Foreign firms and productivity spillover effects

Bruno Merlevede

Department of Economics, Ghent University, BE
IWH Halle, DE

visiting UC3M, Sep 14 - Jan 15, office 15.2.09

October 21, 2014

Introduction

Together with enterprise creation, encouraging foreign direct investment (FDI) is one of the cornerstones of most industrial policy

- MNEs expected to bring resources, technology, jobs, ...
  - MNEs are more productive

Introduction

Together with enterprise creation, encouraging foreign direct investment (FDI) is one of the cornerstones of most industrial policy

- MNEs expected to bring resources, technology, jobs, ...
  - MNEs are more productive
- MNEs also expected affect domestic firms through (positive) indirect/spillover effects
  - 'knowledge' transfer in a broad sense (e.g. pure technology, but also managerial know-how)
    - developing/transition countries!
    - industrialised countries?

Introduction

Together with enterprise creation, encouraging foreign direct investment (FDI) is one of the cornerstones of most industrial policy

- MNEs expected to bring resources, technology, jobs, ...
  - MNEs are more productive
- MNEs also expected affect domestic firms through (positive) indirect/spillover effects
  - 'knowledge' transfer in a broad sense (e.g. pure technology, but also managerial know-how)
    - developing/transition countries!
    - industrialised countries?
  - channels: demonstration/imitation, labour mobility, competition, supply chain linkages

FDI Spillover effects

- General framework and overview of the literature
  - FDI and domestic firms' TFP
- Earlier contributions and where they fit in
- Work in progress

The Literature (1) - Within industry effects

- Caves (1074) - Greenaway and Goerg (2004, review)
  - Effect of foreign presence on domestic industries' TFP?
  - Within industry (*horizontal*) effects only
  - Need for firm versus industry-level analysis
    - Identification, cherry picking
  - Measure to proxy foreign presence:

$$HR_{jt} = \frac{\sum_{i \in j} F_{it} * Y_{it}}{\sum_{i \in j} Y_{it}} \tag{1}$$

  - Aitken and Harrison (1999) vs Haskel et al. (2007)

The Literature (2) - Between industry effects

- Javorcik (2004) - Havranek and Irsova (2011, meta study)
  - Supply chain argument: incentive for foreign firms to transfer technology to domestic firms depends on latter's relative position in the supply chain
    - *Case study evidence in late 70s!*
    - More likely to observe spillovers through backward linkages rather than the horizontal or forward channel

FDI Spillover effects and the supply chain

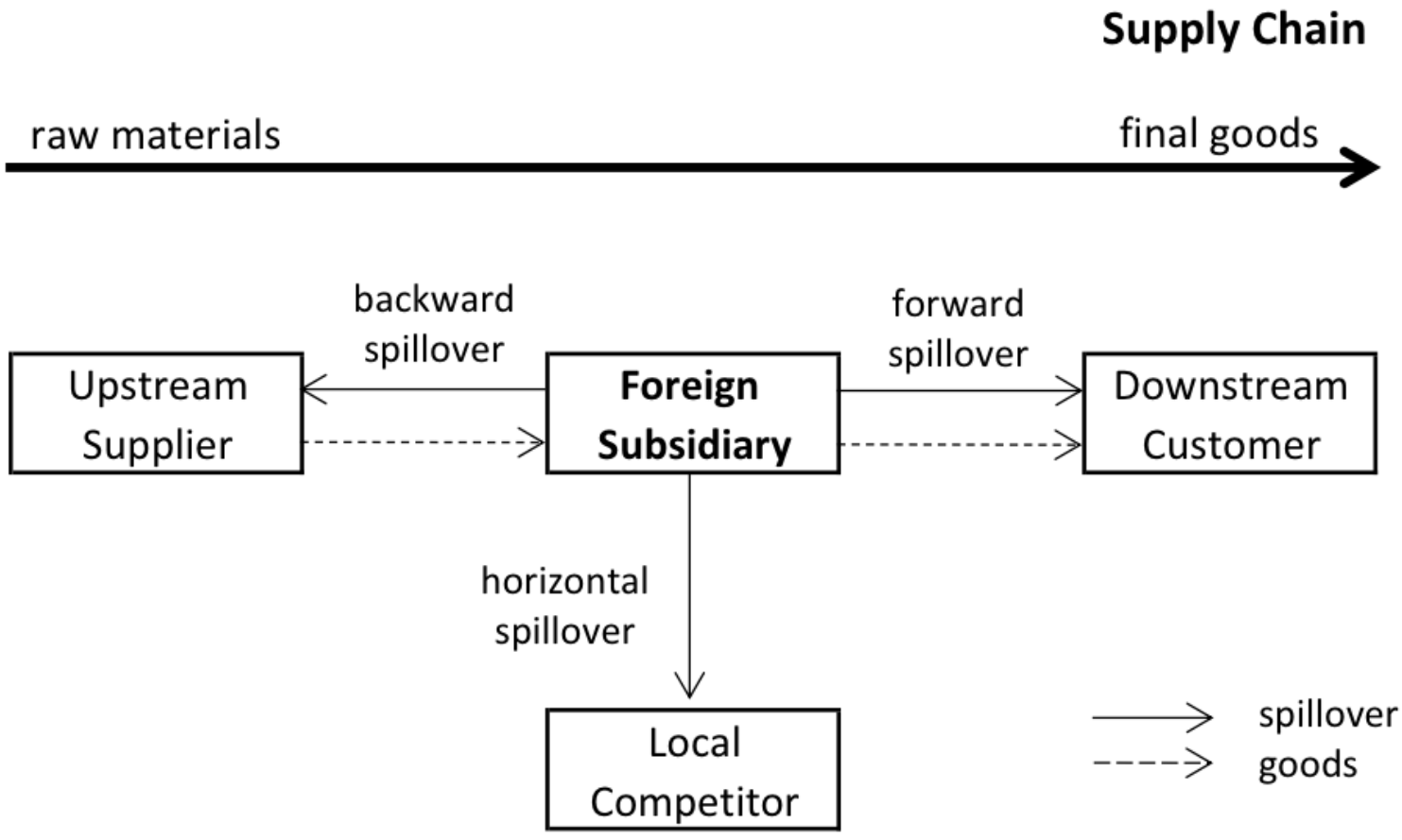


Figure : Spillover effects and foreign and domestic firms' position in the supply chain.

The Literature (2) - Between industry effects

- Javorcik (2004) - Havranek and Irsova (2011, meta study)
  - Supply chain argument: incentive for foreign firms to transfer technology to domestic firms depends on latter's relative position in the supply chain
    - *Case study evidence in late 70s!*
  - Firm-level studies (domestic firms)
  - Input-output tables for vertical relationships
  - Measures proxying upstream and downstream foreign presence using input-output tables (*forward* and *backward* spillover effects):

$$BK_{jt} = \sum_{k} \gamma_{jkt} * HR_{kt} \tag{2}$$

$$FW_{jt} = \sum_{l} \delta_{jlt} * HR_{lt} \tag{3}$$

Empirical framework - Havranek and Irsova (2011, JIE)

- standard approach = analyse FDI spillovers as additional inputs explaining total factor productivity (TFP) in a production function framework
  - Two-step procedure
    - Obtain firm-level TFP-measure
    - Relate TFP-measure to variables capturing foreign presence (HR, BK, FW) and controls in first differenced specification

$$\Delta TFP_{ijrt} = \psi_1 \Delta f(FDI_{jt-1}) + \psi_2 \Delta Z_{i(j)t-1} + \psi_3 Y_{i(j)t-1} + \alpha_t + \alpha_j + \alpha_r + \epsilon_{ijrt} \quad (4)$$

  - *Controls*: (firm-level) age, size, exit; (industry-level) competition, downstream demand, import competition, export orientation

The Literature (3) - Where and when?; 'Heterogeneity'

- Crespo and Fontoura (2007) WD-review
- Characteristics that obstruct/mediate spillovers: '*heterogeneity*' rather than overall (average) positive effect
  - Domestic firm characteristics
  - Foreign firm characteristics
  - Country, industry, region, ... characteristics

Testing implicit assumptions/issues in the literature

- Horizontal-vertical: mechanisms versus measurement

Testing implicit assumptions/issues in the literature

- Horizontal-vertical: mechanisms versus measurement

- All foreign firms generate spillover effects ...
  - Maturity
  - Size
  - Technology

- ... and all domestic firms capture them?
  - Absorptive capacity, technology
  - Distance

Testing implicit assumptions/issues in the literature

- Horizontal-vertical: mechanisms versus measurement
- All foreign firms generate spillover effects ...
  - Maturity
  - Size
  - Technology
- ... and all domestic firms capture them?
  - Absorptive capacity, technology
  - Distance
- two general components
  - scope for spillover effect
  - probability of contact/linkage

Testing implicit assumptions/issues in the literature

- Throughout the contributions discussed same (pilot) dataset of Romanian firms (BvDEP Amadeus) is used, focus is on spillover effects to manufacturing firms
  - Amadeus is used in *augmented* form, i.e. we rely on multiple annual issues (DVDs) to overcome some drawbacks associated with a single issues of the database
  - About 200.000 firm-year observations (manufacturing), period 1996-2005
  - Detailed IO-tables, time-varying
- Finalised similar dataset for 'Europe' this summer

Foreign firms' size

Foreign firms' size

- (implicit) assumption = foreign firms are big
  - *however* ...

Foreign firms' size

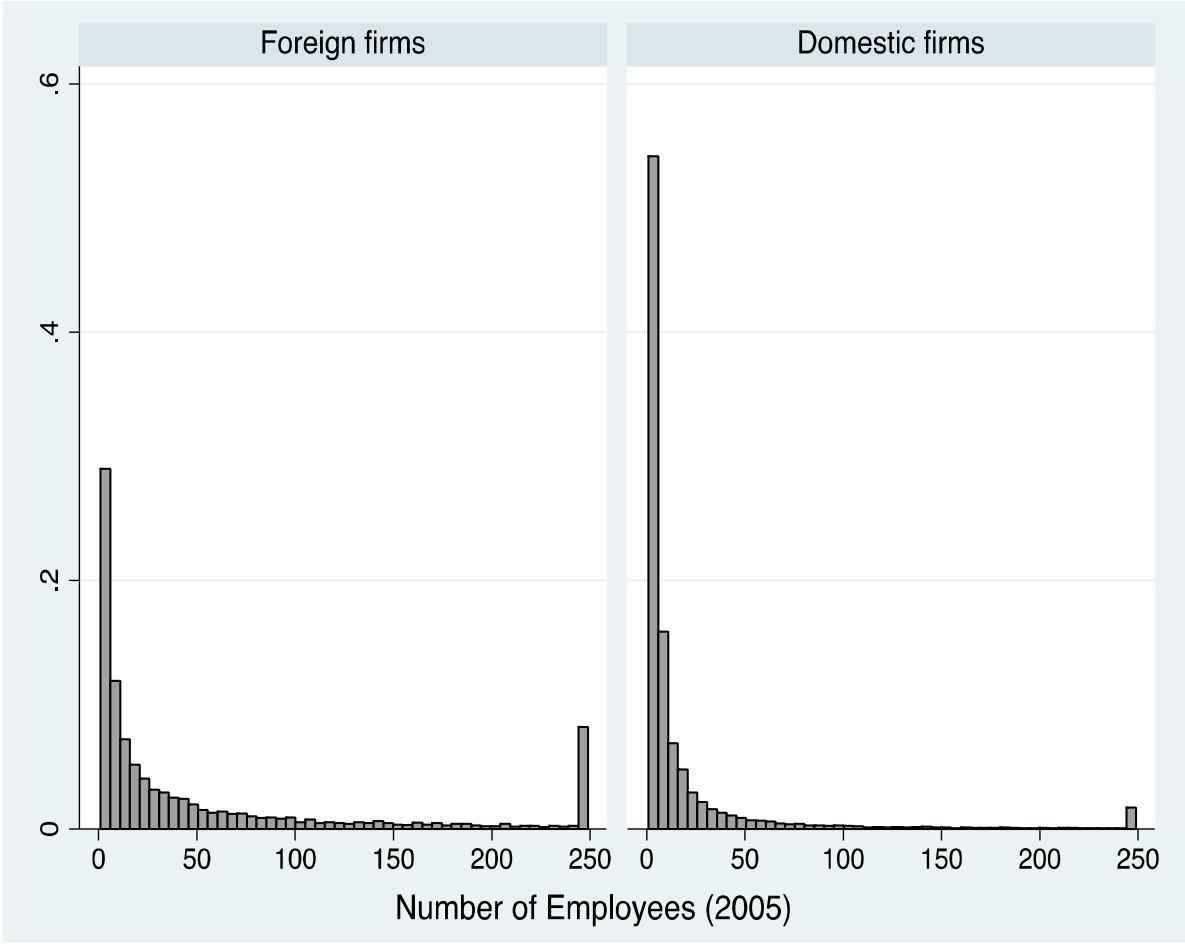


Figure : Domestic and foreign firm size distribution (firms employing more than 250 employees are included in the 250 employee category).

Foreign firms' size

- (implicit) assumption = MNEs are big
- question = do small foreign invested firms generate spillover effects?
  - lack the scale to affect domestic firms?
- test by decomposing spillover variables (backward/forward spillover variables follow) and allowing components do have a different impact:

$$HR_{jt} = \frac{\sum_{i \in j} F_{it}^{mic} Y_{it}}{\sum_{i \in j} Y_{it}} + \frac{\sum_{i \in j} F_{it}^{sma} Y_{it}}{\sum_{i \in j} Y_{it}} + \frac{\sum_{i \in j} F_{it}^{med} Y_{it}}{\sum_{i \in j} Y_{it}} + \frac{\sum_{i \in j} F_{it}^{lar} Y_{it}}{\sum_{i \in j} Y_{it}} \quad (5)$$

Foreign firms' size

Domestic and foreign firm size and spillover effects

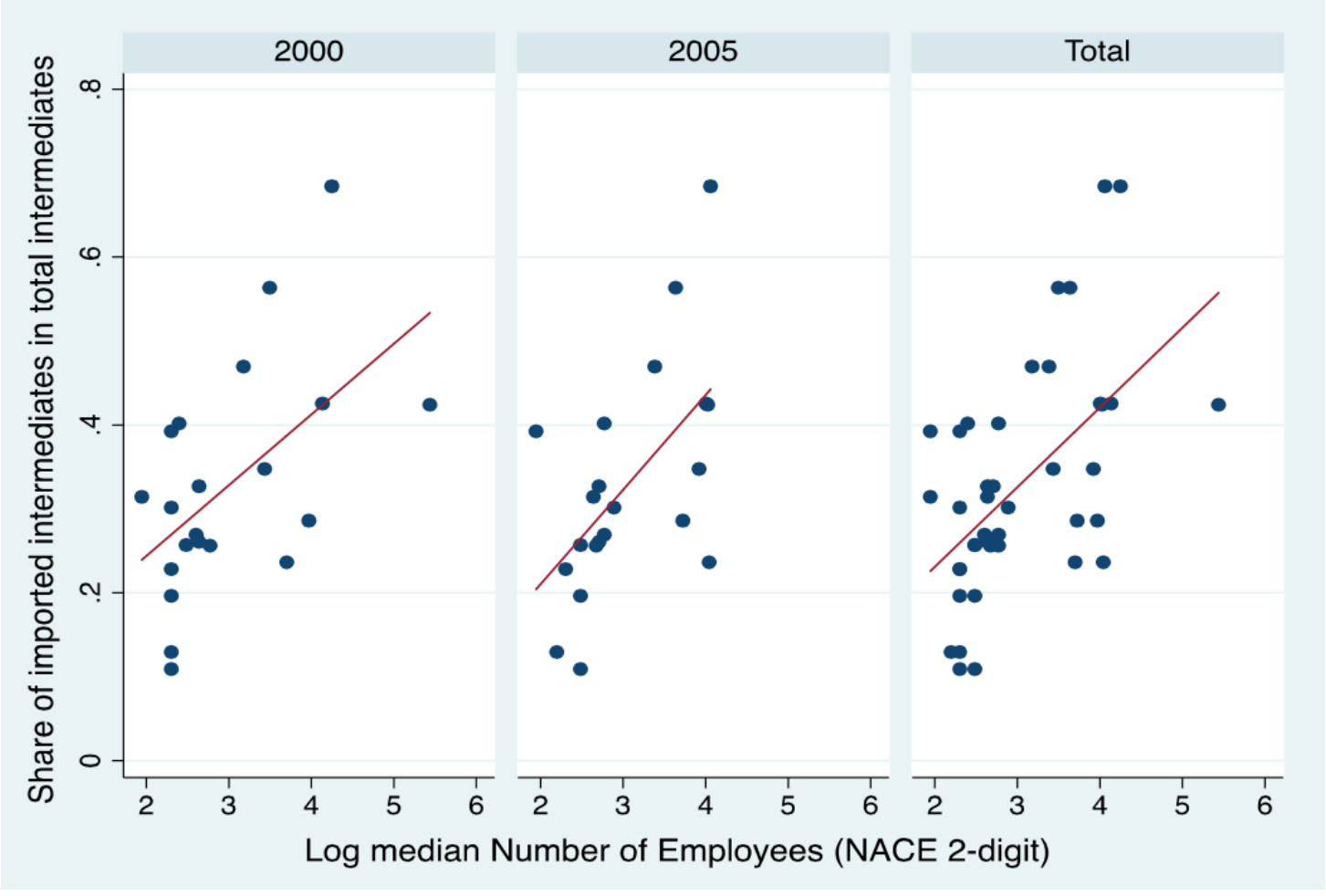
	OP TFP					ACF TFP				
	all domestic firms	domestic firms with average number of employees				all domestic firms	domestic firms with average number of employees			
		below 10	between 10 and 50	between 50 and 250	above 250		below 10	between 10 and 50	between 50 and 250	above 250
horizontal										
below 10	0.598	0.856	0.412	-0.591	-0.324	-0.107	0.124	-0.611	-1.723	-0.223
	[1.278]	[1.356]	[1.207]	[1.173]	[0.987]	[3.156]	[3.323]	[3.104]	[3.021]	[2.520]
between 10 and 50	0.359	0.547	0.197	0.186	0.508	0.752	1.095	0.261	0.653	2.205
	[0.605]	[0.661]	[0.576]	[0.459]	[0.463]	[1.443]	[1.542]	[1.555]	[1.182]	[1.645]
between 50 and 250	1.225**	1.334***	1.147**	0.713	0.620*	3.068***	3.349***	2.961***	1.724	1.270
	[0.477]	[0.482]	[0.488]	[0.502]	[0.332]	[1.059]	[1.076]	[1.107]	[1.127]	[0.874]
above 250	-0.087	-0.079	-0.087	-0.053	-0.076	-0.053	-0.082	0.218	-0.242	-0.229
	[0.212]	[0.217]	[0.222]	[0.210]	[0.153]	[0.573]	[0.595]	[0.622]	[0.573]	[0.544]
backward										
below 10	0.064	0.093	0.307	-0.794	-0.601	-0.616	-0.529	-0.194	-1.822	-0.400
	[1.575]	[1.620]	[1.693]	[1.432]	[0.999]	[3.391]	[3.584]	[3.600]	[2.959]	[2.157]
between 10 and 50	0.699	0.255	1.150	1.219	1.176**	2.507	1.695	3.998	2.254	2.224**
	[1.252]	[1.489]	[1.387]	[1.125]	[0.469]	[3.361]	[4.396]	[4.020]	[2.684]	[1.092]
between 50 and 250	2.034***	1.980**	2.002**	2.691***	1.976***	6.916***	6.761***	7.080***	8.340***	3.780**
	[0.776]	[0.827]	[0.787]	[0.798]	[0.549]	[2.229]	[2.337]	[2.666]	[2.703]	[1.498]
above 250	0.584	0.700	0.364	0.311	0.290	1.300	1.509	1.276	0.665	0.123
	[0.586]	[0.608]	[0.619]	[0.518]	[0.397]	[1.676]	[1.776]	[1.828]	[1.345]	[1.158]
Observations	167,022	107,780	42,847	11,161	5,234	120,763	74,783	32,262	9,081	4,637
R-squared	0.054	0.056	0.086	0.101	0.137	0.077	0.086	0.108	0.115	0.105

Foreign firms' size

- (implicit) assumption = MNEs are big
- small foreign invested firms do not generate spillover effects, NEITHER DO LARGE
  - technological superiority does not differ across size classes
  - small = lack of scale
  - large?
    - less involved in domestic economy than medium-sized
    - import intermediates, export output, bring their own supply chain

Foreign firms' size

Median size and imported intermediates (industry level)



Foreign firms' size

Supply chain entry (industry level)

	entry of type of firms							
	2005					2001-2005		
	large	medium	large or medium	small	micro	large	medium medium	large or
Concurrent entry of large firms in sourcing industries	0.831	1.701	0.982	0.509	1.140	0.881**	0.560	0.805**
	[1.471]	[1.422]	[1.366]	[1.344]	[1.377]	[0.375]	[0.348]	[0.352]
Concurrent entry of large firms in supplying industries	-0.131	0.051	-0.005	0.042	0.173	-0.031	0.031	-0.108
	[0.379]	[0.319]	[0.306]	[0.300]	[0.294]	[0.229]	[0.195]	[0.193]
Observations	61	61	61	61	61	305	305	305
Concurrent and last year entry of large firms in sourcing industries	2.547*	2.421**	2.074*	0.238	-0.155	1.088**	0.849**	0.985**
	[1.320]	[1.197]	[1.168]	[1.104]	[1.117]	[0.452]	[0.408]	[0.400]
Concurrent and last year entry of large firms in supplying industries	1.113	-0.301	-0.117	-0.427	0.845	-0.128	-0.258	-0.294
	[1.106]	[0.892]	[0.838]	[0.805]	[0.806]	[0.456]	[0.391]	[0.377]
Observations	61	61	61	61	61	305	305	305

Probit (2005) and random effect probit estimates (2001-2005)

Foreign firms' size

Firm-level evidence (BEEPS)

	(1) interm. importer	(2) imp. int. share	(3) exporter	(4) export share	(5) supplier to MNE	(6) MNE sup. share
	probit	*OLS*	*probit*	*OLS*	*probit*	*OLS*
medium	0.408	8.247	0.419	13.663*	0.266**	2.319**
	[0.275]	[7.617]	[0.268]	[7.150]	[0.131]	[1.177]
large	1.208***	32.873***	0.933***	19.630**	0.682***	5.654***
	[0.347]	[9.327]	[0.326]	[8.645]	[0.159]	[1.609]
foreign					0.536***	7.416***
					[0.148]	[1.498]
Obs.	113[a]	113[a]	118[a]	118[a]	819	819
(Pseudo) R-sq.	0.09	0.10	0.03	0.06	0.05	0.05
Chi-sq.	12.9		8.76		34.2	
Prob.>Chi-sq.	0.00		0.03		0.00	

Data for Romania from BEEPS 2002 and 2005. [a] Only foreign firms used in the estimations. Firm-level estimates for firms responding to questions detailed in the text. Standard errors in brackets; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Foreign firms' size

- (implicit) assumption = MNEs are big
- small foreign invested firms do not generate spillover effects, neither do large
  - technological superiority does not differ across size classes
  - small = lack of scale
  - large?
    - less involved in domestic economy than medium-sized
    - import intermediates, export output, bring their own supply chain
- domestic firms' size not related to spillover effects
  - absorptive capability is! (TFP gap with most productive foreign firms in the industry)

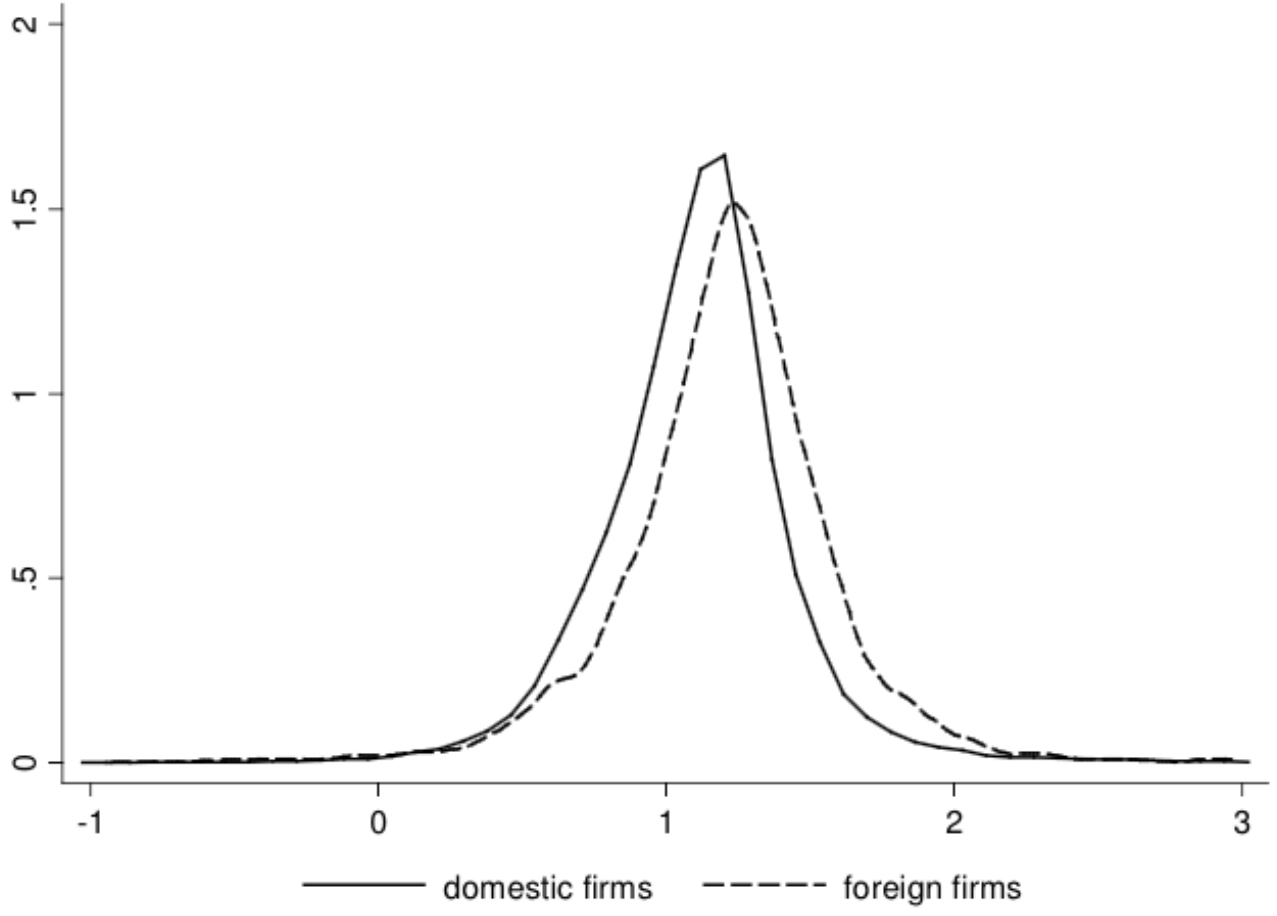
Foreign and domestic firms' technology

Foreign and domestic firms' technology

- advanced technology is ultimate source of productivity spillover
- Helpman et al. (2004) and Antras and Helpman (2003): only most productive firms are able to cover fixed cost of doing FDI
- additional investment promotion will result in a country attracting less productive firms
- do less productive firms generate spillover effects?
  - how does this relate to domestic firms' level of productivity?

Foreign and domestic firms' technology

Foreign and domestic firm technology distribution - log OP-TFP



Foreign and domestic firms' technology

- test by creating firm-level decomposition of spillover variables according to productivity of individual domestic firm relative to each foreign firm

$$HR^{\alpha}_{djt} = \frac{\sum_{i \in j} F_{it} Y_{it} \left| tfp_{dt} - tfp_{it} \leqslant \alpha \right.}{\sum_{i \in j} Y_{it}} \tag{6}$$

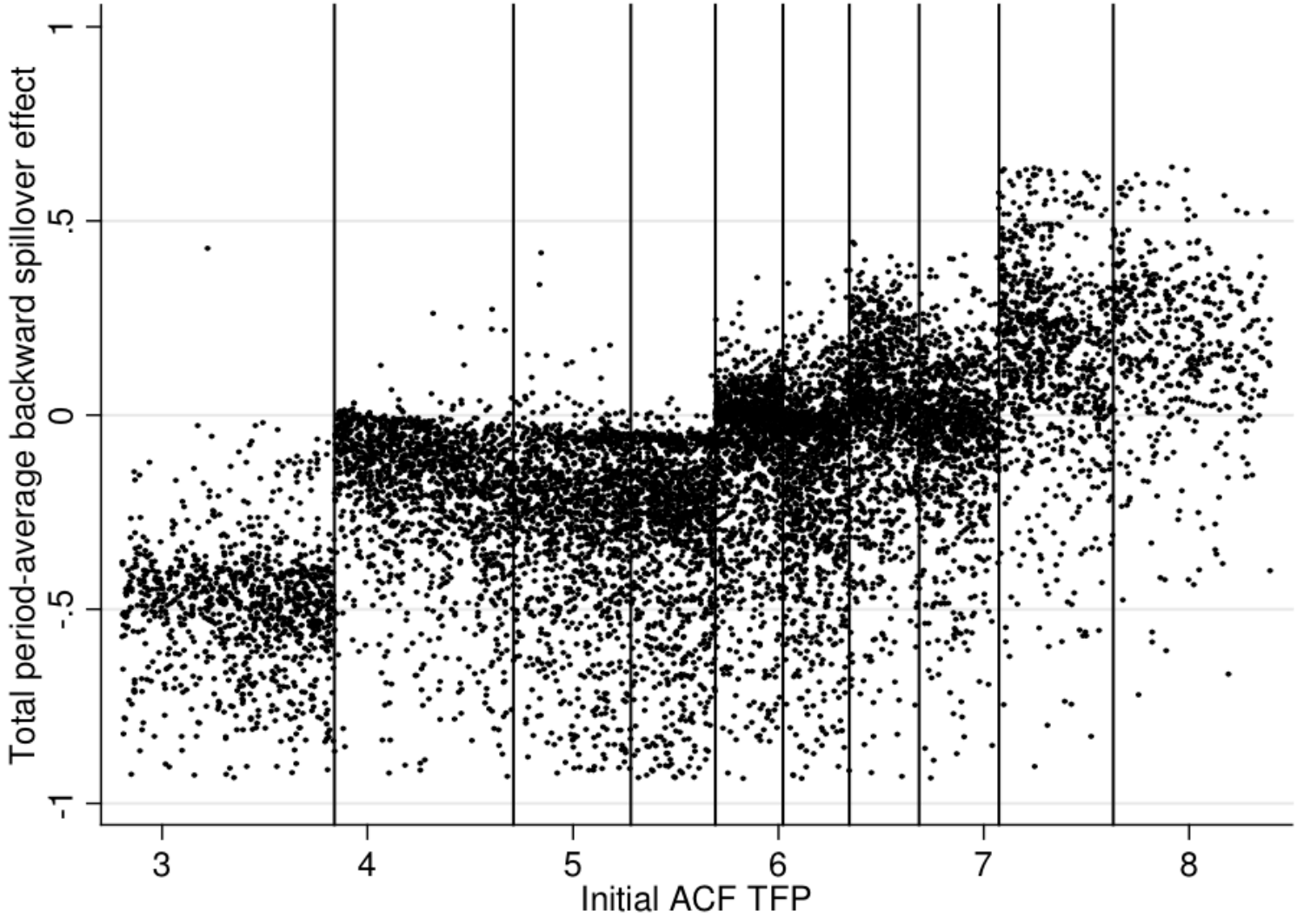
- α is used to define spillovers from
  - more (less) productive foreign firms (i) less than 1sd away, (ii) between 1sd and 2sd away, (iii) more than 2sd away
- backward and forward follow

Foreign and domestic firms' technology

Result: domestic firms benefit only from more productive foreign firms; more productive domestic firms benefit more; only through backward spillover effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OP TFP				*ACF TFP*			
	local Q1	*local Q2*	*local Q3*	*local Q4*	*local Q1*	*local Q2*	*local Q3*	*local Q4*
Backward, more >2sd	2.819***	5.081***	8.673***	12.125***	6.133***	9.129***	9.229***	16.460***
	[1.078]	[1.522]	[1.908]	[3.368]	[1.430]	[2.044]	[2.462]	[2.849]
Backward, more >1sd <2sd	1.042***	1.089**	2.283***	2.519**	-2.006***	0.328	2.826*	4.980***
	[0.306]	[0.438]	[0.655]	[1.227]	[0.665]	[1.184]	[1.467]	[1.918]
Backward, more <1sd	0.069	-0.047	0.799*	1.047**	-0.609	-0.574	0.403	3.041***
	[0.157]	[0.306]	[0.414]	[0.527]	[0.888]	[0.989]	[1.083]	[1.056]
Backward, less <1sd	-0.763*	-0.795**	-0.353	0.932	-7.495***	-1.894	-0.694	0.049
	[0.424]	[0.341]	[0.344]	[0.641]	[2.114]	[1.419]	[1.372]	[1.167]
Backward, less >1sd <2sd	-2.203	-1.769	-1.905***	-0.373	-12.596***	-12.086***	-7.936***	-1.482
	[2.043]	[1.431]	[0.562]	[0.577]	[3.670]	[3.061]	[2.553]	[1.639]
Backward, less >2sdl	-4.694	-10.006*	-6.032**	-3.034***	-19.386	-11.617	-11.442	-7.815***
	[6.582]	[5.611]	[2.510]	[0.915]	[24.610]	[9.148]	[8.634]	[2.839]
Observations	24,605	24,092	24,536	23,448	14,396	17,350	19,185	18,682
R-squared	0.133	0.124	0.164	0.220	0.180	0.130	0.149	0.225

Foreign and domestic firms' technology



Foreign firms' maturity

Foreign firms' maturity

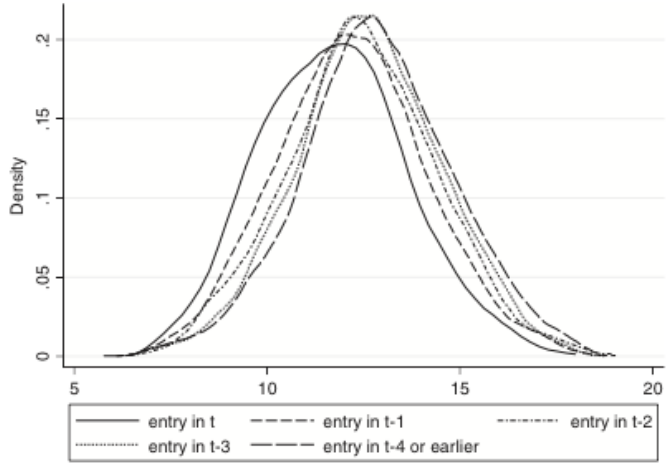
- Arnold and Javorcik (2009): foreign TFP bonus from take-over = largely jump in TFP level, subsequent TFP growth only slightly larger

- 'timing' has received attention in literature, but dealt with by using lag structures
- contribution argues that maturity of foreign firms in domestic market is key
  - imitation/demonstration likely not immediate
  - competition effect will vary with maturity
  - labour mobility: first negative, then positive?
  - local linkages take time to built

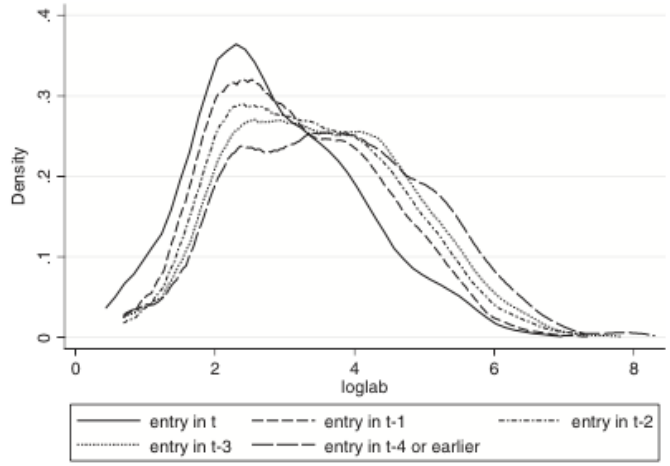
Foreign firms' maturity

Selected variables in time-since-entry (foreign firms)

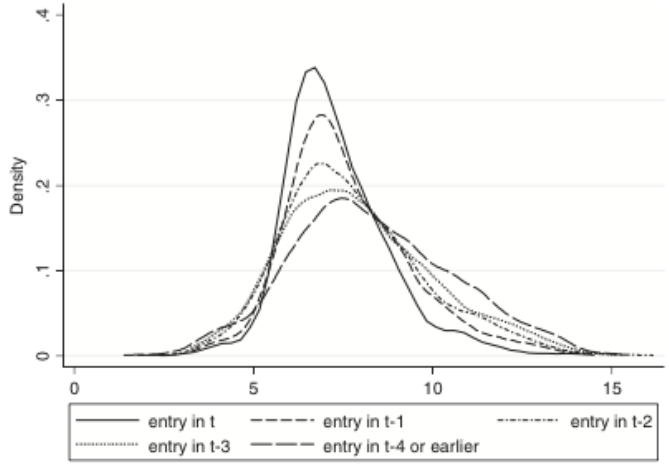
Log tangible fixed assets, deflated



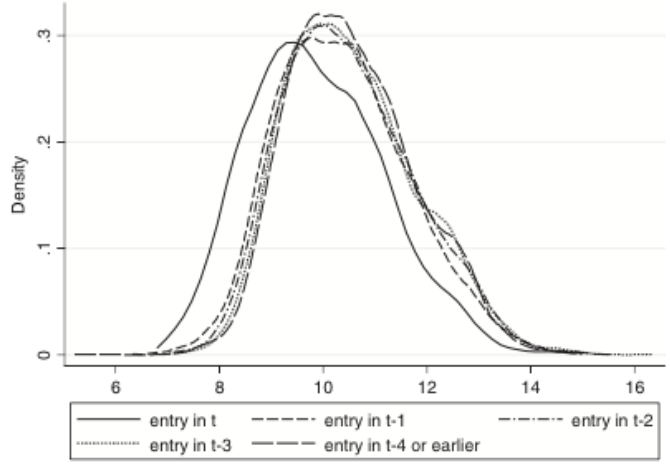
Log number of employees



Log operating revenue, deflated



Log labour productivity



"entry in t" groups all observations of the variables for the first year the foreign firm enters the domestic economy, irrespective of calendar time; "entry in t-1" groups firms in their second year in the domestic economy, …; "entry in t-4 or earlier" groups all firms which have been present for at least five years.

Foreign firms' maturity

- maturity of foreign firms in domestic market is key
- test by decomposing spillover variables:

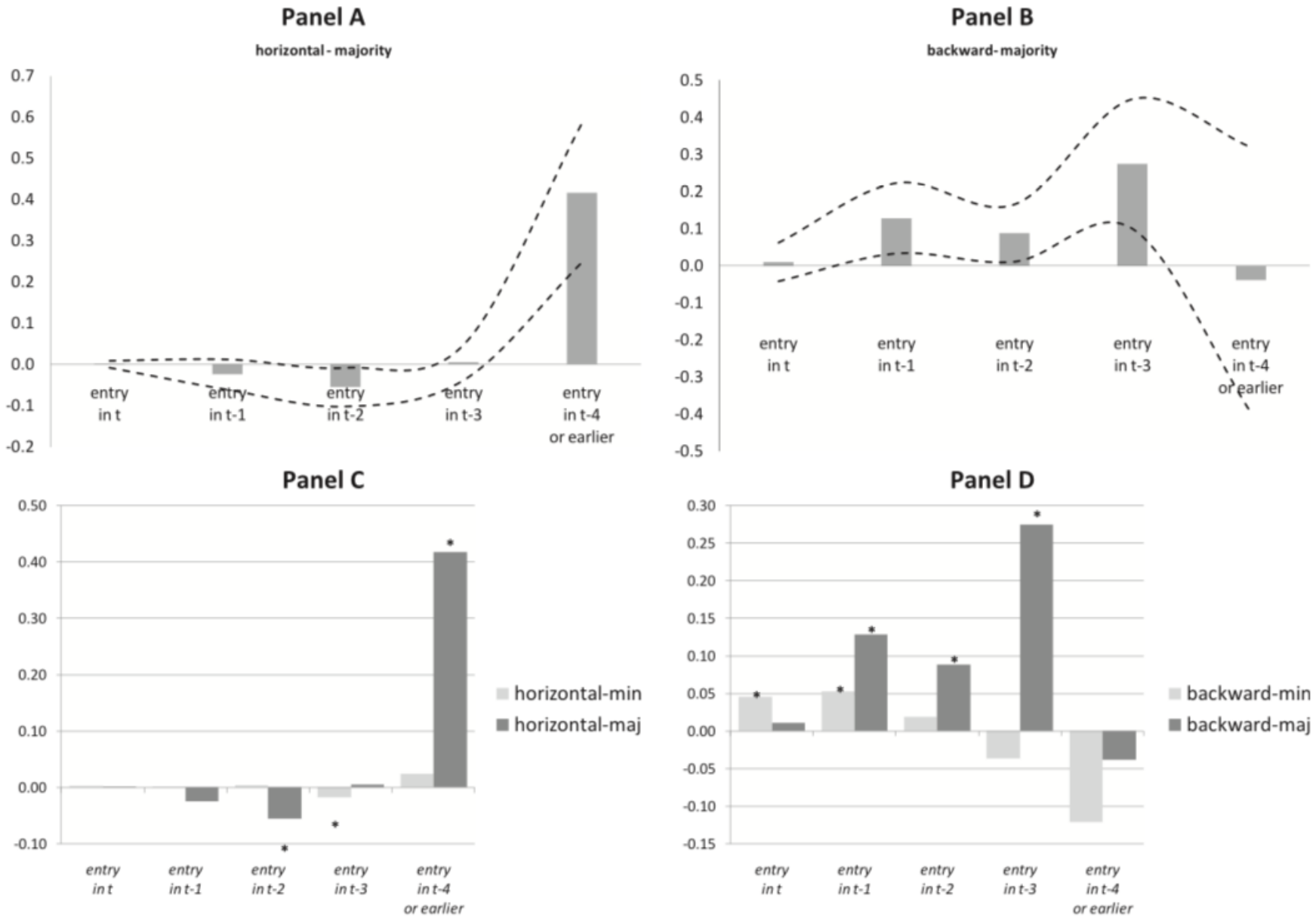
$$HR_{jt} = \frac{\sum_{i \in j} F_{it}^{0} Y_{it}}{\sum_{i \in j} Y_{it}} + \frac{\sum_{i \in j} F_{it}^{1} Y_{it}}{\sum_{i \in j} Y_{it}} + \frac{\sum_{i \in j} F_{it}^{2} Y_{it}}{\sum_{i \in j} Y_{it}} + \ldots + \frac{\sum_{i \in j} F_{it}^{n} Y_{it}}{\sum_{i \in j} Y_{it}} \tag{7}$$

$$F_{it}^{x} = 1 \; if \; \left(\sum_{v=0}^{x-1} F_{i,t-v} = x \right) \wedge \left(\sum_{v=x}^{\infty} F_{i,t-v} = 0 \right) \tag{8}$$

- backward/forward spillover variables follow

Foreign firms' maturity

Time-since-entry and spillover effects



Foreign firms' maturity

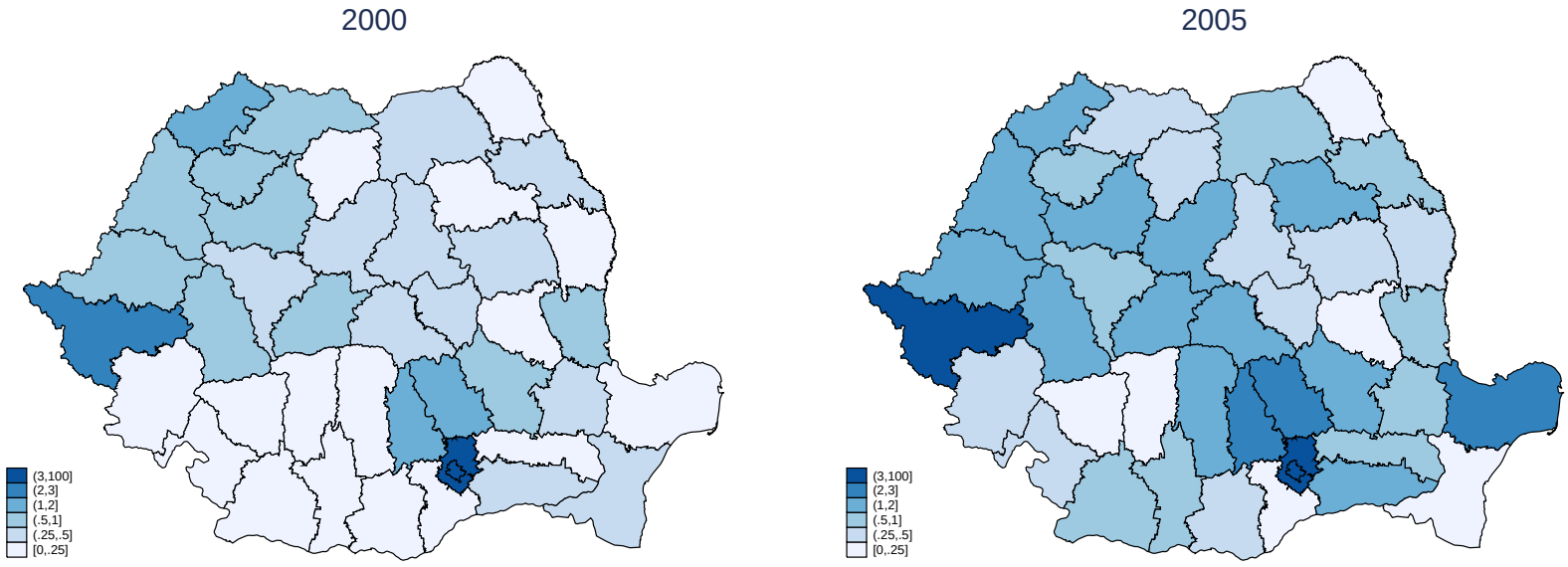
- foreign entry affects local competitors productivity initially negatively,
- followed by a positive 'permanent' effect from majority foreign owned firms present for longer time

- effect on the productivity of local suppliers is transient
  - majority foreign owned firms boost local suppliers productivity for a few years after entry, then the effect fades out
  - minority foreign owned firms boost local suppliers productivity immediately upon entry; the effect is smaller and fades out faster

The interaction of maturity and distance

Regional spillover potential

Figure : Foreign presence at NUTS3-level (41 NUTS3 regions, est.1967)



Literature on regional spillovers:

- transfers traditional nation-wide definition to the regional level
- does not model/allow for spillovers between regions

- contribution
  - test whether spillover effects are localised
  - combine with maturity
    - especially backward spillover effects may (only) materialise (faster) at shorter distance (e.g. technical assistance/monitoring)

  - double decomposition of measure for spillover potential

Regional decomposition

$$HR_{jt} = \frac{\sum R_{it} F_{it} Y_{it}}{\sum Y_{it}} + \frac{\sum NB_{it} F_{it} Y_{it}}{\sum Y_{it}} + \frac{\sum (1 - R_{it} - NB_{it}) F_{it} Y_{it}}{\sum Y_{it}} \tag{9}$$

- Spillovers from the same region: R_{it}
- Spillovers from the neighboring region: NB_{it}
- Spillovers from the rest of the country: $1 - R_{it} - NB_{it}$

Region-Time decomposition

Table : Spillover dynamics

Region/Time of Entry	t	t-1	t-2	t-3	t-4+
same region	$C_{R,t}$	$C_{R,t-1}$	$C_{R,t-2}$	$C_{R,t-3}$	$C_{R,t-4+}$
neighbour region	$C_{NB1,t}$	$C_{NB1,t-1}$	$C_{NB1,t-2}$	$C_{NB1,t-3}$	$C_{NB1,t-4+}$
rest of country	$C_{RoC,t}$	$C_{RoC,t-1}$	$C_{RoC,t-2}$	$C_{RoC,t-3}$	$C_{RoC,t-4+}$

Empirical framework

$$\Delta TFP_{ijrt}^{ACF} = \psi_1 \Delta f(FDI_{jt-1}) + \psi_2 \Delta Z_{i(j)t-1} + \psi_3 Y_{i(j)t-1} + \alpha_t + \alpha_j + \alpha_r + \epsilon_{ijrt} \quad (10)$$

- Controls
  - firm age, (initial) firm size, exit
  - competition in the industry
  - import competition in the industry
  - export orientation of the industry
  - industry intermediates supplied as a share of total industry output
  - region-industry share of national industrial activity
  - region share of national manufacturing activity
  - border, time, industry, region dummies

How do spillovers spread across maturity and regions?

Table : Horizontal Spillovers

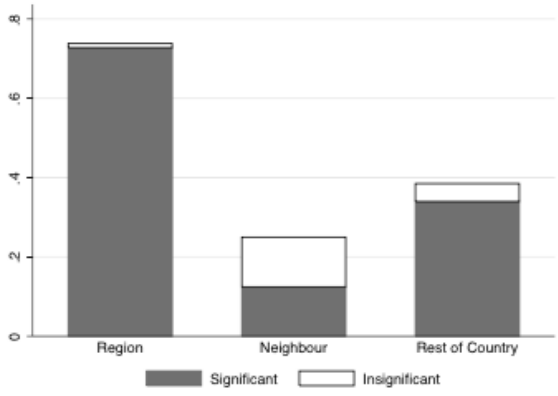
Region/Time of entry	t	t-1	t-2	t-3	t-4+
same region	-0.573	-2.483***	-1.426***	0.263	1.546***
neighbouring region	0.888	-1.575***	-2.461***	0.083	1.814***
rest of country	0.183	-1.089***	-1.427***	0.583***	2.109***

Table : Backward Spillovers

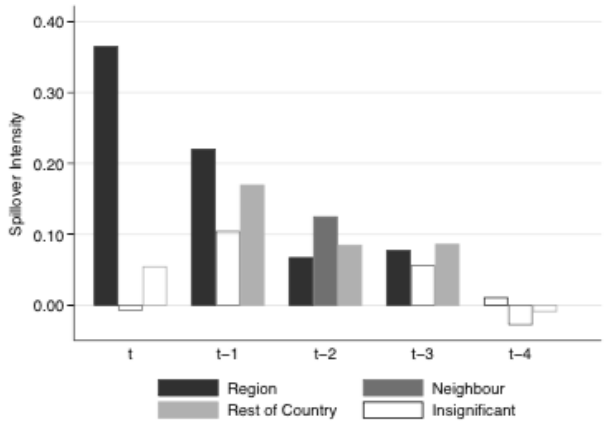
Region/Time of entry	t	t-1	t-2	t-3	t-4+
same region	18.229***	10.983***	3.342***	3.844***	0.525
neighbouring region	-0.347	5.202	6.227**	2.785	-1.368
rest of country	2.712	8.464***	4.223***	4.287***	-0.439

Figure : Where would a domestic firm like to see a foreign client enter?

(a) Distance impact



(b) Distance and time-since-foreign-entry impact



The figure shows the actual contribution to a domestic firm's TFP level of a foreign firm each year producing 2 per cent of downstream output.

What do we have so far?

- Decomposition of traditional spillovers measures into geographic and time components
- Both time and geography matter

Maturity and distance

- Next steps
  - Cross-country analysis
  - Do border effects exist in knowledge spillovers?
    - Cross-border production networks (e.g. Germany - Czech Republic)
  - Heterogenous distance effect?
    - Impact of institutions?
    - Home country of MNE?
- Issues
  - Location choice of foreign firms
  - Firm-level data coverage
  - Measurement
  - IO-tables?

Location of foreign firms?

Control variables	New foreign firms (region)	New foreign firms (region industry)
Regional productivity growth	0.021	-0.006
	[0.576]	[0.006]
DN1 road	11.146***	0.220***
	[2.550]	[0.048]
HU border	10.564***	0.313***
	[2.424]	[0.057]
Rural rate	-52.326***	-1.740***
	[11.965]	[0.194]
Observations	369	6,293
R-squared	0.356	0.061

Robust standard errors in brackets; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure : European firm-level data

	SBS	AUGAMA as share of SBS				SBS 2007		AUGAMA 2007	
	#firms	#firms	#empl.	turnover	costs of empl.	manufacturing	services	manufacturing	services
AT	269,426	11.0 %	46.5 %	40.8 %	34.6 %	10.0 %	90.0 %	22.2 %	77.8 %
BE*	333,564	42.3 %	85.0 %	81.3 %	87.7 %	9.1 %	90.9 %	14.2 %	85.8 %
BG	221,116	17.6 %	60.3 %	83.5 %	66.4 %	11.8 %	88.2 %	15.2 %	84.8 %
CZ	871,067	11.4 %	74.7 %	76.0 %	72.5 %	16.9 %	83.1 %	19.7 %	80.3 %
DE	1,714,904	14.6 %	32.4 %	42.0 %	36.1 %	11.0 %	89.0 %	21.0 %	79.0 %
DK	198,369	18.4 %	41.9 %	36.7 %	45.8 %	8.7 %	91.3 %	14.2 %	85.8 %
EE	38,270	86.9 %	98.6 %	97.7 %	62.1 %	12.2 %	87.8 %	16.2 %	83.8 %
ES	2,499,620	36.9 %	71.3 %	75.1 %	72.1 %	7.9 %	92.1 %	17.2 %	82.8 %
FI	186,972	28.2 %	49.1 %	47.1 %	39.9 %	12.0 %	88.0 %	17.3 %	82.7 %
FR	2,158,887	23.6 %	62.1 %	63.9 %	62.9 %	10.2 %	89.8 %	14.0 %	86.0 %
GB	1,571,916	10.0 %	80.0 %	65.8 %	67.1 %	8.9 %	91.1 %	22.0 %	78.0 %
GR	694,183	12.7 %	52.3 %	50.4 %		11.2 %	88.8 %	27.2 %	72.8 %
HU*	551,119	8.5 %	35.2 %	38.7 %	35.7 %	10.4 %	89.6 %	19.2 %	80.8 %
IE	87,175	12.6 %	26.0 %	31.2 %	8.6 %	4.7 %	95.3 %	18.8 %	81.3 %
IT	3,790,324	15.0 %	55.8 %	58.8 %	57.8 %	13.1 %	86.9 %	30.7 %	69.3 %
LT	88,187	22.8 %	52.5 %	61.9 %		11.6 %	88.4 %	20.4 %	79.6 %
LV	60,581	18.7 %	54.9 %	57.1 %	7.0 %	11.1 %	88.9 %	16.5 %	83.5 %
NL**	497,613	5.2 %	54.5 %	42.9 %	39.0 %	8.6 %	91.4 %	18.4 %	81.6 %
NO	198,926	38.6 %	72.5 %	65.8 %	72.5 %	12.0 %	88.0 %	11.9 %	88.1 %
PL	1,452,512	6.5 %	46.8 %	50.3 %	27.9 %	13.3 %	86.7 %	30.9 %	69.1 %
PT	711,778	34.0 %	30.9 %	34.9 %	33.6 %	10.9 %	89.1 %	16.0 %	84.0 %
RO	389,286	67.6 %	87.7 %	36.1 %	34.6 %	12.6 %	87.4 %	15.8 %	84.2 %
SE	514,925	32.2 %	64.5 %	78.6 %	79.2 %	10.9 %	89.1 %	13.6 %	86.4 %
SI	91,065	24.2 %	80.8 %	80.2 %	79.6 %	17.8 %	82.2 %	30.6 %	69.4 %
SK	42,525	40.7 %	78.4 %	89.3 %	89.2 %	14.3 %	85.7 %	21.4 %	78.6 %

* For BE and HU the period is 2003-2007; ** For NL some outlier firms in levels were removed after manual inspection.

Figure : European firm-level data

	SBS (2002-2007 avg)				AUGAMA (firms with employment) (2002-2007 avg)				AUGAMA (firms with TFP) (2002-2007 avg)			
	1-19	20-49	50-249	250+	1-19	20-49	50-249	250+	1-19	20-49	50-249	250+
AT	94.3%	3.7%	1.7%	0.3%	52.1%	21.6%	20.4%	5.9%	17.8%	14.4%	42.8%	25.1%
BE	96.3%	2.5%	0.9%	0.2%	87.6%	8.1%	3.5%	0.7%	36.3%	30.2%	27.5%	6.0%
BG	94.9%	3.1%	1.7%	0.3%	75.3%	12.3%	10.0%	2.4%	60.4%	19.2%	16.6%	3.9%
CZ	97.5%	1.4%	0.8%	0.2%	69.1%	14.6%	13.0%	3.3%	65.8%	15.8%	14.7%	3.8%
DE	92.6%	4.4%	2.3%	0.5%	69.3%	15.6%	12.2%	3.0%	40.7%	19.5%	28.9%	10.9%
DK	93.6%	4.2%	1.9%	0.3%	80.2%	11.8%	6.6%	1.4%				
EE	91.0%	5.7%	2.9%	0.4%	86.1%	8.8%	4.5%	0.6%	85.8%	9.2%	4.4%	0.6%
ES	96.7%	2.3%	0.8%	0.1%	86.6%	9.5%	3.4%	0.5%	84.7%	10.8%	3.9%	0.6%
FI	96.2%	2.3%	1.2%	0.3%	88.9%	7.2%	3.2%	0.7%	88.3%	7.7%	3.3%	0.6%
FR	96.2%	2.5%	1.0%	0.2%	84.7%	9.7%	4.6%	1.1%	83.4%	10.4%	4.9%	1.2%
GB	94.6%	3.3%	1.7%	0.4%	40.3%	18.3%	31.0%	10.5%				
GR	98.5%	0.8%	0.3%	0.1%	68.1%	21.7%	9.1%	1.2%				
HU	96.0%	1.5%	0.7%	0.1%	74.1%	13.1%	10.0%	2.9%	73.4%	13.4%	10.2%	2.9%
IE	91.2%	5.1%	2.7%	0.5%	42.8%	22.4%	28.6%	6.2%				
IT	98.2%	1.3%	0.5%	0.1%	75.6%	15.2%	8.1%	1.1%	74.3%	16.0%	8.5%	1.1%
LT	93.2%	4.6%	2.6%	0.3%	52.1%	24.8%	19.8%	3.2%				
LV	91.8%	5.2%	2.7%	0.4%	64.2%	19.2%	14.4%	2.2%	47.1%	16.9%	27.7%	8.4%
NL	94.7%	3.4%	1.6%	0.3%	43.6%	19.1%	30.2%	7.0%	55.8%	16.6%	21.5%	6.1%
NO	99.0%	2.7%	1.2%	0.2%	87.6%	8.4%	3.3%	0.6%	85.8%	9.7%	3.8%	0.7%
PL	97.6%	1.3%	0.9%	0.2%	35.9%	21.7%	33.3%	9.2%	36.2%	22.9%	32.7%	8.2%
PT	97.1%	1.8%	0.8%	0.1%	90.7%	6.0%	2.8%	0.5%	89.2%	7.0%	3.3%	0.5%
RO	93.6%	3.7%	2.3%	0.5%	88.9%	6.4%	3.9%	0.8%	88.1%	6.8%	4.1%	0.9%
SE	97.2%	1.8%	0.8%	0.2%	92.1%	5.2%	2.2%	0.5%	91.4%	6.1%	2.2%	0.3%
SI	96.2%	2.1%	1.3%	0.3%	78.0%	10.8%	8.5%	2.7%	76.5%	11.6%	9.1%	2.8%
SK	89.0%	4.9%	4.7%	1.1%	66.2%	11.4%	17.3%	5.2%	63.1%	12.0%	19.1%	5.8%

Figure 2.9: *WLP TFP* distributions for domestic and foreign firms - Europe.

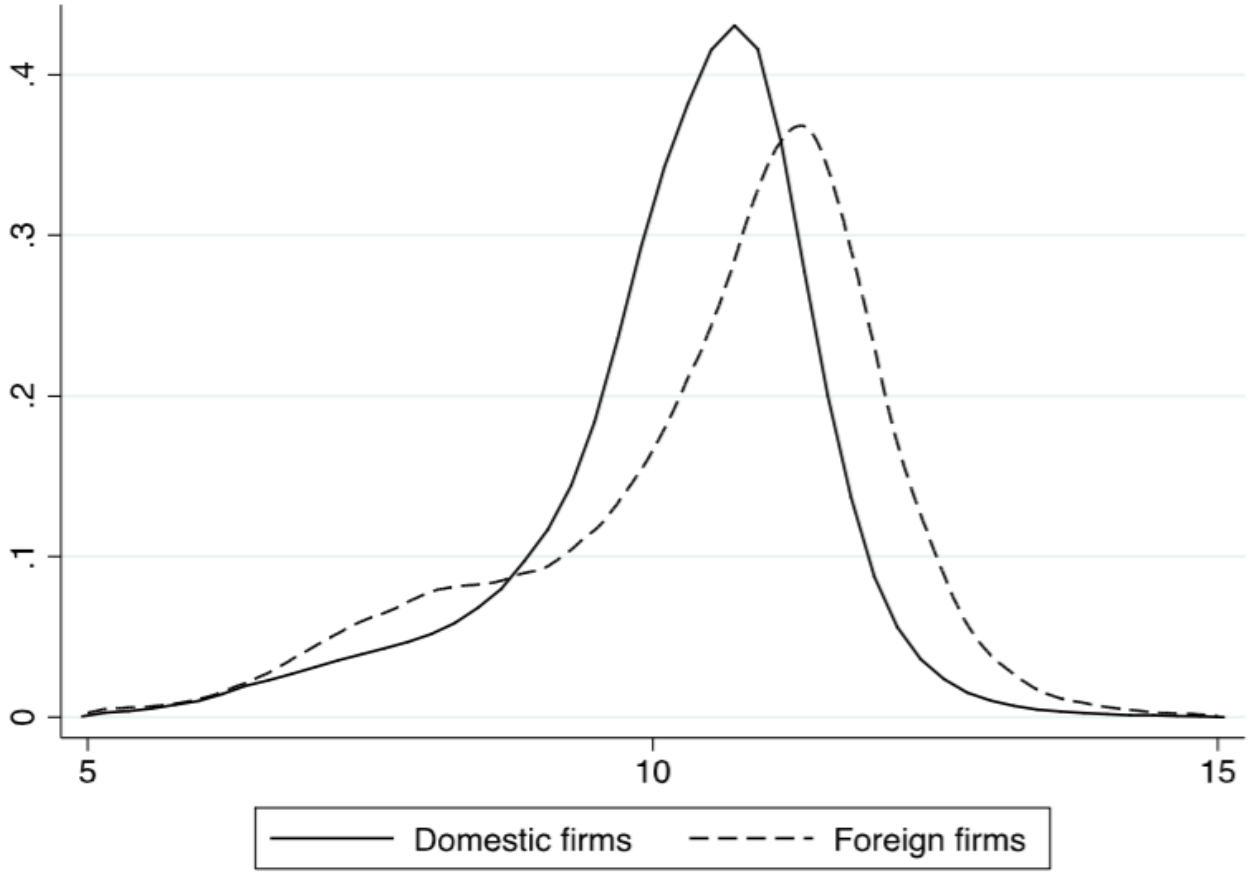


Figure 2.10: *WLP TFP* distributions for domestic firms - Macro-regions compared.

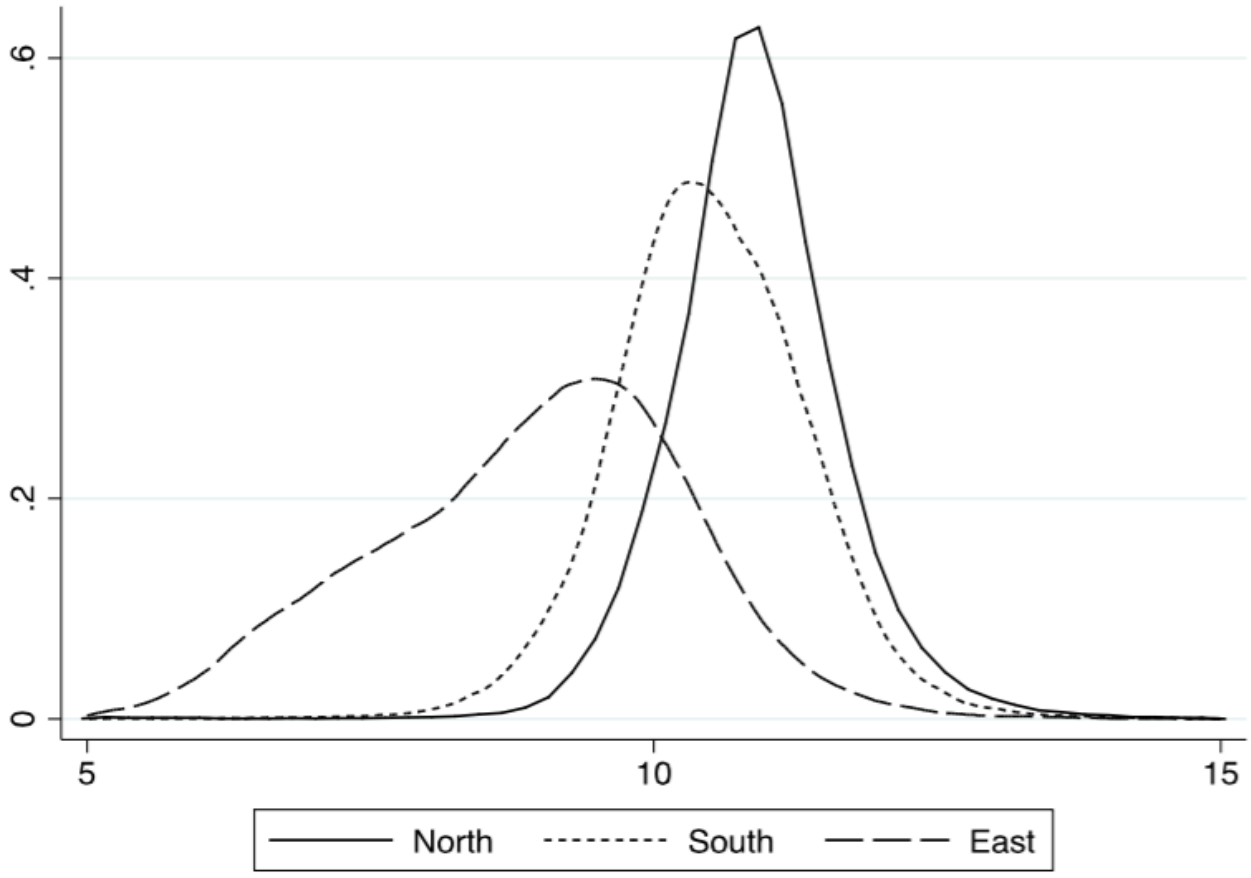
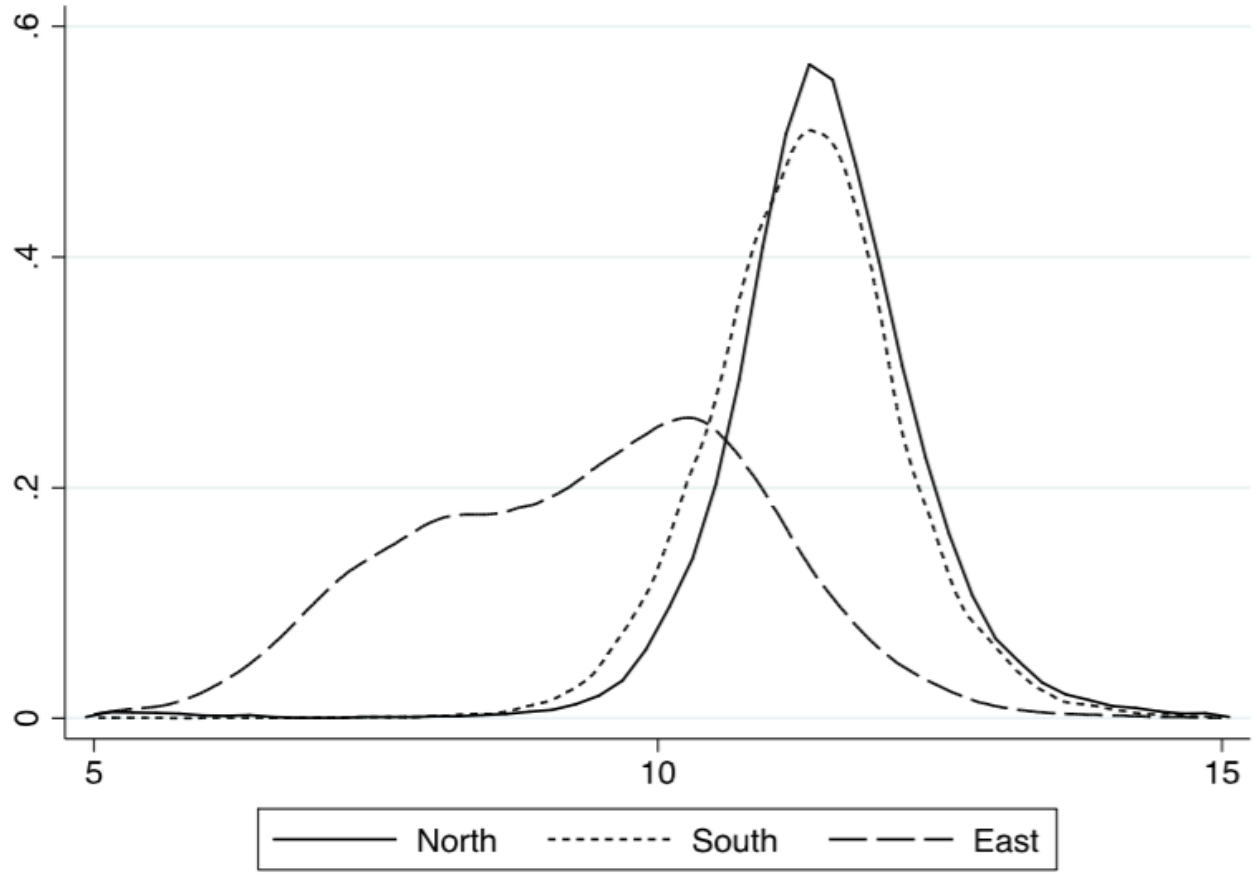


Figure 2.11: *WLP TFP* distributions for foreign firms - Macro-regions compared.



Foreign TFP bonus - Matching and treatment

Europe

Sample	Treated	Controls	Difference	S.E.	T-stat
Unmatched	10.3732	9.9518	0.4214	0.0022	188.79
ATT	10.3732	10.3202	0.0529	0.0037	14.29

Romania

Sample	Treated	Controls	Difference	S.E.	T-stat
Unmatched	7.8135	6.9961	0.8174	0.0037	218.28
ATT	7.8135	7.6370	0.1764	0.0058	30.38