ICT and Productivity: How Strong is the Link Really?

Bart van Ark
University of Groningen
and The Conference Board

OECD Joint WPIIS-WPIE Workshop
“The economic and social impacts of broadband communications:
From measurement to policy implications”
Session: The Productivity Impacts

22 May 2007
DTI Conference Centre, London

The EU KLEMS project is funded by the European Commission, Research Directorate General as part of the 6th Framework Programme, Priority 8, "Policy Support and Anticipating Scientific and Technological Needs".
Common Wisdom

- ICT is a major vehicle in supporting productivity growth.
- Differences in ICT production intensity drive part of growth differential between countries.
- ICT investment intensity have strongly converged across countries.
- The key to long run growth differential is productive use of ICT, in particular in services.
- Productive use of ICT requires:
  - Strong skill complementarity.
  - A conducive regulatory environment.
  - Organizational capabilities linked to intangible investment.
- Europe has problems to exploit ICT’s productivity benefits compared to other parts of the world.
Some key findings from EU KLEMS Project

- **Productivity convergence halted both across European countries as well as relative to US**
  - Mainly driven by developments in market services
  - Investment in ICT and skills are important, but
  - ….recent divergence is driven by MFP growth

- **Drivers of MFP growth not well understood**
  - Returns to skills and ICT investment appear captured by investor
  - At industry level regulatory practice has no clear impact on MFP

- **Measurement matters!!**
  - Detailed accounting of labor and capital measurement
  - Output measurement in services
  - Measurement of intangibles
Market services are main source of growth differentials across Europe and relative to US

Industry decomposition of market economy labour productivity growth, 1995-2004

- Market services
- Other industries
ICT investment contributes to labour productivity growth market services, 1995-2004

LP growth

ICT capital deepening contribution
Complementarity with labour composition is strong
Non-ICT Capital Deepening Matters Less for Fast Growers

LP growth

Non-ICT capital deepening contribution
ICT capital deepening contribution
Labour composition change contribution
... but MFP contribution makes the biggest difference between fast and slow growers
How to unravel the “mystery” of MFP growth differentials?

Unconditional convergence:

\[ \Delta \ln MFP^i = \beta \ln \left( \frac{MFP^F}{MFP^i} \right) \]

Following Griffith et al. 2000

Conditional convergence:

\[ \Delta \ln MFP^i = \beta \ln \left( \frac{MFP^F}{MFP^i} \right) + \gamma Z + \delta Z \cdot \ln \left( \frac{MFP^F}{MFP^i} \right) \]

Following Griffith et al. 2000
Crude level measures show US leading in market services MFP

Crude measure: value added, GDP PPPs, persons engaged, capital stocks
...but detailed EU KLEMS MFP level measures show U.S. is not always leading

Crude measure: value added, GDP PPPs, persons engaged, capital stocks
Detailed: gross output, output & inputs PPPs, hours by type, capital services
Unconditional convergence of MFP levels in market services ended after 1995

Standard deviation of MFP levels relative to the leading country, average across market services, 1980-2004
ICT: no additional impact on MFP growth since 1995

Explanatory variable: Contribution of ICT to output growth

<table>
<thead>
<tr>
<th>Period</th>
<th>MFP gap</th>
<th>Variable</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-2004</td>
<td>0.017***</td>
<td>-0.381</td>
<td>-0.056</td>
</tr>
<tr>
<td>1980-1995</td>
<td>0.029***</td>
<td>0.006</td>
<td>-0.496</td>
</tr>
<tr>
<td>1995-2004</td>
<td>-0.003</td>
<td>-1.039*</td>
<td>-1.229</td>
</tr>
</tbody>
</table>

Also no explanatory value at industry level when using skills or regulations as variables.
Research priorities

Heterogeneity between industries
- Variable lags and interactions in effects of ICT, skills, and regulation
- Growth accounts provide starting point/benchmark but need to understand subtleties of drivers of productivity at industry level (retail, finance)

Firm-level heterogeneity and impact on industry level results
- How does firm level heterogeneity drive industry level differentials?
- What is impact of scale effects?
- How do regulations affect firm dynamics?

Measurement issues are key:
- Are we measuring input with sufficient detail?
- How big are the measurement problems, in particular for services output?
- Need to explicitly measure intangibles
We need to keep challenging the common wisdom

收支对研究的启示：
- 投资在ICT和技能是重要的，但如果没有对MFP的额外影响，投资的回报似乎被投资者捕获。
- 规则与MFP差异的联系仍然很弱（Nicoletti/Scarpetta和他人）。
- 重要的是要有详细输入和行业水平生产力的衡量。

政策含义
- 行业水平政策的基础是什么？
- 应该集中在优化宏观投资氛围上吗？
- ...或者应该集中在识别企业水平的多样性上？