

Quantifying Productivity Gains from Foreign Investment

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- Large increase in FDI during recent decades
- An extensive literature searches for positive effects of FDI on growth and productivity:
 - Direct productivity effects (on acquired firms)
 - Knowledge spillovers from foreign-owned companies to domestic
- Micro literature typically focuses on single country. Results differ by developed/emerging countries.
- Identification is a serious issue: **selection and simultaneity**

Selecting more or less productive firms

- Firm carefully decide in which firms to invest
- Corporate finance literature suggest under-performing firms are likely targets
- Empirically it appears that multinationals target more productive firms

Spillovers

- Why would there be spillovers? Suggested stories: imitation, labor mobility, competition (positive/negative), forward or backward linkages
- More selection: Multinationals drive out weak domestic firms
⇒ domestic firms are becoming more productive on average with increased multinational presence in the host economy—spurious spillover
- Simultaneity: a host of sector, time, firm unobserved variables potentially affect productivity:
 - country-time effects: reform may increase productivity and open economy for investment at the same time;
 - sector-time effects: technological breakthroughs, sector specific: cell phones, Internet, etc.

Aims of this paper:

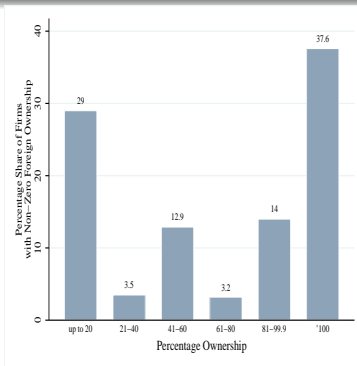
- Provide evidence on firm-level productivity effects of FDI:
- Direct and Spillover effects of FDI
- Decompose spillover effects into “knowledge” spillovers and “competition” effects on domestic firms
- Backward (from foreign customers) and forward (from foreign suppliers) spillovers (compare to literature)
- Accounting for selection and simultaneity

Methodological contributions

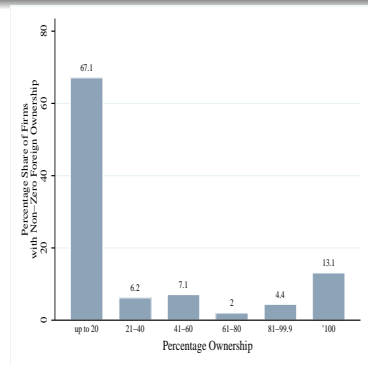
- Multiple country setting: control for sector-year patterns (simultaneity).
- Industrial vs Financial owners
- Exploit 4 digit sector classification:
- Address endogeneity using a new instrument.

- ORBIS database provided by Bureau van Dijk (BvD) (worldwide)
- Public firms are less than 1 percent of the data as opposed to COMPUSTAT, which is all public
- We use manufacturing only (to compare to literature)
- We use unconsolidated accounts.
- Collected from official registers, annual reports, and newswires
- Data shows fully list of direct and indirect shareholders and subsidiaries, company's degree of independence, its ultimate owner, all in time series
- Foreign Ownership (FO): For a firm i , FO_i is the sum of all percentages of direct ownership by foreigners.
- We distinguish between:
 - Industrial-FDI: Parent company industrial.
 - Financial-FDI: Parent company is a bank, financial company, private equity, mutual fund, or other financial institution.

Distribution of FDI Among Foreign Owned Firms: Developed Countries

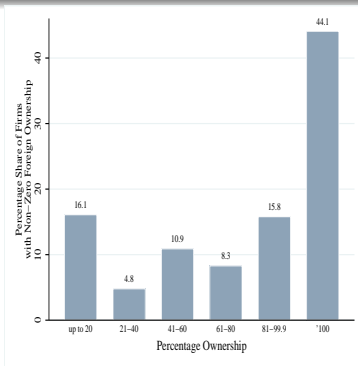


(a) Industrial FDI

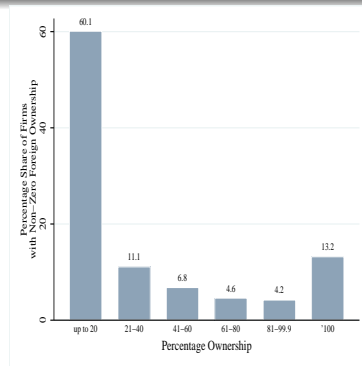


(b) Financial FDI

Distribution of FDI Among Foreign Owned Firms: Emerging Market Countries



(c) Industrial FDI



(d) Financial FDI

Are foreign-owned firms more productive? (Direct Effects)

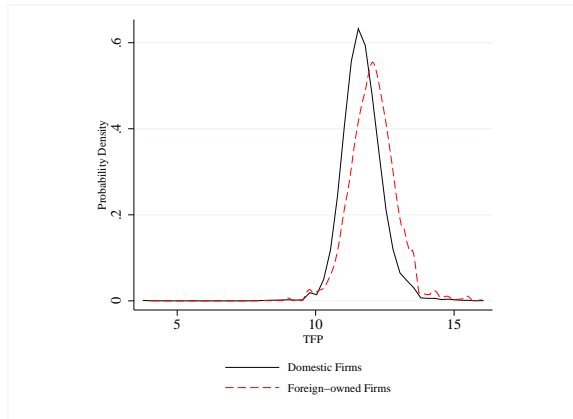
Simple measure of productivity: Value Added

	(1)	(2)
LHS:	VA/L	VA/L
Firms:	Manuf.	Manuf.
Foreign Ownership	0.494*** (0.011)	0.002 (0.008)
Firm fixed	no	yes
Sector fixed	yes	yes
Country-Year fixed	yes	yes

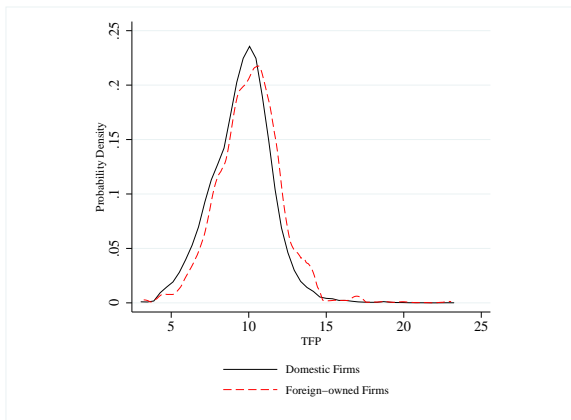
- Total Factor Productivity (TFP)

$$\log TFP_{i,t} = \log(Y_{i,t} - M_{i,t}) - \alpha_1 \log L_{i,t} - \alpha_2 \log K_{i,t}$$

- Y: output, M: materials, L: employment and K: capital.
- α_1 and α_2 estimated, by country-sector, using the non-parametric approach of Levinsohn and Petrin (2003) and Wooldridge (2009) (WLP).



TFP density distribution by foreign ownership:
Developed Countries



TFP density distribution by foreign ownership:
Emerging Countries

Control for sector- and country-level trends

- Typical regression in (single-country) literature:

$$\log TFP_{i,s,t} = \beta FO_{i,s,t} + \alpha_i + \delta_t + \epsilon_{i,s,t}$$

where i : firm, s : sector and t : time. (Or, differences, rather than firm fixed-effect.)

- We estimate:

$$\log TFP_{i,s,c,t} = \beta FO_{i,s,c,t} + \alpha_i + \delta_{c,t} + \phi_{s,t} + \epsilon_{i,s,c,t}, \quad (1)$$

where $TFP_{i,s,c,t}$ is total factor productivity and $\delta_{c,t}$ and $\phi_{s,t}$ are country-year and sectoral-year fixed effects, respectively

- (Controlling for sector-year patterns potentially important)

Construct Exogenous Sector-Country-Year Variation

- Potential bias if foreign investors target firms with predicted growing productivity (a potential firm-year effect)
- We construct new instrument
- Start at sectoral level

- 1 Define sector, country financial investment as

$$I_{c,s,t}^F = \frac{\sum_{i \in c,s} FO_{i,t}^F \times Y_{i,0}}{\sum_{i \in c,s} Y_{i,0}} .$$

- 2 We assume that financial investors are passive investors who invest based on forecasted profit growth, but who do not actively change production.

Time-varying measure of growth in (sectoral) Foreign Ownership (cont.)

- ③ Define industrial investment $I_{c,s,t}^I = \frac{\sum_{i \in c,s} FO_{i,t}^I \times Y_{i,0}}{\sum_{i \in c,s} Y_{i,0}}$
- ④ We assume industrial investment is determined by the same profit motive as financial investment,
- ⑤ plus a term “A” which reflects further profit from active management (increased market power, etc.)

$$(2) \quad I_{c,s,t}^I = b * I_{c,s,t}^F + \delta * A_{c,s,t} + e_{c,s,t} ,$$

Sector-Level Instrument

- If we know coefficient b , we can use
- $I_{c,s,t}^I - b \cdot I_{c,s,t}^F = \delta \cdot A_{c,s,t} + \text{error}$
as an exogenous instrument (at sector, country, year level)
because endogenous E term has disappeared
- So we proceed as follows:
 - 1 Regress $I_{c,s,t}^I$ on $I_{c,s,t}^F$ and take residuals $\Rightarrow W_{c,s,t}$
 - 2 $W_{c,s,t} = I_{c,s,t}^I - \hat{b} \cdot I_{c,s,t}^F$
- (had we had very long firm-level time series, would want to at firm level)

Instrument at Firm Level

- We assume that impact of sectoral exogenous investment is proportional to initial foreign ownership
- Generate $Z_{it} = FO_{i0} \cdot W_{c,s,t}$ and use as instrument where FO_{i0} is non-time varying initial FO of firm i
- Type of instrument first suggested by Acemoglu and Johnson (2007)
- Recall: firm fixed effect in regressions removes levels effects, so endogeneity of FO_{i0} is not a problem in general

Table: Are Foreign Firms more Productive? (dep. var. log TFP)

	Developed			Emerging		
	GLS	GLS&IV	GLS&IV	GLS	GLS&IV	GLS&IV
log(F_O)	0.007** (0.003)	0.031** (0.014)		0.048*** (0.010)	0.125 (0.108)	
$\Delta_2 \log(F_O)$			0.023 (0.017)			0.116 (0.082)
Firm Fixed Eff	yes	yes	no	yes	yes	no
1st Stage Results						
F-Test		770.24	237.23		43.37	53.65
Obs	402,137	402,137	235,529	72,349	72,349	36,479

- Do domestic firms benefit (productivity) from foreign companies?
- Ambiguous evidence on spillover effects (horizontal):
- Explanations:
 - Absorptive capacity: human capital, local financial markets.
 - Competition/rivalry.
- We argue that to identify spillover effects we have to:
 - Separate positive knowledge spillovers from negative competition effects: precise sectoral FDI measure is needed
 - Address potential simultaneity concerns by including sector-year fixed effects

- Traditionally the literature on spillovers has estimated:

$$\log TFP_{i,s,t} = \beta Spillover_{s,t} + \alpha_i + \delta_t + \epsilon_{i,s,t}$$

- We estimate:

$$\log TFP_{i,s,c,t} = \beta Spillover_{s,c,t} + \alpha_i + \delta_{c,t} + \phi_{s,t} + \epsilon_{i,s,c,t}$$

$\phi_{s,t}$ sector \times year fixed effects (dummies).

$\delta_{c,t}$ country \times year fixed effects (dummies).

- Usual horizontal spillover (2-digit sectors):

$$Spillover_{s,t} = \sum_{i \in s} \omega_{i,t} FO_{i,t}$$

$$\text{where } \omega_{i,t} = Y_{i,t} / \sum_{i \in s} Y_{i,t}$$

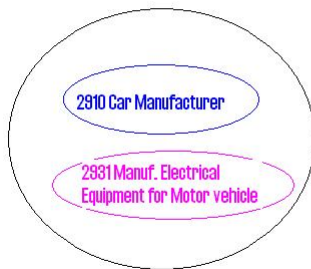
- Our spillover measures: **finer level of aggregation: 4 digit**

$$SpilloverCompetition_{s4,t} = \sum_{i \in s4} \omega_{i,t} FO_{i,t}$$

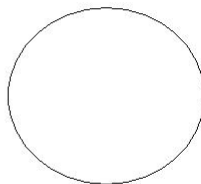
- where “s4” refers to the four-digit sector classification.

$$SpilloverKnowledge_{s4,t} = \sum_{i \in s2, \neq s4} \omega_{i,t} FO_{i,t}$$

29 Manufacture of Motor Vehicles



27 Manufacture of Electrical Equipment



Are There Positive Spillover Effects on TFP from Foreign Ownership? (Domestic firms only.)

DEPENDENT VARIABLE	Developed			Emerging		
	log(TFP)	log(TFP)	log(TFP)	log(TFP)	log(TFP)	log(TFP)
Spillover _{s2}	0.026** (0.009)	0.008 (0.010)		-0.061*** (0.014)	-0.090*** (0.016)	
Spillover_Competition _{s4}			-0.028*** (0.004)			-0.080*** (0.011)
Spillover_Knowledge _{s4}			0.020** (0.008)			-0.078*** (0.018)
Sector2dig-Year Fix Eff.	no	yes	N/A	no	yes	N/A
Sector4dig-Year Fix Eff.	no	no	yes	no	no	yes

- Does increasing FO imply higher market shares?
- (Otherwise, competition story maybe not true)

$$\log MS_{i,s,c,t} = \alpha + \beta_1 FO_{i,s,c,t} + \alpha_i + \delta_{c,t} + \phi_{s,t} + \epsilon_{i,s,c,t} \quad (2)$$

- where MS: share of firm “i” output in total sectoral output in her country.

Competition Spillover Channel: Output Market Shares (2nd stage displayed only)

DEPENDENT VARIABLE	Developed	Emerging
	log MS4dig	log MS4dig
log FO	0.042** (0.017)	0.214* (0.125)
Observations	402,137	72,349
Firms	59,306	12,758
Firm Fix Eff.	yes	yes
Ctry-4dig-Year F.E.	yes	yes
F-Test	770.24	43.37

- Failure to find positive horizontal spillovers lead researchers to search for vertical spillovers:
- Vertical Measures

$$\text{Backward}_{s,t} = \sum_{k \neq s} \alpha_{sk} \text{Horizontal}_{k,t} \quad (3)$$

$$\text{Forward}_{s,t} = \sum_{m \neq s} \sigma_{mk} \text{Horizontal}_{m,t} \quad (4)$$

where α_{sk} : proportion of sector “s” output supplied to (customer) sector “k”, and σ_{mk} is the share of inputs purchased by sector “s” from (upstream, supplier) sector “m”

Vertical Spillovers

DEPENDENT VARIABLE: FIRM PRODUCTIVITY

SAMPLE: DOMESTIC FIRMS

	DEVELOPED (1)	EMERGING (2)
Backward Spillover	0.063** (0.023)	0.076** (0.034)
Forward Spillover	0.027 (0.030)	-0.089** (0.038)
Horizontal Spillover	0.014* (0.009)	-0.057*** (0.013)
Observations	357,995	55,565
Firm Fixed Effects	yes	yes
Country-Year Fixed Effects	yes	yes
Sector2dig-Year Fixed Effects	yes	yes

Firm Heterogeneity: Spillovers by TFP fractiles

	DEVELOPED	EMERGING
Spillover_Competition _{s4} × 1st Quartile	-0.036** (0.014)	-0.157*** (0.030)
Spillover_Competition _{s4} × 2nd Quartile	-0.009 (0.007)	-0.094*** (0.018)
Spillover_Competition _{s4} × 3rd Quartile	-0.021** (0.008)	-0.060** (0.018)
Spillover_Competition _{s4} × 4th Quartile	-0.070*** (0.016)	0.008 (0.039)
Spillover_Knowledge _{s4} × 1st Quartile	-0.008 (0.028)	0.064 (0.046)
Spillover_Knowledge _{s4} × 2nd Quartile	0.011 (0.013)	-0.073** (0.029)
Spillover_Knowledge _{s4} × 3rd Quartile	0.011 (0.014)	-0.203*** (0.031)
Spillover_Knowledge _{s4} × 4th Quartile	0.072** (0.031)	-0.052 (0.056)

So is FDI important for aggregate growth?

- Calculate effect of a doubling (huge change!) of foreign ownership from current levels in percent of aggregate assets implied by our point estimates.
- Developed countries: total effect of 1.1 percent
- 0.9 percent if the insignificant coefficient to Spillover_Forward is set to 0).
- Emerging countries: total effect of -0.4 percent
- (-1.2 percent if the insignificant coefficient to FO is set to 0).

FDI is not of first-order importance for economic growth.

Thank you for listening!