1 per cent, 5 per cent, 10 per cent level respectively

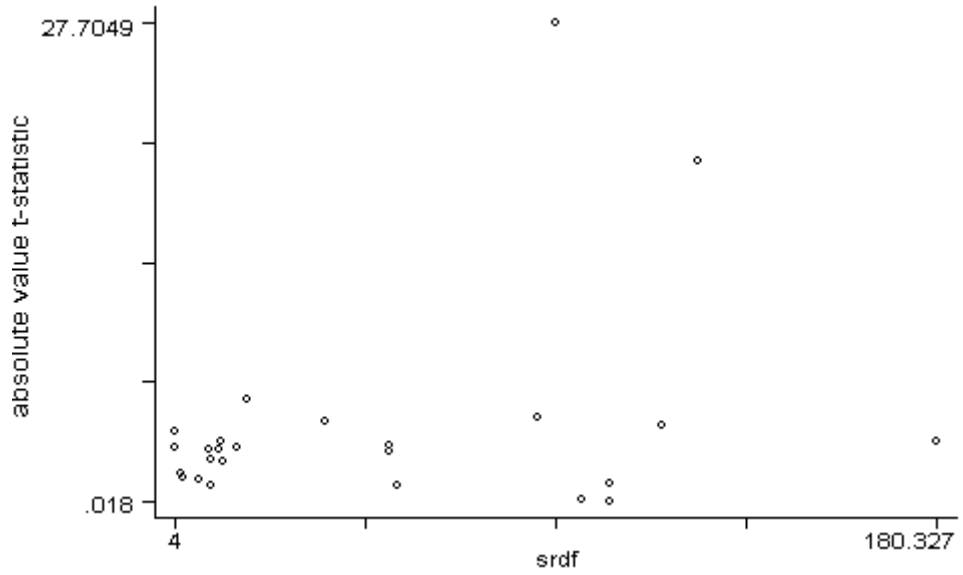
Table 4: Results of meta-regression to test for publication bias
Dependent variable: log of absolute value of *t*-statistic

Variable	(1)	(2)	(3)	(4)
lsrdf	-0.306 (0.273)	-0.303 (0.487)	-0.377 (0.385)	-0.094 (0.425)
ind	-	0.204 (0.810)	-	1.016 (1.159)
cs	-	0.127 (0.634)	-	-0.018 (0.729)
dev	-	1.056 (0.768)	-	0.826 (0.748)
year	-	-0.002 (0.027)	-	-0.025 (0.045)
y2	-	-	0.085 (0.648)	0.463 (0.741)
y3	-	-	0.884 (0.630)	0.695 (0.791)
x2	-	-	0.658 (0.793)	1.083 (0.989)
x3	-	-	0.474 (0.760)	0.654 (0.844)
constant	1.596 (0.672)**	5.093 (54.073)	1.363 (0.670)	48.316 (88.419)
# of obs.	23	23	23	23
t-stat (h_0: b=1)	-4.78	-2.68	-3.58	-2.57
F	1.25	0.81	1.55	0.74
R^2	0.08	0.27	0.16	0.37

Note: heteroskedasticity-adjusted standard errors in parentheses.

***, **, * denote statistical significance at the 1 per cent, 5 per cent, 10 per cent level respectively

Figure 1: Relation of *t*-statistics to log of degrees of freedom



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