A Comparative Perspective on Technology Regimes and Productivity Growth in Europe and the US: Discussion

Bronwyn H. Hall
UC Berkeley and NBER
September 2004

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

$$TFP = g_y - s_L g_L - s_K g_K - s_I g_I$$

Quantities above are real - example:

$$g_Y = g_Q - g_P$$

g_P is growth in GDP deflator. Therefore, measurement equation is

$$TFP = g_Q - g_P - s_L g_L - s_K g_{KN} + s_K g_{PK} - s_I g_{IN} + s_I g_{PI}$$

N denotes nominal quantities

The effect of input deflation

$TFP = g_Q – g_P – s_L g_L – s_K g_{KN} + s_K g_{PK} – s_I g_{IN} + s_I g_{PI}$

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%)

The effect of output deflation

$g_Q - g_P = (1-s_{QI}) (g_{QN} - g_P) + s_{QI}(g_{QI} - g_{PI})$

QN = nominal non-ICT production

QI= nominal ICT production

$TFP = g_Q – g_P + s_{QI}(g_P - g_{PI}) – s_L g_L – s_K g_K – s_I g_I$

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

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

Example: US 1995-2001 (per capita)

	TFP =	Labor prod-uctivity	Less IT contribution	Less non-IT contribution
Conventional (using GDP deflator)	1.25	1.81	0.47	0.09
Using inv. deflators for inputs	1.25	2.24	0.72	0.32
Using both inv. deflators (this paper?)	0.80	1.85	0.72	0.32
Jorgenson (2004)	0.95	3.06	0.97	1.13

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
  - Fraumeni (2003) – US national accounts

Comment on Table 7

g_i = 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*

$$g = \sum_{i=1}^{N} s_i g_i = g_{IT} + g_{NIT} = \sum_{i=1}^{N} w_i s_i g_i + \sum_{i=1}^{N} (1 - w_i) s_i g_i$$

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?