Productivity spillovers through labor flows: productivity gap, multinational experience and industry relatedness

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Goals of our research

- Describe the structure of labor flows
- Identify the effect of different labor flows on firm productivity

Whether incoming workers from…

- more productive firms
- firms in related industries
- firms with foreign ownership

increase firm productivity?

Productivity spillovers on the firm level

- **Stoyanov-Zubanov 2012**
  - The productivity of the previous employer of new hires affect firm productivity
  - Positive difference improves productivity; Negative difference: no significant effect
  - Higher effect for high-skilled employees
- **Maliranta et al. 2009**
  - the mobility of R&D personnel has positive effect on the recipient firm's productivity, if they are employed in non-R&D jobs
- **Balsvik 2011**
  - the private reward of moving from MNEs to non-multinational firms is far less than the productivity premium they cause at the hiring non-multinational firm
- **Boschma-Eriksson-Lindgren 2009**
  - those new skills provide the most benefits that are related but not identical to the existing skills of the recipient firm

- Research gap: multinational spillovers tested in a common framework with productivity gap and industry relatedness

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Data

Administrative integrated database **(Databank of CERS HAS):**

employer-employee linked anonimized panel (2003-2011)

- Employment spells of a 50% sample of the 15-74 aged population (National Employment Office, NMH)
- Demographic features, Occupation (ISCO-88), Wage

Prodcom **(Central Statistical Office Research Lab):**

production of manufactured goods (1996-2012)

- 8-digit product codes (PC8) → concordance to CN8 codes

Both datasets were merged (separately) to firms' balance sheet data (National Tax Authority, NAV) to calculate the productivity gap, the technological proximity measures and additional controls for the productivity regressions.

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Empirical strategy: base model

Baseline model:

$$A_{j,t+1} = \alpha A_{j,t} + \beta \cdot prodgap_{j,t} + \gamma \boldsymbol{X}_{j,t} + \delta \boldsymbol{D} + \varepsilon_{j,t}$$

Productivity gap:

$$prodgap_{j,t} = \frac{\sum_{i=1}^{H_{j,t+1}} (A_{i,t} - A_{j,t})}{H_{j,t+1}} \cdot \frac{H_{j,t+1}}{N_{j,t+1}},$$

$A_{i,t}$ and $A_{j,t}$ = productivity of the source firm *i* and the recipient firm *j* at time *t*,
(log) value-added/number of employees, standardized by its 4-digit yearly industry mean
$H_{j,t+1}$ = number of new workers in the recipient firm *j*,
$N_{j,t+1}$ = number of total employees in the recipient firm *j*,
$\boldsymbol{X}_{j,t}$ = characteristics of the recipient firm at *t* (firm size, total assets, general inflow-outflow measures),
D = industry-region-year dummies.

Productivity gap can also be splitted up to positive and negative productivity gap.

Extension with ownership

Extended model:

$$A_{j,t+1} = \alpha A_{j,t} + \beta_1 \cdot prodgap_{j,t} + \beta_2 \cdot \frac{H^{PD}_{j,t+1}}{N_{j,t+1}} + \beta_3 \cdot \frac{H^{F}_{j,t+1}}{N_{j,t+1}} + \beta_4 \cdot D^{F}_{j,t+1} \frac{H^{F}_{j,t+1}}{N_{j,t+1}} + \gamma \boldsymbol{X}_{j,t} + \delta \boldsymbol{D} + \varepsilon_{j,t}$$

$H^{PD}_{j,t+1}$ = number of new arrivals to firm *j* from private domestic companies,

$H^{F}_{j,t+1}$ = number of hires from foreign-owned companies,

$D^{F}_{j,t+1}$ = 1 if firm *j* is foreign-owned at year *t*+1, otherwise 0.

Technological Proximity

- Technological Proximity: the extent to which the same inputs are used to produce different products
  - if two products are produced in the same firm, the production processes of the two products apply similar resources → (aggregate) product co-occurrences indicate the proximity of production technologies between industries
- Revealed Relatedness: the degree to which products produced in the same firm exceed their expected levels (technological proximity index gained from the co-occurrence matrix)
  - regression analysis (ZINB) based on general industry level characteristics (Neffke and Henning 2009, 2013) → estimated / actual co-occurrence

- Alternative measure for industry relatedness: „Skill Relatedness" calculated from inter-industry labor flows (Neffke and Hidalgo 2015) – would be endogenous here

„Product Space”

Co-occurrence network of products

Nodes: products (CN8 codes), links: co-occurring products (directed and weighted)

Aggregating to industry level

Co-occurrence network of industries

Nodes: industries, links: co-occurrences aggregated to industry level (directed and weighted)

Standardization by the size of source and recipient industries

„Product Space” network of industries

Nodes: industries, links: **technological proximity** index = relative probability of co-production (directed and weighted, [0;1])

Extension with technological proximity

Extended model 2:

$$A_{j,t+1} =$$

$$A_{j,t} + \beta_0 \cdot prodgap_{j,t} + \sum_{k=1}^{4} \beta_k \frac{H_{j,t+1}^{RRk}}{N_{j,t+1}} + \beta_5 \cdot \frac{H_{j,t+1}^{SAME}}{N_{j,t+1}} +$$

$$\sum_{k=1}^{4} \beta_{k+5} prodgap_{j,t}^{RRk} + \beta_{10}\, prodgap_{j,t}^{SAME} + \gamma \boldsymbol{X}_{j,t} + \delta \boldsymbol{D} + \varepsilon_{j,t},$$

$H_{j,t+1}^{RRk}$ = number of new arrivals from firms with the respective technological proximity (revealed relatedness),

$H_{j,t+1}^{SAME}$ = number of new workers from same 4-digit industry at firm *j*,

$prodgap_{j,t}^{RRk}$ = productivity gap for only those workers, who arrived from firms with the specific technological proximity:

$$prodgap_{j,t}^{RRk} = \frac{\sum_{i=1}^{H_{j,t+1}} D_{i,t}(A_{i,t} - A_{j,t})}{H_{j,t+1}} \cdot \frac{H_{j,t+1}}{N_{j,t+1}},$$

where $D_{i,t} = 1$ if $RR(i,j)$ corresponds to ranges: *RR0*: [0], *RR*1: (0;median], *RR*3: (median;).

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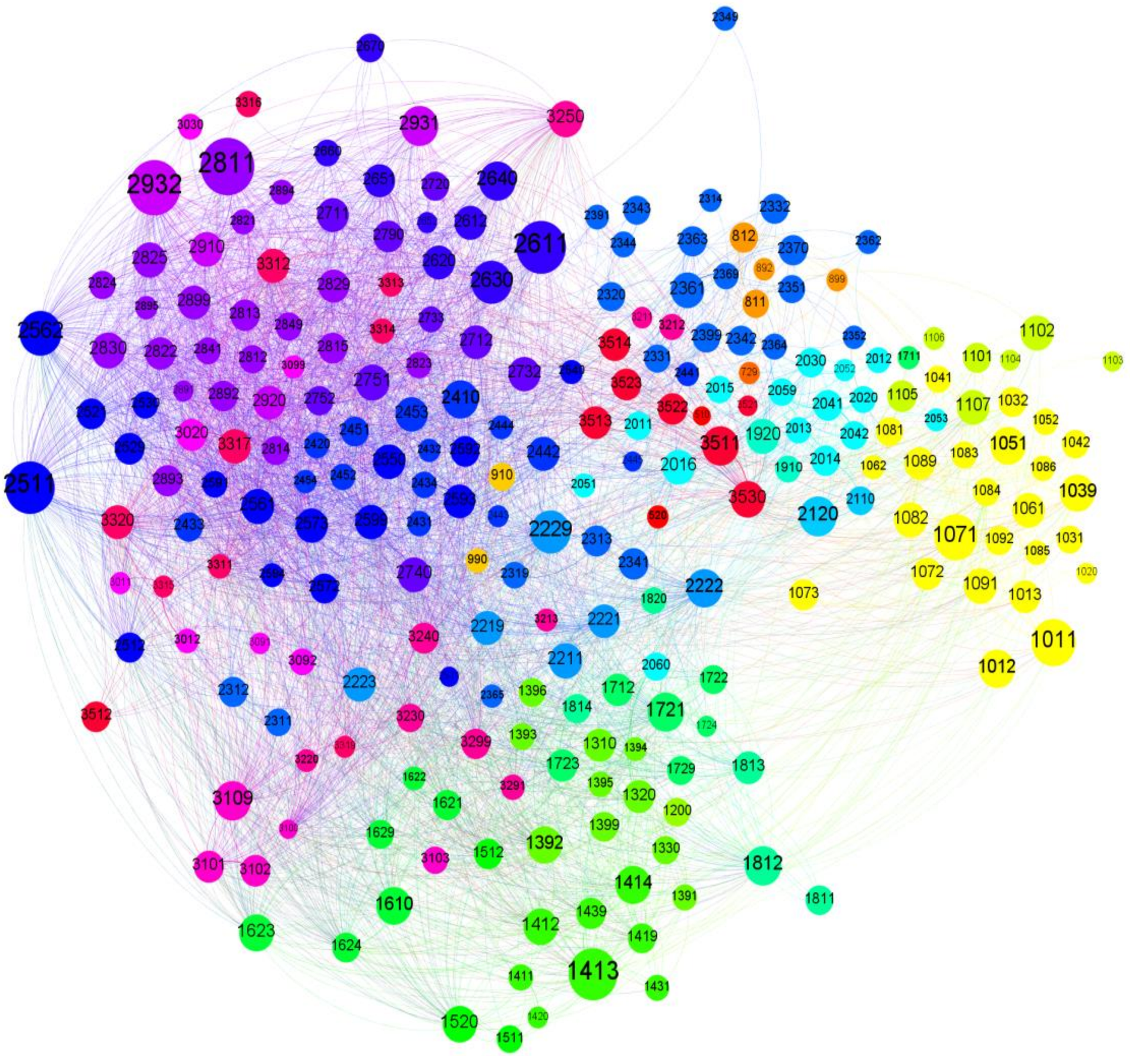
„Product space” network of industries



Nodes = NACE Rev.2 4-digit

Colors = NACE Rev.2 2-digit

Size = (log) employment

Position: Force Atlas 2 (Gephi)

only edges where $\overline{Ri}j$ >0

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Job switches and technological proximity by occupation

Segment	different industry			same industry	job switch	
	RR=0	RR below median	RR above median		%	N
Managers	35,3%	27,2%	16,0%	21,6%	100,0%	540
High-skilled	38,1%	31,6%	15,1%	15,2%	100,0%	668
Mid-skilled high-wage	38,8%	29,0%	13,2%	19,0%	100,0%	5 253
Mid-skilled low-wage	39,8%	29,2%	12,2%	18,9%	100,0%	7 188
Low-skilled	46,9%	25,2%	9,3%	18,6%	100,0%	1 465

Notes: N denotes the number of job switches of the occupation segment on average per year. ISCO-88 1-digit categories were used to identify occupation segments: 1 Managers, 2 High-skilled, 3-8 Mix of mid-skilled high-earners and mid-skilled low-earners separated by industry median wage, 9 Low-skilled.

- When changing jobs, only 18.8% of workers remain in the same industry
- Low-skilled workers tend to switch into less related industries more often
- Managers and high-skilled workers tend to remain in their industry, or choose more related industries when switching (Neffke, Otto, Weyh 2015)
- Reason: more industry-specific skills

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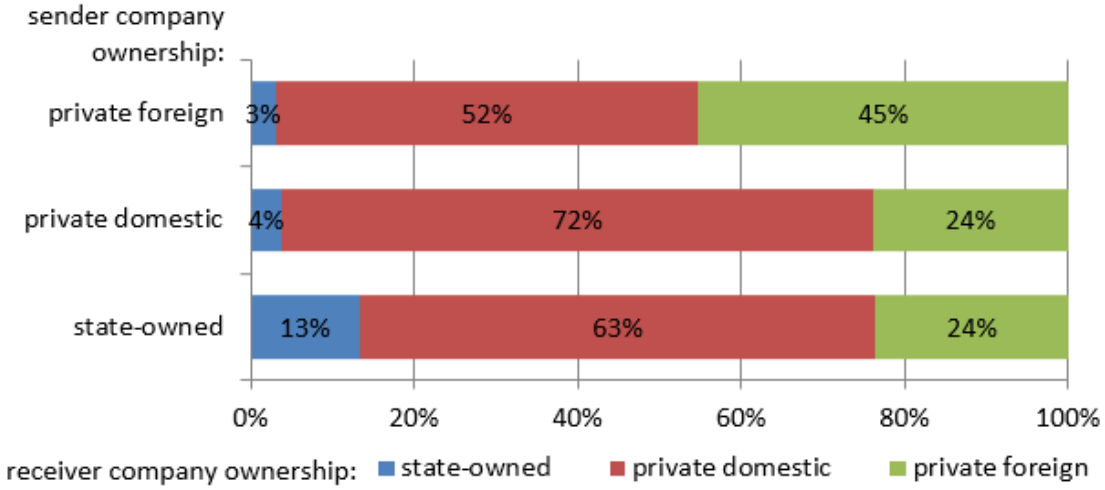
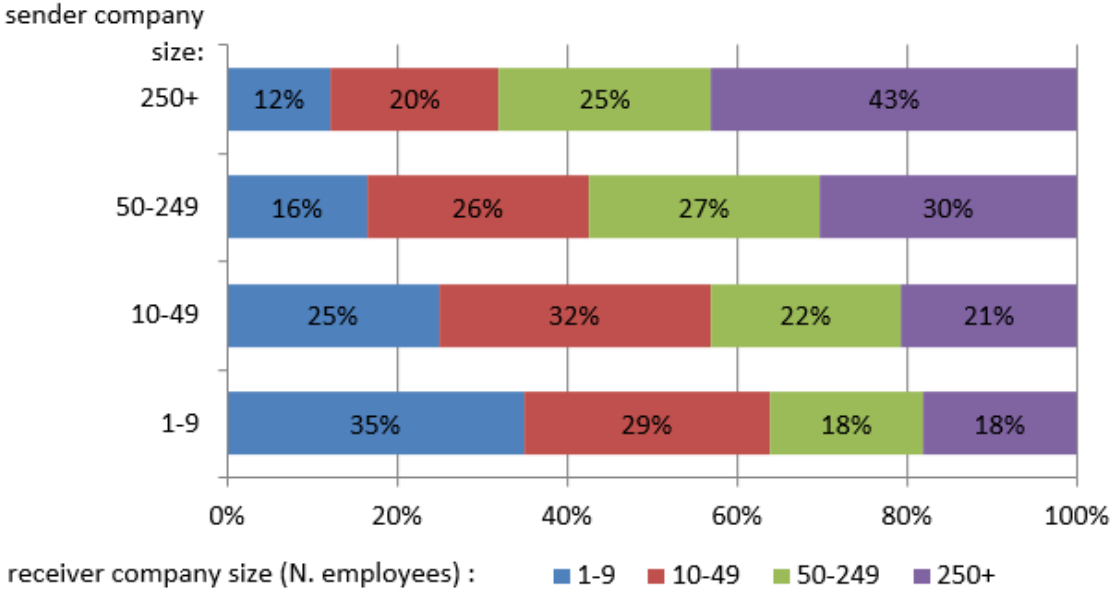
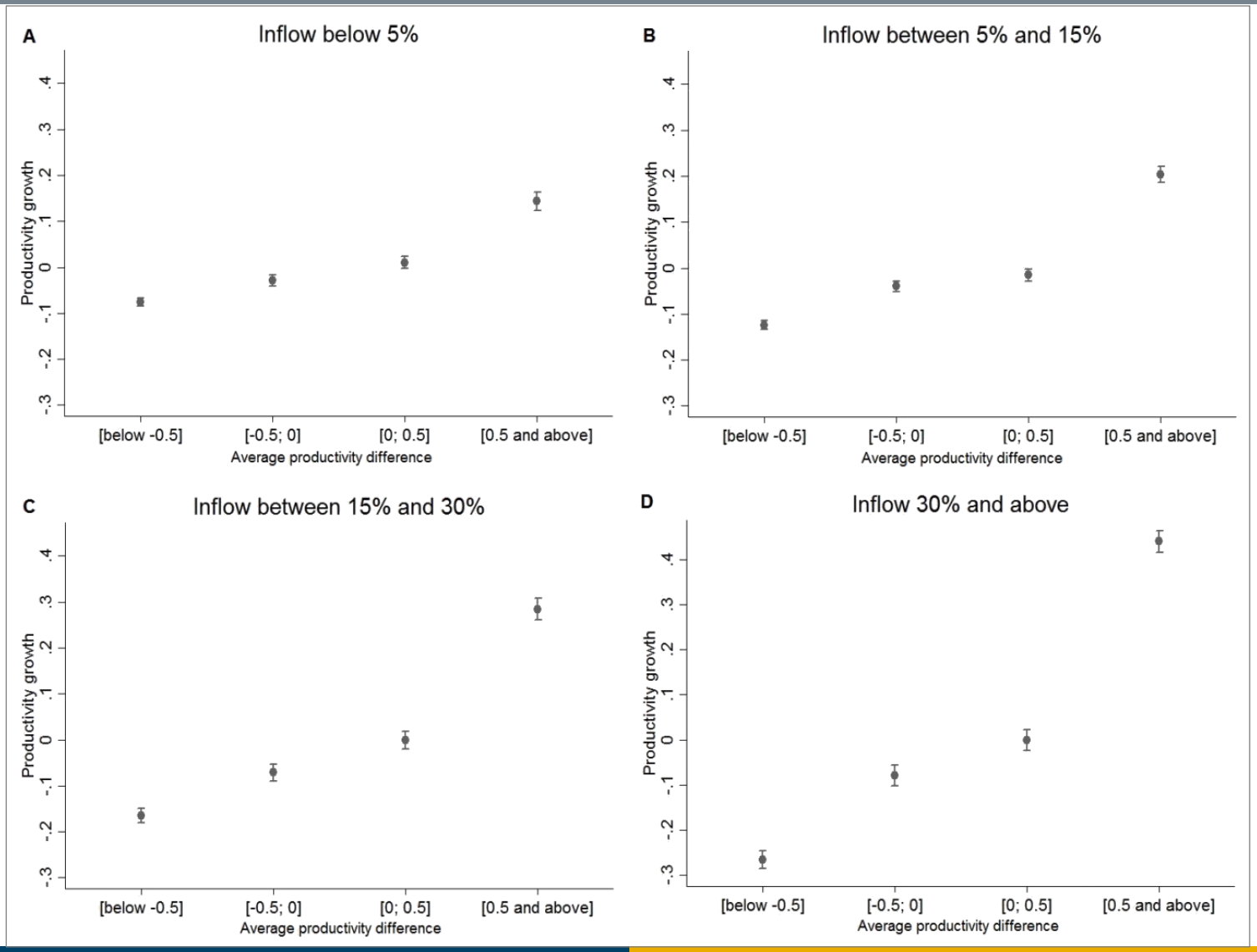
Job switches by firm size and ownership





Growth and productivity gap



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Productivity spillovers (PG effect)

	Column A	Column B	Column C	Column D
Lagged productivity	0.682***	0.673***	0.690***	0.681***
	(0.006)	(0.006)	(0.006)	(0.006)
Productivity gap	0.172***	0.163***		
	(0.010)	(0.010)		
Positive productivity gap			0.327***	0.311***
			(0.018)	(0.018)
Negative productivity gap			0.013	0.011
			(0.015)	(0.015)
Human capital		0.136***		0.130***
		(0.012)		(0.012)
Lagged human capital		-0.003		-0.005
		(0.011)		(0.011)
Observations	70,771	70,771	70,771	70,771
R-squared	0.606	0.608	0.608	0.610

Notes: industry-region-year FE, firm-clustered robust standard errors in parentheses. Additional controls are the characteristics of the recipient firm (total assets, ownership, size), and inflow-outflow measures (share of outflows, fluctuation, share of workers without a job in the previous year).

*** p<0.001, ** p<0.01, * p<0.05

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Dynamics in the PG effect

Panel A			
	Productivity in 1 year	Productivity in 2 years	Productivity in 3 years
Productivity Gap	0.157***	0.057	0.097*
	(0.043)	(0.032)	(0.046)
Observations	17,057	17,057	17,057
R-squared	0.707	0.713	0.716
Panel B			
	Productivity in 1 year	Productivity in 2 years	Productivity in 3 years
Positive Productivity Gap	0.343***	0.089	0.185**
	(0.099)	(0.066)	(0.069)
Negative Productivity Gap	0.004	0.044	0.031
	(0.061)	(0.050)	(0.086)
Observations	17,057	17,057	17,057
R-squared	0.707	0.713	0.716

Notes: industry-region-year FE, firm-clustered robust standard errors in parentheses. Control variables are the characteristics of the recipient firm (productivity, total assets, average human capital, ownership, size), and inflow-outflow measures (share of outflows, fluctuation, share of workers without a job in the previous year), and the respective lagged values of these controls.

*** p<0.001, ** p<0.01, * p<0.05

Sample: firms with at least 1 new hire in the starting year *t*.

Spillovers via technological proximity

	Column A	Column B	Column C
Share of unrelated inflows	0.167**	0.130*	0.074
	(0.062)	(0.059)	(0.062)
Share of related inflows	0.230**	0.239**	0.181*
	(0.082)	(0.082)	(0.084)
Share of same industry inflows	0.169**	0.147**	0.083
	(0.059)	(0.055)	(0.058)
Share of non-tradable inflows	0.096***	0.081***	0.027
	(0.019)	(0.018)	(0.022)
Productivity gap		0.149***	0.146***
		(0.021)	(0.021)
PGs by proximity categories	No	Yes	Yes
Human Capital	Yes	Yes	Yes
Ownership of source firm	No	No	Yes
Observations	69,143	69,143	69,143
R-squared	0.607	0.610	0.611

Notes: Industry-region-year FE models. Firm ID-clustered robust standard errors in parentheses. Additional controls are the characteristics of the recipient firm (total assets, ownership, size), and general inflow-outflow measures (share of outflows, fluctuation, share of workers without a job in the previous year, share of workers from public administration).
*** p<0.001, ** p<0.01, * p<0.05

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Multinational spillovers

	Column A	Column B	Column C
Lagged productivity	0.646***	0.638***	0.673***
	(0.006)	(0.006)	(0.006)
Productivity gap			0.161***
			(0.010)
Human capital		0.146***	0.135***
		(0.012)	(0.012)
Lagged human capital		-0.003	-0.004
		(0.011)	(0.010)
From private domestic	0.110***	0.102***	0.096***
	(0.020)	(0.020)	(0.019)
From private foreign	0.193***	0.164***	0.079**
	(0.027)	(0.027)	(0.027)
Observations	70,764	70,764	70,764
R-squared	0.602	0.604	0.608

Notes: industry-region-year FE, firm-clustered robust standard errors in parentheses.

Additional controls are: the characteristics of the recipient firm (total assets, ownership, size), general inflow-outflow measures (share of outflows, fluctuation, share of workers with no job in the previous year). The reference category of the ownership type of incoming workers contains state-owned companies and those companies where neither ownership type reaches 50%.

*** p<0.001, ** p<0.01, * p<0.05

Thank you for your attention!

Obrigado pela sua atenção!

Köszönöm a figyelmet!

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