

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

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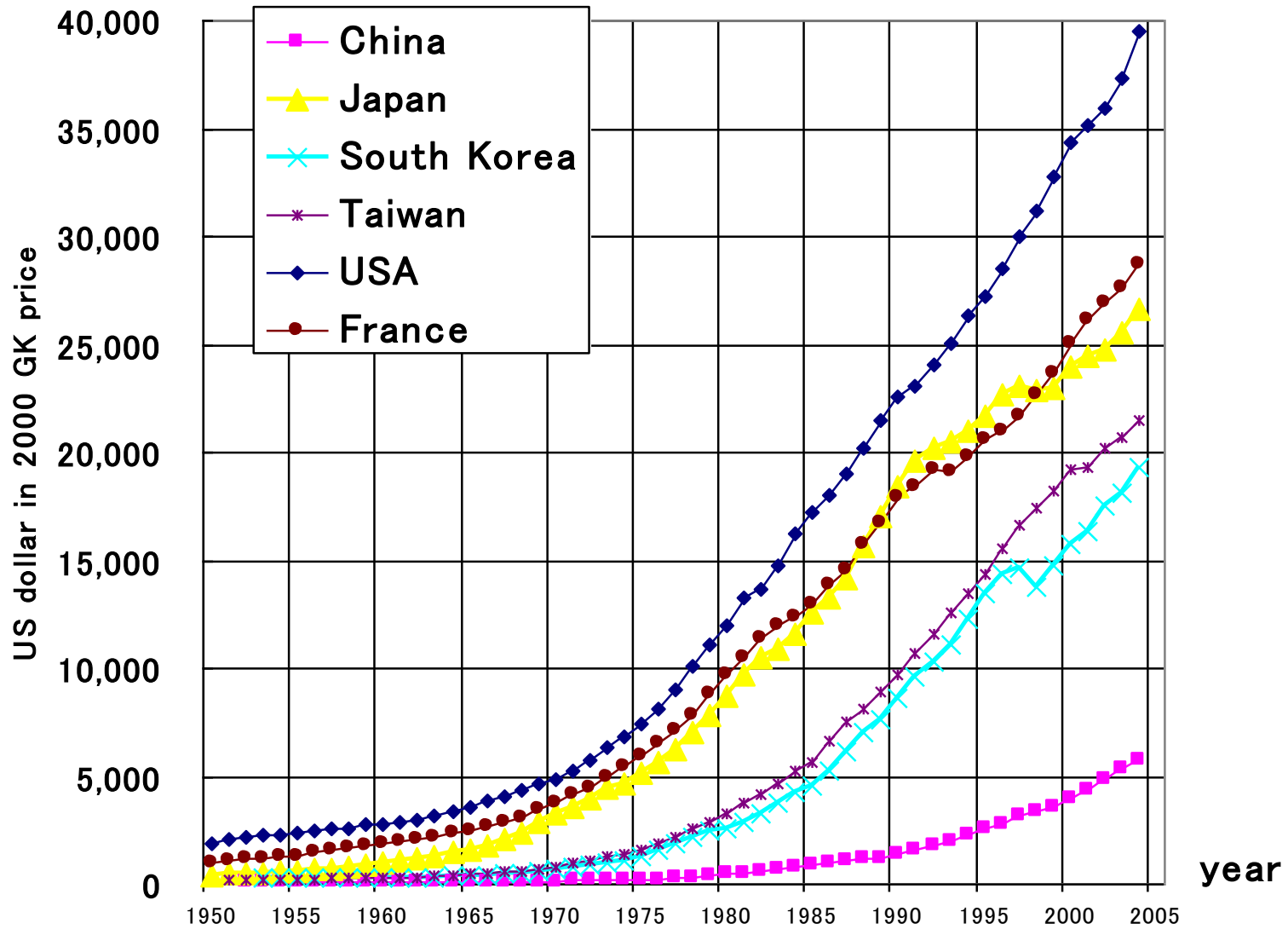
1. Motivation

- **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 author, 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, 2007. The final version will be released soon.

Real GDP per Capita of East Asian Countries Based on PPP of 2000



Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006.

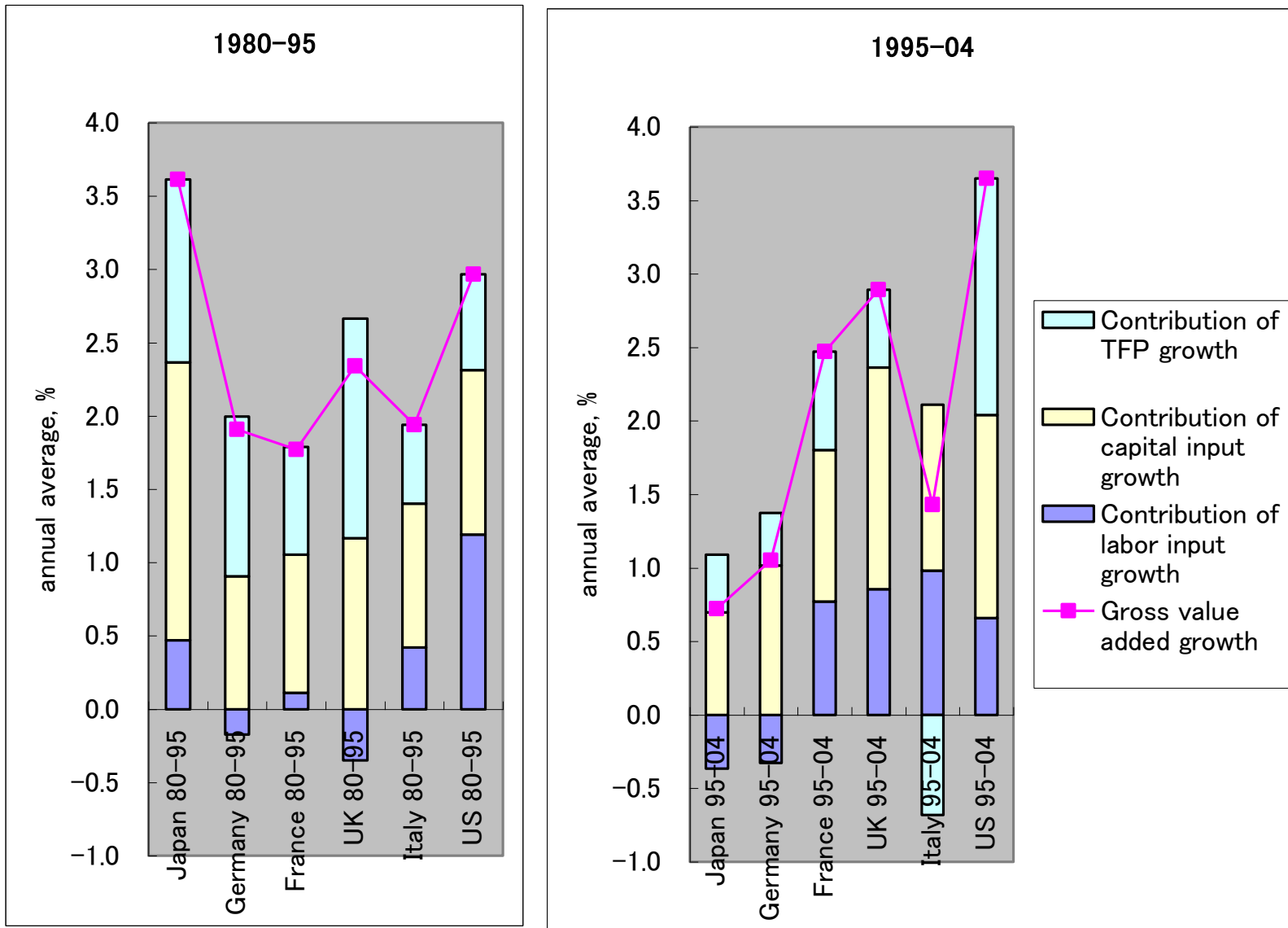
Summary of the presentation

- **Presenting 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.**
- **Analyzing the role of ICT investment on economic growth in these countries.**
- **Analyzing 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

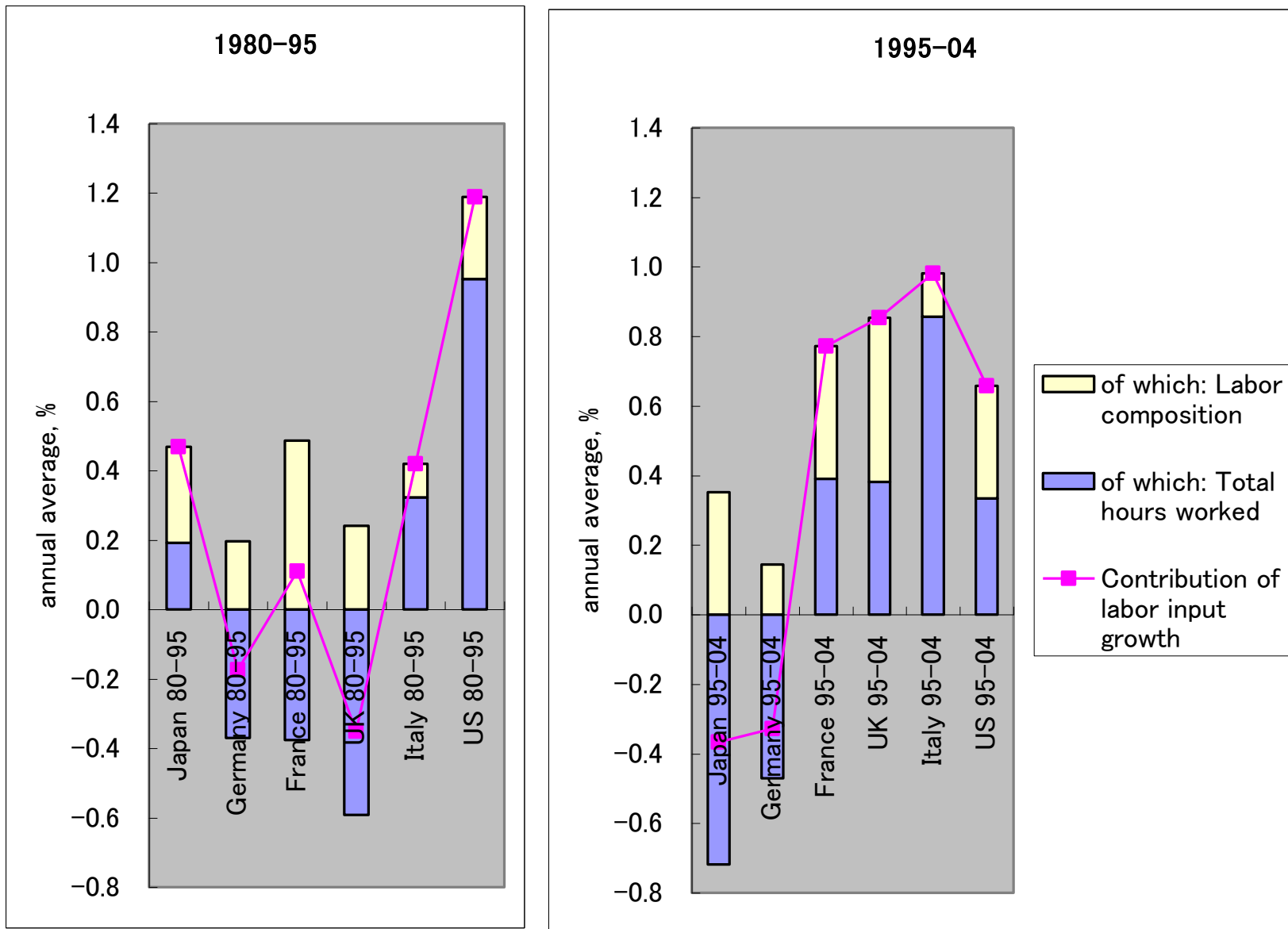
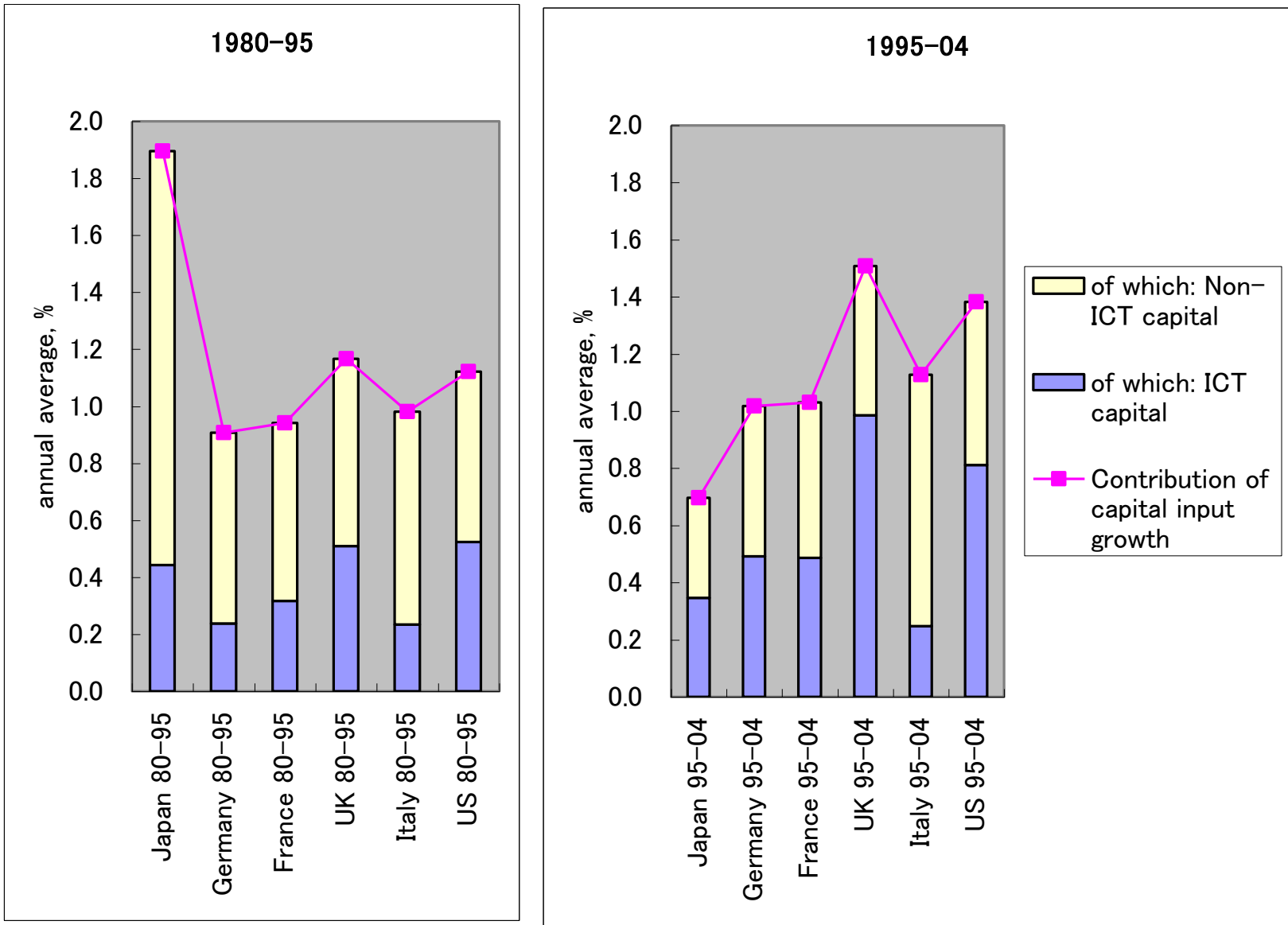


Figure 3. Contribution of Capital Input Growth: Japan, the US and the Major EU Economies

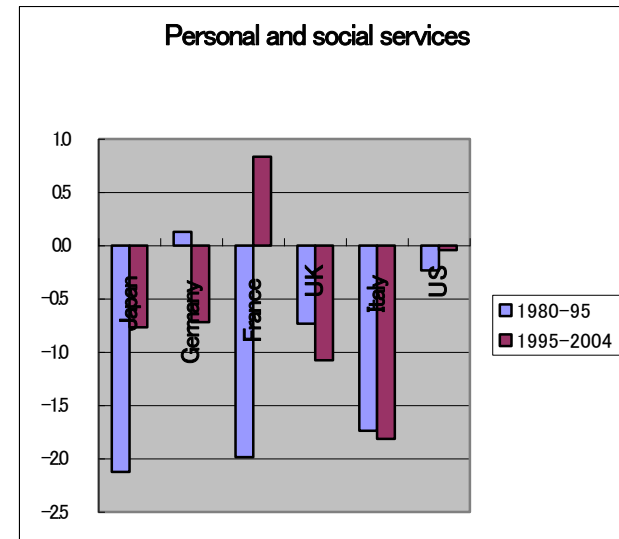
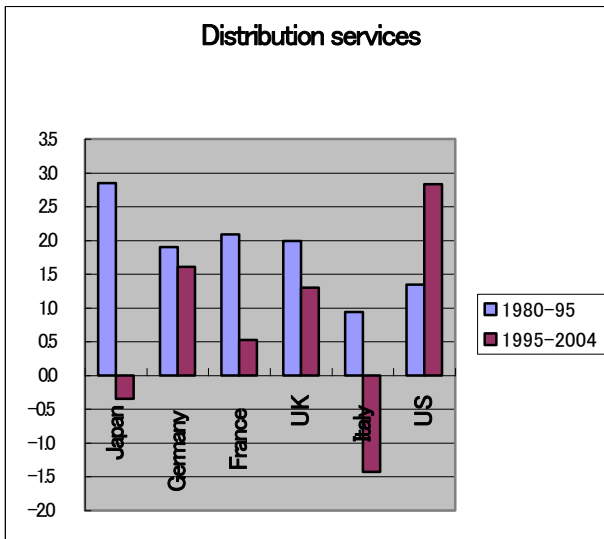
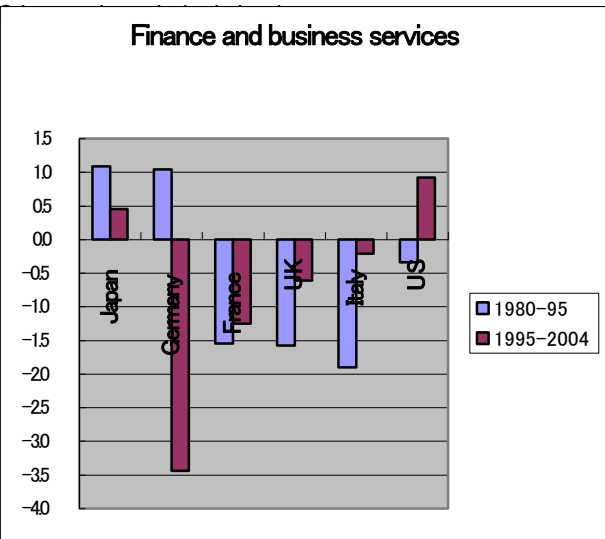
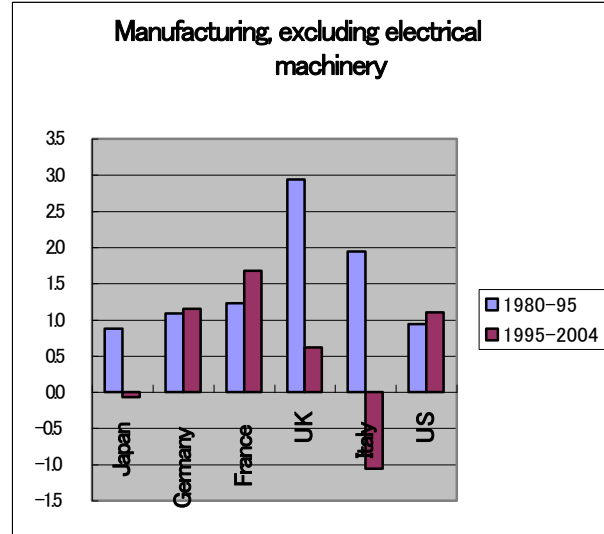
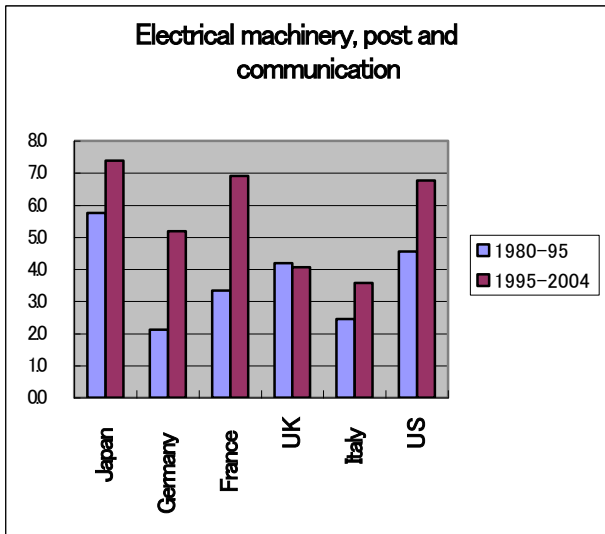


Source: EU KLEMS Database, March 2007.

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.**

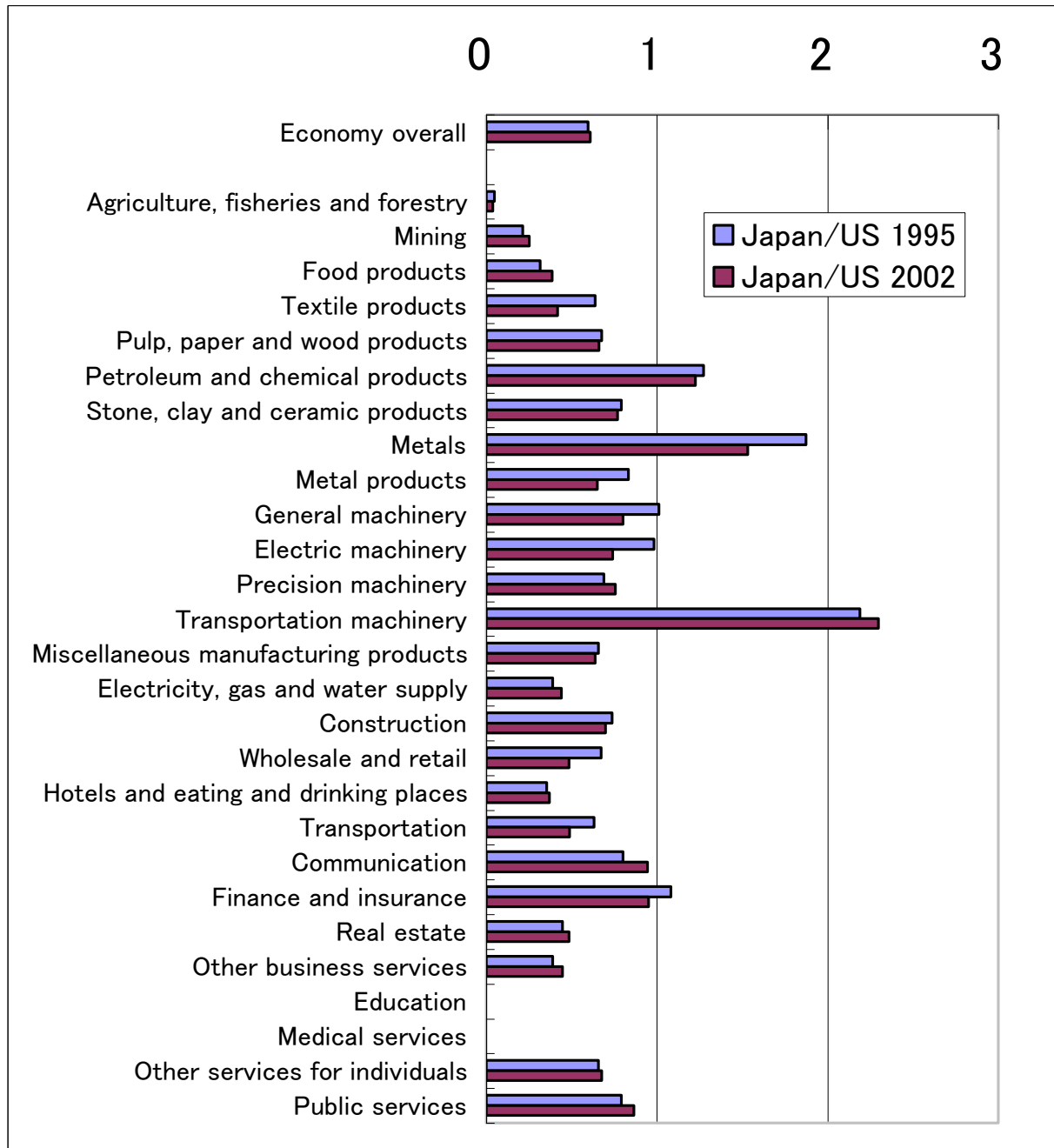
Figure 4. TFP Growth in the Market Sector: by Sector and by Country



Source: EU KLEMS Database, March 2007.

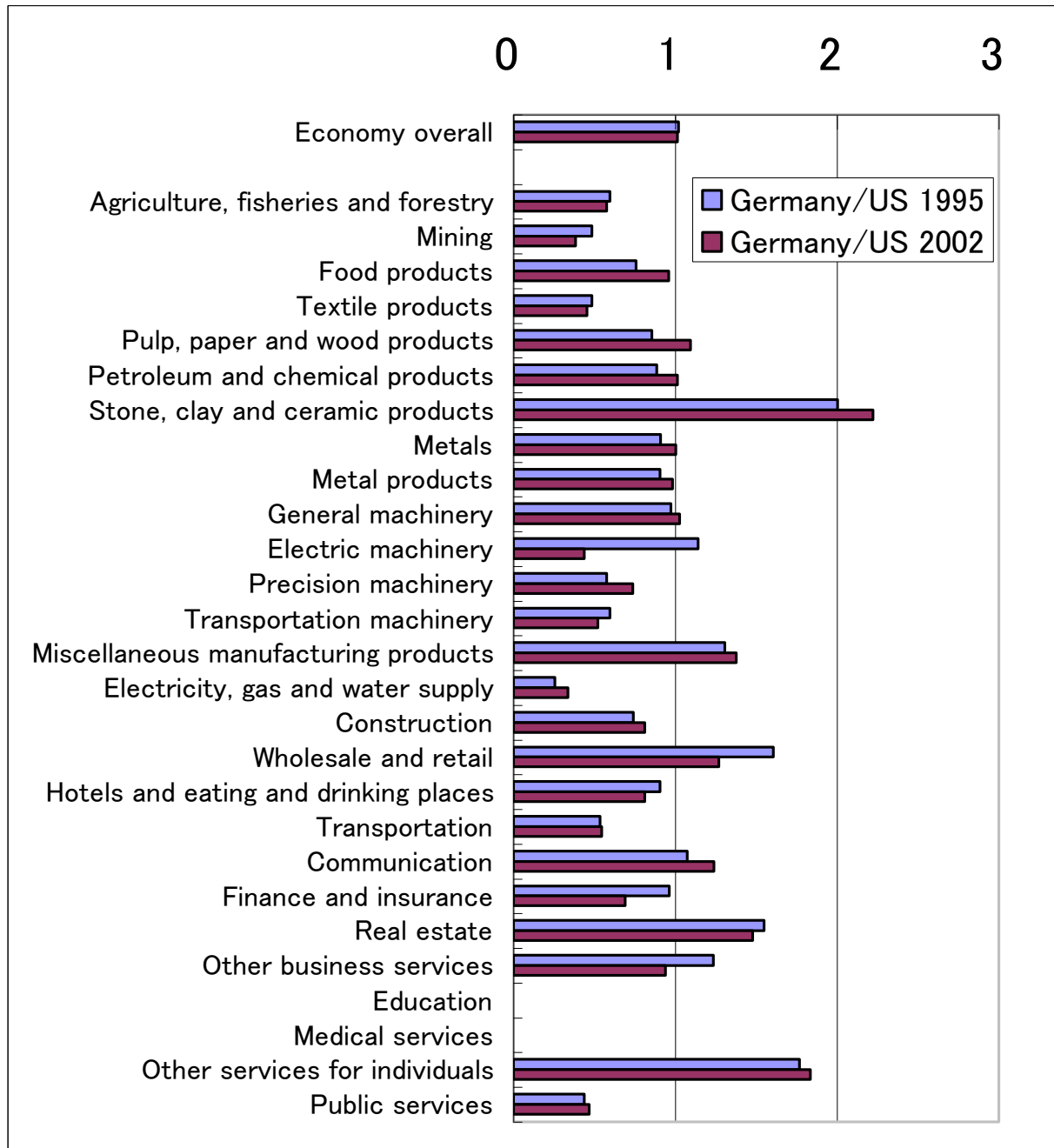
- **Inklaar et al. (2006) found that labor productivity levels in market services in continental Europe were on par with the US in 1997, but since then productivity growth in Europe has been much weaker, suggesting that the continental European countries need to do more to innovate and adjust economic 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



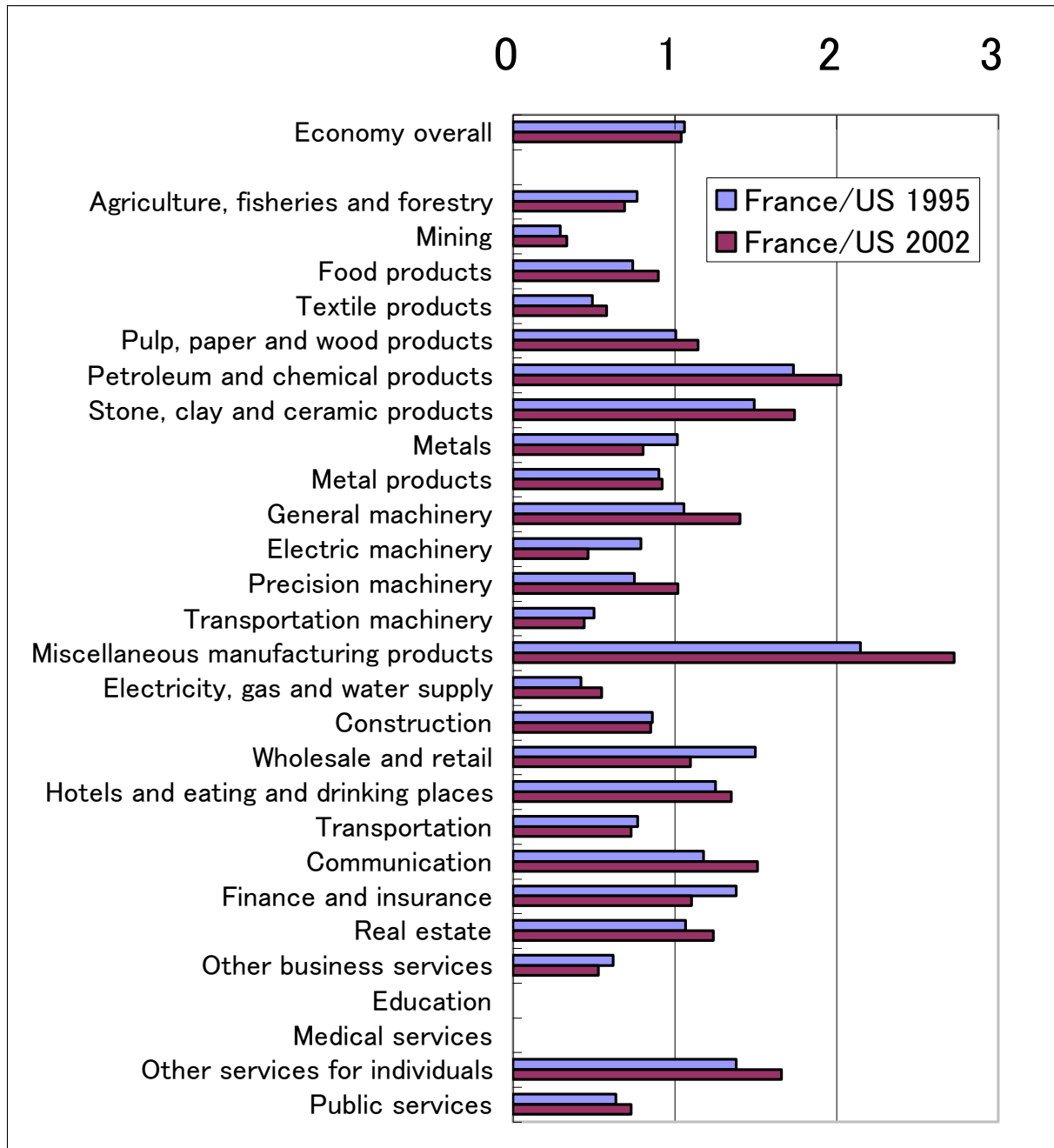
Source: JEF-JCER (2007).

Figure 6. Labor Productivity: Germany-US Comparison



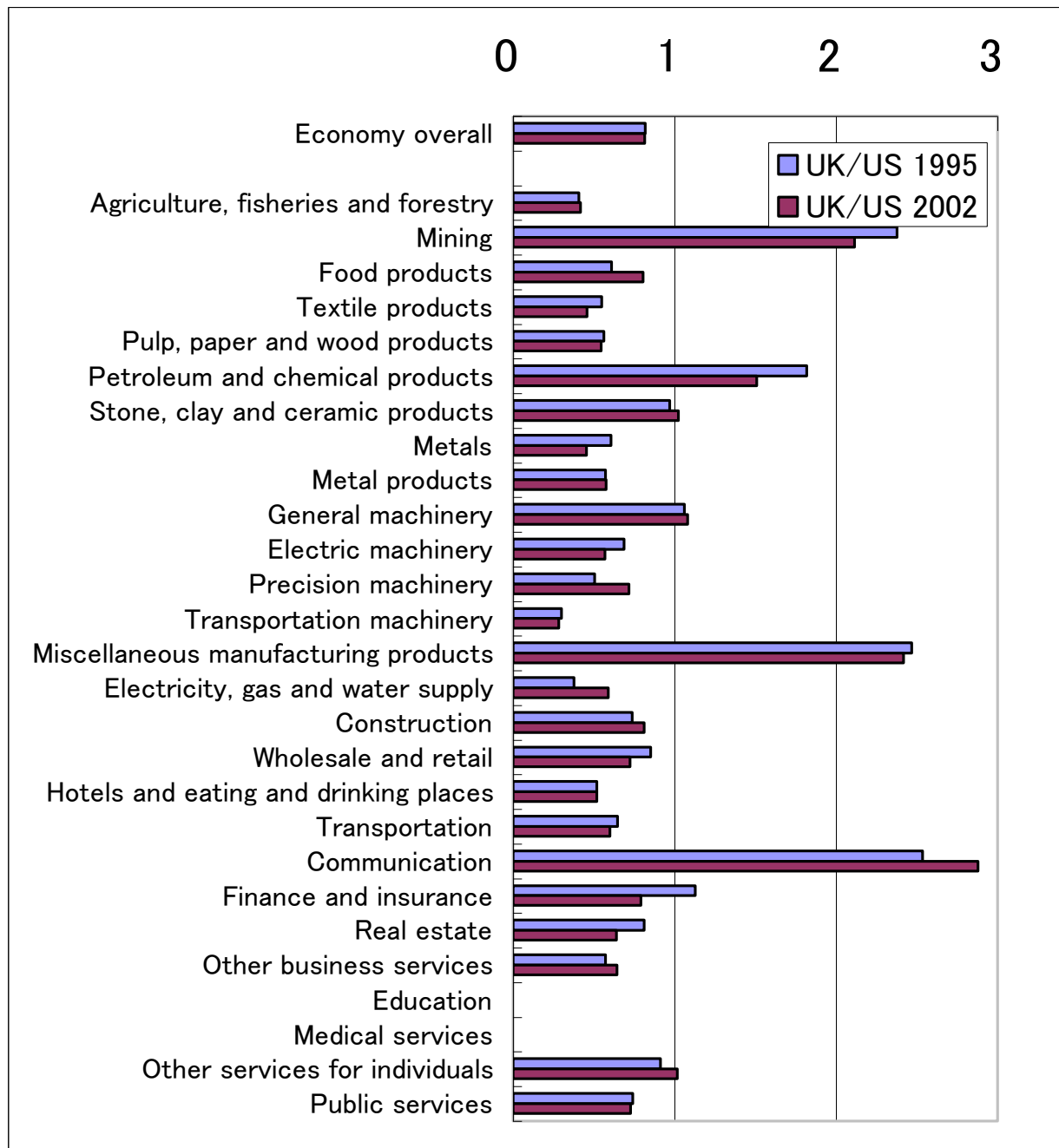
Source: JEF-JCER (2007).

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.**

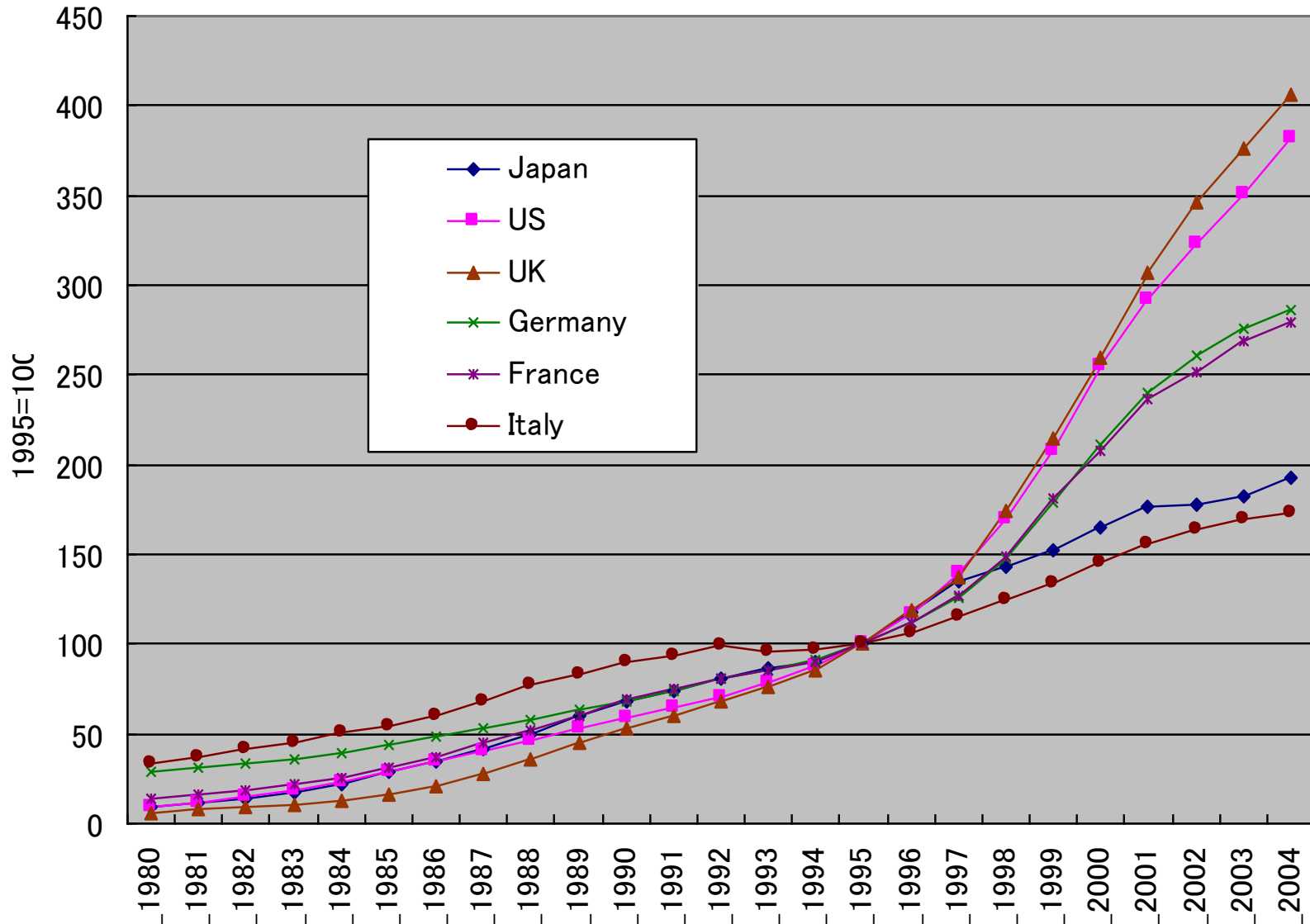
3. The Role of ICT Investment (1)

- **The previous studies about the role of ICT investment on economic growth;**
 - **Jorgenson (2001) Jorgenson and Stiroh (2000), Oliner , Sichel and Stiroh (2007): 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)

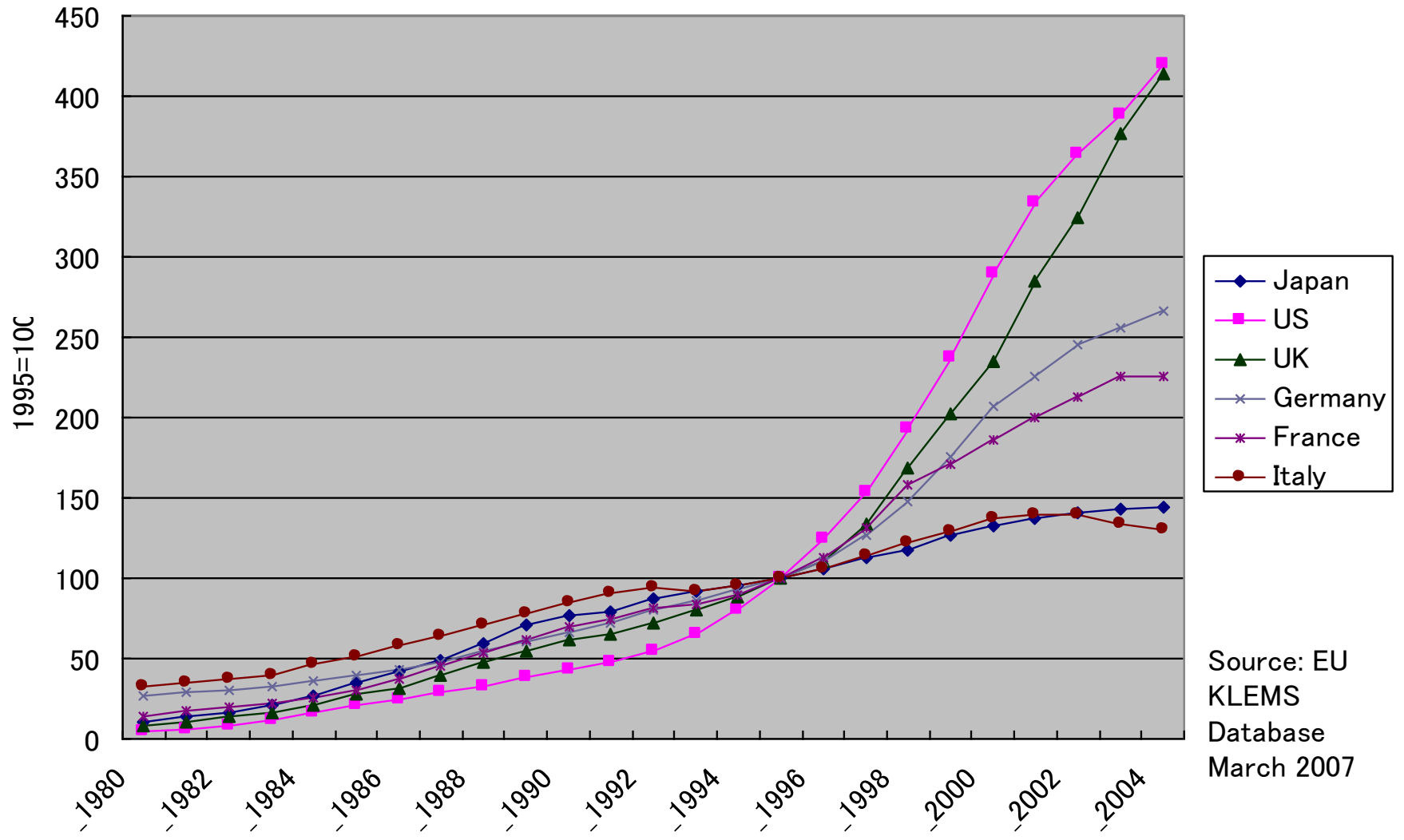
- **Comparing ICT investment by using EU KLEMS database**
- **The definition of ICT assets in EU KLEMS database: computing equipment, communication equipment, and software.**
- **Figure 9: comparing ICT capital service in Japan, the US, and the major EU countries.**

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



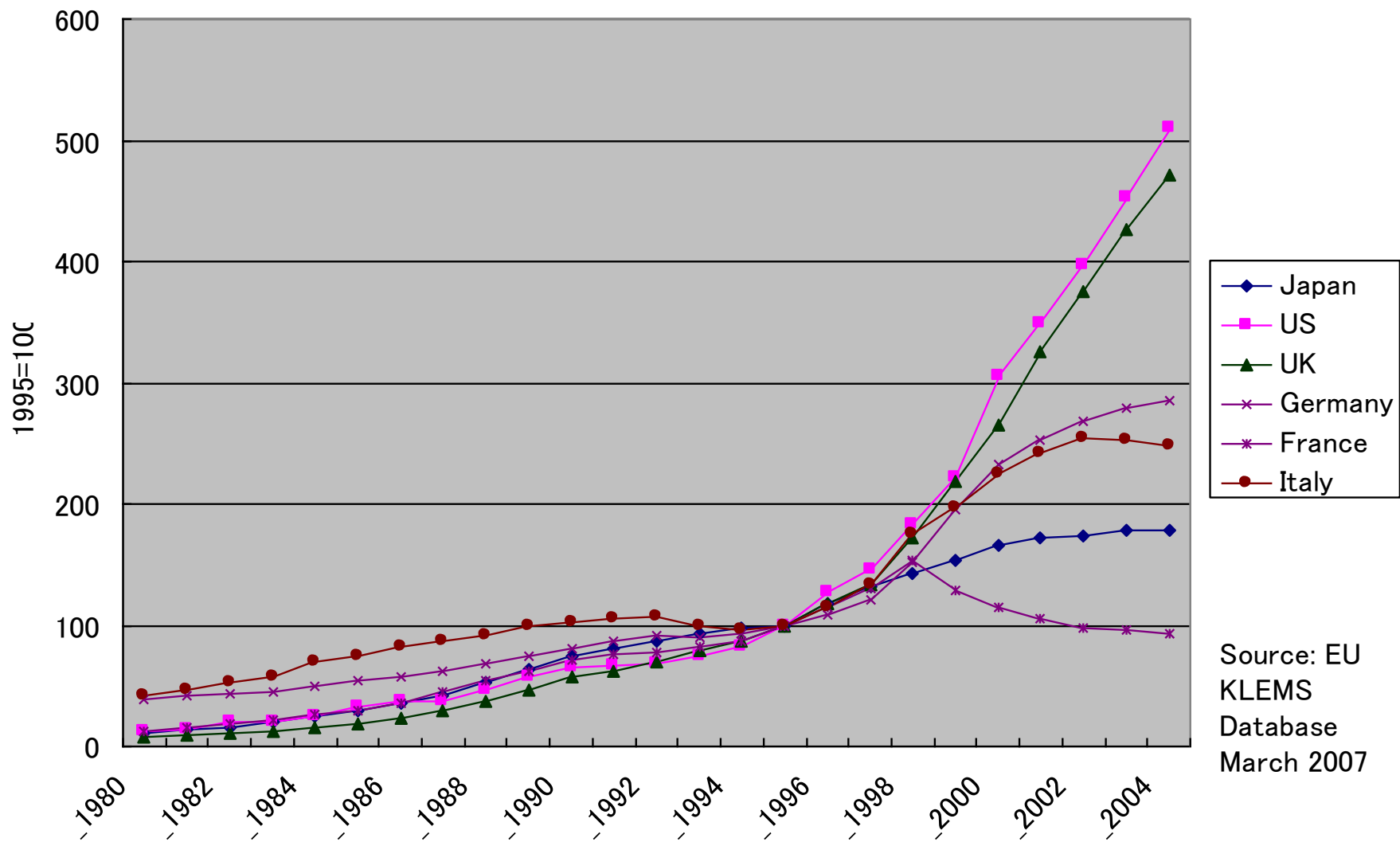
Source:
EU
KLEMS
Database
March

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



Source: EU
KLEMS
Database
March 2007

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



Source: EU
KLEMS
Database
March 2007

3. The Role of ICT Investment (3)

- 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.**

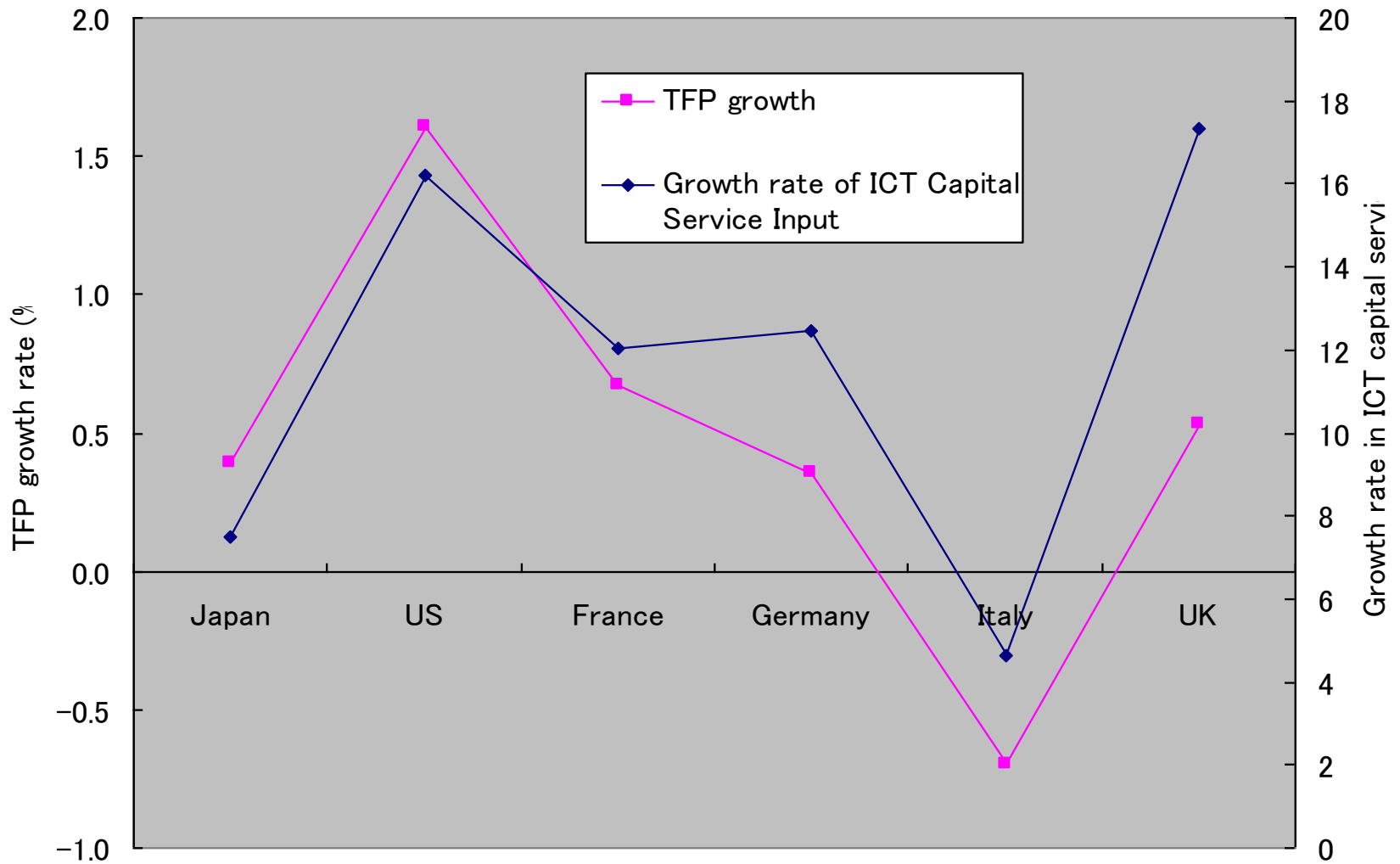
Table 1. Direct Contributions of ICT Capital Service Input Growth to the Economic Growth

	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												

4. Intangibles as Complements to ICT Capital

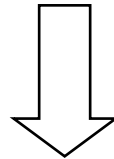
- **Figure 12: The degree of effects of ICT capital on TFP growth is different among firms and among countries (for example the US vs. the UK).**
- **Figure 12 implies that the second effect of accumulation in ICT capital depends on complementary factor to ICT capital.**

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



4. Intangibles as Complements to ICT Capital (contd.)

- **Intangible assets may play a complementary role on the effects of ICT capital on TFP growth**
- **In order to explain the productivity gap between the US and other developed countries, economists have focused on the role of intangible assets.**



- **Van Ark (2004), McGrattan and Prescott (2005), Corrado, Hulten, and Sichel (2005; 2006)**

Measurement of intangible investment in Japan

We measure intangible investment in Japan following the approach of Corrado, Hulten, and Sichel (2005, 2006). We estimated the three categories of intangible asset investment using the sources listed below.

1. Computerized information

Software and databases → *IO tables, Survey on Selected Service Industries, etc.*

2. Innovative property

Scientific and nonscientific R&D, mineral exploitation, copyright and license costs, and other product development, design, and research expenses → *Japan Industrial Productivity (JIP) Database, etc.*

3. Economic competencies

Brand equity, firm-specific human capital, and organizational structure → *JIP Database, The General Survey on Wages and Working Hours System, and Survey on Financial Statements of Business Enterprises*

Table 2: Intangible investment by category: US-Japan comparison

	Japan	US	UK
	2000-2004	CHS (2006)	MH (2006)
	(billion yen)	1998-2000	2004
		(billion US dollars)	(billion pounds)
Computerized information	10,630	154	19.8
Custom software	6,626		
Packaged software	841		7.5
In-house software	2,088	151	12.4
Databases	1,075	3	
Innovative property	26,991	425	37.6
Science and engineering R&D	13,522	184	12.4
Mineral exploration	17	18	0.4
Copyright and license costs	4,636	75	2.4
Other product development, design, and research expenses	8,815	149	22.4
Economic competencies	13,042	505	58.8
Brand equity	4,929	140	11.1
Firm-specific human capital	1,165		28.5
Organizational structure	6,948	365	19.2
Total	50,663	1085	116.2
Intangible investment /Value Added (%)	9.6	11.7	10.0
Intangible investment/tangible investment	0.5	1.2	1.1

1) Sources: Japan-authors' calculation, US-Corrado, Hulten and Sichel (2006), UK-Marrano and Haskel (2006).

Table 3 Comparison in intangible investment/GDP in US, UK , and Japan

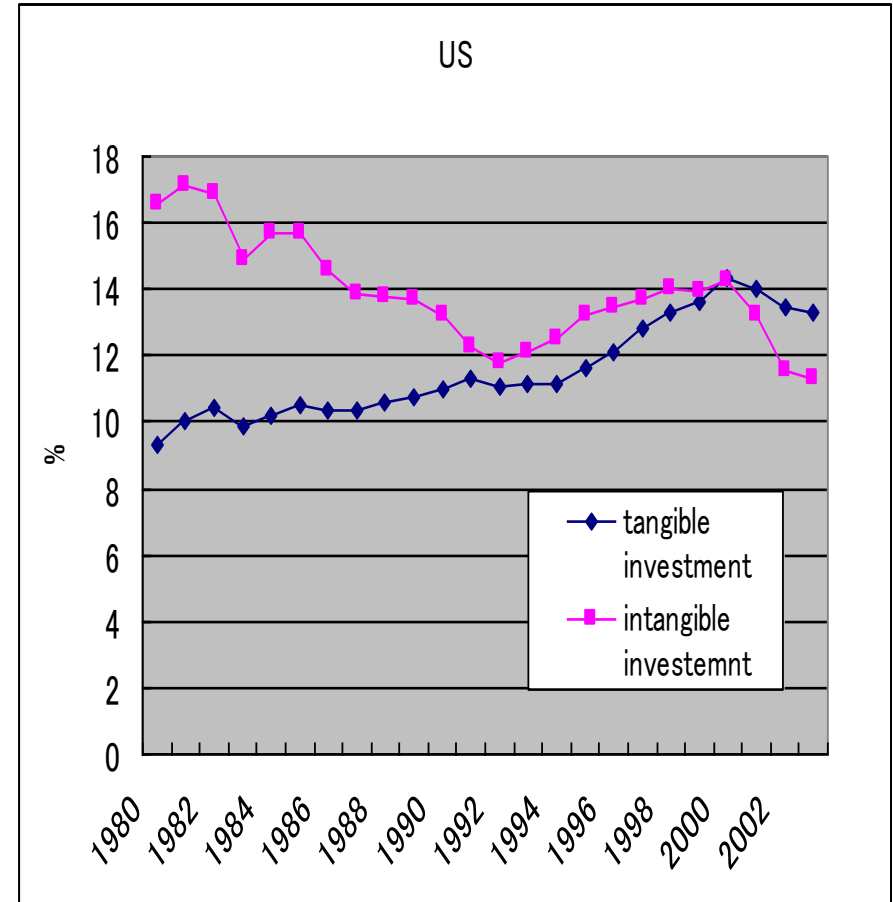
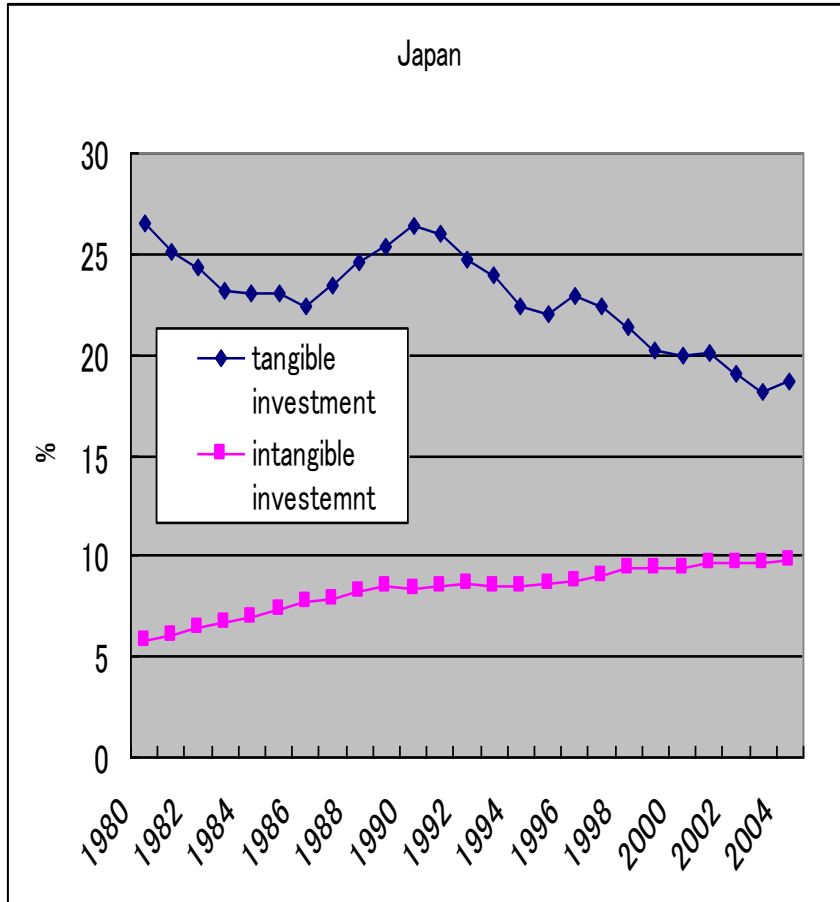
(%)

		Total intangible investment	Computerized information	Innvative property	Economic competencies
Japan	All industries (2000-04)	9.6	2.0	5.1	2.5
	Manufacturing (2000-04)	13.0	1.8	8.5	2.7
	Service (2000-04)	8.2	1.6	3.9	2.7
US	All industries (1998-2000)	11.7	1.7	4.6	5.4
UK	All industries (2004)	10.9	1.7	3.2	6.0

Measurement of intangible investment in Japan (Contd.)

- **The ratio of intangible investment to GDP was 9.6%, which is less than the equivalent figures for the US and the UK.**
- **While investment in computerized information and innovative property in Japan was not lower than that in the US and the UK, investment in economic competencies (especially, firm-specific human capital and organizational change) was much lower than that in the US and the UK.**
- **Moreover, the ratio of intangible investment to tangible investment was much lower than that in the US.**
- **While in the US, intangible investment has exceeded tangible investment since the mid-1990s, in Japan, intangible investment is still smaller than tangible investment.**

Tangible and intangible investment in Japan and US



Measurement of intangible investment in Japan: growth accounting

We examine the contribution of intangible assets to economic growth in Japan by following CHS (2006). The growth accounting results are as follows:

- 1. The contribution of intangible capital accumulation to labor productivity did not change from the 1980s to the 1990s.**
- 2. However, it turned to be negative in the early 2000s. The TFP growth calculated by the conventional way may be underestimated. The negative growth in intangible assets in Japan was caused by the decline in firm specific human resources due to the increase in non-regular labor force.**
- 3. The contribution of intangible capital to total labor productivity growth in Japan is substantially smaller than in the US.**

Table 4 Source of Labor Productivity Growth

	Japan	US
	2000-05	1995-2003
Labor productivity	1.40	3.09
Capital deepening	0.88	1.68
Tangibles	0.97	0.85
Intangibles	-0.09	0.84
Labor composition		0.33
TFP growth	0.52	1.08

5. The Major Results

- 1. It is not the gap in TFP growth but differences in factor input growth that underlie the large difference in the economic growth performance of France, the UK and Italy on the one hand and Japan on the other in the period after 1995. 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. The US was exceptional in accomplishing an acceleration in TFP growth.**
- 2. TFP growth in the ICT-producing sector was still highest in Japan among the six economies after 1995. However, the problem for Japan is that, like in other countries, the share of this sector in the economy overall is not very large. 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 very large (23.4% and 16.8% respectively).**

5. The Major Results (Contd.)

- 3. 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.**
- 4. The US and the UK experienced a very rapid increase in ICT capital service inputs after 1995. In contrast with this, in Japan, the contribution of ICT capital service input growth declined in all sectors after 1995.**
- 5. According to several recent studies, it seems that in order to fully realize the direct and indirect efficiency-improving effects of ICT capital, the simultaneous accumulation of intangible assets, such as human capital and organizational capital, is indispensable. Investment activity in intangibles is less active in Japan than in the US and the UK. The relatively low level of intangible investment may be a good candidate to explain why the accumulation of ICT capital and TFP growth stalled in Japan.**