FDI and OECD Industry Productivity: Technology, Capital and Country Size

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Outline

- Introduction/Motivation
- Main findings/Related literature
- Data/Estimation framework
- Estimation results/Analysis
- Conclusions/Implications
- Avenues for further research
Introduction

- Impact of FDI on productivity, 1987-2003 (capital deepening and TFP)

- 5 groups of major industrial sectors ("high-tech" and "low-tech")

- 11 OECD economies (Western Europe plus the Czech Republic, USA and Canada: "large" and "small" countries)
Empirical Motivation

- McKinsey Global Institute Study on Productivity of US Auto Industry
- World Investment Report 2005: Internationalization of R&D
Insights from the studies

- **Capital deepening** made 10% of US auto industry’s labor productivity growth in ‘87-‘96, but 60% in ‘97-‘02, when K/L ratio increased by 40% (McKinsey 2005)

- Foreign ownership had a negative impact on **R&D activity** in the Czech electronics sector, economy (UNCTAD, Srholec 2005)
Main Hypotheses

1. Does high-tech benefit more from FDI?
2. Does FDI affect capital deepening more?
3. Do large countries benefit from FDI more?
Previous Findings

- Individual country FDI studies inconclusive on where do productivity spillovers exist:
  - more evidence for high-tech, TFP

- Cross section studies disagree on existence of overall FDI spillovers:
  - more evidence for small countries
Related Literature

Cross-section studies of many countries
- Bitzer, Görg and Kerekes (2005)
- Van Pottelsberghe and Lichtenberg (2001)

FDI spillovers studies for one country
- Keller and Yeaple 2003 (US)
- Aghion et al 2006, Haskel et al 2002 (UK)
- Kosova 2005, Kinoshita 2001 (Czech R.)
- Benfratello, Sembenelli 2005 (Italy)
My Main Results

FDI has a significant positive effect on:

1. High-Tech
2. Capital Deepening
3. Large Countries
Theories: high-tech and low-tech

- Distance from technological frontier
- Foreign=technologically advanced entry?
Theories: capital and productivity

- Solow’s growth model
- **TFP: Solow’s residual**
- Productivity Growth = TFP Growth?
Theories: large vs small countries

- Markusen (2002)
- Horizontal/vertical FDI
- Vertical FDI = High R&D = Small Countries?
Figure 1.4. R&D expenditure by affiliates abroad as a percentage of domestic R&D expenditure, 2001

2. Manufacturing sector only.
Data

- Source: OECD

- 11 countries, 5 groups of industrial sectors (21 two-digit ISIC sectors), 1987-2003

- 459 observations, unbalanced panel
Perpetual inventory method

- Stocks as distributed lag of past flows
- Using depreciation rate of 15%
- $K$ is the stock, $i$ is flow
- Used to calculate capital and R&D stock

$$K_{cjt} = \sum_{n=1970}^{t} (1 - \delta)^{n-1970} i_{c,j,t-(n-1970)}$$
FDI Stock/Gross Capital Formation

FDI / Capital Stock

- Czech
- UK
- US
- Finland
- Norway
- France
- Denmark
- Italy
- Netherlands
- Canada
- Germany
UNCTAD Estimates of FDI/Capital Stock

Source: UNCTAD, FDI/TNC database.
Estimation equation 1

\[
\ln Y_{jct} = \alpha + \beta \ln K_{jct} + \gamma \ln L_{jct} + \delta \ln M_{jct} + \\
\theta \ln R&D_{jct} + \tau \ln FDI_{jct} + \\
\sigma \ln FDI^{*} \text{Dummy (HT, LT, SM, LA)}_{jct} + \\
y_j + \mu_c + \iota_t + \varepsilon_{jct}
\]
Estimation equation 2

\[
\ln K_{jct} / L_{jct} = \alpha + \beta \ln \text{R&D}_{jct} + \gamma \ln \text{FDI}_{jct} \\
+ \delta \ln \text{FDI}^*\text{Dummy (HT, LT, SM, LA)}_{jct} \\
+ u_j + \mu_c + I_t + \epsilon_{jct}
\]
\[ \ln \frac{Y_{jct}}{K_{jct}} = \alpha + \beta \ln R&D_{jct} + \gamma \ln FDI_{jct} \]
\[ + \delta \ln FDI^* \text{Dummy (HT, LT, SM, LA)}_{jct} \]
\[ + u_j + \mu_c + \iota_t + \epsilon_{jct} \]
Estimation equation 4

\[
\ln \frac{Y_{jct}}{L_{jct}} = \alpha + \beta \ln R&D_{jct} + \gamma \ln FDI_{jct} \\
+ \delta \ln FDI^*Dummy (HT, LT, SM, LA)_{jct} \\
+ u_j + \mu_c + \iota_t + \epsilon_{jct}
\]
### FGLS Estimation Results: High-Tech and Capital

<table>
<thead>
<tr>
<th></th>
<th>Ln FDI</th>
<th>Ln R&amp;D</th>
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<th>Ln R&amp;D</th>
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<tbody>
<tr>
<td>Low-Tech</td>
<td>-.029*** (0.008)</td>
<td>.093*** (0.022)</td>
<td>-.061*** (0.018)</td>
<td>.258*** (0.015)</td>
<td>-.526*** (0.045)</td>
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<td>-.061*** (0.018)</td>
</tr>
<tr>
<td>High-Tech</td>
<td>.061*** (0.018)</td>
<td>.258*** (0.015)</td>
<td>.186*** (0.040)</td>
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**Result 1**

**Result 2**
### FGLS Estimation Results:

<table>
<thead>
<tr>
<th>Large Countries</th>
<th>Large States</th>
<th>Small States</th>
<th>Large States</th>
<th>Small States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln FDI</td>
<td>-.117***</td>
<td>-.141***</td>
<td>.326***</td>
<td></td>
</tr>
<tr>
<td>Ln R&amp;D</td>
<td>.045**</td>
<td>.095***</td>
<td>-.217***</td>
<td></td>
</tr>
<tr>
<td>Ln Y</td>
<td>.141***</td>
<td>-.141***</td>
<td>-.326***</td>
<td></td>
</tr>
<tr>
<td>Ln Y/L</td>
<td>.095***</td>
<td>(.029)</td>
<td>(.041)</td>
<td></td>
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<tr>
<td>Ln Y/K</td>
<td>(.018)</td>
<td>(.029)</td>
<td>(.015)</td>
<td></td>
</tr>
</tbody>
</table>

Note: *p < 0.1, **p < 0.05, ***p < 0.01, ****p < 0.001.
Limitations of the Results

- Quantify the impact on capital deepening
- Distinguish between market-seeking, efficiency-seeking, knowledge-seeking FDI
- Industry-level data and stock variables reduce but don’t erase endogeneity issues
Conclusions

- In high-tech sectors and large OECD economies, FDI increases productivity;
capital accumulation can be key to growth.

- Low-tech (in small countries also other sectors) may not benefit much from FDI in terms of R&D and productivity spillovers.
Implications: Business Strategy

In high-tech and large countries, foreign entry is an opportunity for learning and global competitiveness, but wise capital investments are needed for productivity.
US automotive industry, 1997-2002

- **Automation** (started in early 90s)
- Changes in physical plants required for implementation of lean production
- The upgrading of plants needed for producing **new models of SUVs**
- Non-US original equipment manufacturers’ (OEMs)—construction of new plants
- OEM outsourcing—it encouraged investments by the parts sector
Implications: Economic Policy

Facilitate the reallocation of factors and resources from less to more technologically developed industries that react more positively to foreign entry.
Czech electronics and automotives

- In electronics industry, R&D intensity of foreign affiliates lower than that of locals
- Contract manufacturing plants of Flextronics and LG Philips left recently
- In auto industry, R&D intensity of both foreign and domestic firms at OECD levels
Further improvement, research

- Better **estimates of stocks**, FDI (UNCTAD)
- Better estimates of **shares of capital deepening & TFP on productivity changes**
- BEA Data on **US FDI and FDI in US**
- Hausmann & Sturzenegger’s hypothesis: undervalued know-how and **higher productivity of US FDI**
- Small and large countries: Differences in **FDI and R&D patterns**