Multinational Enterprises and Technology Frontier: Productivity and Competitiveness in Central Europe

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Main puzzle: Did FDI improve industrial performance in Central Europe? What role did technology play in this?

Main thesis 1: FDI had a significant productivity impact on the high-tech, but no impact on the low-tech sector.

Main thesis 2: FDI had a positive dynamic impact on high-tech’s productivity, static impact was negative.

Secondary question 1: Was impact on competitiveness different than on productivity?

Secondary question 2: Did R&D at local firms affect productivity and competitiveness?
Definitions

- **FDI**-any foreign investment, not just MNEs
- **Central Europe**-Czech Rep., Hungary, Poland
- **Productivity**-value added per worker in sector
- **Competitiveness**-value added per wage costs
- **Static impact**-same-year
- **Dynamic impact**-one year lag
- **High-tech**-cars, electronics, machinery, chemicals
- **Low-tech**-foodstuffs, textiles, lumber, metals
- **Industries**-no services, white collar jobs
- **R&D**-local business, not academia, government
Main results

- For high-tech, negative same-year and positive one-year lagged impact of FDI on productivity
- For low-tech, no statistically significant results.
- No statistically significant impact of FDI on competitiveness, especially for high-tech.
- Significant impact of local business R&D on productivity of high-tech and competitiveness of low-tech, but no impact vice versa.
- Knowledge intensity matters for performance.
Outline of presentation

- Motivation
  - Policy and strategy implications
  - Big picture
  - World technology frontier
- Literature review
- Analytical framework
- Empirical exercise
- Summary
Policy & Strategy Implications

- Which (if any) foreign investors should governments subsidize because of positive spillovers to the host economy *(Investment incentives debate)*

- Which types of production (and for how long) should multinationals locate in emerging economies to stay globally competitive *(Outsourcing/offshoring debate)*
Big picture

We have moved beyond **geographic borders**
- Rise of multinationals (1945-1989)
- National vs multinational firms

We have moved beyond **firm boundaries**
- Alliance revolution (1990-2000)
- Firms vs markets

We may move beyond **technology frontiers**
- Offshoring/outsourcing (2001-present)
- Headquarters vs subsidiaries
World technology frontier

- Caselli and Coleman (2000)
- On the frontier, increases in efficiency of unskilled labor are achieved at the cost of a declining efficiency of skilled labor
- Poor countries may be stuck inside the frontier
- Multinationals may have helped Central Europe to move outside world technology frontier by increasing efficiency of skilled labor
- Emerging countries became developed
Outline of presentation

- Motivation
- Literature review
  - Relevant literature
  - Most relevant papers
  - New contributions
- Analytical framework
- Empirical exercise
- Summary
Relevant literature

Development economics
- Innovation & development

Political economy of FDI
- Host country effects of FDI

International business
- Strategy in emerging economies

Industrial organization
- Industry dynamics & technology
Most relevant papers

- **Kosova (2004)** - found FDI had a negative short-run impact on local firms’ sales and increased exit; over time the impact was opposite in the Czech Rep (CR).
- Her findings were robust across subsamples but the primary beneficiaries of technology spillovers were firms in more technologically advanced industries.
- **Keller and Yeaple (2002)** - using firm-level data for the US, found statistically significant positive impact of FDI on productivity of high-tech, not low-tech.
- The finding for high-tech held for no & one year lag.
- **Kinoshita (2001)** found no spillovers in CR; when FDI was interacted with local firms’ R&D, he got it.
New contributions

Theoretical front
- Estimation of host country effects of FDI must take into account *productivity* and *competitiveness*.
- We need to model both *firm growth* and *exit*.

Empirical front
- Productivity spillovers occur only in *high-tech* (different than Kosova ’04, same as Keller et al ‘02).
- Spillovers are negative in the *short-run* (different than Keller et al ’02, consistent with Kosova ‘04).
Outline of presentation

- Motivation
- Literature review
- Theoretical framework
  - Conceptual framework
  - Analytical framework
  - Theoretical model
- Empirical exercise
- Summary
## Impact of multinational enterprises on performance of manufacturing sectors

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<th>Productivity</th>
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<td>Technology spillovers</td>
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Static crowding out

FIGURE 1: Dominant firm and competitive fringe
Dynamic crowding out

\[ E(\pi_t) = [ p_t \, q_t - C(q_t) \, T_t \, E(x_t) ] \] (1)

Local firm in competitive fringe chooses output \( q_t \) to max expected profit
\( p_t \) - price sequence known by all firms in \( t=0 \); \( C(q_t) \, T_t \, E(x_t) \) - total costs
\( T_t \) - firm technology level (cumulated value of all technology shocks \( u_t \))
\( E(x_t) \) - inverse of expected production efficiency (firms learn about this)

\[
\frac{(q_{t+1}^* - q_t^*)}{q_t^*} = k \cdot \left\{ \left[ \frac{(p_{t+1} - p_t)}{p_t} \right] - \frac{E(x_{t+1}) - E(x_t)}{E(x_t) + u_{t+1}} \right\} \] (2)

\( q_t^* \) - optimal output choice; \( q_t \) chosen before \( x_t \) observed but after \( u_t \)
Firm growth rate increases with larger prices and positive technology shock but decreases with firm’s expected inefficiency
Domestic firm exit and growth

\[ g = g_s P_s + g_{\text{exit}} (1 - P_s) = g_s P_s - (1 - P_s) \] (3)

Besides choosing an output every period, a fringe firm also decides whether to stay or exit. \( g \) – firm expected growth rate with exit choice; \( g_s \) – mean growth rate of surviving firms; \( g_{\text{exit}} \) – mean growth rate of exiting firms (-1); \( P_s \) – probability that a randomly drawn firm will survive.

Under the DF/CF industry structure, growth rate of a local firm is negatively related to \( \frac{Q^d_{t+1} - Q^d_t}{Q^d_t} \) (rise in output of dominant firm) and local firm age & size, positively related to technology shock.

\[
\frac{q^*_{t+1} - q^*_t}{q^*_t} = -k m_t \left[ \frac{(Q^d_{t+1} - Q^d_t)}{Q^d_t} \right] \\
- k(\text{age}_t, \text{size}_t) + k u_{t+1} + \text{ind} \times \text{trend} \] (4)
Technology shock and spillovers

- How foreign output expansion affects domestic output and survival over time depends also on exogenous shifts in market demand $D(p)$, technology spillover effects.

- While crowding out occurs via changes in prices associated with foreign output changes, technology spillovers enter via exogenous shock $u_{t+1}$ (that can be estimated empirically).
Conclusions of the model

- The model predicts that higher foreign growth rates decrease growth and increase exit rates of domestic firms in the short run.
- To test empirically whether this "crowding out" effect is also dynamic, one can introduce into the equations for growth and exit dummies for the year of foreign entry into a particular industry.
- How exogenous technology spillovers and endogenous crowding out effects play against each other also has to be estimated empirically.
Outline of presentation

- Motivation
- Literature review
- Theoretical framework
- Empirical exercise
  - Data
  - Estimation framework
  - Results
- Summary
Data

- All data sources from OECD Databases
- Industry-level FDI per worker, value added per worker, value added per total wage costs
- Nation-level R&D in local businesses
- Czech R., Hungary, Poland, 1994-2000
- Total 76 annual observations
- 40 in “low-tech” and 36 in “high-tech” sectors
- “High-tech” clustered according to R&D intensity in FDI source countries (G-7)
Estimation framework

\[ \Delta \text{Value added per worker} = \alpha + \beta_1 \Delta \text{FDI} + \]
+ \( \beta_2 \Delta \text{FDI}_\text{LAG} + \beta_3 \Delta \text{R&D} + \beta_4 \Delta \text{FDI} \times \text{R&D} + \]
+ \( \beta_5 \Delta \text{FDI} \times \text{R&D}_\text{LAG} + \epsilon \)

\[ \Delta \text{Value added per total wages} = \alpha + \beta_1 \Delta \text{FDI} + \]
+ \( \beta_2 \Delta \text{FDI}_\text{LAG} + \beta_3 \Delta \text{R&D} + \beta_4 \Delta \text{FDI} \times \text{R&D} + \]
+ \( \beta_5 \Delta \text{FDI} \times \text{R&D}_\text{LAG} + \epsilon \)
### Same-year impact of FDI on sectors

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### One-year lagged impact of FDI

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## Impact of R&D on performance

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Outline of presentation

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- Literature review
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- Summary
  - Key results
  - Limitations
  - Implications
Key results

- **Main thesis 1**: FDI had a significant productivity impact on the high tech, but no impact on the low-tech sector.

- **Main thesis 2**: FDI had a positive dynamic impact on high-tech’s productivity, static impact was negative.

- **Secondary question 1**: Did FDI’s impact on competitiveness & productivity differ?

- **Secondary question 2**: Did R&D at local firms affect productivity and competitiveness of high-tech and low-tech differently?
Limitations

- Small data set puts all results in question
- Endogeneity issues potentially severe
- Clustering of industries somewhat ad hoc
- National-level R&D distorts interaction terms
- Definitions of performance not rigorous
- One-year lag insufficient to capture dynamics
- Impact on industry & on local firms may differ
- Model not perfectly integrated with empirics
Implications for further research

- Reconsider country coverage and obtain a better data set—firm level data on one of Central European countries, industry level on all OECD, data on firm linkages (World Bank data on linkages and competitiveness in China)
- Reconsider whether you can analyze productivity and competitiveness within one analytical framework
- Reconsider whether you want to focus both on policy and strategy implications