

Which Foreigners Are Worth Wooing?

A Meta-Analysis of Vertical Spillovers from FDI

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Outline

- 1 Spillovers from FDI
- 2 Data Set of Spillover Estimates
- 3 Publication Bias
- 4 Heterogeneity
- 5 Summary and Policy Implications

Productivity Spillovers from Foreign Direct Investment

- Hypothesis: domestic firms benefit from the presence of foreign investors, and foreigners are not able to internalize the benefits.
- Such “spillover” of productivity is the rationale for FDI subsidies.

Types of spillover

- Horizontal** Foreign presence in the same industry (foreigners are competitors): labor turnover.
- Backward** Foreign presence in downstream industries (foreigners are customers): quality requirements.
- Forward** Foreign presence in upstream industries (foreigners are suppliers): better inputs.

Estimation of Spillovers

Researchers employ a variant of the following model:

$$\log(\text{productivity})_{ijt} = \alpha_i + e \cdot (\text{foreign presence in } \%)_{jt} + \text{controls}_{ijt} + \epsilon_{ijt}.$$

Economic effect of foreign presence

$$\rightarrow e \approx \% \Delta (\text{productivity}) / \Delta (\text{foreign presence in } \%).$$

- Coefficient e is the semi-elasticity of domestic firms' productivity with respect to foreign presence.
- For example, if $e = 0.1$, a 10-percentage-point rise in foreign presence increases domestic productivity by about 1%.
- e is directly comparable across studies that use the log-level specification (> 95% of studies).

Literature Selection

- We were looking for empirical papers estimating vertical (backward or forward) spillovers.
- After reading a few survey articles, we tuned up a search query for EconLit: 108 hits.
- Additional search in Scopus, RePEc, Google Scholar, and citations of Javorcik (AER, 2004): extended to 183.
- We downloaded about 120 studies that showed any promise to contain an empirical estimate.
- All empirical studies estimating vertical spillovers were used: 57, including 1 in Spanish and 1 in Portuguese.

Coding

- We used all reported estimates.
 - If the specification was not log-level or not linear, we evaluated semi-elasticity at sample means (Tom Stanley: “Better err on the side of inclusion.”)
 - Data were coded separately by both of us to eliminate errors.
 - We reached consensus for each discordant data point.
 - In many cases some information was missing or the methodology was not clearly explained.
- ⇒ We had to ask the authors; 20% of the studies could be included only thanks to cooperation with the authors.

Data Description

- We collected 3,626 estimates of the spillover effect and 70 explanatory variables reflecting data, methods, and quality.
- Quarter million cells in Excel manually filled.
- All studies in our sample combined use 6 million observations.
- The sample gets 400 citations in Google Scholar per year.
- Evidence on 47 countries by 107 researchers.
- Median study was published in 2008 and uses data for 1996–2002.
- We employ Hadi distance to identify outlying estimates (main results are robust to the inclusion of outliers).

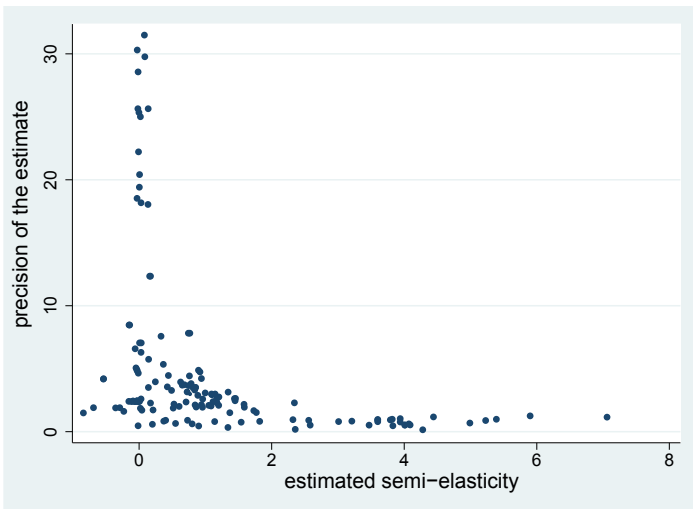
Results from Top Journals

Qualitative Results

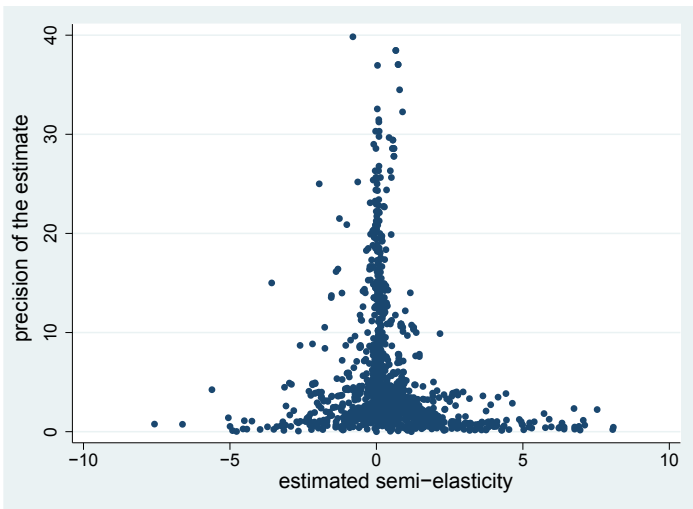
| | authors | journal | back | forw | horiz |
|--|--------------------------------|---------|------|------|-------|
| | Javorcik (2004) | AER | + | ? | ? |
| | Bwalya (2006) | JDE | + | / | - |
| | Kugler (2006) | JDE | + | + | ? |
| | Blalock and Gertler (2008) | JIE | + | / | ? |
| | Javorcik and Spatareanu (2008) | JDE | + | / | - |
| | Liu (2008) | JDE | + | ? | + |
| | Blalock and Simon (2009) | JIBS | + | / | ? |
| | Liu et al. (2009) | JIBS | + | + | - |

Average semi-elasticities are significant: 1.1 for backward, 0.5 for forward, and -0.1 for horizontal. But ...

Publication Bias in Top Journals (Backward Spillovers)



No Bias if also Unpublished Papers Considered



Formal Test of Publication Bias (Multilevel FAT-PET)

If statistical significance is required, estimates will be correlated with standard errors:

$$\hat{e}_i = \underbrace{e}_{\text{true effect}} + \underbrace{\beta_0 SE_i}_{\text{publication bias}} + \mu_i.$$

Controlling for heteroscedasticity and dependence within studies j (multilevel mixed-effects weighted least squares):

$$t_{ij} = \frac{\hat{e}_{ij}}{SE_{ij}} = \beta_0 + \zeta_j + e \left(\frac{1}{SE_{ij}} \right) + \epsilon_{ij}.$$

Publication bias in top journals is confirmed using this test.

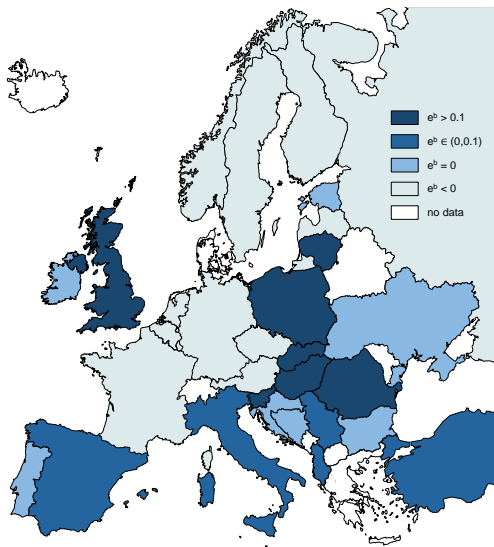
Beyond Publication Bias

Results for both published and unpublished studies

- The semi-elasticity for backward spillovers net of publication bias and unconditional on methodology is economically significant (0.3).
 - The semi-elasticity for forward spillovers is small (0.07).
 - The semi-elasticity for horizontal spillovers is statistically insignificant.
- ⇒ We concentrate on backward spillovers.

These are unconditional effects. Are spillovers the same across countries?

Backward Spillovers Differ Across Countries



What Explains Heterogeneity?

- Rodriguez-Clare (AER, 1996): FDI from **distant countries** should generate more spillovers since such investors will buy more local inputs.
- We need geographical breakdowns of FDI stocks, but for some countries this information is not available.
- Therefore, we use data on outward FDI positions from OECD and the statistical offices of Hong Kong, Taiwan, and Singapore (> 95% of the world stock of outward FDI) to compute the average distance of inward FDI for each country.
- Similarly we compute the average **technology gap** of each country with respect to its inward FDI: high technology gap may prevent domestic firms from adopting technology.

What Explains Heterogeneity?—Cont.

- **Openness**: firms used to foreign competition may be more flexible in adopting technology from multinationals.
- **Financial development**: if multinationals help to improve their local suppliers' access to financing, spillovers would be higher in countries with less developed financial sector.
- **Intellectual property rights**: low protection could discourage high-tech FDI.
- **The degree of foreign ownership**: joint ventures may use more accessible technology than do fully foreign-owned affiliates.
- **Sector differences**: manufacturing firms (usually export-intensive) may have more experience with foreigners.

Variables Capturing Structural Heterogeneity

Country-level variables

- Average distance of inward FDI from source countries.
- Average technology gap of inward FDI.
- Trade openness [(exports and imports)/GDP].
- Development of financial system [(private credits)/GDP].
- Ginarte-Park index of patent rights.

Specification-level variables

- Domestic firms in services (as opposed to manufacturing).
- Fully foreign-owned affiliates (as opposed to joint ventures).

Multivariate Meta-Regression

We extend the framework to account for heterogeneity captured by variables X_k :

$$t_{ij} = \beta_0 + \zeta_j + e \left(\frac{1}{SE_{ij}} \right) + \sum_k \frac{X_{kij}}{SE_{ij}} + \epsilon_{ij}.$$

Although we are mainly interested in structural heterogeneity, we also control for data properties, methodology, and publication quality by including additional 36 variables.

- Values for 1999 (median year of data used in studies) used to compute country-level variables.
- Multicollinearity is not dramatic (all VIFs < 10).

Estimation Results

- Multilevel restricted maximum likelihood used; OLS with study-level clustered standard errors as a robustness check.
- All variables included in one regression; 19 jointly insignificant are excluded using the Wald test.

Estimated signs for structural variables

Distance (+), technology gap (−), openness (+), financial development (−), patent rights (n.s.), services (−), fully foreign-owned (−).

- Results are robust and mostly correspond with our hypotheses.

Best Practice

- 17 aspects of methodology, data, and publication quality are significant as well.
- It is important whether one of the co-authors is native to the country under investigation.
- We construct a synthetic study with ideal parameters: firm-level panel data, minimum age of data, Olley-Pakes TFP computation, estimation in differences, control for sectoral competition and cyclicalities, published, native co-author, maximum number of citations.
- Plugging the values yields semi-elasticity equal to 1.1 (significant; robust across specifications and methods).
- This is four-times greater than the unconditional effect (0.3).

Policy Implications

- 1 FDI on average robustly increases productivity in supplier sectors of the host economy (10pp increase in foreign presence \Rightarrow 11% increase in productivity).
- 2 Countries with higher openness and underdeveloped financial sectors benefit more from FDI.
- 3 The most beneficial is FDI from distant and only slightly more developed countries.
- 4 Joint ventures are more beneficial for the economy than are fully foreign-owned projects.
- 5 FDI is more beneficial for domestic manufacturing sectors than for services sectors.

In a Nutshell



Summary

- Articles published in top journals suffer from publication bias.
- Backward spillovers are economically significant, forward and horizontal spillovers are not.
- FDI from distant countries generates higher spillovers.

Bottom line

- Meta-analysis is more than a literature survey: it can be used to examine important hypotheses not testable in primary studies due to data limitations.

For Further Reading

-  Hoekman, B. M. & B. S. Javorcik (2006): Global Integration and Technology Transfer.
Palgrave Macmillan, The World Bank.
-  Görg, H. & E. A. Strobl (2001): Multinational Companies and Productivity Spillovers: A Meta-Analysis.
The Economic Journal **111(475)**: pp. F723–39.
-  Meyer, K. E. & E. Sinani (2009): When and Where Does Foreign Direct Investment Generate Positive Spillovers? A Meta-Analysis.
Journal of International Business Studies **40(7)**: pp. 1075–1094.