

Evaluating the Causal Effect of Foreign Acquisition on Domestic Performances: The Case of Slovenian Manufacturing Firms

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Outline

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1 Motivation

Assess the impact of FDI on economic growth

- Governments in developing countries attract FDI by offering various incentives to MNEs
- Rationale: they hope to enjoy *productivity spillovers* from the presence of foreign firms [Blomström and Kokko (1998)]
- Is this rationale justified?

Focus on technology spillovers

- A presupposition for them to arise is that foreign firms transfer their technology to affiliates established in the host country, as stated by the *internalisation theory* [Caves (1996); Dunning (1981)]
- The empirical finding of a superior performance of foreign affiliates compared to domestic firms is viewed as a confirmation of this theory
- However, it might be driven by a selection problem (foreign investors target the most productive firms within the most productive sectors)
⇒ OLS tends to overestimate the real impact of foreign ownership

2 Contribution

- Evaluate the *causal effect* of foreign acquisition on the performances of Slovenian manufacturing firms subject to takeover in 1997
- Drawing on the *evaluation literature* [Blundell and Costa Dias (2000, 2002)], we control for the selection problem by using the *propensity score matching* and the *difference-in-differences* estimators
- Previous works using these methodologies are Girma *et al.* (2003), Girma and Görg (2003), and Arnold and Javorcik (2005). Other works use different approaches [Harris and Robinson (2002); Conyon *et al.* (2002)]

3 Empirical methodology

Basic concern: evaluate the impact (causal effect) of foreign acquisition on the performance y for each firm i . The *causal effect* in the post-acquisition period $t + s$ ($s \geq 0$) is represented by

$$y_{i,t+s}^1 - y_{i,t+s}^0$$

where the superscript indicates whether i is owned by a foreign investor at $t + s$ or not.

Missing-data problem: only one outcome is observable

⇒ cannot measure the impact of acquisition for each firm i

Following the evaluation strategy [see Heckman *et al.* (1997)], we define the *average effect of acquisition on the acquired firm* as

$$\alpha = E(y_{i,t+s}^1 - y_{i,t+s}^0 | d_{it} = 1) = E(y_{i,t+s}^1 | d_{it} = 1) - E(y_{i,t+s}^0 | d_{it} = 1)$$

where d_{it} is a dummy variable indicating whether firm i is acquired by foreigners at time period t .

Central issue: can we use $E(y_{i,t+s}^0 | d_{it} = 0)$ as a valid *counterfactual* for $E(y_{i,t+s}^0 | d_{it} = 1)$? *Selection bias* may arise!

The *matching* strategy deals with the selection bias by making the assumption that selection is on the observables. In other words, treatment status is random conditional on a set of observable pre-acquisition characteristics $X_{i,t-1}$:

$$E(y_{i,t+s}^0 | d_{it} = 1, X_{i,t-1}) = E(y_{i,t+s}^0 | d_{it} = 0, X_{i,t-1})$$

Build a counterfactual by matching each acquired firm i with domestically owned firm j which shows the same values of the observables

Curse of dimensionality problem

⇒ match firms based on the *propensity score* [Rosenbaum and Rubin (1983)]:

$$P(X_{i,t-1}) = P(d_{it} = 1 | X_{i,t-1})$$

In this way, a valid counterfactual (C) for the acquired group (A) is built. The causal effect of foreign acquisition is empirically estimated by means of the *matching (M) estimator*

$$\hat{\alpha}_M = \sum_{i \in A} \left(y_{i,t+s} - \sum_{j \in C} W_{ij} y_{j,t+s} \right) w_i$$

What about selection on the unobservables?

Combine the matching estimator with the *difference-in-differences (DID) estimator* to partially take this problem into account:

$$\hat{\alpha}_M^{DID} = \sum_{i \in A} \left((y_{i,t+s} - y_{i,t-n}) - \sum_{j \in C} W_{ij} (y_{j,t+s} - y_{j,t-n}) \right) w_i$$

4 Dataset and construction of the sample

Starting dataset: unbalanced panel of 6,020 Slovenian manufacturing firms observed over the interval 1994-1999 (22,466 observations), provided by The William Davidson Institute, Michigan. Not all the observations can be used

- Impossibility to retrieve the 2-digit sector for some firms
- Olley and Pakes (1996) methodology to calculate TFP
- Focus only on two types of firms

1. Domestic firms (DOMs): firms staying domestically owned over the interval 1995-1999
2. Acquired firms (ACQs): firms switching status in year 1997 from domestic to foreign owned

⇒ Two final samples:

Number of firms by ownership type

Ownership type	Sample 1	Sample 2
Domestically-owned firms (DOMs)	952	678
Acquired firms in 1997 (ACQs)	28	19
Total	980	697

Analysis is on cross-sectional basis

We single out a specific year of investment ($t = 1997$)

Advantages

- Observe firms' performances for two consecutive years following acquisition ($s = 1, 2$)
- Reduce the effect of previous foreign ownerships (if any)
- Post-acquisition effects are calculated for a fixed set of switching firms

5 Empirical results

A probit regression is run to derive the probability of each firm being acquired by foreign investors in 1997 as a function of its observable characteristics in 1996:

$$P(d_{i,1997}=1)=F(\text{TFP}_{i,1996}, \text{Exp int}_{i,1996}, \text{Age}_{i,1996}, \text{Size}_{i,1996}, S_i)$$

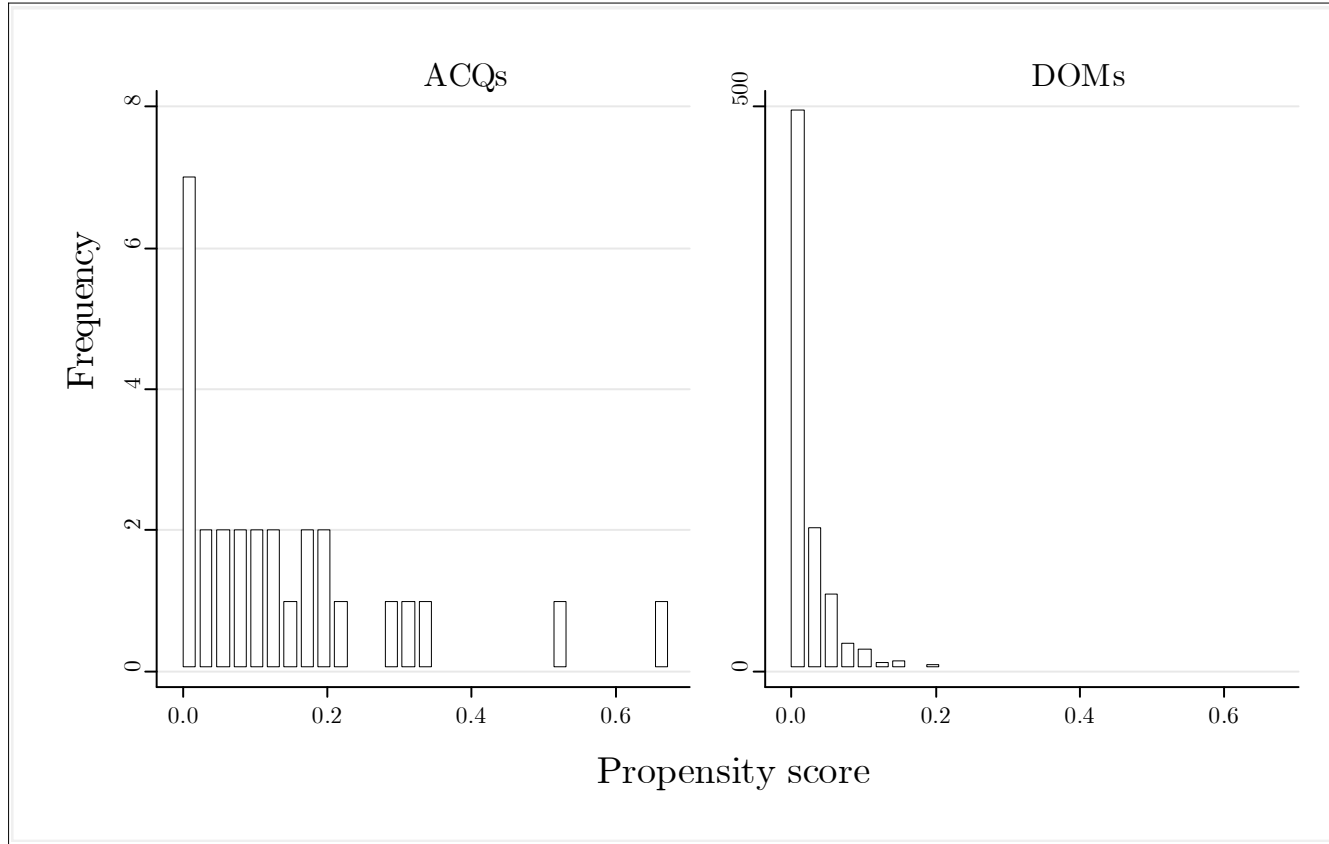
F is a standard normal cumulative distribution function. Its arguments are some possible determinants of foreign acquisition [Eddey (1991); Bernard and Jensen (1999); Harris and Robinson (2002); Girma and Görg (2002); Girma *et al.* (2003)]

Probit for the probability of a firm being acquired in 1997

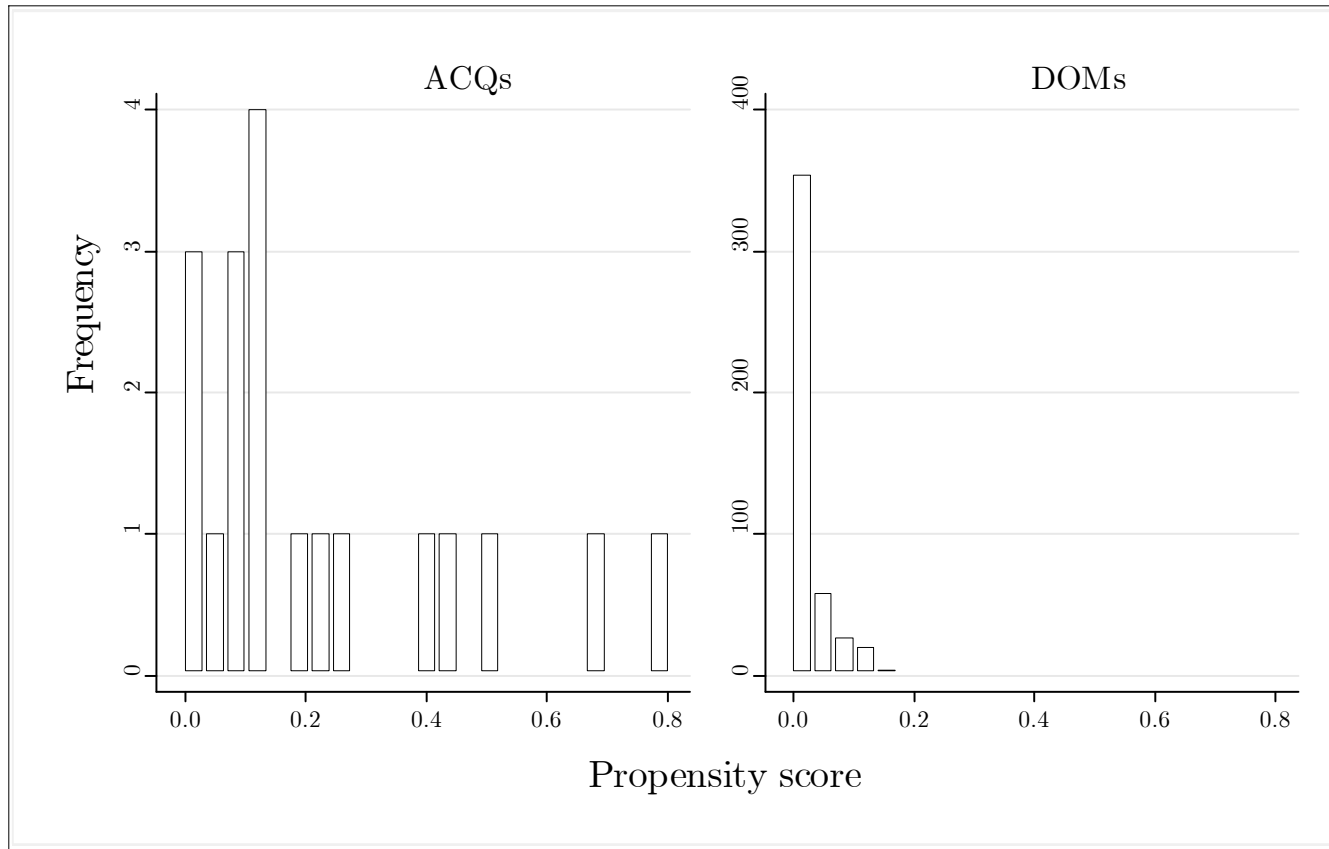
Variable	Sample 1		Sample 2	
	Coefficient	(std. err.)	Coefficient	(std. err.)
(Log) TFP ₁₉₉₆	1.166***	(0.399)	2.432***	(0.771)
Export intensity ₁₉₉₆	1.278***	(0.373)	1.069**	(0.498)
(Log) Age ₁₉₉₆	-0.583***	(0.183)	-0.548**	(0.218)
(Log) Capital assets ₁₉₉₆	0.029	(0.087)	0.226	(0.158)
(Log) N. of employees ₁₉₉₆	0.042	(0.111)	-0.056	(0.172)
(Log) N. of plants ₁₉₉₆	0.101	(0.224)	0.014	(0.248)
Sector dummies	Yes		Yes	
N. of observations	802		494	
Pseudo R-squared	0.205		0.273	

***: significant at 1%; **: significant at 5%.

Frequency distribution of the propensity score by ownership type (Sample 1)



Frequency distribution of the propensity score by ownership type (Sample 2)



Single nearest neighbour matching (Sample 1)

ACQ firm identifier	PS_{ACQ}	PS_{COUNT}	PS_{DIFF} (abs. val.)	$\frac{PS_{DIFF}}{PS_{ACQ}}$ (%)
1	0.0037	0.0038	0.000035	0.95
2	0.0048	0.0048	0.000004	0.09
3	0.0093	0.0092	0.000086	0.92
4	0.0175	0.0175	0.000011	0.06
5	0.0205	0.0204	0.000116	0.56
6	0.0210	0.0210	0.000018	0.09
7	0.0222	0.0221	0.000099	0.45
8	0.0384	0.0384	0.000013	0.03
9	0.0439	0.0437	0.000151	0.34
10	0.0652	0.0657*	0.000522	0.80
11	0.0655	0.0657*	0.000188	0.29
12	0.0710	0.0709	0.000080	0.11
13	0.0861	0.0854	0.000618	0.72
14	0.0985	0.0994	0.000917	0.93
15	0.1142	0.1139	0.000359	0.31

continued

ACQ firm identifier	PS_{ACQ}	PS_{COUNT}	PS_{DIFF} (abs. val.)	$\frac{PS_{DIFF}}{PS_{ACQ}}$ (%)
16	0.1211	0.1214	0.000258	0.21
17	0.1358	0.1326	0.003216	2.37
18	0.1510	0.1553	0.004229	2.80
19	0.1782	0.1791	0.000908	0.51
20	0.1868	0.1881	0.001241	0.66
21	0.1919	0.1918	0.000045	0.02
22	0.2063	0.2055	0.000825	0.40
23	0.2299	0.2357	0.005758	2.50
24	0.2950	0.2911	0.003906	1.32
25	0.3049	0.3111	0.006171	2.02
26	0.3453	0.3538	0.008513	2.47
27	0.5191	0.4295	0.089629	17.27
28	0.6544	0.4295	0.224869	34.36

*: The same domestic firm has been matched with two acquired firms

Single nearest neighbour matching (Sample 2)

ACQ firm identifier	PS_{ACQ}	PS_{COUNT}	PS_{DIFF} (abs. val.)	$\frac{PS_{DIFF}}{PS_{ACQ}}$ (%)
1	0.0030	0.0030	0.000016	0.53
2	0.0046	0.0046	0.000012	0.26
3	0.0104	0.0104	0.000042	0.41
4	0.0444	0.0442	0.000265	0.60
5	0.0746	0.0745	0.000121	0.16
6	0.0759	0.0761	0.000141	0.19
7	0.0866	0.0872	0.000610	0.70
8	0.1059	0.1081	0.002197	2.07
9	0.1174	0.1176	0.000156	0.13
10	0.1319	0.1325	0.000605	0.46
11	0.1366	0.1365	0.000155	0.11
12	0.1788	0.1740	0.004715	2.64
13	0.2119	0.2001	0.011844	5.59
14	0.2490	0.2305	0.018569	7.45
15	0.3917	0.3440	0.047699	12.18
16	0.4560	0.4527	0.003277	0.72
17	0.4915	0.4527	0.038779	7.89
18	0.6816	0.4527	0.228871	33.58
19	0.7721	0.4527	0.319341	41.36

Comparison between unmatched and matched Sample 1 (statistics for 1996)

	Unmatched sample			Matched sample		
	ACQs Mean (Std. dev.)	DOMs Mean (Std. dev.)	t-test on the equality of means (p-value)	ACQs Mean (Std. dev.)	COUNTs Mean (Std. dev.)	t-test on the equality of means (p-value)
Number of obs.	28	952		26	25	
TFP	4.7041 (1.6058)	4.3480 (2.0191)	0.9244 (0.3555)	4.5608 (1.4640)	4.8195 (4.1477)	-0.2947 [§] (0.7703)
Export intensity	0.5318 (0.3624)	0.2233 (0.2923)	5.4631 (0.0000)	0.4980 (0.3539)	0.4303 (0.3705)	0.6681 (0.5072)
Age	8.3214 (7.0135)	10.3698 (7.8550)	-1.3638 (0.1729)	8.5769 (7.2176)	7.4400 (8.5785)	0.5129 (0.6103)
N. of employees	264.8214 (572.9149)	113.0053 (296.2411)	1.3967 [§] (0.1737)	275.3462 (593.6036)	120.6800 (302.6178)	1.1788 [§] (0.2459)
Real output	6945540 (2.61e+07)	896712.4 (2382189)	1.2284 [§] (0.2299)	7451603 (2.70e+07)	835809.6 (1842799)	1.2462 [§] (0.2241)
Real capital	15830.67 (38649.85)	3012.92 (10080.51)	1.7531 [§] (0.0909)	16956.40 (39935.75)	2441.45 (5888.30)	1.8327 [§] (0.0783)
N. of plants	1.5000 (1.4011)	1.8424 (3.5779)	-1.1847 [§] (0.2434)	1.5000 (1.4491)	1.0400 (0.2000)	1.6028 [§] (0.1211)

[§]: t-test allows the two groups of firms (either in the matched or unmatched sample) to have different variances.

Comparison between unmatched and matched Sample 2 (statistics for 1996)

	Unmatched sample			Matched sample		
	ACQs Mean (Std. dev.)	DOMs Mean (Std. dev.)	t-test on the equality of means (p-value)	ACQs Mean (Std. dev.)	COUNTs Mean (Std. dev.)	t-test on the equality of means (p-value)
Number of obs.	19	678		13	13	
TFP	5.0298 (1.8082)	4.3935 (2.0645)	1.3289 (0.1843)	4.8783 (1.7004)	4.8302 (2.0516)	0.0651 (0.9487)
Export intensity	0.5842 (0.3189)	0.2621 (0.3023)	4.5733 (0.0000)	0.4742 (0.3197)	0.5421 (0.2690)	-0.5862 (0.5632)
Age	10.5263 (7.5083)	11.9115 (8.1230)	-0.7345 (0.4629)	12.8462 (8.0916)	16.9231 (11.2284)	-1.0621 (0.2988)
N. of employees	378.5789 (670.1567)	140.6077 (335.3760)	1.5424 [§] (0.1401)	270.0769 (391.4689)	593.1538 (855.2376)	-1.2385 [§] (0.2326)
Real output	1.01e+07 (3.14e+07)	1119632 (2727937)	1.2469 [§] (0.2284)	3329102 (3641457)	6603394 (1.14e+07)	-0.9901 [§] (0.3384)
Real capital	23069.30 (45471.32)	3921.97 (11717.92)	1.8338 [§] (0.0832)	16457.93 (25352.74)	36668.10 (60090.39)	-1.1173 [§] (0.2802)
N. of plants	1.7368 (1.6614)	1.9735 (3.5645)	-0.5842 [§] (0.5648)	1.8462 (1.9513)	4.1538 (7.2669)	-1.1058 [§] (0.2878)

[§]: t-test allows the two groups of firms (either in the matched or unmatched sample) to have different variances.

Causal effect of foreign acquisition: matching estimates ($\hat{\alpha}_M$) and combined matching-DID estimates ($\hat{\alpha}_M^{DID}$) (Sample 1)

Year		1996		1998		1999	
Group		ACQs	COUNTs	ACQs	COUNTs	ACQs	COUNTs
Number of obs.		26	25	26	25	26	25
Log(TFP)	Mean	1.4700	1.4426	1.5572	1.4136	1.5764	1.3484
	$\hat{\alpha}_M$	-	-	0.1437	-	0.2280**	-
	(Std. err.) [§]	-	-	(0.1067)	-	(0.1184)	-
	$\hat{\alpha}_M^{DID}$	-	-	0.1162	-	0.2006**	-
	(Std. err.) [§]	-	-	(0.1061)	-	(0.1045)	-
Log(output)	Mean	8.3528	7.2306	8.7973	7.4222	8.8836	7.2341
	$\hat{\alpha}_M$	-	-	1.3751**	-	1.6495**	-
	(Std. err.) [§]	-	-	(0.5363)	-	(0.5620)	-
	$\hat{\alpha}_M^{DID}$	-	-	0.2530	-	0.5274**	-
	(Std. err.) [§]	-	-	(0.1856)	-	(0.2371)	-
Log(empl.)	Mean	4.0024	3.1595	4.1431	3.2935	4.1040	3.3025
	$\hat{\alpha}_M$	-	-	0.8496*	-	0.8016	-
	(Std. err.) [§]	-	-	(0.4916)	-	(0.4967)	-
	$\hat{\alpha}_M^{DID}$	-	-	0.0067	-	-0.0413	-
	(Std. err.) [§]	-	-	(0.1428)	-	(0.1982)	-

§: Standard errors are calculated by means of bootstrap technique (10,000 replications);

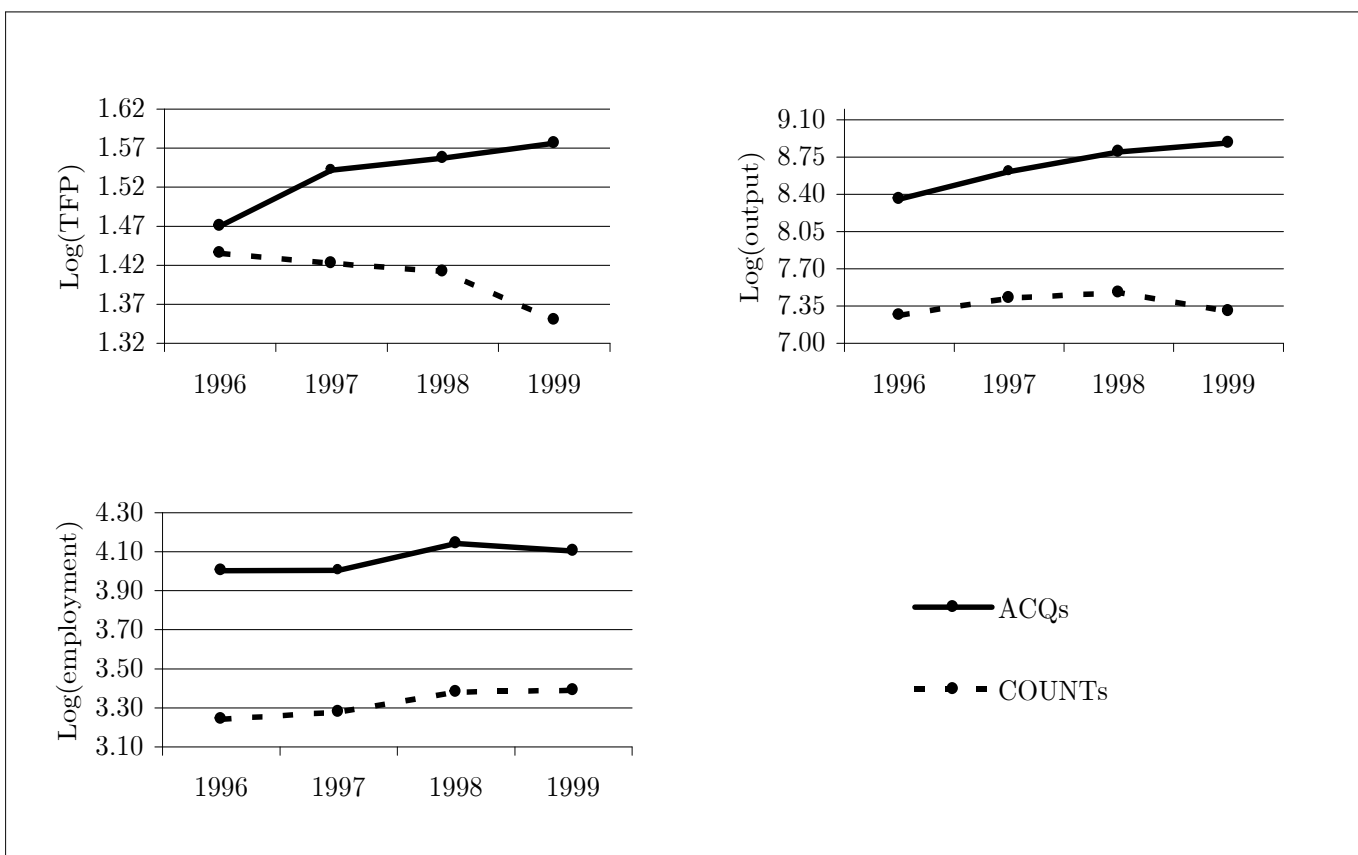
*: significant at 10%; **: significant at 5%.

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Year Group		1998		1999	
		ACQs	COUNTs	ACQs	COUNTs
Number of obs.		26	25	26	25
TFP growth	Mean	0.0156	-0.0141	0.0191	-0.0652
	$\hat{\alpha}_M$	0.0297		0.0843	
	(Std. err.) [§]	(0.0543)		(0.0613)	
Output growth	Mean	0.1844	0.0353	0.0862	-0.1882
	$\hat{\alpha}_M$	0.1491		0.2744**	
	(Std. err.) [§]	(0.1482)		(0.1174)	
Empl. growth	Mean	0.1383	0.0995	-0.0390	0.0090
	$\hat{\alpha}_M$	0.0388		-0.0481	
	(Std. err.) [§]	(0.0883)		(0.1175)	

§: Standard errors are calculated by means of bootstrap technique (10,000 replications); **: significant at 5%.

Average trajectories of TFP, output and employment (matched Sample 1)



Causal effect of foreign acquisition: matching estimates ($\hat{\alpha}_M$) and combined matching-DID estimates ($\hat{\alpha}_M^{DID}$) (Sample 2)

Year		1995		1998		1999	
Group		ACQs	COUNTs	ACQs	COUNTs	ACQs	COUNTs
Number of obs.		13	13	13	13	13	13
Log(TFP)	Mean	1.4581	1.3956	1.6122	1.6023	1.6113	1.5759
	$\hat{\alpha}_M$		-		0.0099		0.0354
	(Std. err.) [§]		-		(0.1526)		(0.1594)
	$\hat{\alpha}_M^{DID}$		-		-0.0526		-0.0271
	(Std. err.) [§]		-		(0.0651)		(0.0677)
Log(output)	Mean	8.9453	9.0317	9.2208	9.2875	9.3581	9.3455
	$\hat{\alpha}_M$		-		-0.0667		0.0126
	(Std. err.) [§]		-		(0.7211)		(0.7191)
	$\hat{\alpha}_M^{DID}$		-		0.0197		0.0990
	(Std. err.) [§]		-		(0.2097)		(0.2560)
Log(empl.)	Mean	4.5390	4.9866	4.5762	5.0867	4.6010	5.0666
	$\hat{\alpha}_M$		-		-0.5105		-0.4656
	(Std. err.) [§]		-		(0.6783)		(0.6577)
	$\hat{\alpha}_M^{DID}$		-		-0.0629		-0.0180
	(Std. err.) [§]		-		(0.1839)		(0.2214)

[§]: Standard errors are calculated by means of bootstrap technique (10,000 replications).

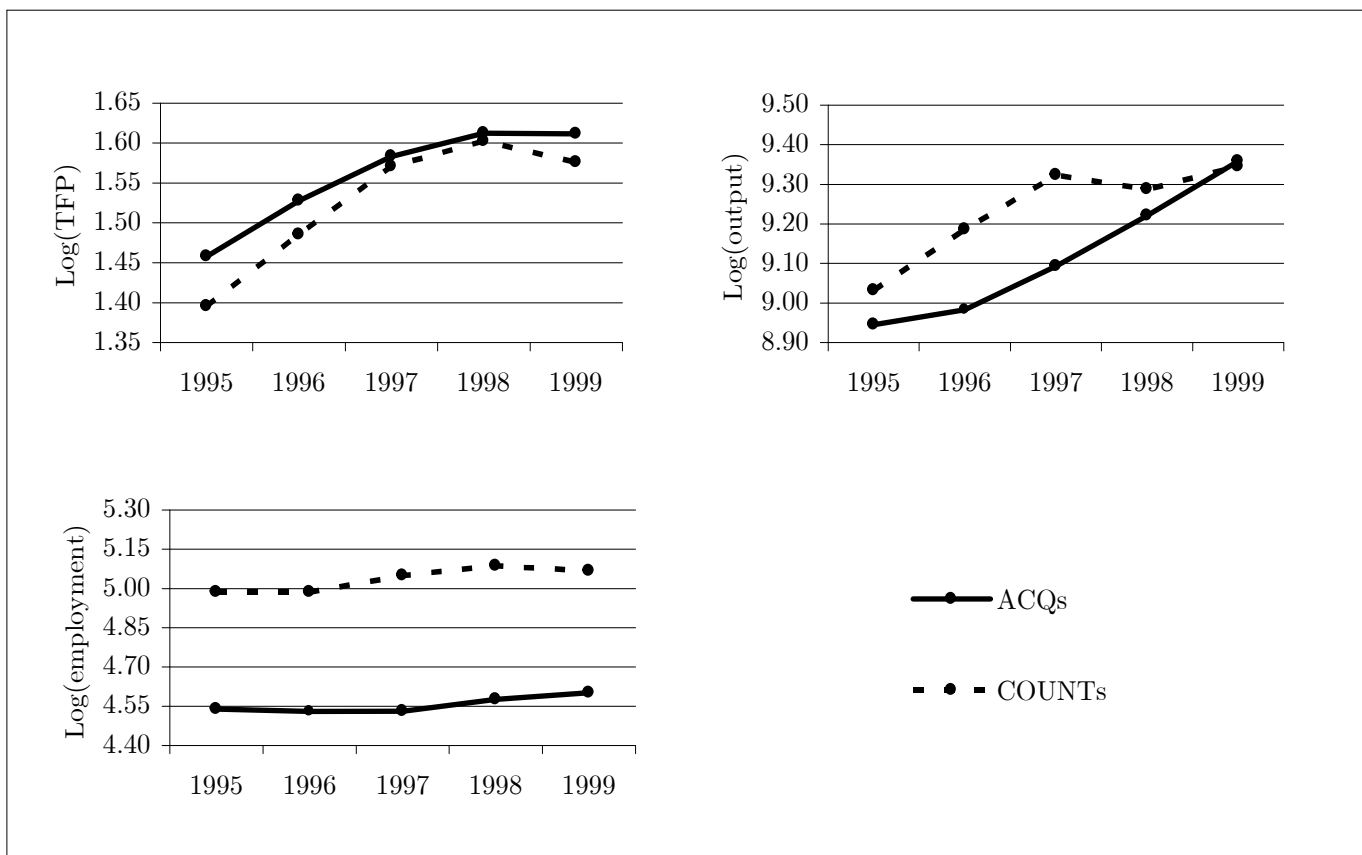
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Year Group		1996		1998		1999	
		ACQs	COUNTs	ACQs	COUNTs	ACQs	COUNTs
Number of observations		13	13	13	13	13	13
TFP growth	Mean	0.0696	0.0898	0.0291	0.0317	-0.0010	-0.0265
	$\hat{\alpha}_M$	-	-	-0.0026	-	0.0255	-
	(Std. err.) [§]	-	-	(0.0484)	-	(0.0464)	-
	$\hat{\alpha}_M^{DID}$	-	-	0.0176	-	0.0457	-
	(Std. err.) [§]	-	-	(0.0727)	-	(0.0624)	-
Output growth	Mean	0.0376	0.1539	0.1272	-0.0360	0.1373	0.0580
	$\hat{\alpha}_M$	-	-	0.1632	-	0.0793	-
	(Std. err.) [§]	-	-	(0.1201)	-	(0.1339)	-
	$\hat{\alpha}_M^{DID}$	-	-	0.2795*	-	0.1957	-
	(Std. err.) [§]	-	-	(0.1538)	-	(0.1701)	-
Empl. growth	Mean	-0.0092	-0.0001	0.0452	0.0368	0.0248	-0.0201
	$\hat{\alpha}_M$	-	-	0.0085	-	0.0449	-
	(Std. err.) [§]	-	-	(0.0654)	-	(0.0627)	-
	$\hat{\alpha}_M^{DID}$	-	-	0.0176	-	0.0541	-
	(Std. err.) [§]	-	-	(0.1130)	-	(0.0976)	-

§: Standard errors are calculated by means of bootstrap technique (10,000 replications);

*: significant at 10%.

Average trajectories of TFP, output and employment (matched Sample 2)



6 Conclusions

- The selection problem is important in the case of Slovenian manufacturing
- Evidence that foreign acquisition increases the productivity of domestic firms
- Assimilation problems may arise in the immediate post-acquisition period