

FDI Spillover Studies with Incomplete Datasets

The Case of Indonesia

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Introduction

Research on FDI productivity spillovers developed in last three decades.

- Different results from empirical literature: positive backward (Javorcik, 2004), negative or insignificant horizontal FDI spillovers (Aitken & Harrison, 1999; Blalock & Gertler, 2008).
- Large variation in results!
- Model specification and methodology (Havranek and Irsova, 2011)
 - Cross-sectional vs. panel analysis
 - Level of aggregation: industry vs. firm-level productivity
 - Estimation method (Olley Pakes, GMM, OLS, etc.)
- FDI variable definition and measurement (Görg and Strobl, 2001)
- Structural heterogeneity.
 - Domestic firm characteristics (age, technological gap, etc.).
 - Foreign firm characteristics (country of origin, ownership structure, etc.)
- Type of dataset?

Incomplete datasets

- Structurally omit or over-represent certain segments of the population.
- May produce unreliable estimates.
- Eapen (2013): datasets with only publically listed firms underestimate FDI concentration in industry.

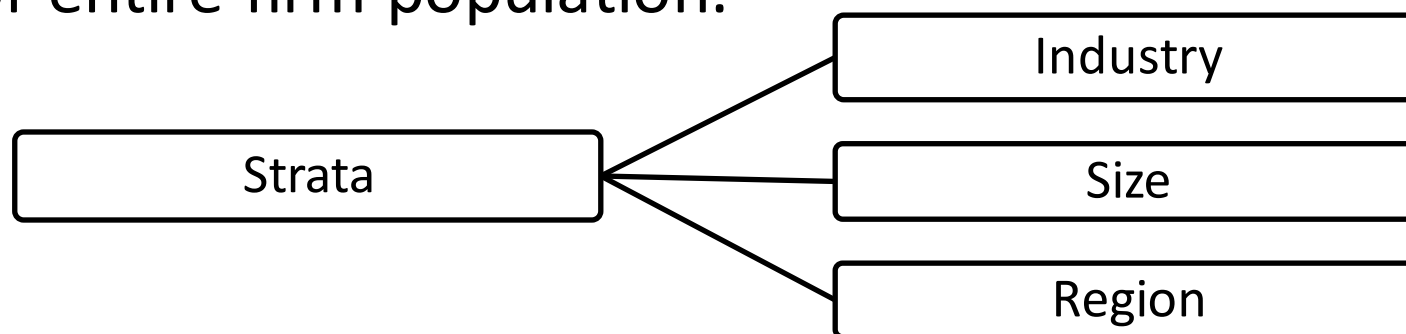
Do incomplete datasets produce unreliable estimates of FDI spillovers?

- We compare estimates from two different data sources on Indonesian manufacturing firms in 2009, using the same estimation method.
- **Contribution:** Provide empirical evidence that divergence in findings due in part to incomplete datasets.

- + Comparative analysis including many countries
- + Including retail and service sectors
- Small sample size
- Unrepresentative sample
- Level of aggregation too high

Author	Year of publication	Estimates	Country
Javorcik	2004	Backward +; Horizontal ?	Lithuania
Kaditi	2006	Backward +; Horizontal ?	Central Europe & East Asia
Yasar & Morrison Paul	2007	Horizontal +	Transition Economies
Waldkirch	2014	Horizontal ?	118 countries

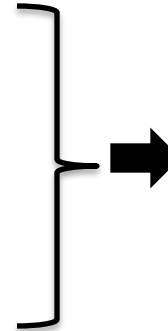
- Stratified random sampling – previously separated, non-overlapping groups, based on universe estimates for entire firm population.



- In firm population: # small firms > # medium & large firms.
 - ➡ In stratified samples too many small firms.
- Such small firms not affected by FDI spillovers due to lack of absorptive capacity (Zhang et al, 2010).
 - ➡ Effects of FDI spillovers are underestimated.

Over-representation of small firms,
usually domestic (Altomonte &
Pennings, 2009).

Foreign firms usually larger.



Mismeasuring FDI
presence in the
industry (downward
bias).

Item non-response and statistical power:

- Necessary sample size per industry stratum, to obtain 7.5% precision level at 90% confidence interval is 120 firms.
- Due to item non-response, missing information on necessary variables for up to 50% of firms per industry.
- Low statistical power!

- *Enterprise Survey* conducted by World Bank in 2009-2010.
- Stratified survey (stratification by industry, size, region) of companies with more than 5 employees.
- # of observations in 2009: 1,444.
- Aggregation level: 2 digit ISIC Code, 7 manufacturing, 2 service sectors.
- Available information on 260 variables, including production, output and ownership.

- *Manufacturing Census* conducted annually by Indonesian Statistics Office (BPS) since 1975.
- ALL registered firms with more than 20 employees across all provinces.
- # Observations in 2009: 22,939.
- Aggregation level: 5 digit ISIC code, 337 industries.
- Available information: ownership structure, sales performance, production inputs, etc.

Empirical Specification

- Following Blalock & Gertler (2008), we estimate a trans-log production function:

$$\begin{aligned} \log Y_i = & \beta_0 + \beta_1 \text{Backward FDI}_j + \beta_2 \text{Horizontal FDI}_j + \beta_3 \log K_i + \beta_4 \log L_i + \beta_5 \log M_i + \beta_6 \log E_i \\ & + \beta_7 \log^2 K_i + \beta_8 \log^2 L_i + \beta_9 \log^2 M_i + \beta_{10} \log^2 E_i + \beta_{11} \log K_i \log L_i \\ & + \beta_{12} \log K_i \log M_i + \beta_{13} \log K_i \log E_i + \beta_{14} \log L_i \log M_i \\ & + \beta_{15} \log L_i \log E_i + \beta_{16} \log M_i \log E_i + \beta_{17} \text{FOREIGN}_i + \beta^* \text{Industry}_i^* + \varepsilon_i \end{aligned}$$

Horizontal FDI:

Backward FDI:

$$\text{Horizontal FDI}_j = \frac{\sum_{i \in j} \text{Foreign output}_i}{\sum_{i \in j} \text{Output}_i} \quad \text{Backward FDI}_j = \sum_k \alpha_{jk} \text{Horizontal FDI}_k$$

- Cross-sectional analysis (OLS) for year 2009. Still to do: Olley- Pakes analysis.

Methodology

1.

- Run regression analysis for Indonesian firms with Manufacturing data from the Indonesian Office of Statistics.

2.

- Run regression analysis for Indonesian firms with WBES data.

3.

- Use the sampling methodology of WBES to create random samples from the Indonesian dataset.

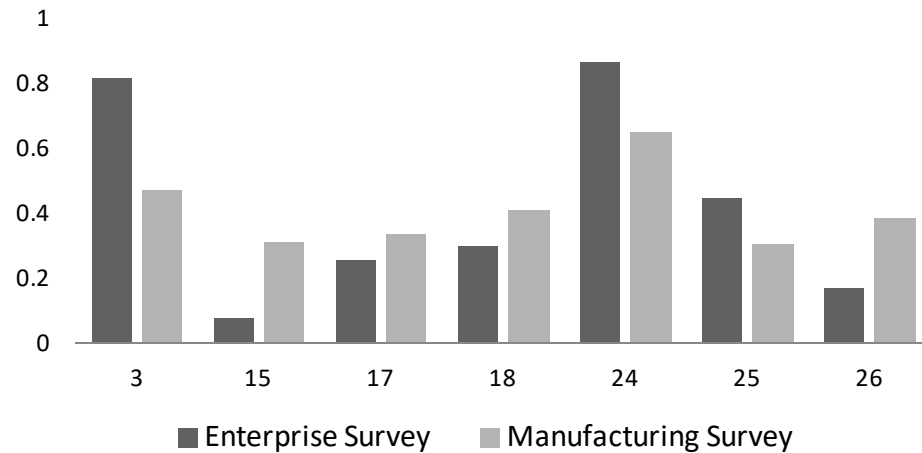
4.

- Run regression analysis on up to 10,000 random samples created with WBES sampling methodology.

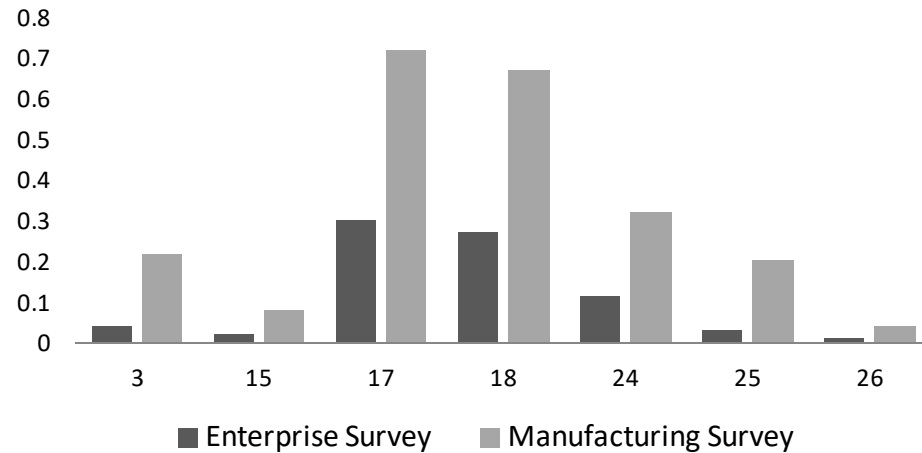
5.

- Change sampling methodology to include FDI criterion.

Horizontal FDI per industry, ISIC2 categorization



Backward FDI per industry, ISIC2 categorization



Variable	Observations		Mean		Std. Dev.	
	ES	MS	ES	MS	ES	MS
Foreign share	1,164	22,939	0.08	0.090	0.271	0.286
Horizontal FDI	1,164	22,939	0.329	0.369	0.286	0.146
Backward FDI	1,164	22,939	0.092	0.251	0.110	0.242

Manufacturing Survey regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign Ownership	0.130*** (0.018)	0.130*** (0.018)	0.130*** (0.018)			
Horizontal FDI	4.177*** (0.425)		0.126 (0.109)	4.282*** (0.434)		0.106 (0.112)
Backward FDI		3.312*** (0.337)	3.212*** (0.368)		3.396*** (0.344)	3.311*** (0.375)
Observations	12,541	12,541	12,541	11,661	11,661	11,661
R-squared	0.966	0.966	0.966	0.963	0.963	0.963

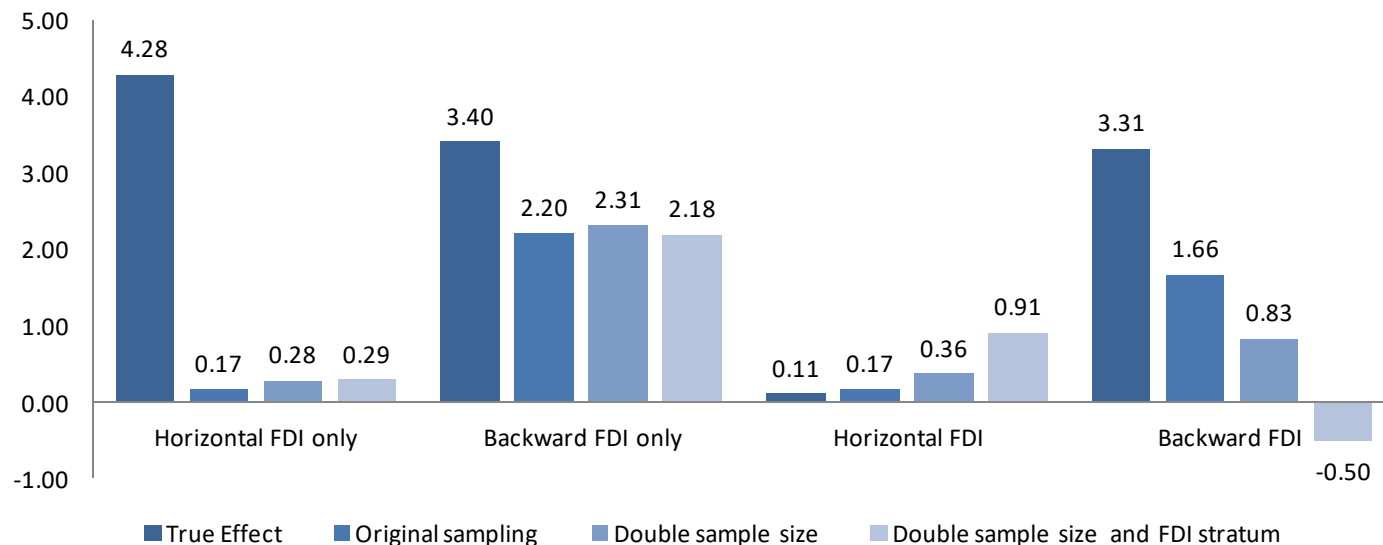
Enterprise Survey regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign Ownership	0.152 (0.106)	0.152 (0.106)	0.152 (0.106)			
Horizontal FDI	-0.0795 (0.189)		-0.288 (0.410)	-0.0487 (0.190)		-0.236 (0.428)
Backward FDI		-1.751 (4.157)	4.587 (8.452)		-1.071 (4.176)	4.115 (9.057)
Observations	699	699	699	637	637	637
R-squared	0.924	0.924	0.924	0.910	0.910	0.910

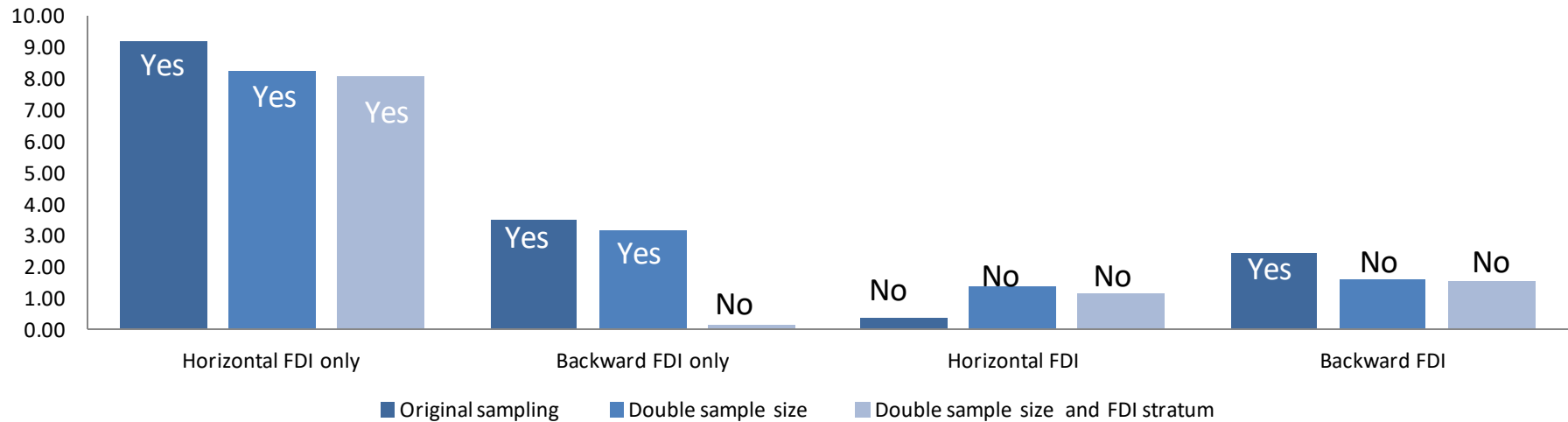
(1) Only horizontal FDI, whole sample. (2) Only backward FDI, whole sample. (3) Horizontal and backward FDI, whole sample. (4) Only horizontal FDI, only domestic firms. (5) Only backward FDI, only domestic firms. (6) Horizontal and backward FDI, only domestic firms. Industry dummies, inputs' quadratic terms and interaction terms not reported here.

1. We draw 10,000 random samples, with replacement from MS population (true population).
 - Strata: industry, size, region. Sample size: 1,164 observations.
2. We double sample size, 2,328 observations per sample, with replacement.
3. We add *industry FDI share* stratum – additional sampling criterion: FDI share per industry equal to true population share. We keep doubled sample size.

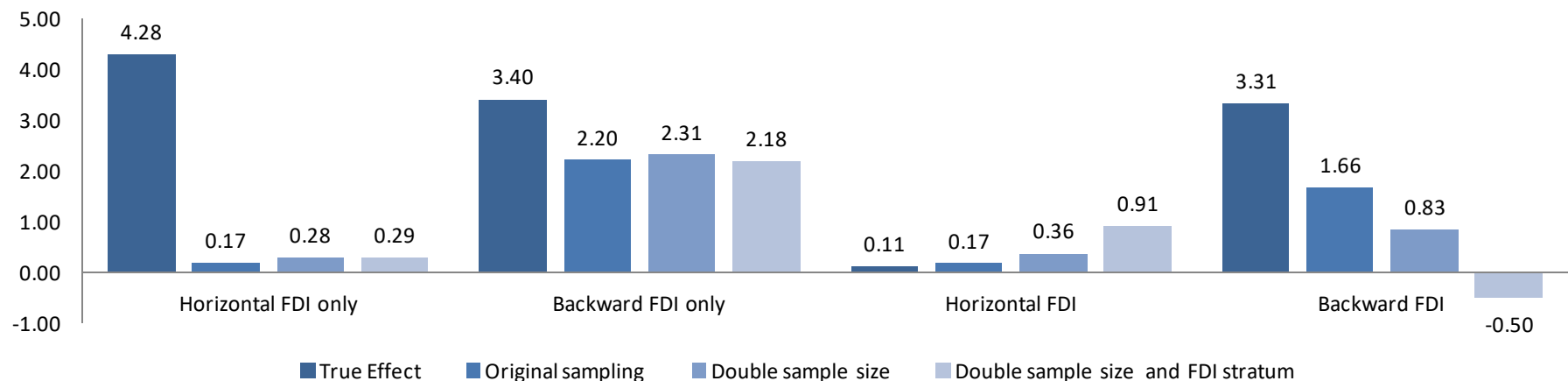
Mean estimates from simulations



Statistical difference: t-statistics



Mean estimates from simulations



Conclusions

- We investigate the issues that arise from using incomplete datasets to estimate FDI spillover effects on the productivity of domestic firms.
- We compare estimates from two different Indonesian manufacturing firms datasets: MS and (WB)ES and run our own “simulations” with the ES sampling methodology.
- Due to over-representation of small firms, mismeasurement of FDI share and small sample size, estimates from incomplete datasets are unreliable and insignificant.
- Adding additional *FDI share* stratification criterion improves significance and reliability of estimates considerably.
- Cross-sectional analysis (OLS) for year 2009. Still to do: Olley-Pakes analysis.

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