Information Technology and Education As Determinants of Productivity Growth

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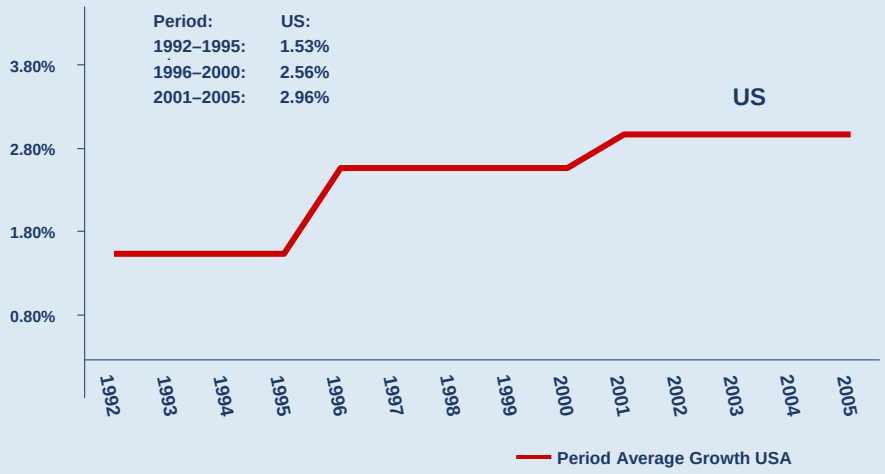
Ifo Institute for Economic Research at the University of Munich

Why Productivity Growth?

- Labor Productivity measures the efficiency in the production process
- Benefits from increased productivity:
  - Lower average costs
  - Improved competitiveness
  - Higher profits
  - Higher real wages
  - Long-run economic growth
- A Key Measure of Living Standards

Productivity Growth, The Tale of Two Countries



Notes: Annual value added per hours worked. *Sources:* US is Nonfarm Business Sector (US Bureau of Labor Statistics, 2009), Germany is Total Economy (German Federal Statistical Office, 2009) and authors' calculations.

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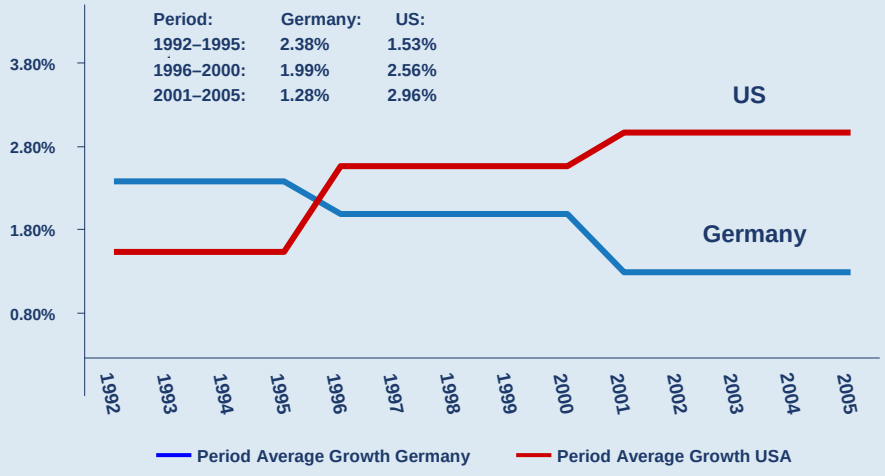

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US/German Productivity Experience

- **US: Two Productivity Surges**
  - 1. Post 1995 Surge:
    - driven by Information Technology *PRODUCING* Industries
  - 2. Post 2000 Surge:
    - driven by Information Technology *USING* industries & market services (NY FED Stiroh, 2006)
- **Germany's: Dual Productivity Declines**
  - ICT Industries Surge
    - Post 1995: noticeable, but much smaller
  - Non-ICT industries
    - productivity collapse too large to be offset by ICT increases, especially post 2000 (Eicher and Roehn, 2007).

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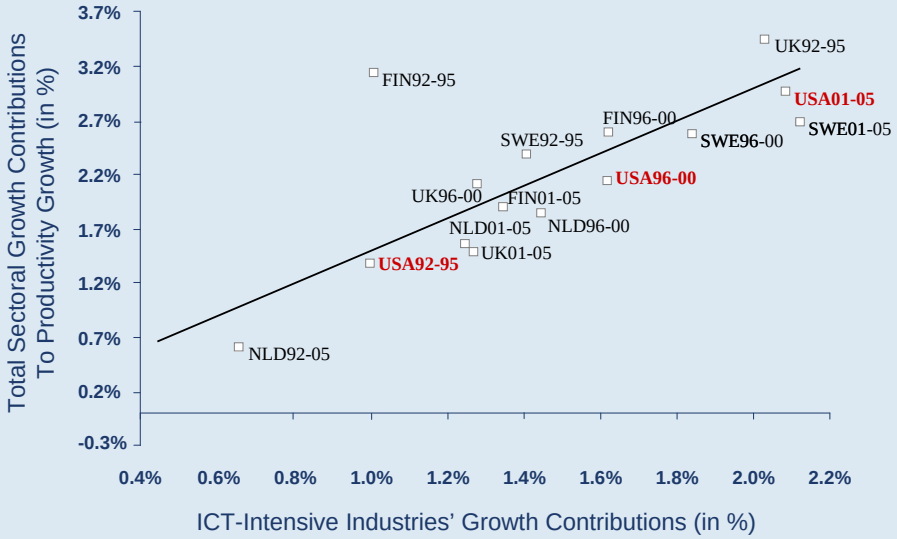
ICT Intensity and Growth



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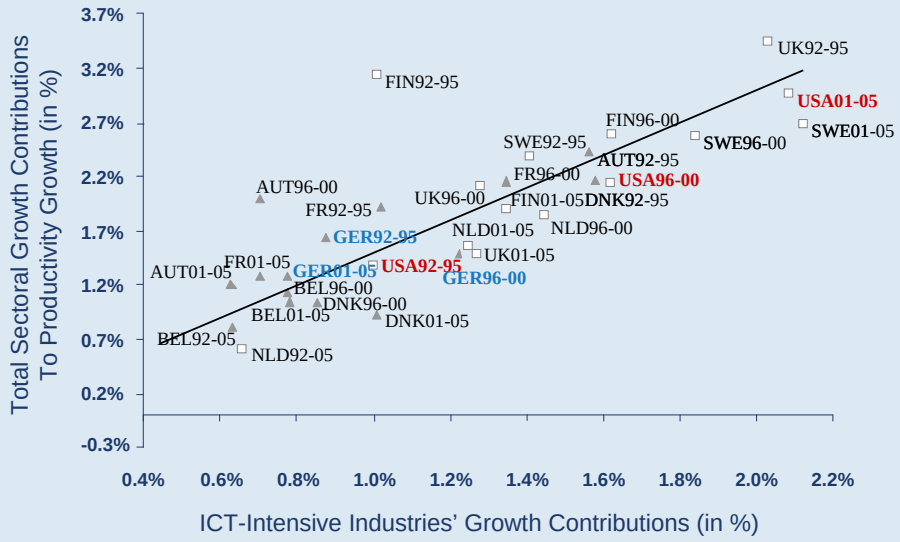

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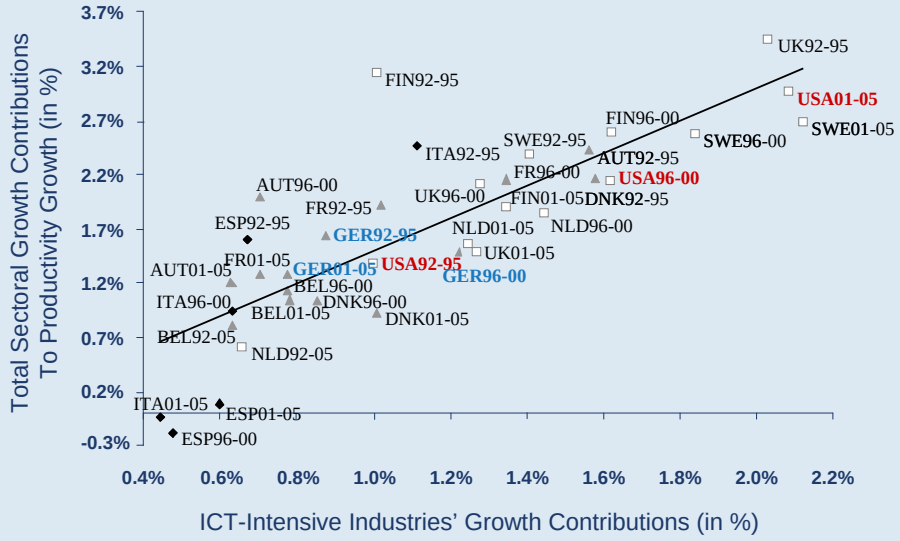

Why Was ICT Investment in Germany Lower Than the US?

- **Return to ICT investment depends crucially on how the production process leverages the new technology**
- **(New) Skills are required to maximize payoff from massive ICT investment:**
  - *Capital-skill complementarity*
    - Griliches (1969)
  - *ICT capital-skill complementarity*
    - OECD Information Technology Outlook (2004, 2006)
    - Bresnahan, Brynjolfsson & Hitt (2002)
  - *Skill-biased technological change*
    - Eicher (1996), Acemoglu (1998), Aghion (2002)

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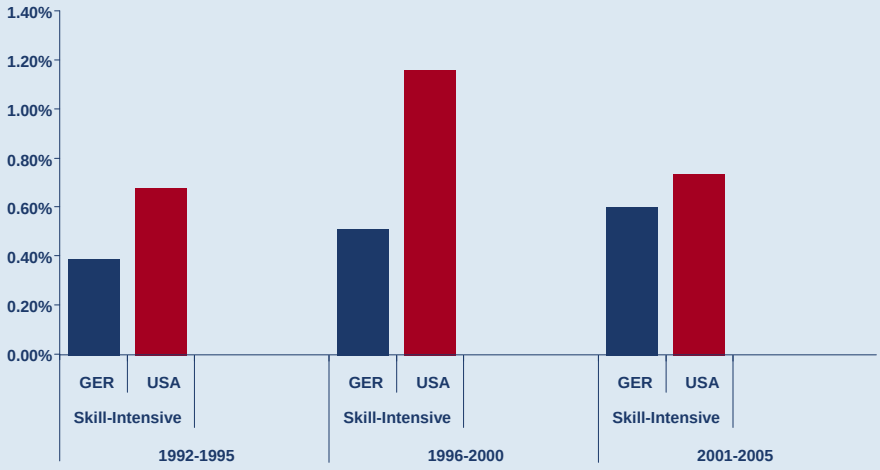
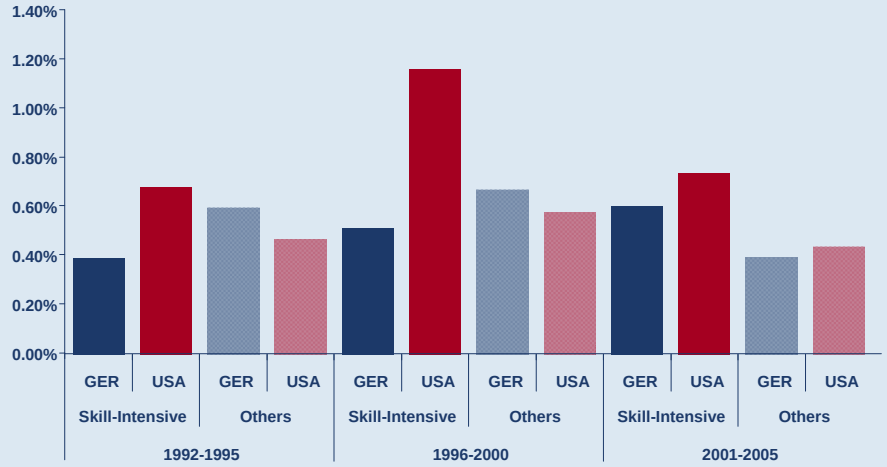
Productivity Growth Contributions
By Skill Intensity in Goods-Producing Industries



Sources: EUKLEMS Growth and Productivity Accounts (2008), IIGAD (2008) and Eicher and Strobel (2009).

Productivity Growth Contributions
By Goods-Producing Industries



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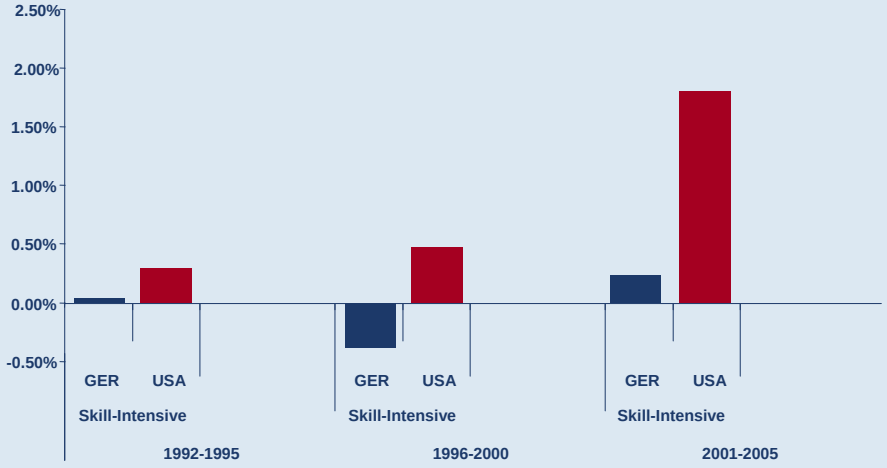
Productivity Growth Contributions
By Skill Intensity in Services



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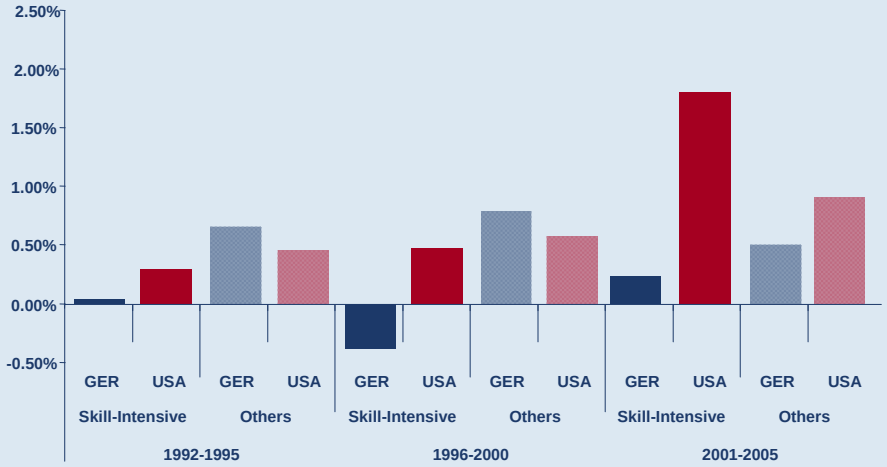
Productivity Growth Contributions
By Services



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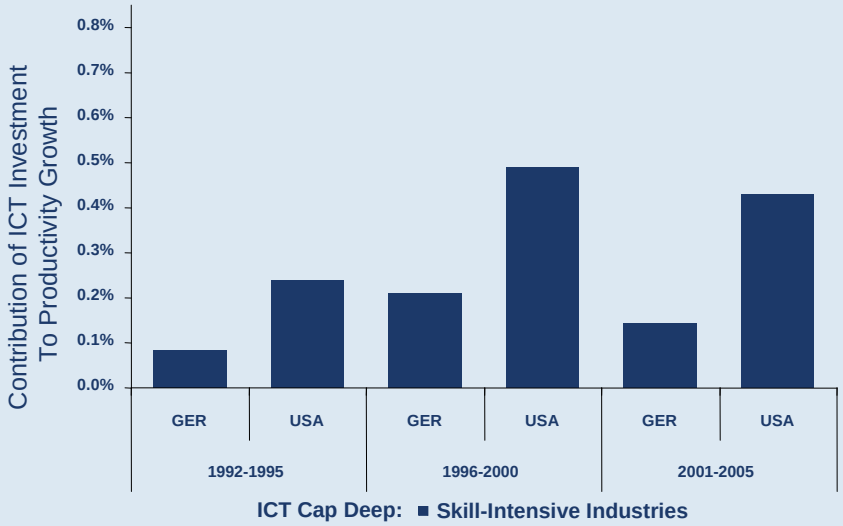
Leveraging ICT Investment
By Skill Intensity, Total Economy



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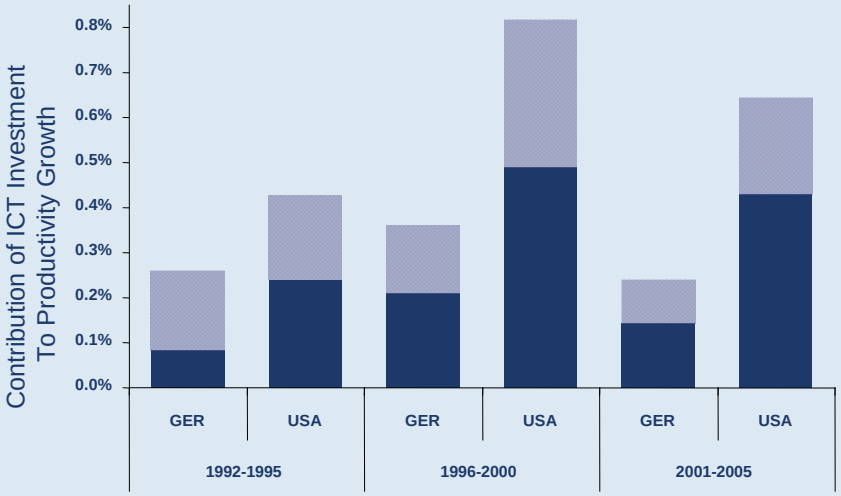
Leveraging ICT Investment

Total Economy



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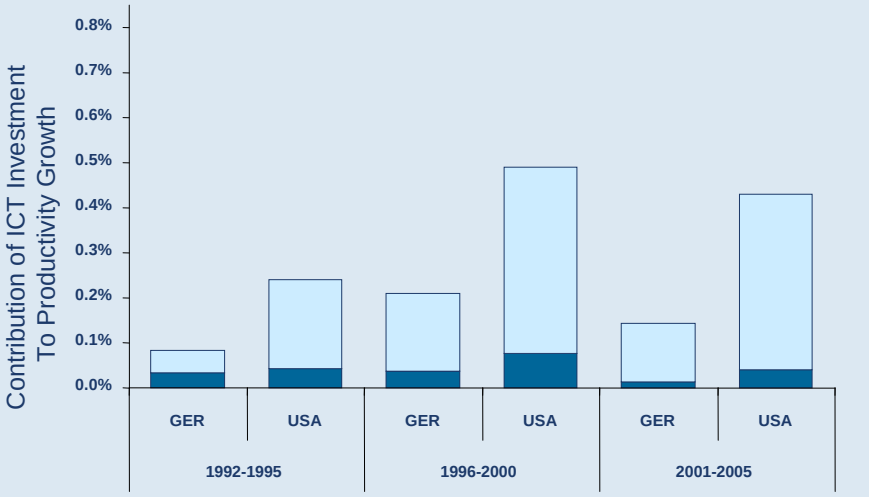
Leveraging ICT Investment

By Skill Intensity, Goods-Producing Industries and Services



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Productivity Contributions by Industry

	GER (in %)			US (in %)		
Skill-Intensive Industries	1992–1995	1996–2000	2001–2005	1992–1995	1996–2000	2001–2005
Goods Producing:						
Office Machinery and Electronic Equipment	0.18	0.33	0.22	0.57	0.89	0.43
Services:						
Communications*	0.24	0.23	0.14	0.09	-0.01	0.39
Financial Intermediation & Insurance	0.10	0.11	-0.10	0.14	0.39	0.21
Business Activities	-0.09	-0.37	-0.21	-0.06	-0.06	0.49

Notes: **Business Activities** comprise: *Rental and Leasing Services*, *Computer and Related Activities*, *Research and Development* and *Other Business Services* (e. g. legal, accounting, book keeping and auditing services, tax consultancy, market research and public opinion polling, business and management consultancy, architectural and engineering activities, advertising); * Non-high-skill intensive in Germany.

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Conclusion

- **ICT-skill complementarity** contributed stronger to productivity growth in the **US than in Germany** because
  - US invested more in ICT
  - US skill-intensive industries invested more in ICT
    - Strong evidence of **ICT-skill complementarities**
    - Strong productivity growth in **skill-intensive US Office Machinery and Electronic Equipment**, lower in GER,
    - But especially in **skill-intensive US services** post 2000 (particularly in Business Services, Financial Intermediation, Communications)
    - Weak productivity growth in **skill-intensive GER services**

Thank You