Motivation
○○○○○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Border Regimes and Indirect Productivity Effects from Foreign Direct Investment

Bruno Merlevede - Ghent University
Victoria Purice - Ghent University

GHENT
UNIVERSITY

Motivation
00000

Methodology
00000000

Data
000000

Results
0000000

Conclusion
00

GHENT
UNIVERSITY

# Introduction

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 to affect domestic firms through (positive) indirect/spillover effects
  - ▸ 'knowledge' transfer in a broad sense (e.g. pure technology, but also managerial know-how)

GHENT
UNIVERSITY

# Spillover/Indirect effects

- MNEs expected to affect domestic firms' productivity through positive indirect/spillover effects

  - competition
  - labour cherry picking/turnover
  - imitation
  - managerial and technical assistance

- Spillovers are contained within country of location

GHENT
UNIVERSITY

Motivation
○○○●○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Literature

Combination of 3 strands of literature

- Literature on productivity spillovers from foreign to domestic firms
  - ▸ Country studies using firm-level data
  - ▸ Javorcik (2004), Damijan et al. (2013); Havranek and Irsova (2011)
- Literature on *macro* technology transfer across countries
  - ▸ Decreases with distance, distance effect weakens over time
  - ▸ Keller (2002), Comin, Dmitriev, and Rossi-Hansberg (2012)
- Border effects in trade literature
  - ▸ Within country trade dwarfs cross-border trade
  - ▸ McCallum (1995), Chen (2004), Havranek and Irsova (2015)

GHENT
UNIVERSITY

Motivation
○○○●○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Contribution

- European integration makes EU a more interesting place to invest; should be beneficial to technology investment and dissemination and in the end to growth and convergence

- Extend micro-evidence on productivity spillovers from FDI to cross-border technology spillovers
  - ‣ do they exist
  - ‣ how are they affected by borders?
    - knowledge spillover effects require interaction between firms, so there is potential for border effects
  - ‣ see it as a test of European integration
  - ‣ look at border heterogeneity (Schengen)

GHENT
UNIVERSITY

# Findings

- National borders constitute significant barrier for within industry productivity spillover effects

- National borders dampen cross-border spillover effects through supplier-customer relations

- Size of border impact related to '*depth*' of the border

GHENT
UNIVERSITY

Motivation
00000

Methodology
00000000

Data
000000

Results
0000000

Conclusion
00

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
●○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Measurement

- Measure to proxy foreign presence within industry (*horizontal spillover effects*):

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

- Input-output tables for vertical relationships
- Measures proxying upstream and downstream foreign presence using input-output tables (*forward* and *backward* spillover effects):

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

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

GHENT
UNIVERSITY

# Empirical framework

- Analyse FDI spillovers as additional input explaining total factor productivity (TFP)
- Use the best practice (Havranek and Irsova (2011, JIE))
  - ▸ (1) Obtain firm-level TFP-measure (WLP-methodology by country-industry)
  - ▸ (2) Relate TFP of <u>domestic</u> firms to variables capturing foreign presence ($HR$, $BK$, $FW$) and controls in first differenced specification

$$\Delta TFP_{ijrt} = \psi_1 \Delta f(FDI_{jt-1}) + \psi_2 Z_{it-1} \\ + \alpha_t + \alpha_j + \alpha_r + \epsilon_{ijrt} \tag{4}$$

  - ▸ *Controls*: (firm-level) age, size, initial productivity, initial market share, demand in downstream industries.

GHENT
UNIVERSITY

# Literature consensus

- Javorcik (2004) - Havranek and Irsova (2011, meta study): backward = most important, statistically significant, meaningful in economic terms

    - meta-analysis: $+100$ researchers; $+3600$ estimates

    - 10-percentage-point increase in foreign presence is on average associated with a 3.1% increase in the productivity of domestic firms in upstream sectors

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○●○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Cross-border spillovers

- Introduce variable to capture border effect for firms near the border
  - location of firms at NUTS3 level
  - define 'area of intrest' for domestic firm in region within 75km (using distances between NUTS3 regions)

$$HR_{jt}^{AI} = \frac{\sum_{i \in j, 75km} F_{it} * Y_{it}}{\sum_{i \in j, 75km} Y_{it}} \qquad (5)$$

$$HR_{jt}^{AI} = 0 \text{ if distance above 75km} \qquad (6)$$

GHENT
UNIVERSITY

# Cross-border spillovers

Split the variable in a home and a cross-border component

$$HR_{jt}^{AI} = \frac{\sum_{i \in j, 75km, home} F_{it} * Y_{it}}{\sum_{i \in j, 75km} Y_{it}} + \frac{\sum_{i \in j, 75km, cross-border} F_{it} * Y_{it}}{\sum_{i \in j, 75km} Y_{it}} \quad (7)$$

$$HR_{jt}^{AI} = HR_{jt}^{AI-H} + HR_{jt}^{AI-CB} \quad (8)$$

- backward and forward spillover variables follow

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○●○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Country-level spillovers

Figure: The spillovers region for a firm in Bratislava - countrywide

Motivation
○○○○○

Methodology
○○○○○○○●○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Country-level spillovers



Figure: The spillovers region for a firm in Bratislava - countrywide

Motivation
○○○○○

Methodology
○○○○○○○●

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

# Cross-border spillovers

Figure: The spillovers region for a firm in Bratislava - 75km distance

Motivation
00000

Methodology
00000000

Data
000000

Results
0000000

Conclusion
00

GHENT
UNIVERSITY
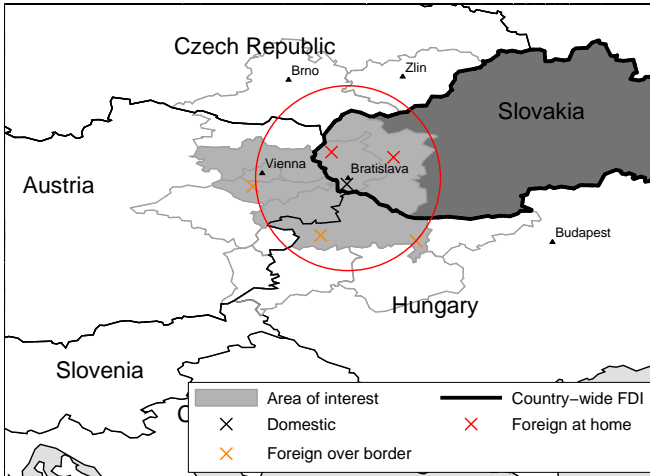
Motivation
○○○○○

Methodology
○○○○○○○○

Data
●○○○○○

Results
○○○○○○○

Conclusion
○○

# Data

- Amadeus Bureau van Dijk firm-level database
- CEEC countries: Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia
- Period: 2000-2010
- Manufacturing firms with 10 employees or more
- Balance sheet data on operating revenue turnover, sales, employment
- Identifier data on location (NUTS3), industry
- Ownership data
- EU-wide IO-tables from Eurostat (2010)

GHENT
UNIVERSITY

# Sample countries

Motivation
00000

Methodology
000000000

Data
00●0000

Results
0000000

Conclusion
00

# Border regions - 75km vs 100 km



GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○○

Data
○○○●○○

Results
○○○○○○○○

Conclusion
○○
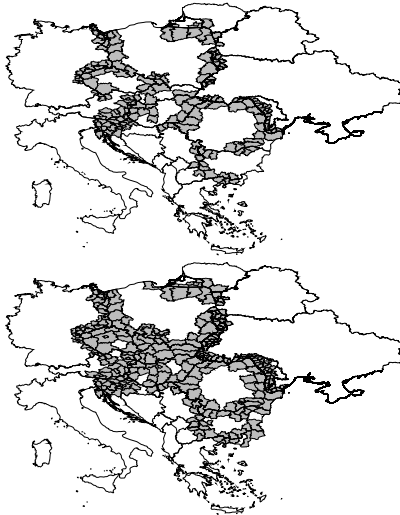
# Firm activity in CEEC border regions

|  | # firm-year in country | | share of firms in border region (75km) | | share of firms in border region (100km) | |
|---|---|---|---|---|---|---|
|  | total | foreign | domestic | foreign | domestic | foreign |
| Bulgaria (BG) | 17,824 | 985 | 27.7 | 32.6 | 50.2 | 45.7 |
| Czech Rep. (CZ) | 97,225 | 2,977 | 47.0 | 45.8 | 94.2 | 95.3 |
| Hungary (HU) | 146,907 | 2,093 | 39.3 | 46.4 | 92.3 | 91.8 |
| Poland (PL) | 118,933 | 9,312 | 22.2 | 21.6 | 33.9 | 32.2 |
| Romania (RO) | 131,993 | 11,056 | 41.6 | 43.3 | 60.3 | 62.3 |
| Slovenia (SI) | 21,413 | 222 | 100 | 100 | 100 | 100 |
| Slovak Rep. (SK) | 24,192 | 676 | 63.5 | 71.2 | 100 | 100 |
|  |  |  |  |  |  |  |
| Total | 558,487 | 27,321 | 40.5 | 37.2 | 71.9 | 68.5 |

GHENT
UNIVERSITY

# Firm activity in neighbouring border regions

|     | border region-75km | | border region-100km | |     | border region-75km | | border region-100km | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|     | total | foreign | total | foreign |     | total | foreign | total | foreign |
| AT | 46,403 | 2,573 | 53,156 | 2,863 | LT | 556 | 28 | 2,631 | 98 |
| BY | 761 | 55 | 1,015 | 70 | MD | 1,747 | 30 | 1,779 | 30 |
| DE | 210,828 | 5,969 | 331,166 | 9,009 | MK | 6,193 | 251 | 6,835 | 268 |
| GR | 4,046 | 6 | 13,379 | 99 | RS | 16,937 | 1,488 | 18,997 | 1,632 |
| HR | 27,966 | 727 | 29,899 | 773 | RU | 2,638 | 86 | 5,598 | 163 |
| IT | 13,970 | 112 | 38,108 | 321 | UA | 7,911 | 66 | 22,569 | 143 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○

Data
○○○○○●

Results
○○○○○○○○

Conclusion
○○

# Summary statistics for manufacturing firms

|  | n | mean | st.dev. | p10 | p50 | p90 |
|---|---|---|---|---|---|---|
| *domestic firms in non-border regions* | | | | | | |
| ln(output) | 114,905 | 13.76 | 2.24 | 10.87 | 13.98 | 16.37 |
| # employees | 92,403 | 125.8 | 303.1 | 15 | 49 | 275 |
| ln(TFP) | 80,738 | 8.81 | 1.58 | 6.59 | 9.00 | 10.72 |
| *domestic firms in border regions* | | | | | | |
| ln(output) | 80,462 | 13.82 | 2.25 | 10.88 | 14.02 | 16.49 |
| # employees | 69,635 | 132.9 | 337.8 | 15 | 45 | 300 |
| ln(TFP) | 65,234 | 8.93 | 1.55 | 6.65 | 9.23 | 10.72 |
| *foreign firms in non-border regions* | | | | | | |
| ln(output) | 12,068 | 15.04 | 2.41 | 11.71 | 15.34 | 18.00 |
| # employees | 10,873 | 278.8 | 647.6 | 19 | 109 | 658 |
| ln(TFP) | 9,483 | 9.33 | 1.72 | 6.97 | 9.57 | 11.43 |
| *foreign firms in border regions* | | | | | | |
| ln(output) | 6,565 | 14.87 | 2.48 | 11.55 | 15.11 | 17.92 |
| # employees | 6,194 | 320.6 | 739.7 | 21 | 125 | 750 |
| ln(TFP) | 5,873 | 9.18 | 1.69 | 6.95 | 9.31 | 11.27 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

GHENT
UNIVERSITY

## Average cross-border effects

|                | (1) | (2) | (3) | (4) | (5) |
|----------------|-----|-----|-----|-----|-----|
| *within country* |     |     |     |     |     |
| horizontal     | 0.017 | 0.017 | 0.016 | 0.005 | 0.005 |
|                | [0.017] | [0.017] | [0.017] | [0.017] | [0.017] |
| backward       | 0.387*** | 0.387*** | 0.389*** | 0.326*** | 0.326*** |
|                | [0.111] | [0.111] | [0.111] | [0.112] | [0.113] |
| *cross-border* |     |     |     |     |     |
| horizontal     |     | 0.069 | 0.067 | 0.039 | 0.044 |
|                |     | [0.050] | [0.049] | [0.049] | [0.050] |
| backward       |     | 0.637*** | 0.640*** | 0.519** | 0.549** |
|                |     | [0.219] | [0.216] | [0.210] | [0.220] |
| N              | 105,968 | 105,968 | 105,968 | 105,968 | 105,968 |
| R-squared      | 0.085 | 0.086 | 0.089 | 0.104 | 0.105 |
| Year FE        | Y | Y | Y | Y | Y |
| Industry FE    |     |     | Y | Y | Y |
| Country FE     |     |     |     | Y |     |
| Region FE      |     |     |     |     | Y |
| *F*-tests $BK^{AoI-WC}=BK^{AoI-CB}$ |     |     |     |     |     |
|                |     | 1.02 | 1.05 | 0.65 | 0.80 |
|                |     | [0.314] | [0.306] | [0.420] | [0.371] |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○●○○○○○○

Conclusion
○○

# Border heterogeneity

# Overview of border regimes in 2000-2010

| Country | Partner | EU | Schengen | Country | Partner | EU | Schengen |
|---------|---------|------|----------|----------|----------|------|----------|
| Bulgaria | Greece | 2007 | - | Poland | Belarus | - | - |
| Bulgaria | Macedonia | - | - | Poland | Germany | 2004 | 2007 |
| Bulgaria | Romania | 2007 | - | Poland | Lithuania | 2004 | 2007 |
| Bulgaria | Serbia | - | - | Poland | Russia | - | - |
| | | | | Poland | Slovakia | 2004 | 2007 |
| Czech Rep. | Austria | 2004 | 2007 | Poland | Ukraine | - | - |
| Czech Rep. | Germany | 2004 | 2007 | | | | |
| Czech Rep. | Poland | 2004 | 2007 | Romania | Moldova | - | - |
| Czech Rep. | Slovakia | 2004 | 2007 | Romania | Serbia | - | - |
| | | | | Romania | Ukraine | - | - |
| Hungary | Austria | 2004 | 2007 | | | | |
| Hungary | Croatia | - | - | Slovakia | Austria | 2004 | 2007 |
| Hungary | Romania | 2007 | - | Slovakia | Ukraine | - | - |
| Hungary | Slovakia | 2004 | 2007 | | | | |
| Hungary | Slovenia | 2004 | 2007 | Slovenia | Austria | 2004 | 2007 |
| Hungary | Serbia | - | - | Slovenia | Croatia | - | - |
| Hungary | Ukraine | - | - | Slovenia | Italy | 2004 | 2007 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○○

Data
○○○○○○

Results
○○○○●○○○

Conclusion
○○

# Trade and Border Agreements

|  | EU accession | Schengen | EU & Schengen | |
|---|---|---|---|---|
| **BACKWARD** | | | | |
| AoI - Within Country | 0.324*** | 0.326*** | 0.324*** | 0.324*** |
|  | [0.113] | [0.113] | [0.113] | [0.113] |
| **AoI - Cross-border** | | | | |
| EU border | 0.776*** | | | |
|  | [0.180] | | | |
| Schengen area border | | 1.199*** | | |
|  | | [0.324] | | |
| EU border | | | | |
| *before entry* | | | | 0.023 |
|  | | | | [0.318] |
| *after entry, before Schengen* | | | 0.605*** | 0.603*** |
|  | | | [0.188] | [0.191] |
| *after Schengen* | | | 1.335*** | 1.329*** |
|  | | | [0.306] | [0.306] |
| other border | 0.128 | 0.378* | 0.004 | 0.171 |
|  | [0.316] | [0.203] | [0.305] | [0.905] |
| Observations | 105,968 | 105,968 | 105,968 | 105,968 |
| R-squared | 0.105 | 0.105 | 0.105 | 0.105 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○○

Data
○○○○○○

Results
○○○○●○○

Conclusion
○○

# Backward spillovers - selected differences in border types

|  | F-value | p-value |
|---|---|---|
| EU effects | | |
| EU border = non EU border | 5.58 | 0.0182 |
| | | |
| Schengen effects | | |
| Schengen border = non Schengen border | 7.87 | 0.0051 |
| | | |
| EU & Schengen effects | | |
| after EU, before Schengen= after Schengen | 6.13 | 0.0134 |
| | | |
| before EU=after EU, before Schengen | 3.94 | 0.0474 |
| before EU=after Schengen | 11.22 | 0.0008 |
| after EU, before Schengen=after Schengen | 6.06 | 0.0139 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○○

Data
○○○○○○

Results
○○○○○●○

Conclusion
○○

# Robustness - alternative specifications

| | base-line | at least 7 obs | only border regions | BK only | country-wide | *CB only* |
|---|---|---|---|---|---|---|
| **BACKWARD** | | | | | | |
| AoI - Within Country | 0.324*** | 0.414*** | 0.724*** | 0.327*** | 0.605*** | |
| | [0.113] | [0.123] | [0.261] | [0.111] | [0.102] | |
| EU border | | | | | | |
| *before entry* | 0.023 | 0.108 | 0.056 | 0.071 | 0.008 | 0.011 |
| | [0.318] | [0.299] | [0.323] | [0.303] | [0.312] | [0.320] |
| *after entry, before Schengen* | 0.603*** | 0.562*** | 0.569*** | 0.531*** | 0.626*** | 0.608*** |
| | [0.191] | [0.211] | [0.187] | [0.192] | [0.192] | [0.195] |
| *after Schengen* | 1.329*** | 1.440*** | 1.303*** | 1.494*** | 1.172*** | 1.332*** |
| | [0.306] | [0.366] | [0.332] | [0.304] | [0.307] | [0.312] |
| | | | | | | |
| other border | 0.171 | -0.108 | 0.299 | 0.255 | 0.306 | 0.146 |
| | [0.905] | [0.950] | [0.970] | [0.941] | [0.965] | [0.893] |
| | | | | | | |
| Observations | 105,968 | 85,832 | 50,364 | 105,968 | 105,968 | 105,968 |
| R-squared | 0.105 | 0.115 | 0.106 | 0.105 | 0.106 | 0.105 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○○

Data
○○○○○○

**Results**
○○○○○○○●

Conclusion
○○

## Robustness - distance

| | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 |
|---|---|---|---|---|---|---|---|---|---|
| BACKWARD | | | | | | | | | |
| AoI - Within Country | 0.299*** | 0.324*** | 0.284*** | 0.305*** | 0.328*** | 0.374*** | 0.351*** | 0.357*** | 0.317*** |
| | [0.110] | [0.113] | [0.109] | [0.106] | [0.107] | [0.111] | [0.112] | [0.117] | [0.118] |
| EU border | | | | | | | | | |
| *before entry* | -0.092 | 0.023 | -0.246 | -0.201 | -0.047 | -0.057 | -0.059 | 0.015 | -0.021 |
| | [0.292] | [0.318] | [0.341] | [0.365] | [0.300] | [0.304] | [0.306] | [0.285] | [0.294] |
| *after entry, before Schengen* | 0.731*** | 0.603*** | 0.308 | 0.394* | 0.446** | 0.343* | 0.404* | 0.453** | 0.206 |
| | [0.153] | [0.191] | [0.206] | [0.211] | [0.193] | [0.208] | [0.208] | [0.207] | [0.228] |
| *after Schengen* | 1.602*** | 1.329*** | 1.095*** | 1.302*** | 1.430*** | 1.395*** | 1.482*** | 1.556*** | 1.378*** |
| | [0.346] | [0.306] | [0.265] | [0.285] | [0.285] | [0.277] | [0.297] | [0.308] | [0.295] |
| other border | -0.181 | 0.171 | -0.134 | -0.335 | -0.478 | -0.308 | -0.522 | -0.920 | -1.056 |
| | [0.584] | [0.905] | [0.629] | [0.547] | [0.602] | [0.459] | [0.445] | [0.564] | [0.682] |
| Observations | 105,968 | 105,968 | 105,968 | 105,968 | 105,968 | 105,968 | 105,968 | 105,968 | 105,968 |
| R-squared | 0.107 | 0.105 | 0.104 | 0.103 | 0.104 | 0.104 | 0.104 | 0.103 | 0.103 |

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○○

**1**  Motivation

**2**  Methodology

**3**  Data

**4**  Results

**5**  Conclusion

GHENT
UNIVERSITY

Motivation
ooooo

Methodology
oooooooo

Data
oooooo

Results
ooooooo

Conclusion
●o

# Conclusion

Productivity spillovers from FDI in multi-country firm-level dataset for 7 CEECs

- country-level spillovers exist and largely confirm earlier findings for single country setting (backward)

- national borders (significantly) dampen cross-border backward spillover effects
    - cross-border backward spillover effects do exist, but ...
    - size of border impact seems related to '*depth*' of the border: EU-accession, Schengen agreement matter for existence and size of effects

GHENT
UNIVERSITY

Motivation
○○○○○

Methodology
○○○○○○○○

Data
○○○○○○

Results
○○○○○○○

Conclusion
○●

Thank you.

GHENT
UNIVERSITY