A Comparative Perspective on Technology Regimes and Productivity Growth in Europe and the US: Discussion
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Overview
- The story thus far
  - Diffusion of GPTs leads to productivity growth over very long periods
  - Historical examples, but measurement difficult
- This paper
- Measurement

The paper
- Compare
  - Three eras when a major technology diffused
    - steam, electricity, ICT
  - Two regions: US and Europe
- Look at effects of GPT diffusion on productivity growth
  - Economy wide
  - By industry

Conclusions
- Steam diffusion “mushroomlike”
  - prod growth concentrated in a few sectors, at least in UK and Netherlands
- Electricity diffusion “yeastlike”
  - Spread through all industries
  - Induced faster prod growth in US than in Europe, but cross-industry pattern similar
  - Institutional as well as industry structure differences

ICT diffusion
- Analysis differs from earlier
  - More and better data (deflation; sectors)
- Looks more like mushrooms than yeast? I am sceptical…..
- ICT contribution to growth roughly the same in Europe as in US
- Non-ICT much lower
- ICT-using service industries in Europe have slower labor productivity growth
  - Is it because ICT makes no contribution here?
  - Or because these industries differ in other ways?

Growth accounting
\[ TFP = g_Y - s_L g_L - s_K g_K - s_I g_I \]
- \( Y \) = output
- \( L \) = labor
- \( K \) = ordinary capital services
- \( I \) = ICT capital services
- \( s \) = share; \( g \) = growth rate
**Growth accounting and deflators**

\[ TFP = g_y - s_y g_L - s_k g_K - s_l g_I \]

Quantities above are real - example:

\[ g_y = g_o - g_p \]

\( g_p \) is growth in GDP deflator. Therefore, measurement equation is

\[ TFP = g_o - g_p - s_y g_L - s_k g_K + s_k g_{PK} - s_l g_{IY} + s_l g_{II} \]

\( N \) denotes nominal quantities

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**The effect of input deflation**

\[ TFP = g_o - g_p - s_y g_L - s_k g_{KN} + s_k g_{PK} - s_l g_{IY} + s_l g_{II} \]

The two highlighted terms are negative.

Implications:
- Measured TFP will be lower if properly deflated
- Contribution of capitals could be higher or lower

Some numbers for 1995-2001:
- IT share ~ 4%; non-IT share ~ 9%
- IT deflator falls 7.3%; non-IT deflator 2.5% (relative to GDP deflator)
- 0.48% = .04 (6.4%) + .09 (2.5%)

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**The effect of output deflation**

\[ g_o - g_p = (1-s_{QN}) (g_{QN} - g_p) + s_{QN}(g_{QI} - g_{PI}) \]

\( QN \) = nominal non-ICT production

\( QI \) = nominal ICT production

\[ TFP = g_o - g_p + s_{QN}(g_p - g_{PI}) - s_y g_L - s_k g_K - s_l g_I \]

The highlighted term is positive => measured TFP will be higher if properly deflated

IT share of GDP = 4% => 0.45% higher

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**Example: US 1995-2001**

(per capita)

<table>
<thead>
<tr>
<th></th>
<th>TFP =</th>
<th>Labor productivity</th>
<th>Less IT contribution</th>
<th>Less non-IT contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional (using GDP deflator)</td>
<td>1.25</td>
<td>1.81</td>
<td>0.47</td>
<td>0.09</td>
</tr>
<tr>
<td>Using inv. deflators for inputs</td>
<td>1.25</td>
<td>2.24</td>
<td>0.72</td>
<td>0.32</td>
</tr>
<tr>
<td>Using both inv. deflators (this paper?)</td>
<td>0.80</td>
<td>1.85</td>
<td>0.72</td>
<td>0.32</td>
</tr>
<tr>
<td>Jorgenson (2004)</td>
<td>0.95</td>
<td>3.06</td>
<td>0.97</td>
<td>1.13</td>
</tr>
</tbody>
</table>

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**Implications and queries**

- Analysis of ICT contribution differs somewhat from earlier efforts
- What would happen if we had quality-adjusted prices in the steam era (Nordhaus 1997)
- Why do DJs number differ (an old question)
- Industry level IT diffusion data?
- The contribution of organized R&D
  - Mairesse and Kocuglu (2004) – France

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**Comment on Table 7**

\[ g_i = \text{labor productivity growth in sector } i \]

\( s_i \) = share of output in sector \( i \)

\( w_i \) = share of inv that is IT in sector \( i \)

\[ g = \sum_{i=1}^{N} s_i g_i = g_{IT} + g_{INT} = \sum_{i=1}^{N} w_i s_i g_i + \sum_{i=1}^{N} (1 - w_i) s_i g_i \]

This paper: \( w_i \) is one or zero (rather arbitrary and the paper does not list the industries)

Why not use the actual share of investment in that industry that is IT?