Productivity in Japan, the US, and the Major EU Economies: Is Japan Falling Behind?

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1. Motivation

- **Japan's economic growth stalled:**

  1973-1995: 3.3%

  1995-2004: 1.0% (lowest among the US, Japan, Germany, France, the UK and Italy).
- **Van Ark et al. (2006) report that TFP growth in ICT-using industries in the core EU countries since 1995 has been much slower than in the US.**
- **Stiroh (2002a) and Triplett and Bosworth (2002) report that TFP growth in ICT-using industries has accelerated substantially since 1995.**
- **Does Japan have a similar problem as the major EU economies with regard to the introduction of ICT to market services?**

1. Motivation contd.

- **There have been few studies which compare TFP growth and the impact of the ICT revolution in the major EU economies, Japan and the US at the industry level, probably because of the lack of appropriate data for a broad and rigorous international comparison.**
- **Researchers of the Japan Industrial Productivity Database Project, including the authors, have joined the EU KLEMS consortium and supplied original data on Japan for the EU KLEMS database.**
- **The first public-release version of the EU KLEMS database became available online at the EU KLEMS website, http://www.euklems.net/ on March 15.**

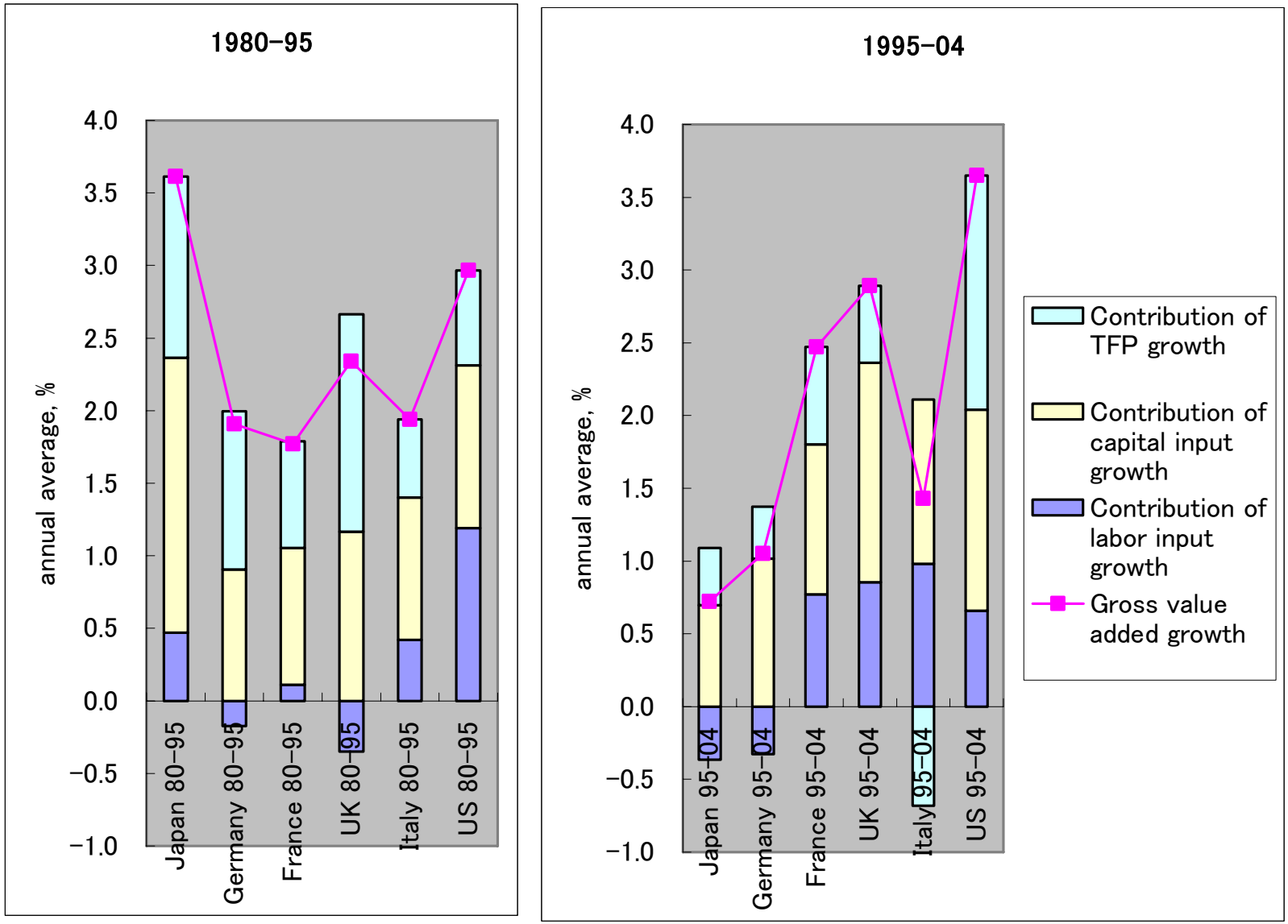
Structure of the paper

- **Section 2; we present an overview of the pattern of economic growth and productivity improvement in Japan, the major EU economies, and the US. We also compare the absolute labor productivity levels of these countries by industry.**
- **Section 3; we analyze the role of ICT investment on economic growth in these countries.**
- **Section 4; We analyze the accumulation of intangible assets, such as human capital and organization capital. (It is frequently argued that in order to fully realize the direct and indirect efficiency-improving effects of ICT capital, the simultaneous accumulation such assets, is indispensable.)**

2. Overview of Economic Growth and Productivity Improvement

- **It is not the gap in TFP growth but differences in factor input growth that caused the large difference in the economic growth performance of France, the UK and Italy, which registered acceleration in economic growth after 1995, on the one hand and Japan on the other in the period after 1995.**

Figure 1. Growth Accounting for the Market Sector in Japan, the US, and the Major EU Economies



Source: EU KLEMS Database, March 2007.

Figure 2. Contribution of Labor Input Growth: Japan, the US and the Major EU Economies

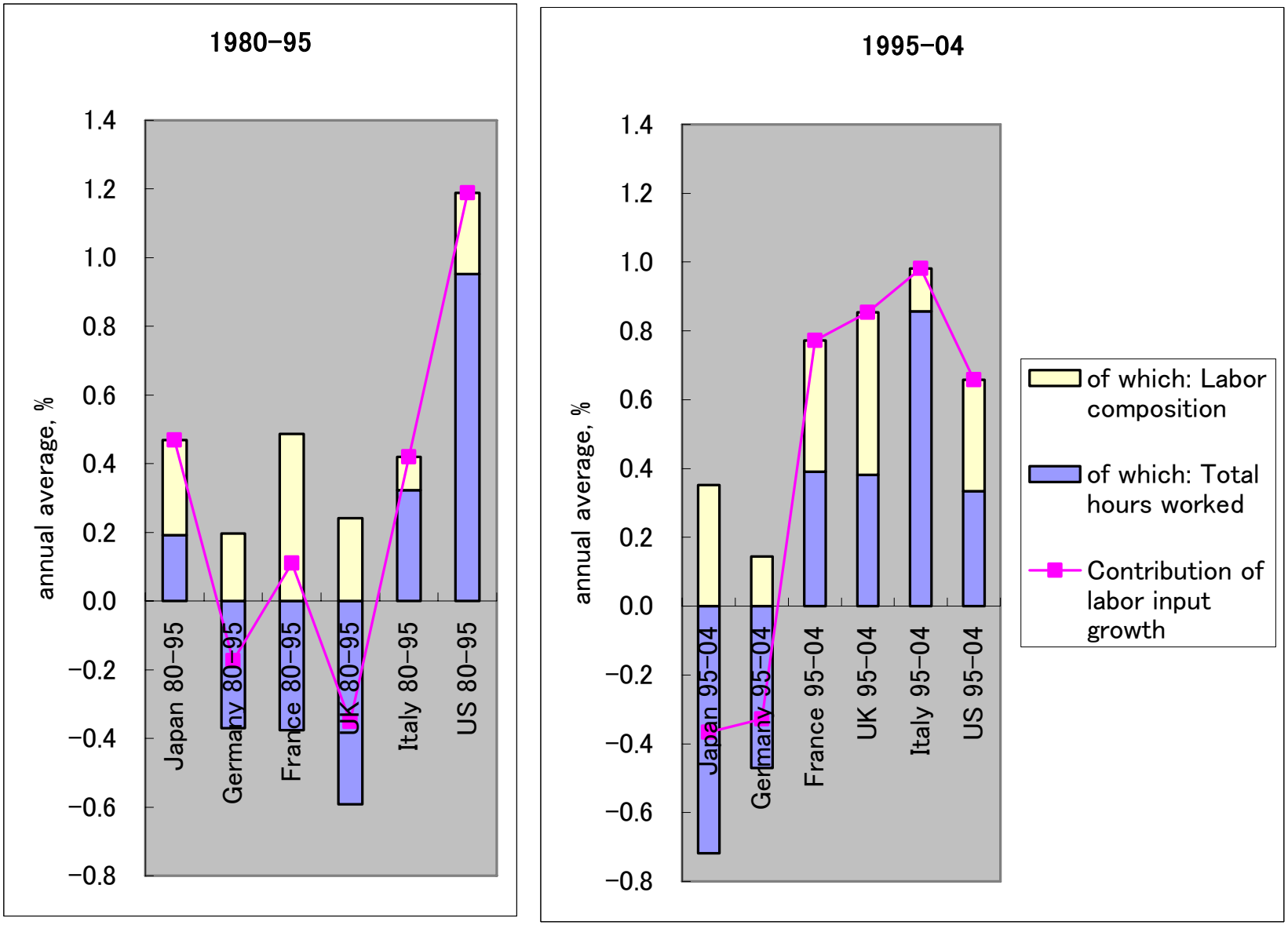
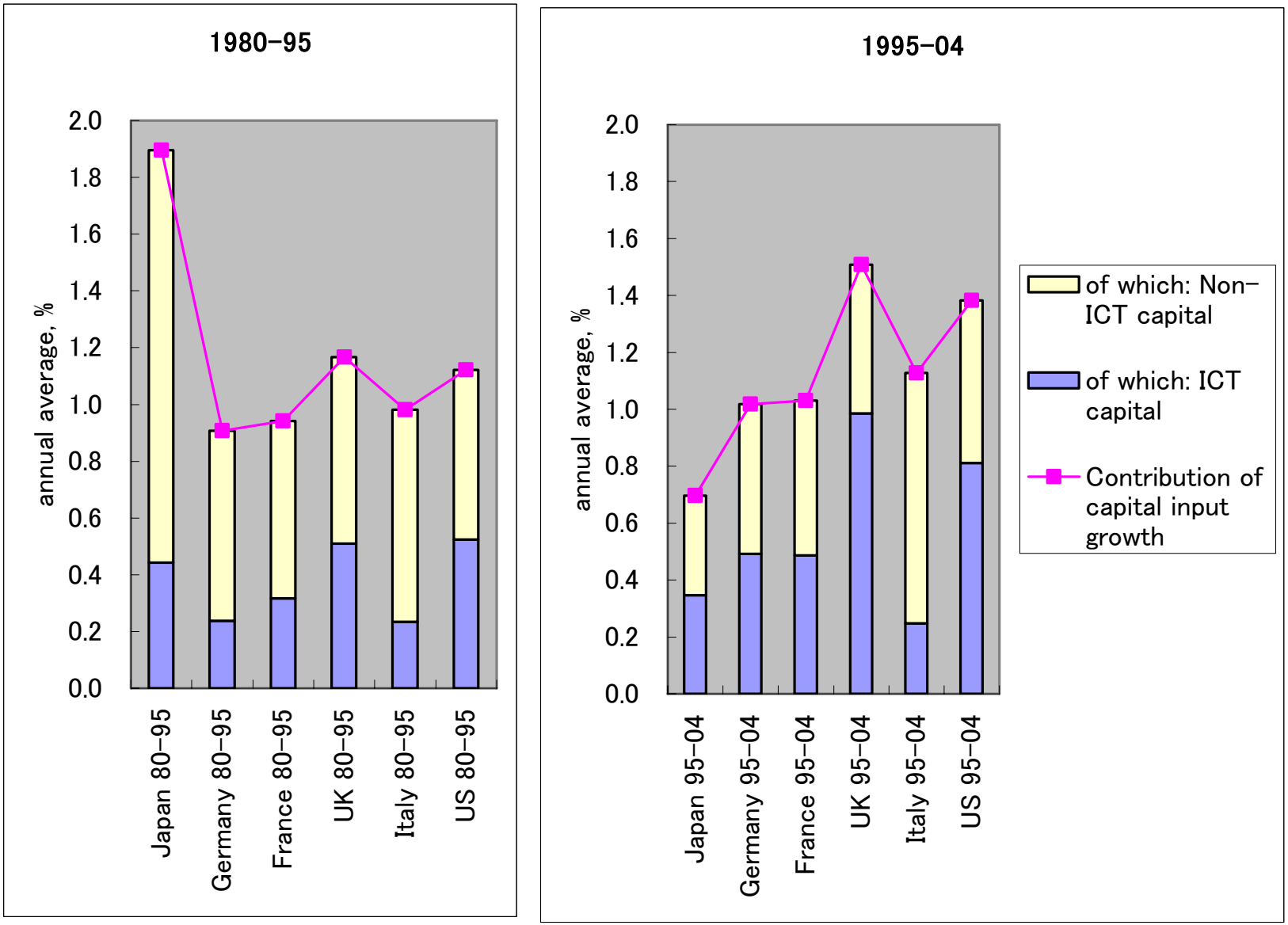


Figure 3. Contribution of Capital Input Growth: Japan, the US and the Major EU Economies

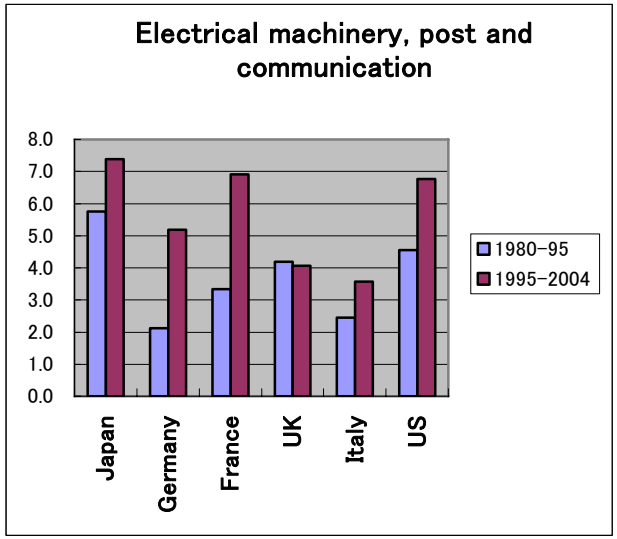


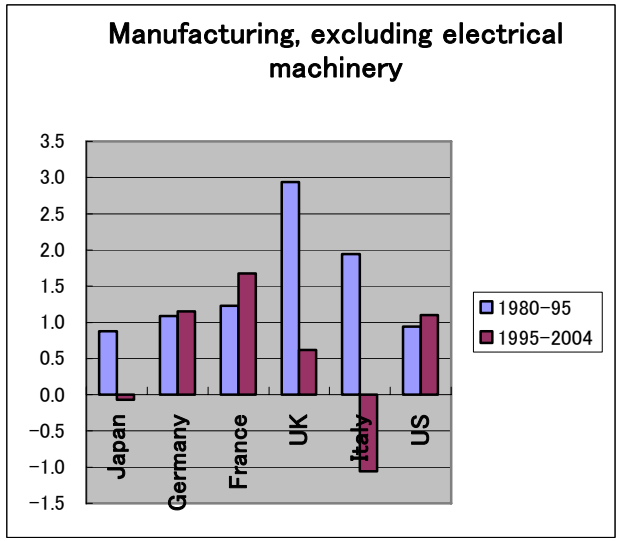
Source: EU KLEMS Database, March 2007.

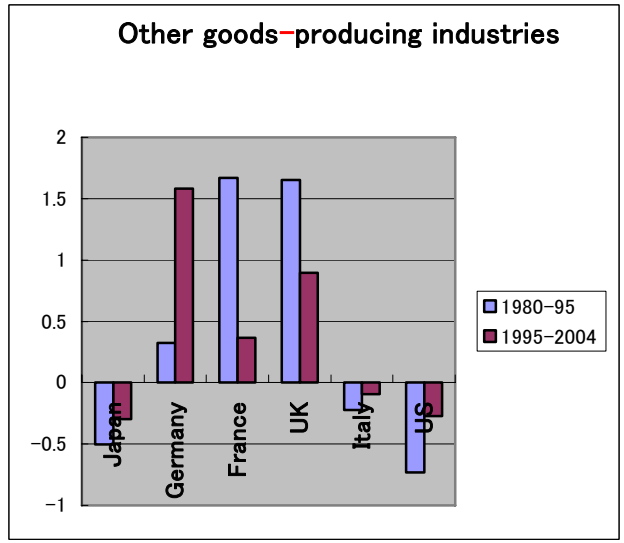
2. Overview contd.

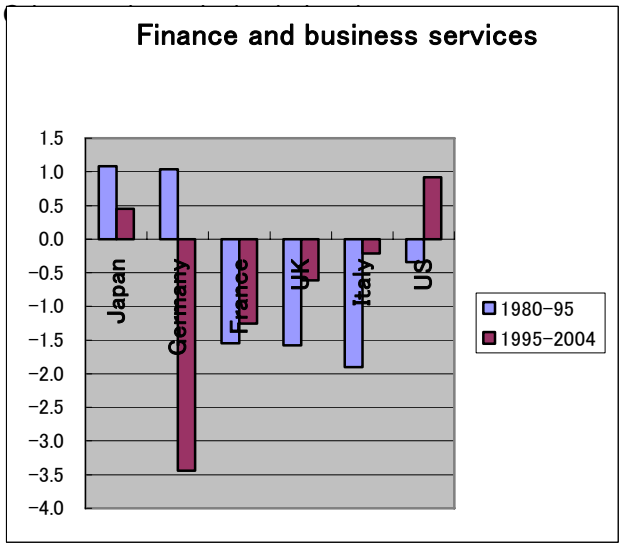
- **The four major EU economies (Germany, France, the UK and Italy) and Japan experienced a slowdown in TFP growth of a similar magnitude after 1995. Only the US accomplished an exceptional acceleration in TFP growth.**
- **TFP growth in the electrical machinery, post and communication sector was still highest in Japan among the six economies after 1995. However, like in other countries, the share of this sector in the economy overall is not very large. The average share of labor input in this sector in Japan's total labor input in 1995-2004 was 4.1%.**
- **The largest declines in TFP growth in Japan occurred in distribution services and in the rest of the manufacturing sector. The labor input shares of these two sectors were 23.4% and 16.8% respectively. The US and the major EU economies except Italy recorded higher TFP growth in these two sectors.**

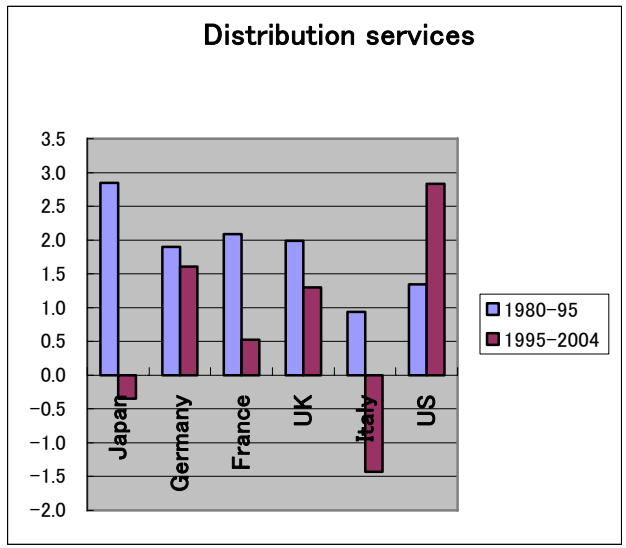
Figure 4. TFP Growth in the Market Sector: by Sector and by Country

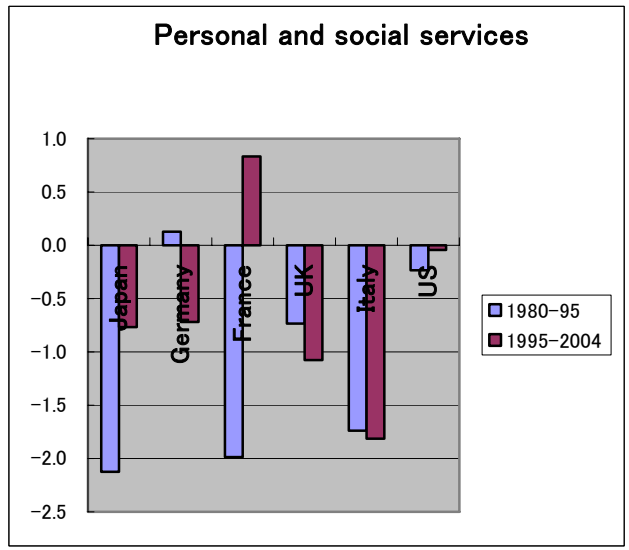








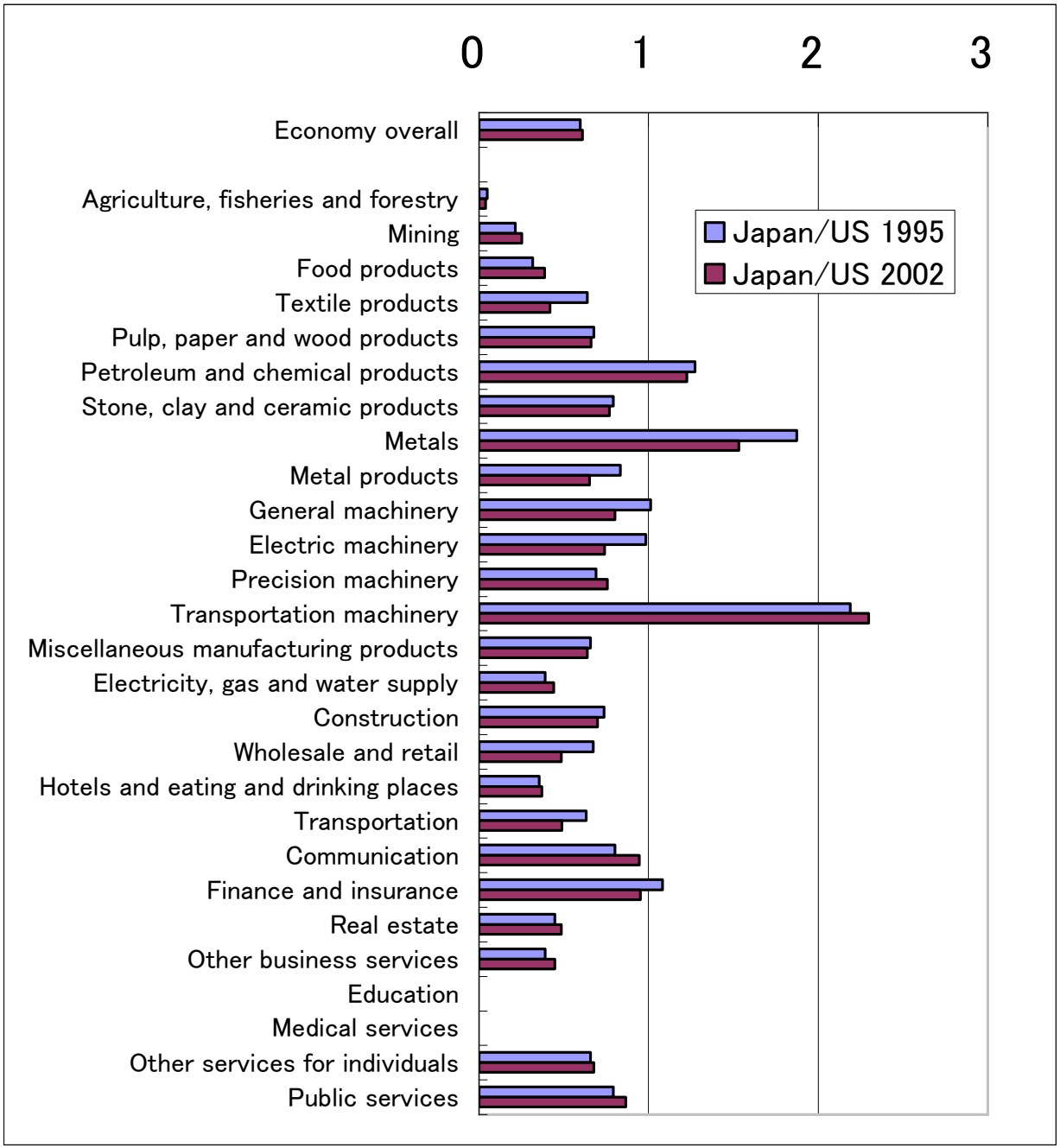




Source: EU KLEMS Database, March 2007.

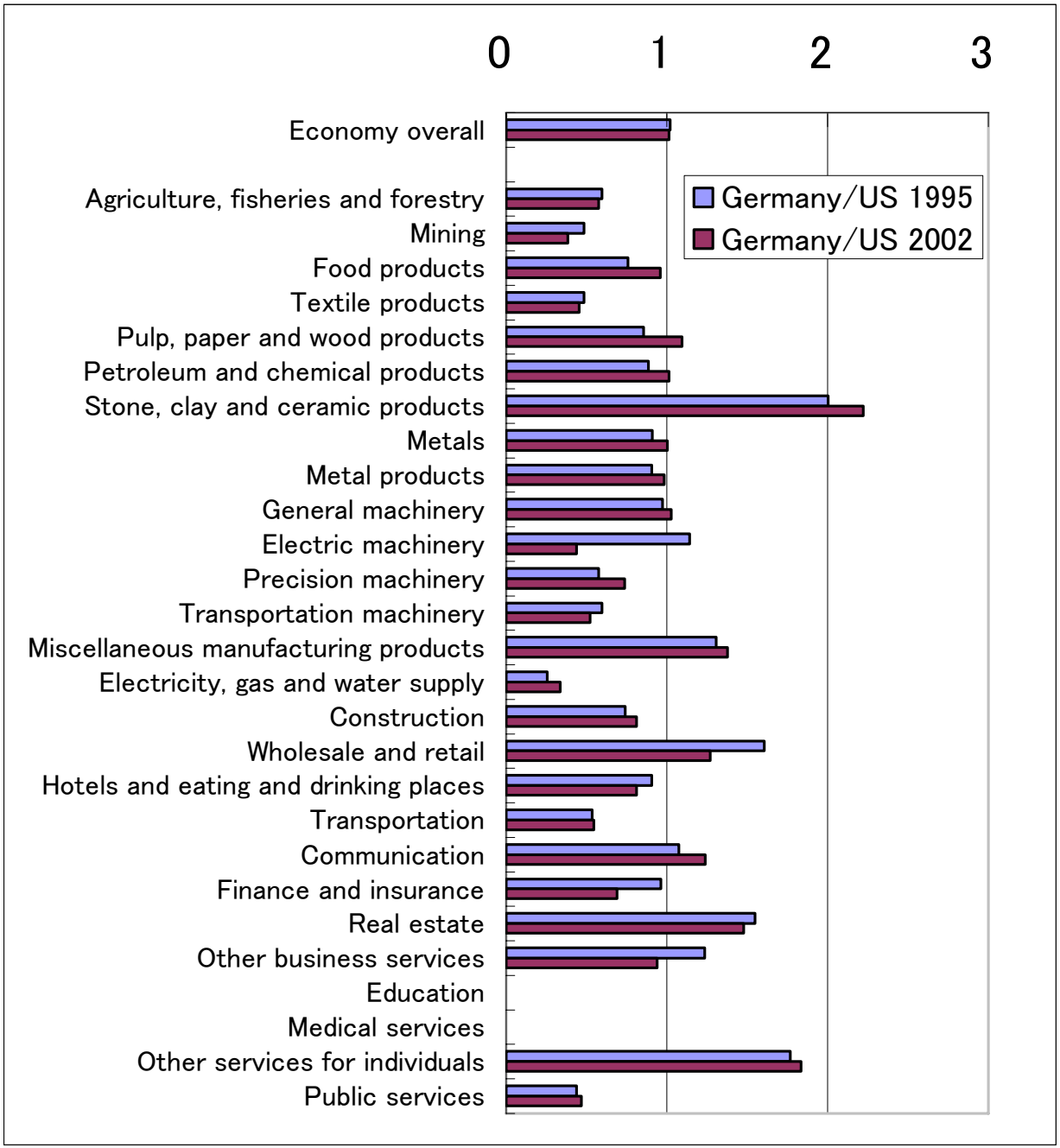
- **Inklaar et al. (2006) found that labor productivity levels in market services in continental Europe were on par with the US in 1997, but since then productivity growth in Europe has been much weaker, suggesting that the continental European countries need to do more to innovate and adjust economic structures to novel technologies.**
- **This observation raises the question: Is Japan in a similar situation as the continental European countries?**
- **We use the results of a comparison of labor productivity (real value added per man-hour) conducted by the Japan Economic Foundation (JEF) and the Japan Center for Economic Research (JCER) (JEF-JCER 2007).**

Figure 5. Labor Productivity: Japan-US Comparison



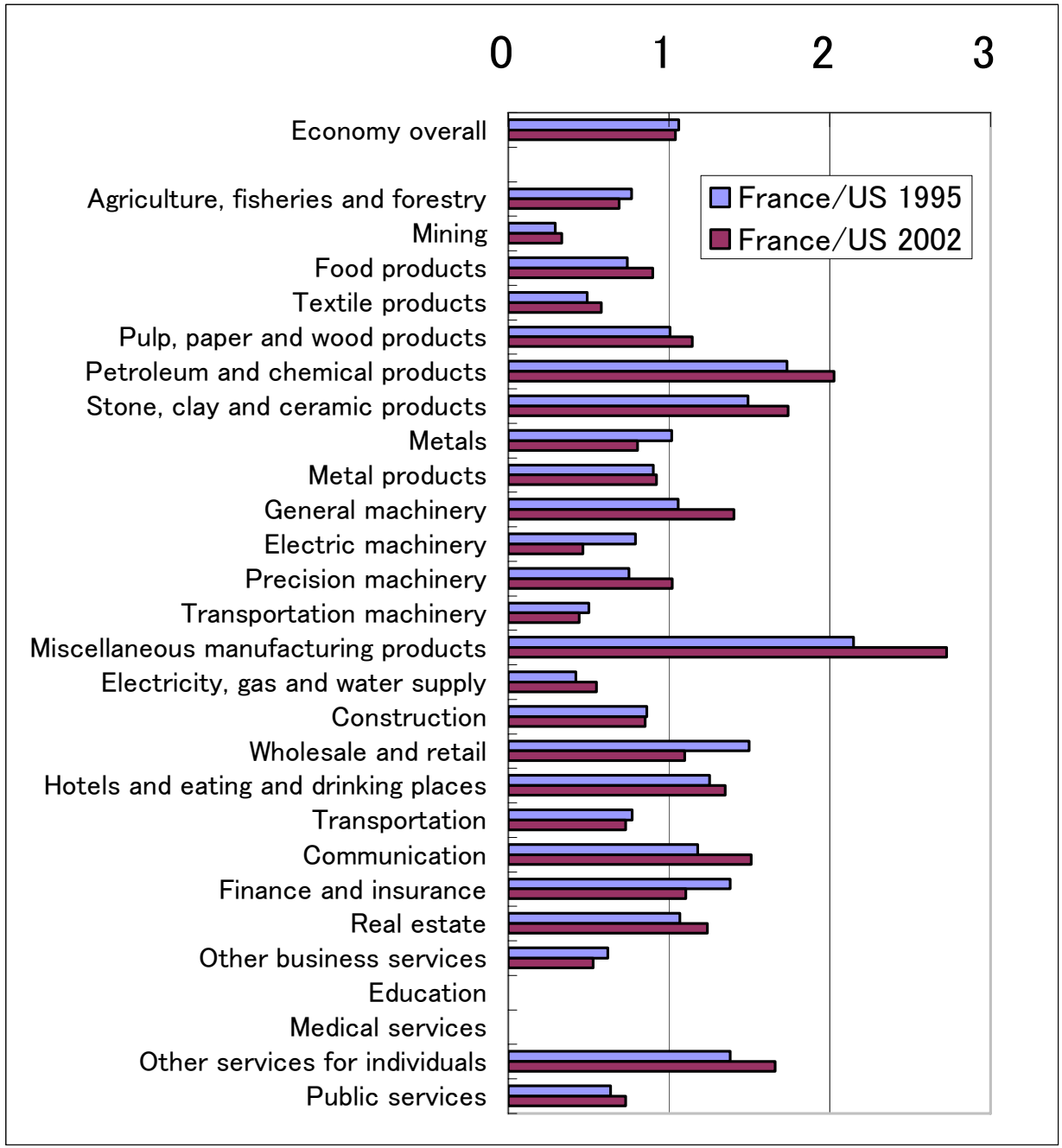
Source: JEF-JCER (2007).

Figure 6. Labor Productivity: Germany-US Comparison



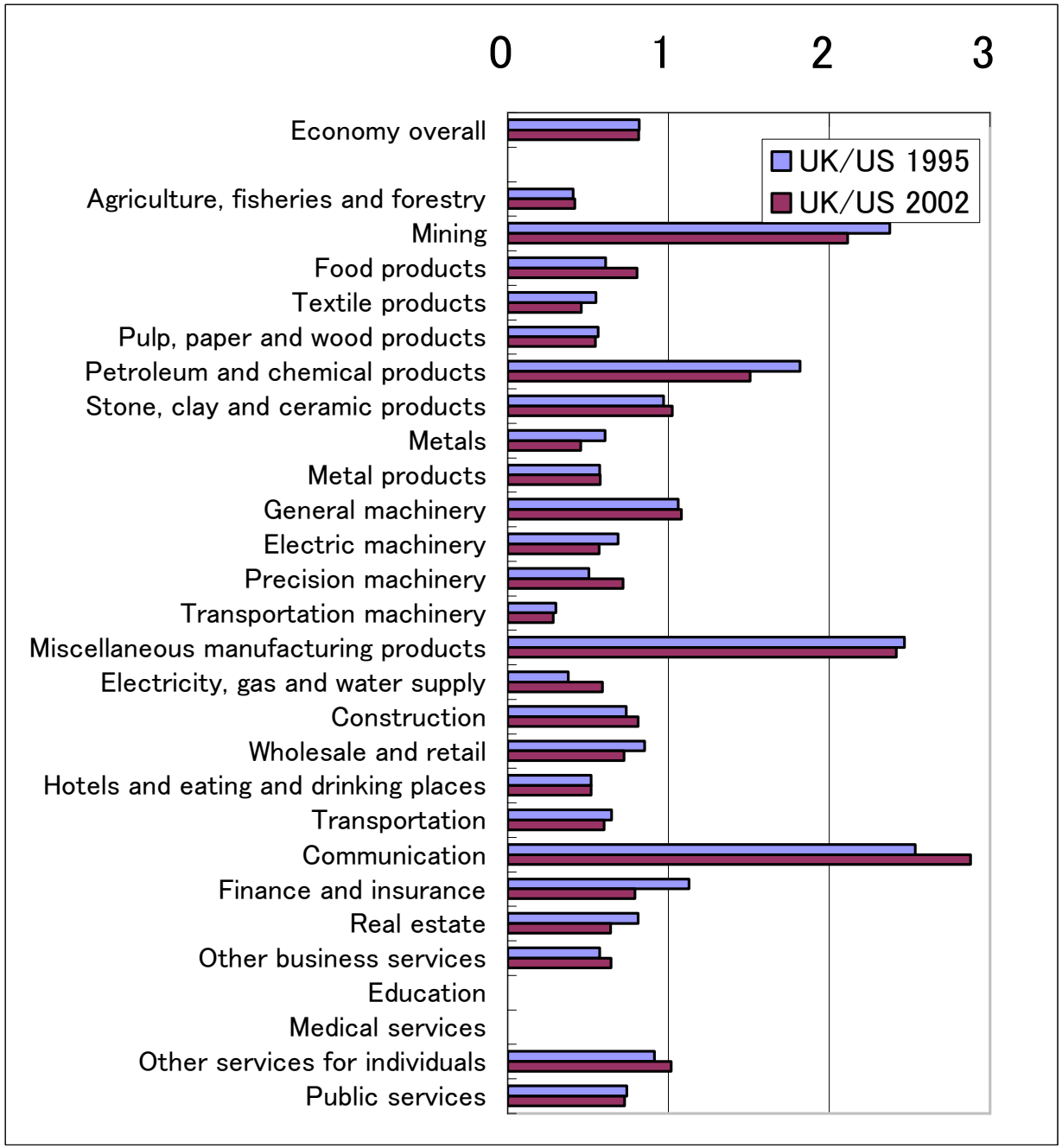
Source: JEF-JCER (2007).

Figure 7. Labor Productivity: France-US Comparison



Source: JEF-JCER (2007).

Figure 8. Labor Productivity: UK-US Comparison



Source: JEF-JCER (2007).

- **Productivity levels in Germany and France were very close to those in the US both in market services and manufacturing.**
- **Productivity levels in the UK were lower than in the two continental European countries.**
- **In manufacturing sectors, productivity levels in Japan were on par with those in the US, Germany and France.**
- **However, they were very low in comparison with the three countries both in market services and other goods-producing industries.**
- **It therefore seems that there is large room for improvement in Japan's productivity in market services and other goods-production services through the adoption of already existing technologies and better resource allocation.**

3 The Role of ICT Investment (1)

- **The previous studies**

→Jorgenson (2001) Jorgenson and Stiroh (2000): ICT investment accelerated the economic growth in the US in the second half of 90s.

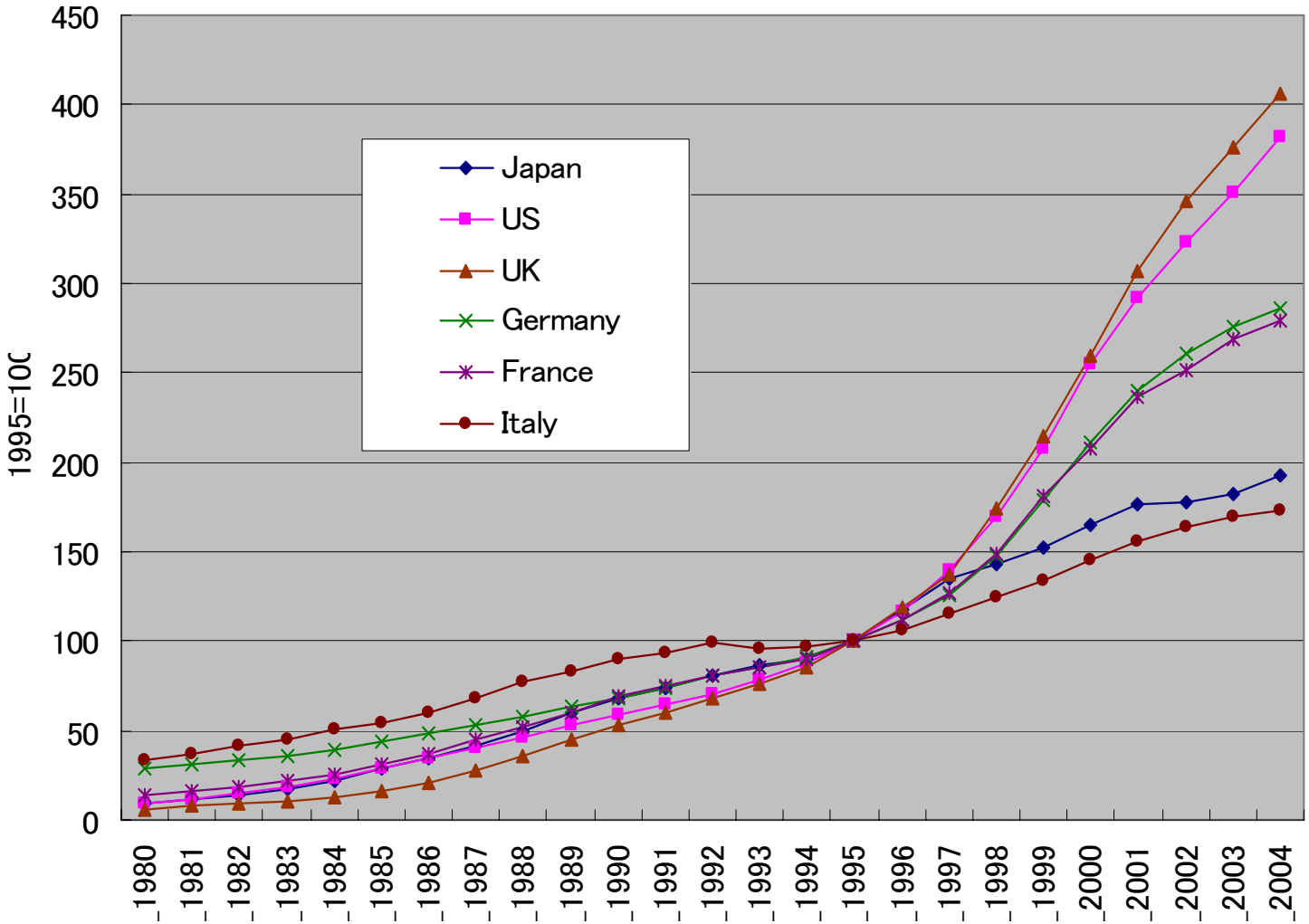
→van Ark et, al. (2003): Due to the slow growth in ICT investment, the economic growth in EU countries lagged behind the US economic growth.

→Shinozaki (1999), Miyagawa, Ito, and Harada (2004) and others: Slow productivity growth in Japan was caused by the lack of the accumulation in ICT assets.

3 The Role of ICT Investment (2)

- Comparing ICT investment by using EU KLEMS database
- The definition of ICT assets in EU KLEMS database: computing equipment, communication equipment, and software.
- Figure 9: comparing ICT capital service in Japan, the US, and the major EU countries.

Figure 9. Growth of ICT Capital Service Input in the Whole Economy



Source:
EU
KLEMS
Database
March

3 The Role of ICT Investment (3)

- Three groups

(1) Front runner: the US and the UK→16-17% per annum from 1995 to 2004.

(2) The second group: Germany and France→12% per annum from 1995 to 2004

(3) The last group: Japan and Italy →ICT capital in 2004 is less than twice as high as their 1995 level →Japan did not catch up the trend of downsizing in the 90s.

(4) Particularly, growth in ICT capital service in the service sector in Japan is relatively low.→Figures 10 and 11

Figure 10. Growth of ICT Capital Service Input in Distributution Industry

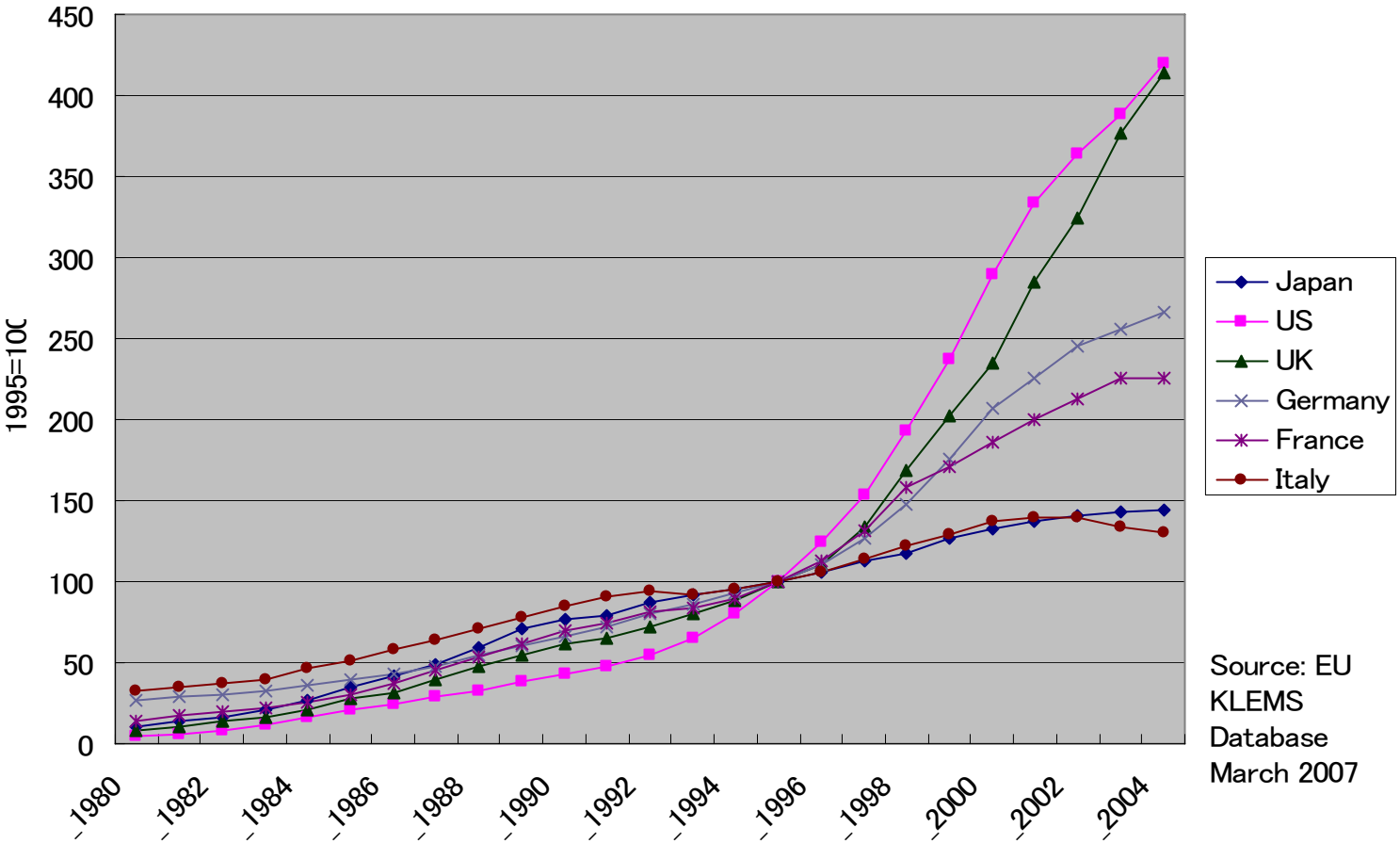
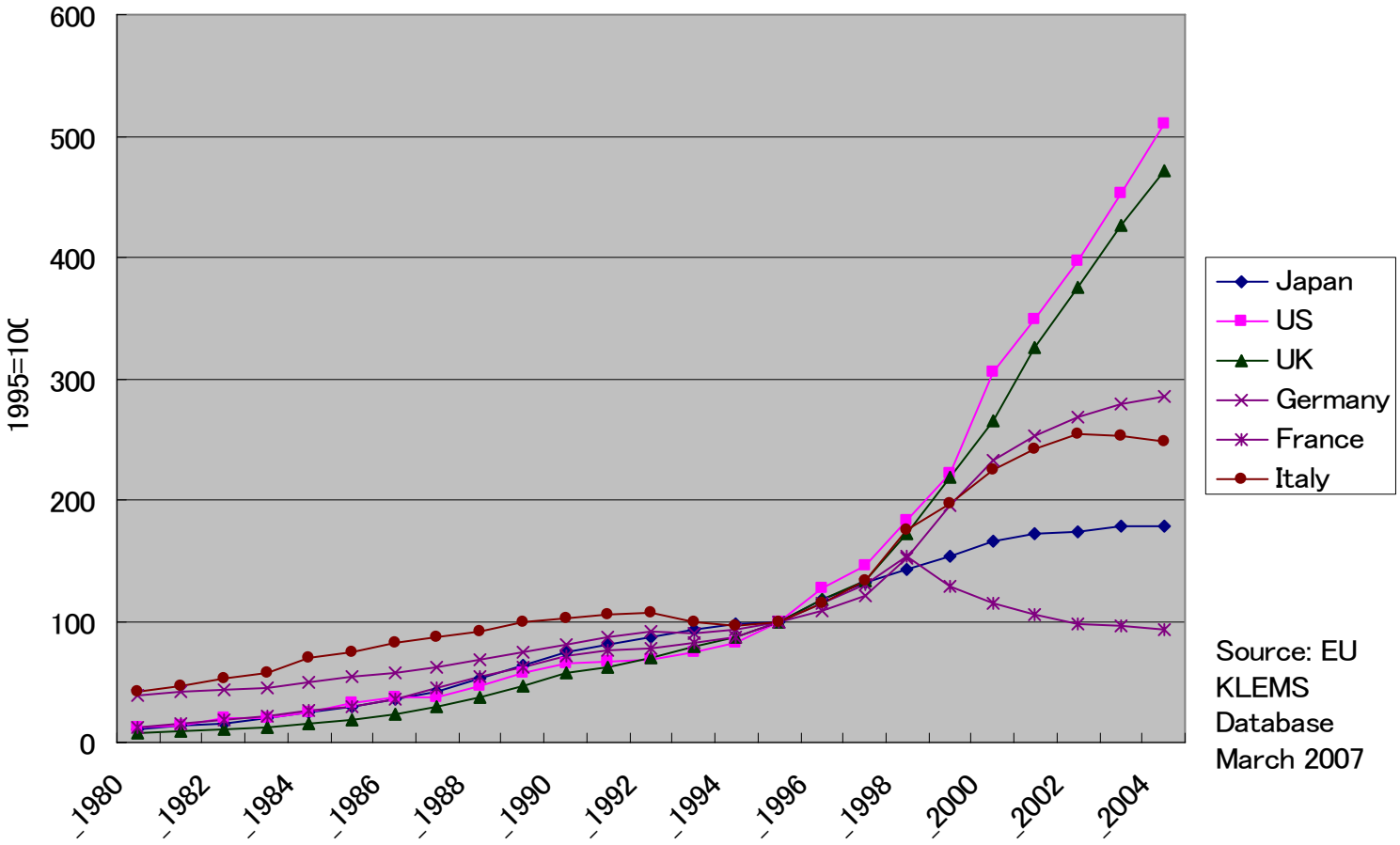


Figure 11. Growth of ICT Capital Service Input in Personal and Social Services



3 The Role of ICT Investment (4)

- The role of ICT investment on economic growth classified into two types: one is capital deepening effect and the other is external effect which affects TFP growth.
- The first effect depends on the accumulation of ICT capital.
- Table 1 : in all countries except Japan, the contribution rate of ICT capital increased from the period before 1995 to the period after 1995.
- In Japan, we do not find any industry where the contribution of ICT capital increased.

Table 1. Direct Contributions of ICT Capital Service Input Growth to the Economic Growth

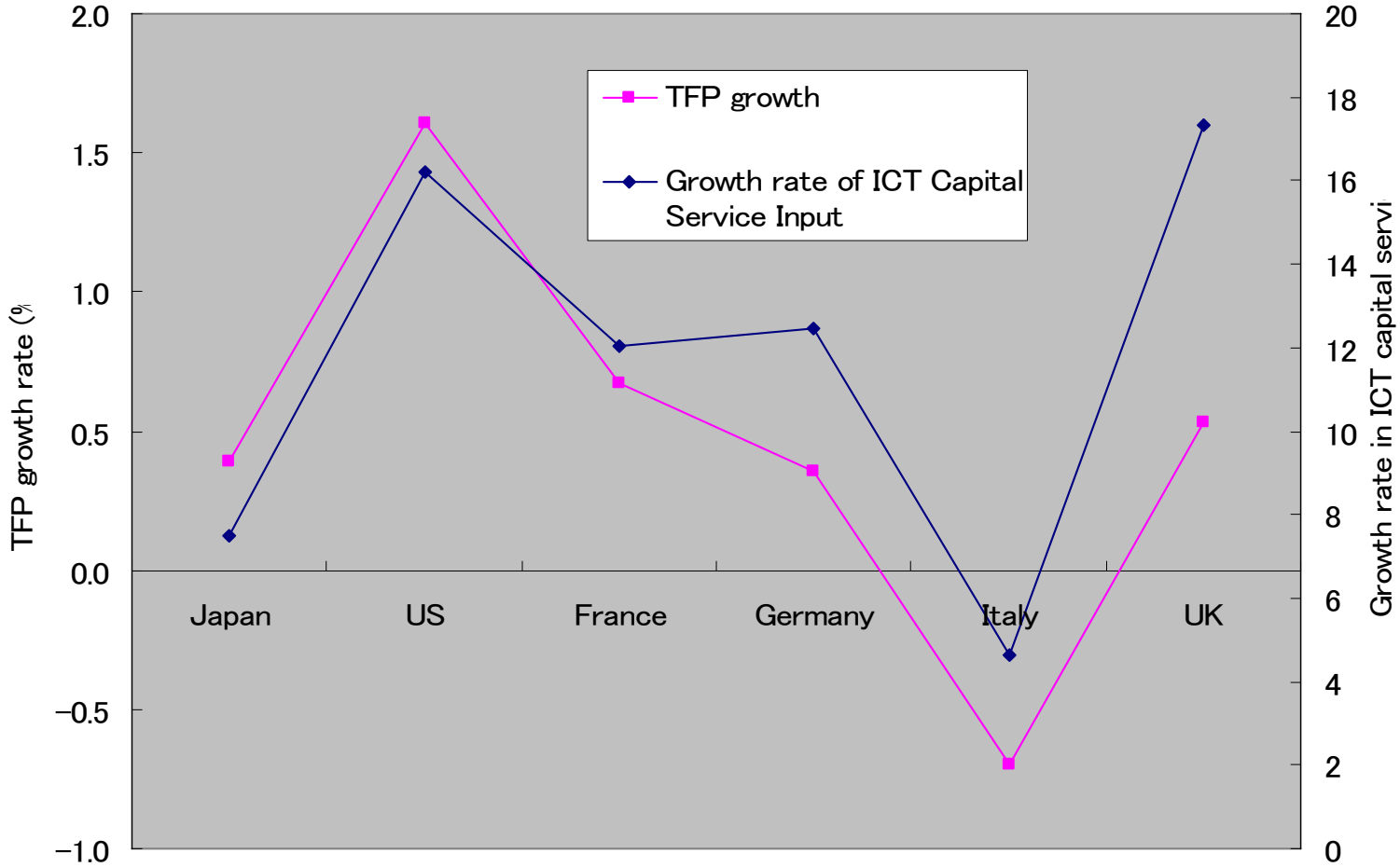
	1980-95						1995-2004					
	Japan	US	France	Germany	Italy	UK	Japan	US	France	Germany	Italy	UK
Market economy total	0.4	0.5	0.3	0.9	0.2	0.5	0.3	0.8	0.5	1.0	0.2	1.0
.Electrical machinery, post and communication	1.2	1.0	0.4	2.3	0.8	1.3	1.0	1.5	0.8	2.7	0.2	2.7
.Manufacturing, excluding electrical	0.2	0.3	0.2	0.4	0.1	0.3	0.1	0.4	0.3	0.5	0.1	0.5
.Other goods producing industries	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.0	0.1
.Distribution services	0.2	0.6	0.2	0.5	0.3	0.4	0.1	1.0	0.3	0.8	0.2	0.8
.Finance and business services	1.6	1.0	0.7	2.2	0.5	1.0	1.2	1.2	1.0	1.8	0.7	1.8
.Personal and social services	0.3	0.2	0.5	0.6	0.0	0.4	0.2	0.4	0.0	0.5	0.3	0.5

Source: EU KLEMS Database March 2007

3 The Role of ICT Investment (5)

- Figure 12 describes the second effect.
- In Figure 12, the growth rate of ICT capital positively correlated to TFP growth.

Figure 12. TFP Growth and the Growth of ICT Capital Service Input



4 Intangibles as Complements to ICT Capital (1)

- The degree of effects of ICT capital on TFP growth is different (for example the US vs. the UK).
- Intangible assets may play a complementary role on the effects of ICT capital on TFP growth
- The definitions of intangible capital → van Ark (2004) and Corrado, Hulten and Sichel (2005, 2006).

Table 2. Classification in Knowledge Capital	
(A) ICT capital	(C) Knowledge capital
(A1) Hardware	(C1) Research and development and patents
(A2) Telecommunication infrsutructure	(C2) Lincenses, brands, and copyrights
(A3) Software	(C3) Other technological innovation
(B) Human capital	(D) Organizational capital
(B1) Formal education	(D1) Engineering design
(B2) Company training	(D2) Organization design
(B3) Experience	(D3) Structure in database and its use
	(D4) Remuneration of innovative idea
	(E) Marketing of new products ('customer capital')
	(F) Social capital
(Source) van Ark (2004)	

Table 3. Intangible Asset Investment: Japan, the US and the UK				
		Japan	US	UK
		(billion yen)	(billion US dollar)	(billion pound)
		(1995-2002)	(1998-2000)	(2004)
Computerlized information		**9,714**	154	19.8
	Custom software	5,663		
	Packaged software	449		7.5
	In-house software	2,708	151	12.4
	Database	894	3	
Innovative property		**18,133**	424	37.6
	Science and engineering R&D	9,634	184	12.4
	Mineral exploration	40	18	0.4
	Copyright and license costs	4,659	75	2.4
	Other product development, design, and research expenses	3,801	149	22.4
Economic competencies		**12,899**	505	69.3
	Brand equity	4,774	140	18.5
	Firm-specific human capital	1,600		28.5
	Organizational structure	6,525	365	69.3
Total		40,746	1085	126.7
	Intangible investment /GDP(%)	7.8	11.7	10.9
	Intangible investment/tangible investment	0.3	1.2	

4 Intangibles as Complements to ICT Capital (2)

- In Table 3, we measure the amount of aggregate intangible investment in Japan following Corrado, Hulten, and Sichel (2005, 2006) and Marrano and Haskel (2006).
- The Japanese intangible investment was about 40 trillion yen on average from 1995 to 2002.
- Its ratio to GDP was 7.5% which is less than those in the US and the UK.
- Moreover, the ratio of intangible investment to tangible investment was much lower than that in the US.

4 Intangibles as Complements to ICT Capital (3)

- The low GDP ratio in Japan is caused by relatively low accumulation in firm-specific human capital and organizational capital.
- The relatively low level of intangible investment in Japan may explain why the accumulation of ICT capital has not raised TFP growth effectively.