

# Which Foreigners Are Worth Wooing?

## A Meta-Analysis of Vertical Spillovers from FDI

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# Outline

- 1 Meta-Analysis and Spillovers
- 2 Data Set of Spillover Estimates
- 3 Publication Bias
- 4 Causes of 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 buyers): 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).

# Meta-Analysis: More than a Literature Survey

- Meta-analysis is the quantitative method of research synthesis.
- Originally developed in medicine to synthesize costly clinical trials.
- Meta-analysis models publication bias and structural heterogeneity using both regression results and standard data.
- It is no voodoo econometrics:

## Meta-analysis in respected journals

Card and Krueger (1995, AER), Smith and Huang (1995, JPE), Stanley (2001, JEconPersp), Görg and Strobl (2001, EJ), Disdier and Head (2008, REStat), Card et al. (2010, EJ).

# 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.
    - Data were coded separately by both of us to eliminate errors.
    - We reached consensus for each discordant data point.
  - If the specification was not in log-level we evaluated semi-elasticity at sample means (Tom Stanley: “Better err on the side of inclusion.”)
  - 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).



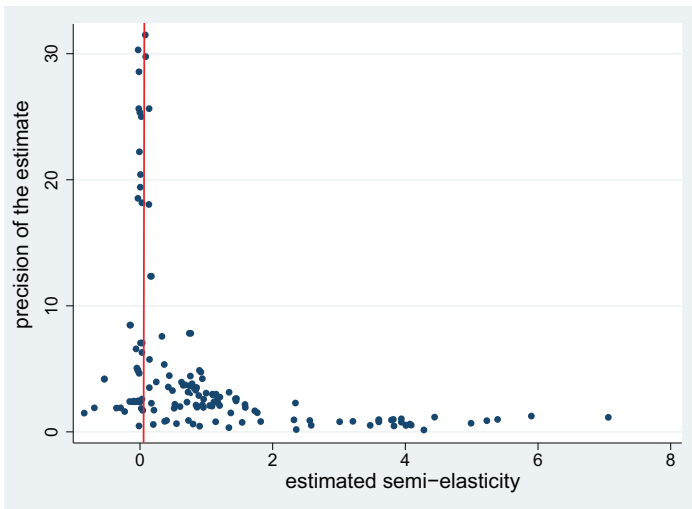
# Results from Top Journals

## Qualitative Results

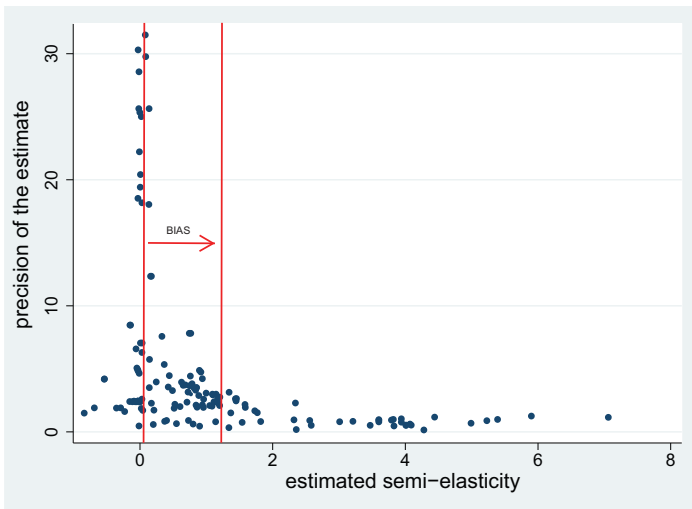
	authors	journal	back	forw	horiz
	Javorcik (2004)	AER	+	?	?
	Bwalya (2006)	JDE	+	/	-
	Kugler (2006)	JDE	+	+	?
	Blalock and Gertler (2008)	JIE	+	/	?
	Javorcik and Spatareanu (2008)	JDE	+	/	-
	Liu (2008)	JDE	+	?	+
	Blalock and Simon (2009)	JIBS	+	/	?
	Liu et al. (2009)	JIBS	+	+	-

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)



# Publication Bias in Top Journals (Backward Spillovers)



# Formal Test of Publication Bias

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.

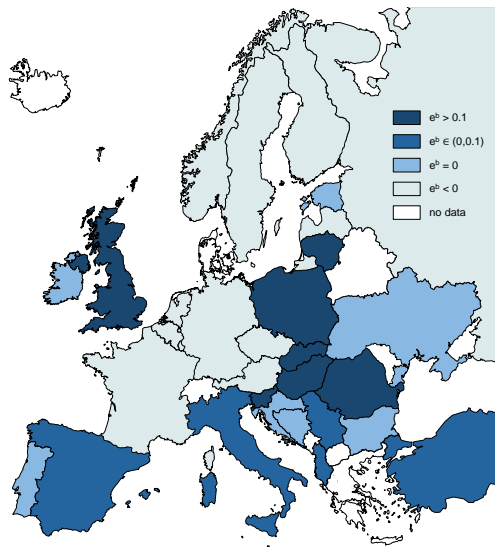
# Beyond Publication Bias

## 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 with respect to 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 the intuition given above.

# Best Practice

- 17 aspects of methodology, data, and publication quality are significant as well.
- 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.

## Related Research

- Meta-analysis of the price puzzle: is it caused by misspecifications? ([meta-analysis.cz/price\\_puzzle](http://meta-analysis.cz/price_puzzle)).

# 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.