

Productivity Dynamics: A Comparison of the Manufacturing Sector in Korea and Japan

Prepared for the one-day workshop on
Intangible Investment, Innovation and Productivity

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- **Long-term Trends**
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- **Preliminary Findings**
 - “ **Productivity Growth by Technology Level**
 - “ **Firm Dynamics by Technology Level**
- **Implications and Future Works**

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Japan and Korea

- **Similarities**

- “ Export-oriented growth
- “ Strong manufacturing (but weak tertiary sector?)
- “ Aging population
- “ Increasing competition from emerging economies (especially from China)

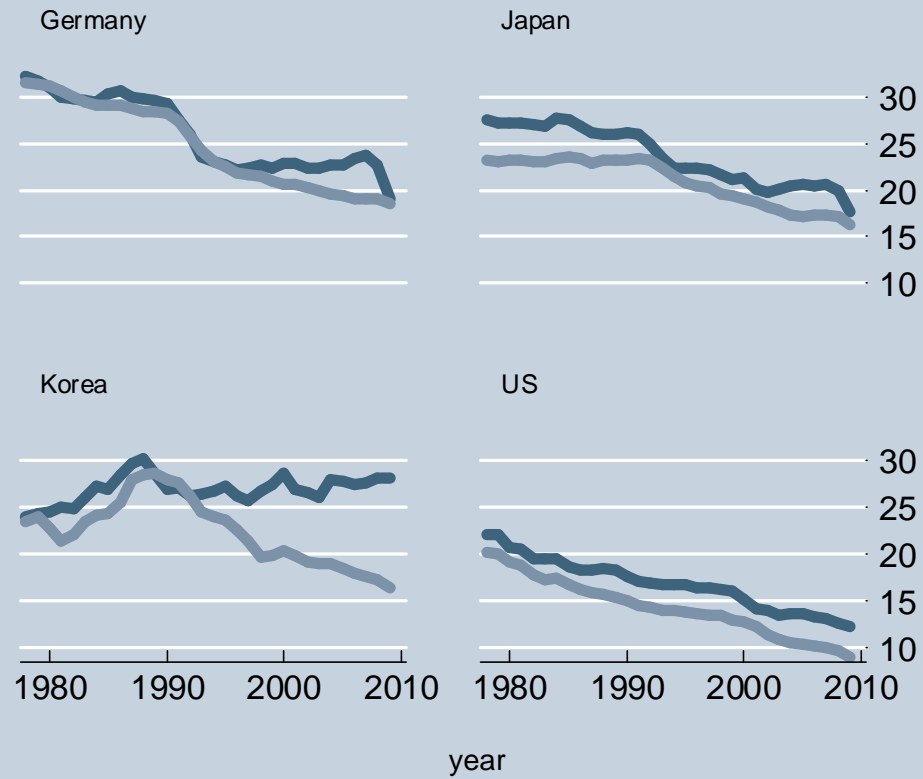
- **Differences**

- “ Different size
- “ Distance to frontier
- “ Latecomer's advantage
- “ Speed of recovery
- “ Different challenges

Past trends

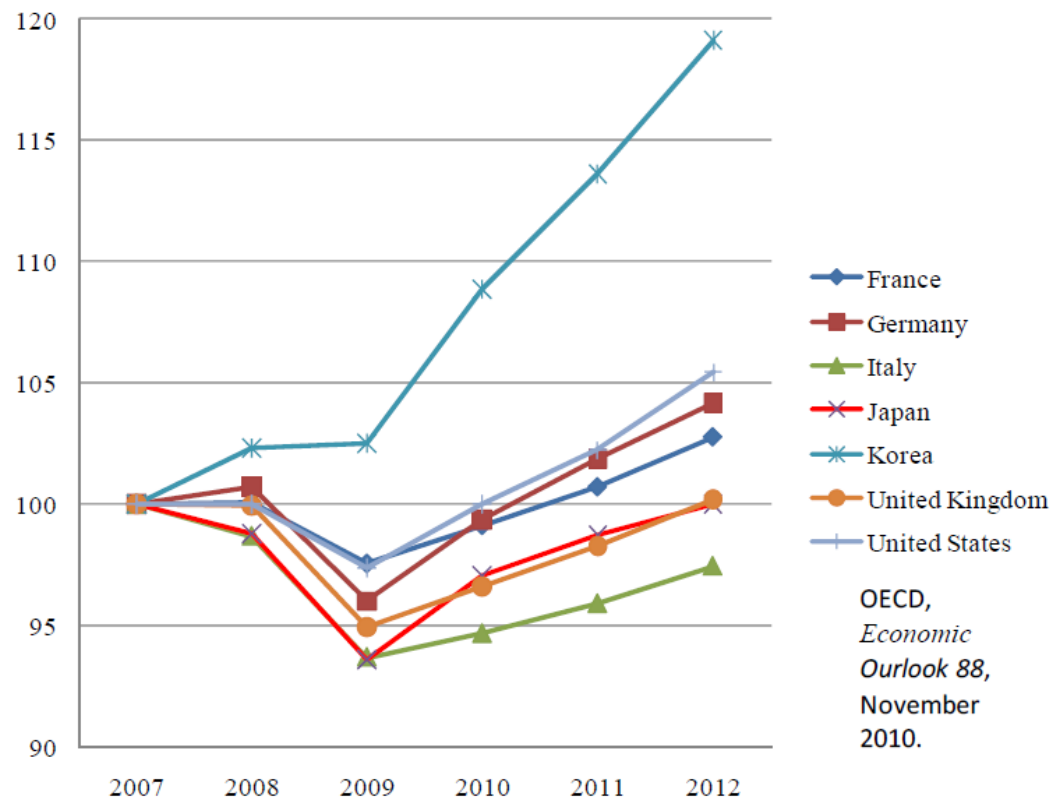
Manufacturing Share relative to Total Economy

Value added Employment



Projections

Figure 16. Real GDP of Major OECD Countries: Past Record and Forecast (2007=100)

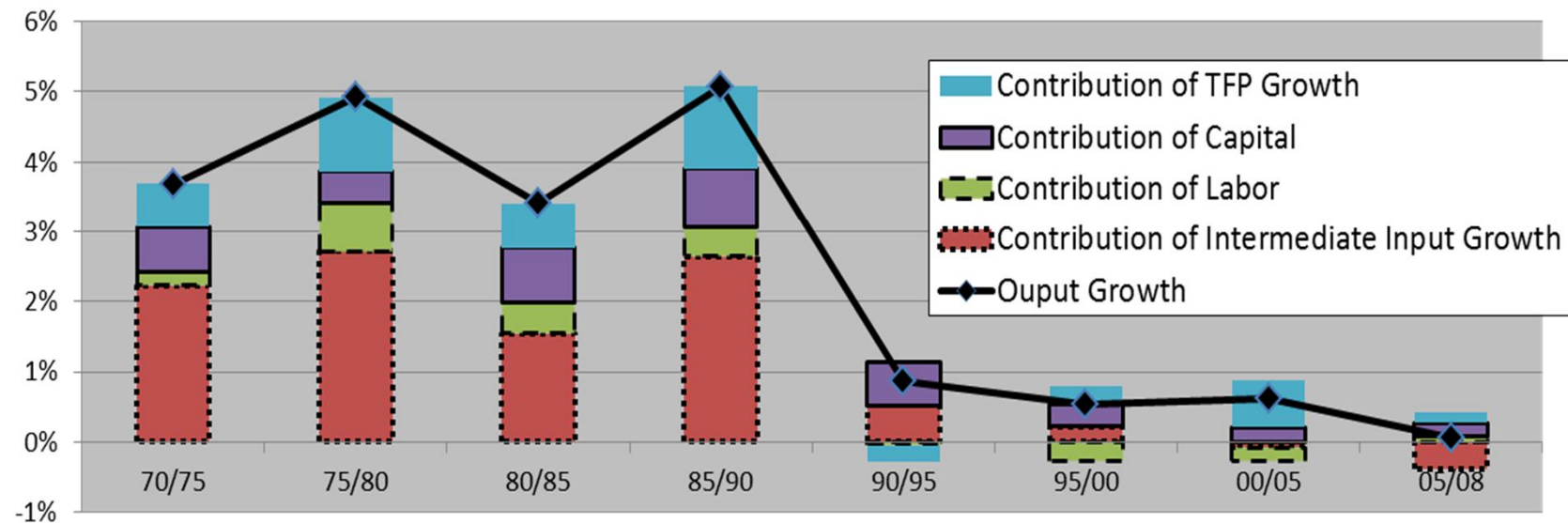


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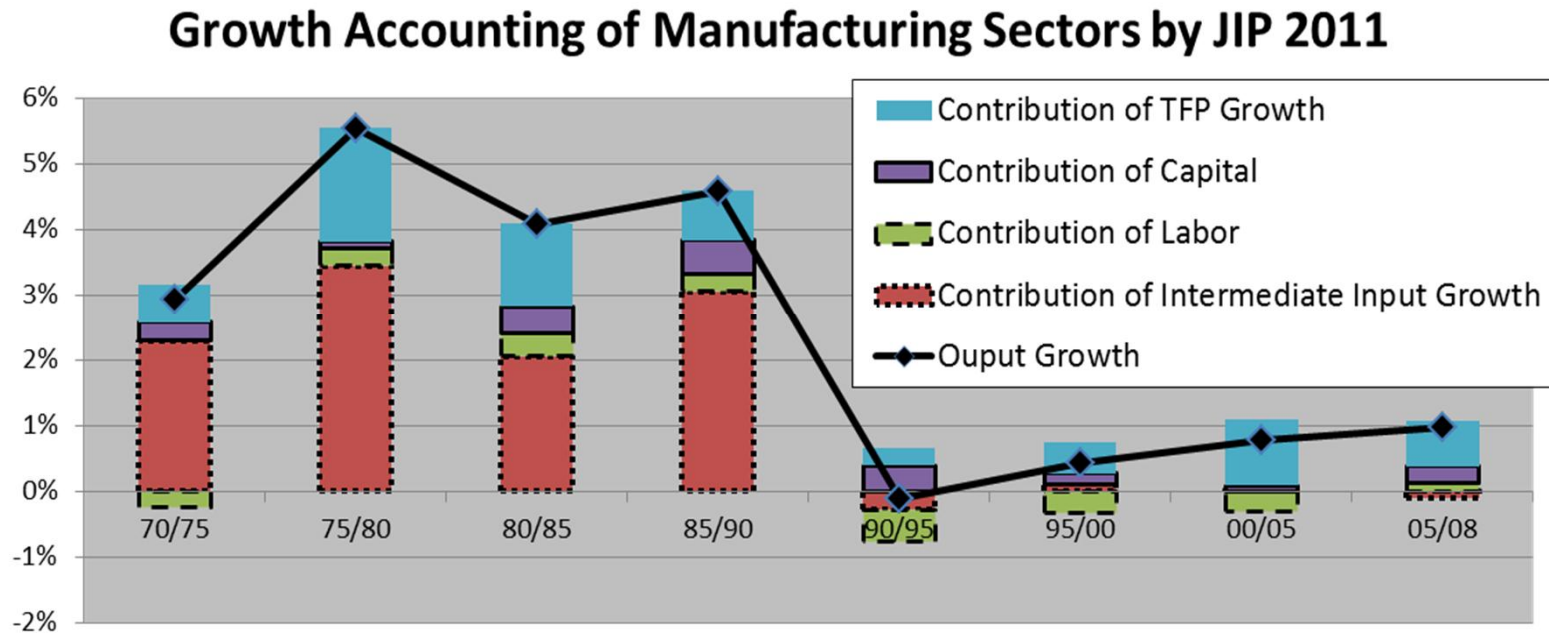
Long-term Trends: Japan (1)

Growth Accounting of Market Economy by JIP 2011



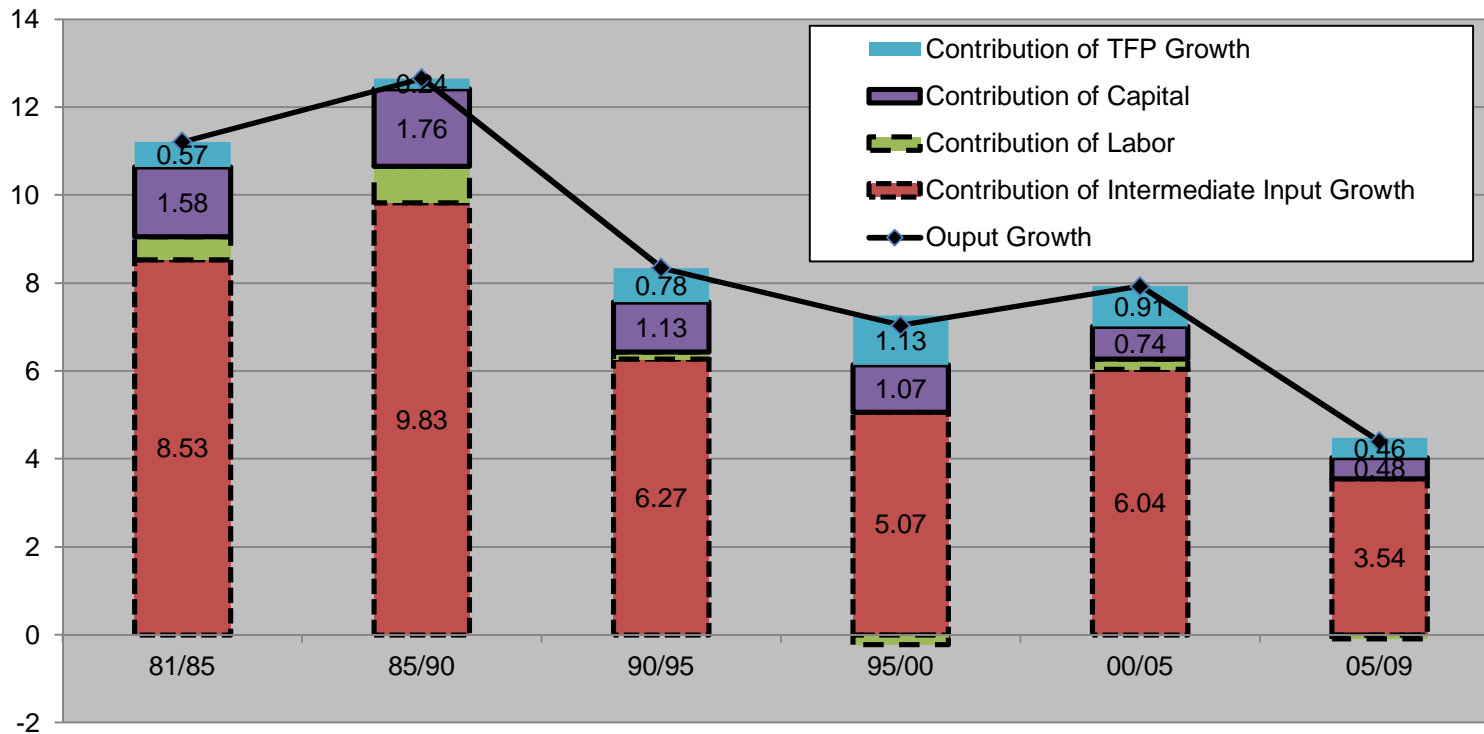
- Growth accounting results for Japan's private sector.
- TFP growth slowed down during the 1990s.
- Since the 2000s, the most important source of Japan's economic growth has been TFP growth.

Long-term Trends: Japan (2)



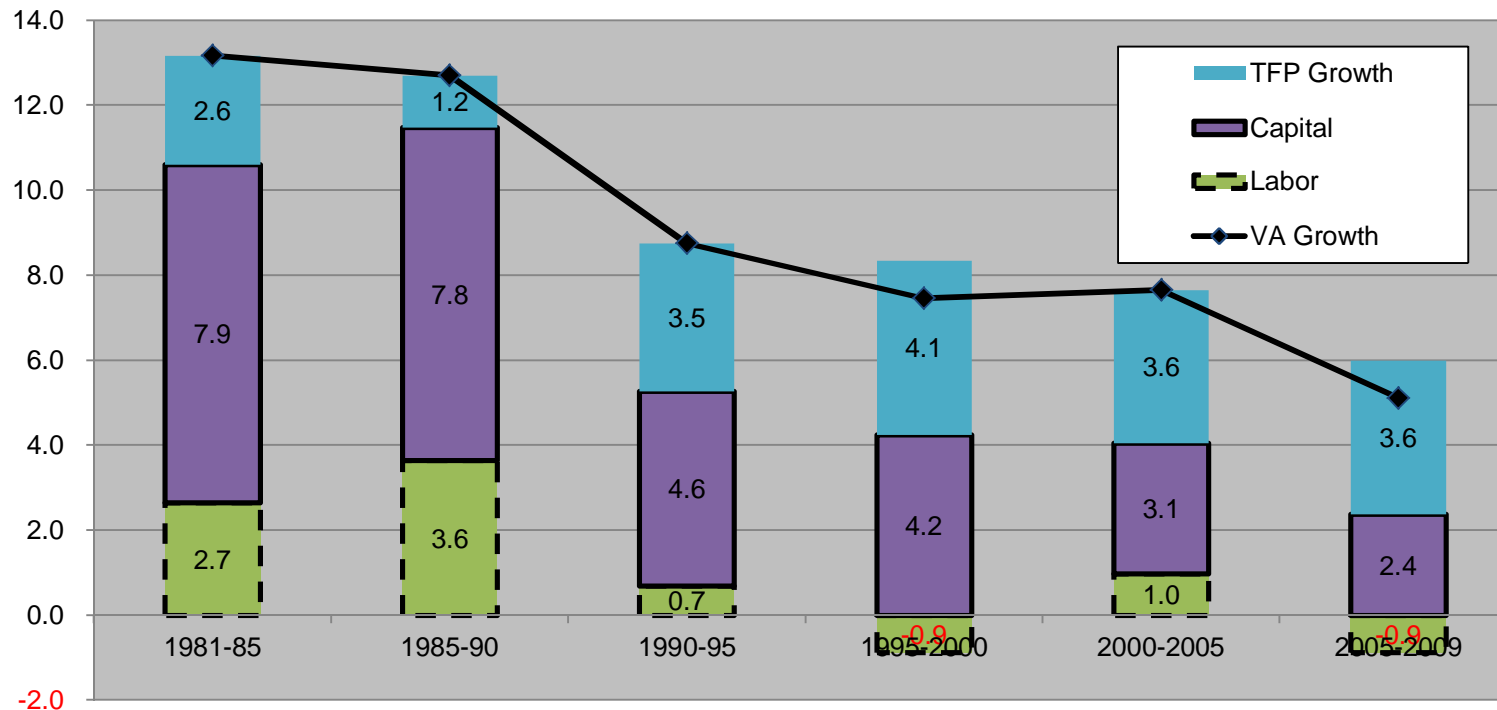
- Growth accounting results for Japan's manufacturing sector.
- TFP growth also slowed down during the 1990s.
- Since the 2000s, TFP growth in the manufacturing sector has recovered.

Long-term Trends: Korea (1)



- Growth accounting of Korea's manufacturing sector output (KIP 2011)
- TFP growth fluctuated, but recently has been decelerating.
- Since the 1990s, the contribution of labor input has been close to zero.

Long-term Trends: Korea (2)



- Growth accounting for Korea's manufacturing sector VA (KIP 2011)
- Growth in VA decelerating, but productivity growth remains robust.
- Contribution of factor input growth has been declining since 1990.

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Micro Data: Japan

- **Main Data Source: *Census of Manufactures***
 - “ Coverage: All plants in the manufacturing sector (with 4 or more employees)
 - “ Information: Shipments, number of employees, book value of tangible fixed assets, wage bill, intermediate materials, etc.
 - “ Plant-level, not firm-level
- **Additional Data Sources**
 - “ *Establishment and Enterprise Census*: Larger coverage of establishments, but fewer items covered
 - “ *Basic Survey of Japanese Business Structure and Activities* : Firm-level data since 1991

Micro Data: Korea

- **Main Data Source: *Mining and Manufacturing Survey***
 - “ Coverage: All plants with five or more employees in the mining and manufacturing industries
 - “ Information: Plant-level information on output, inputs, and a variety of additional items, including the plant ID, the regional code, and the industry code assigned to each plant based on its major product. Similar to *Census of Manufactures* of Japan
 - “ Plant-level, not firm level
- **Additional Data Sources**
 - “ *Census on Establishments*: Larger coverage of establishments, but fewer items covered
 - “ *Survey of Business Activities*: Firm-level data since 2005

Analysis of Productivity Dynamics

- Panel data based on *Census of Manufactures* (Japan, 1985-2005) and *Mining and Manufacturing Survey* (Korea, 1985-2003).

➤ Calculation of TFP at the plant level

“ Following Good, Nadiri and Sickles (1997) and Aw, Chen and Roberts (2001), we measured each plant’s TFP level in comparison with the industry average TFP level.

“ Aggregation at industry level (54 manufacturing sectors in Japan; 34 manufacturing sectors in Korea)

$$\ln TFP_{f,t} = (\ln Q_{f,t} - \overline{\ln Q_t}) - \sum_{i=1}^n \frac{1}{2} (S_{i,f,t} + \overline{S_{i,t}}) (\ln X_{i,f,t} - \overline{\ln X_{i,t}}) \text{ for } t = 0,$$

and

$$\begin{aligned} \ln TFP_{f,t} = & (\ln Q_{f,t} - \overline{\ln Q_t}) - \sum_{i=1}^n \frac{1}{2} (S_{i,f,t} + \overline{S_{i,t}}) (\ln X_{i,f,t} - \overline{\ln X_{i,t}}) \\ & + \sum_{s=1}^t (\overline{\ln Q_s} - \overline{\ln Q_{s-1}}) - \sum_{s=1}^t \sum_{i=1}^n \frac{1}{2} (\overline{S_{i,s}} + \overline{S_{i,s-1}}) (\overline{\ln X_{i,s}} - \overline{\ln X_{i,s-1}}) \text{ for } t \geq 1. \end{aligned}$$

Productivity Dynamics Decomposition

“ We define the industry TFP level in year t as:

$$\ln TFP_t = \sum_{f=1}^n \theta_{f,t} \ln TFP_{f,t}$$

“ We can decompose changes in industry average TFP levels into the sum of the following four factors (Foster, Haltiwanger and Krizan, 2001):

➤ Within effect:

$$\sum_{f \in S} \theta_{f,t-\tau} \Delta \ln TFP_{f,t}$$

➤ Between effect:

$$\sum_{f \in S} \Delta \theta_{f,t} (\ln TFP_{f,t-\tau} - \overline{\ln TFP_{t-\tau}})$$

➤ Covariance effect:

$$\sum_{f \in S} \Delta \theta_{f,t} \Delta \ln TFP_{f,t}$$

➤ Entry effect:

$$\sum_{f \in N} \theta_{f,t} (\ln TFP_{f,t} - \overline{\ln TFP_{t-\tau}})$$

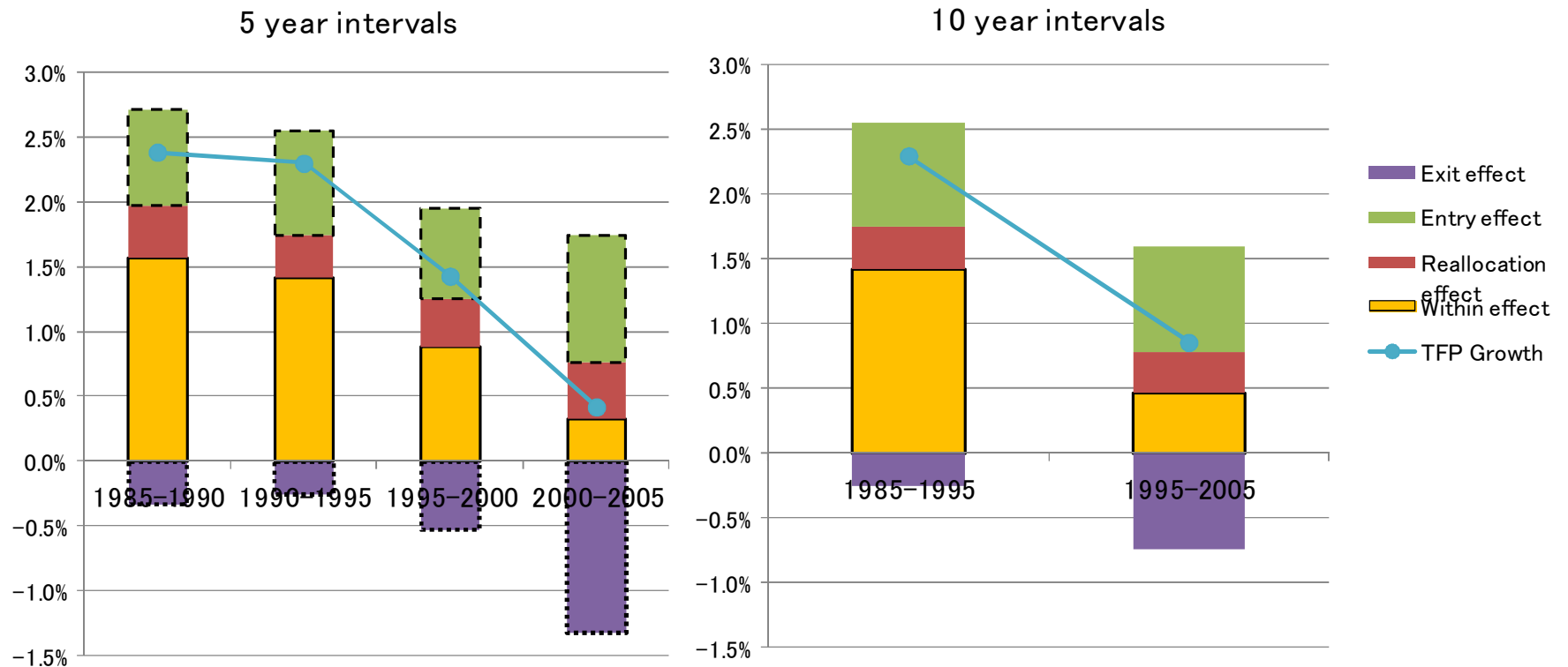
➤ Exit effect:

$$\sum_{f \in X} \theta_{f,t-\tau} (\overline{\ln TFP_{t-\tau}} - \ln TFP_{f,t-\tau})$$

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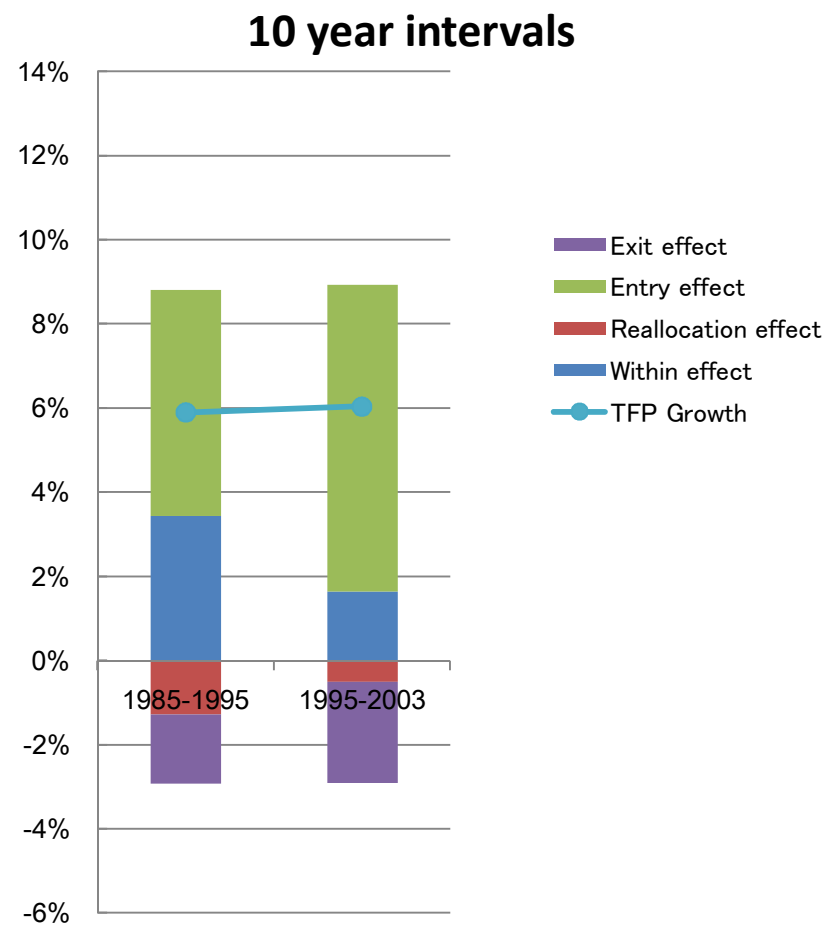
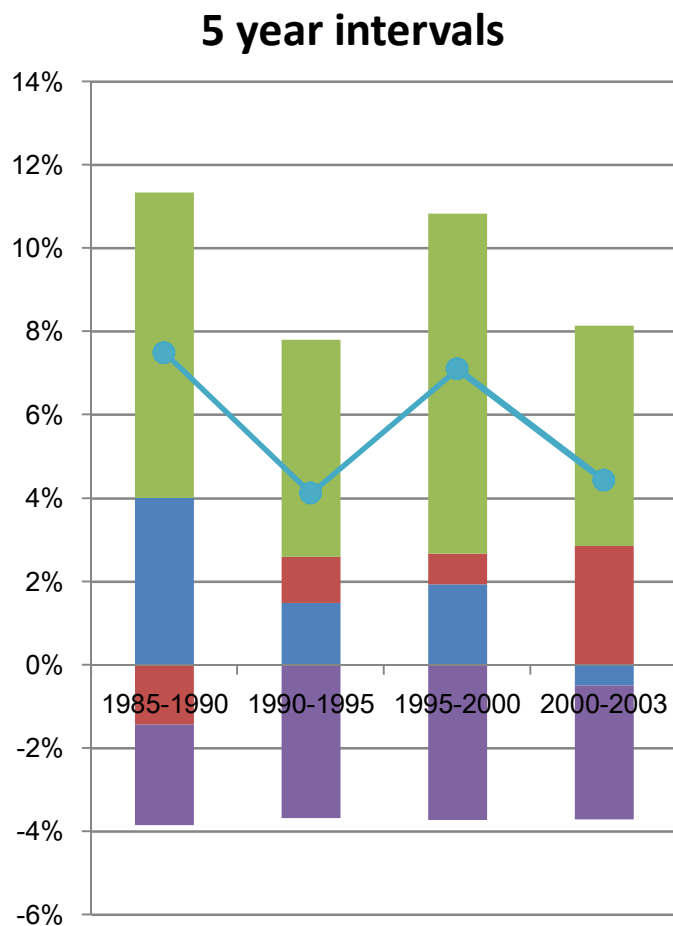
Productivity Dynamics: Japan



Productivity Dynamics: Japan

- **TFP growth has been declining since 1990.**
- **Most of the productivity decline occurred within plants.**
- **Plants with higher productivity tend to increase their market share and Entering plants tend to have above-average productivity levels.**
- **Exiting firms also tend to have above-average productivity levels, lowering aggregate productivity level. Such negative exit effects have been sizable.** (In fact, most of the decrease in TFP growth during 2000-2005 can be explained by negative exit effects.)

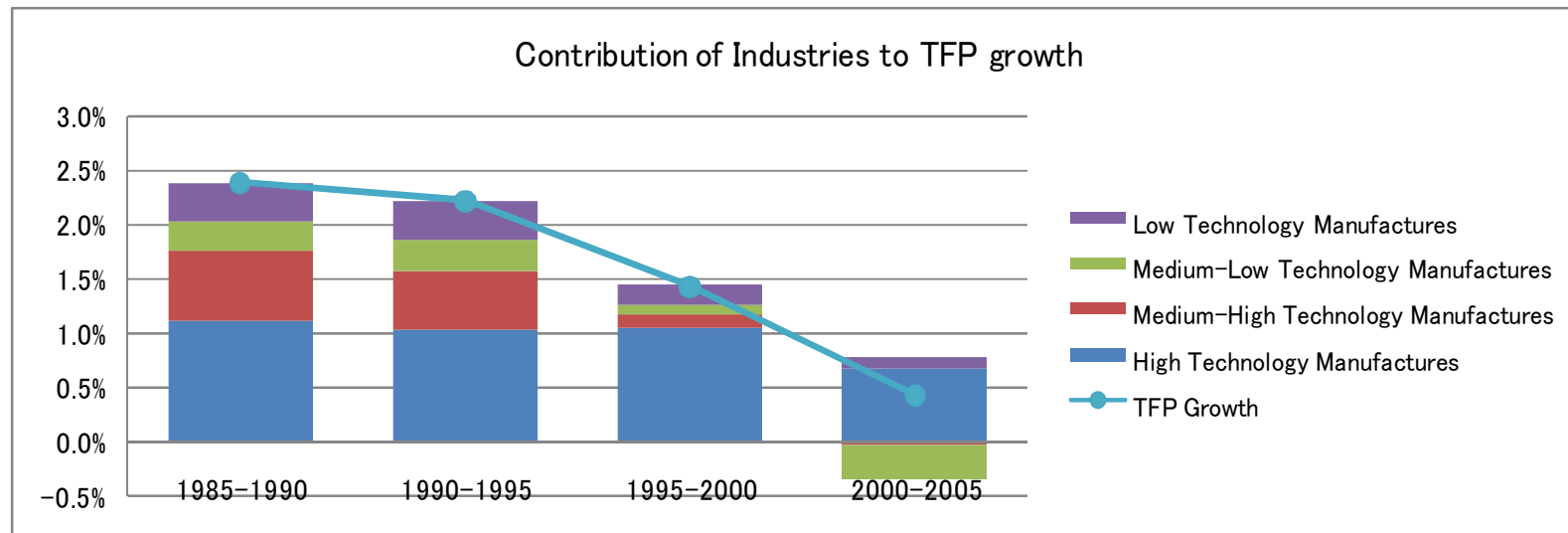
Productivity Dynamics: Korea



Productivity Dynamics: Korea

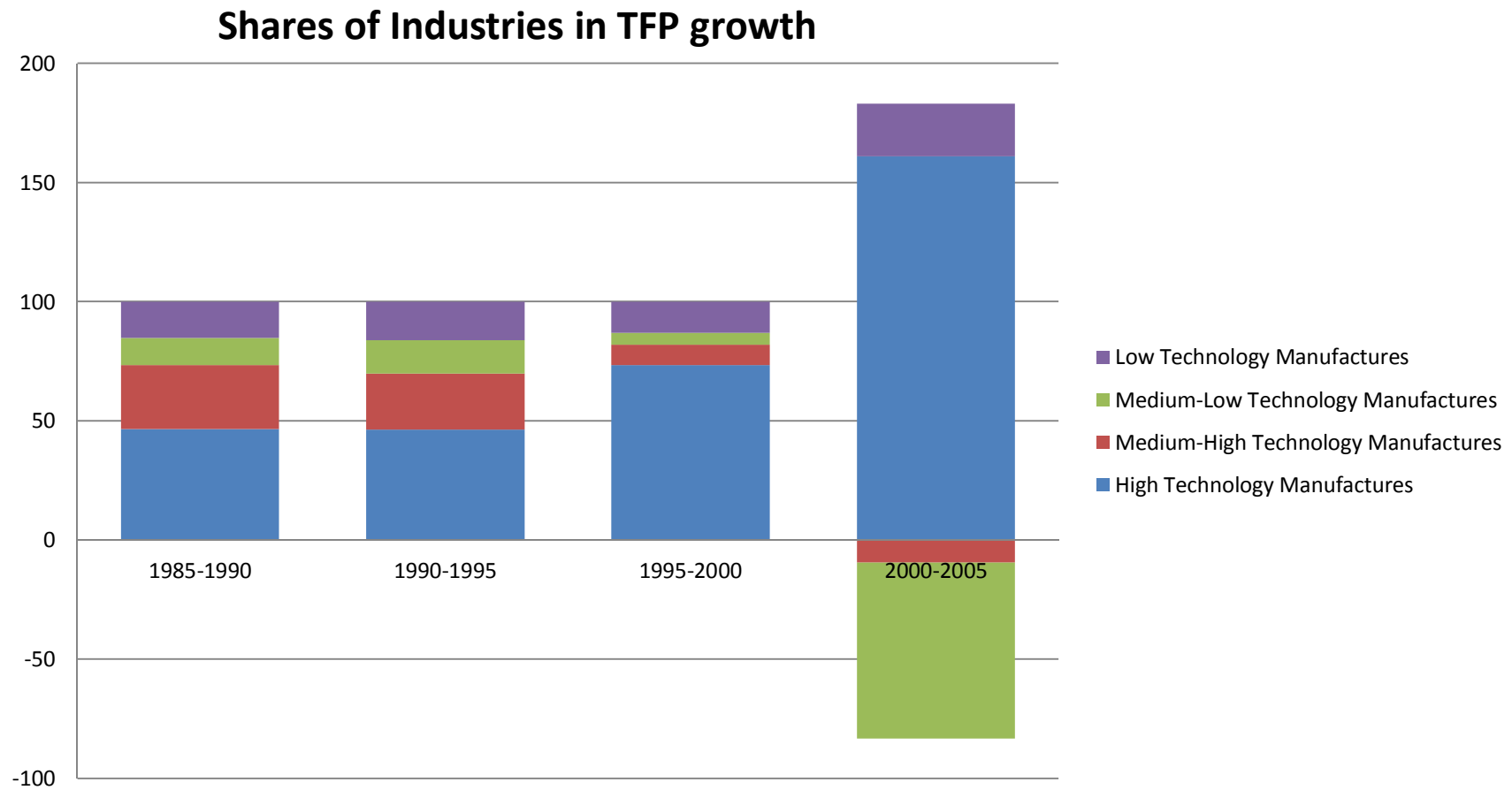
- **TFP growth rate still remains high.**
- **Within plant productivity growth has been declining, while plant entry continues to have positive effects.**
- **Similar to Japan, many exiting plants have above-average productivity.**
- **The negative exit effect was not only sizable but also persistent.**

Technology and Productivity Dynamics: Japan



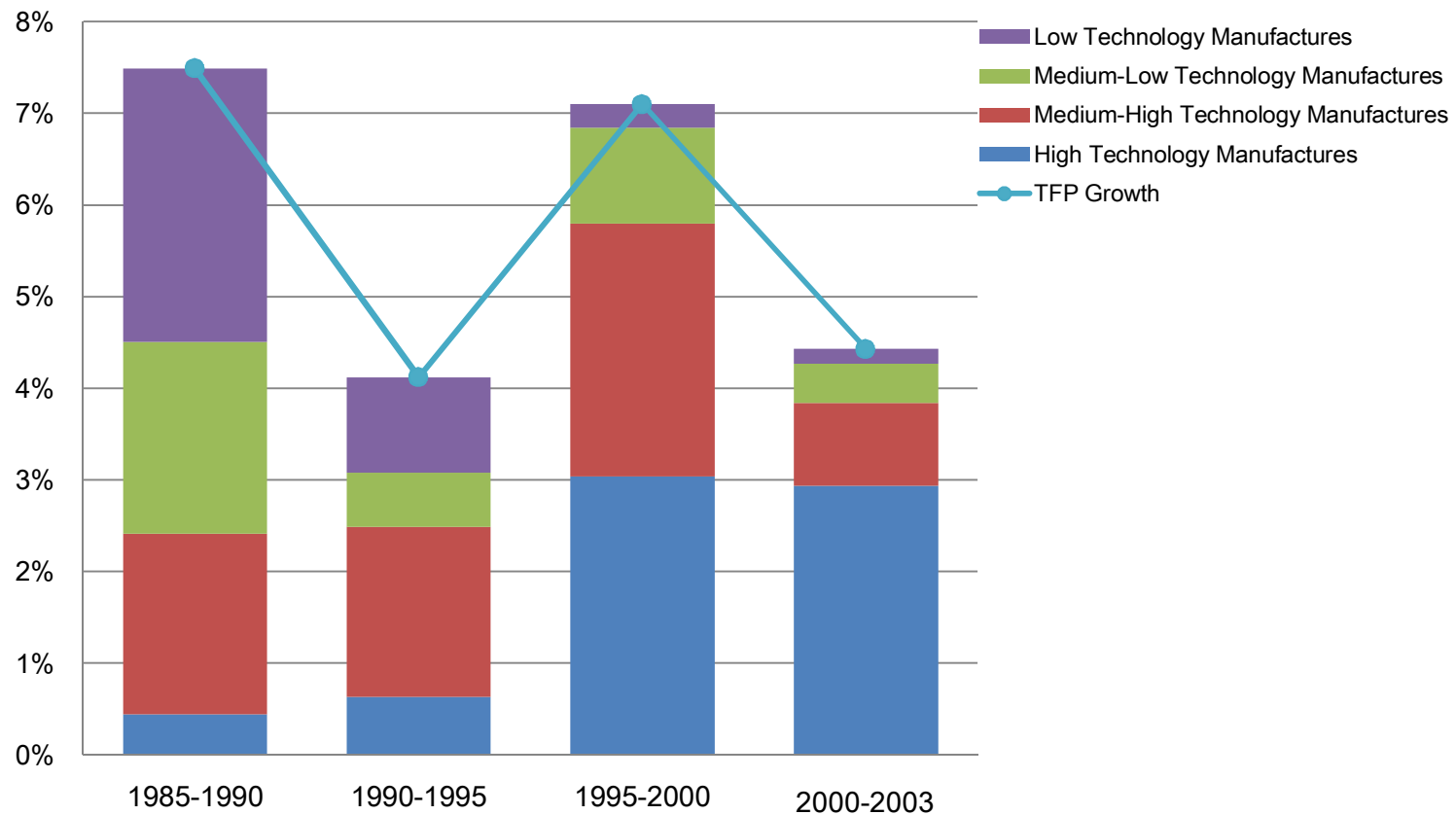
- **High technology industries, such as electronics and pharmaceutical industry account for most of the productivity growth in the manufacturing sector.**
- **The contribution of medium-high and medium low technology industries (such as chemicals, motor vehicles, iron and steel) has sharply declined since 1995.**

Technology and Productivity Dynamics: Japan

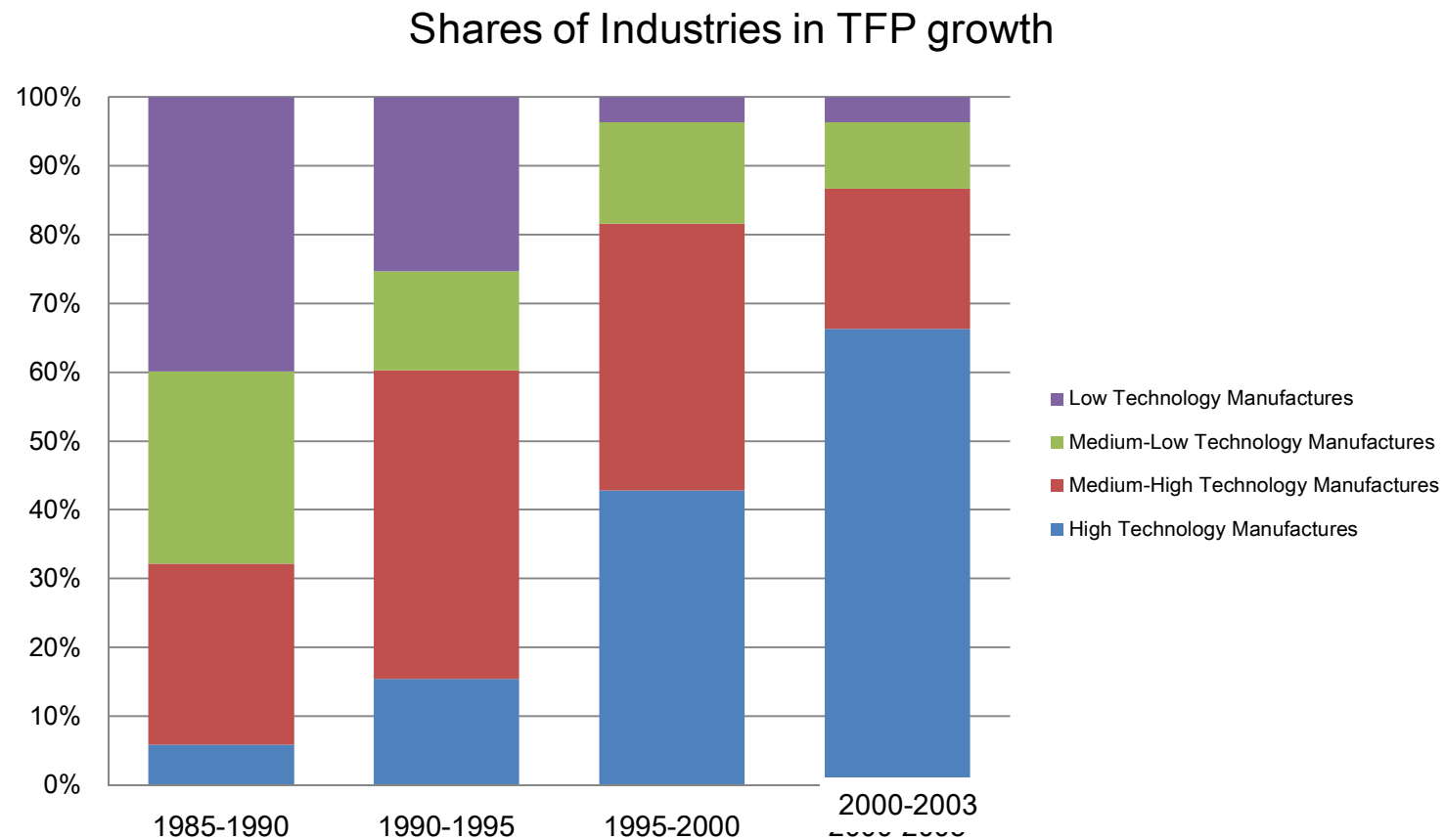


Technology and Productivity Dynamics: Korea

Contribution of Industries to TFP growth



Technology and Productivity Dynamics: Korea



Entry Regulation and Productivity Dynamics

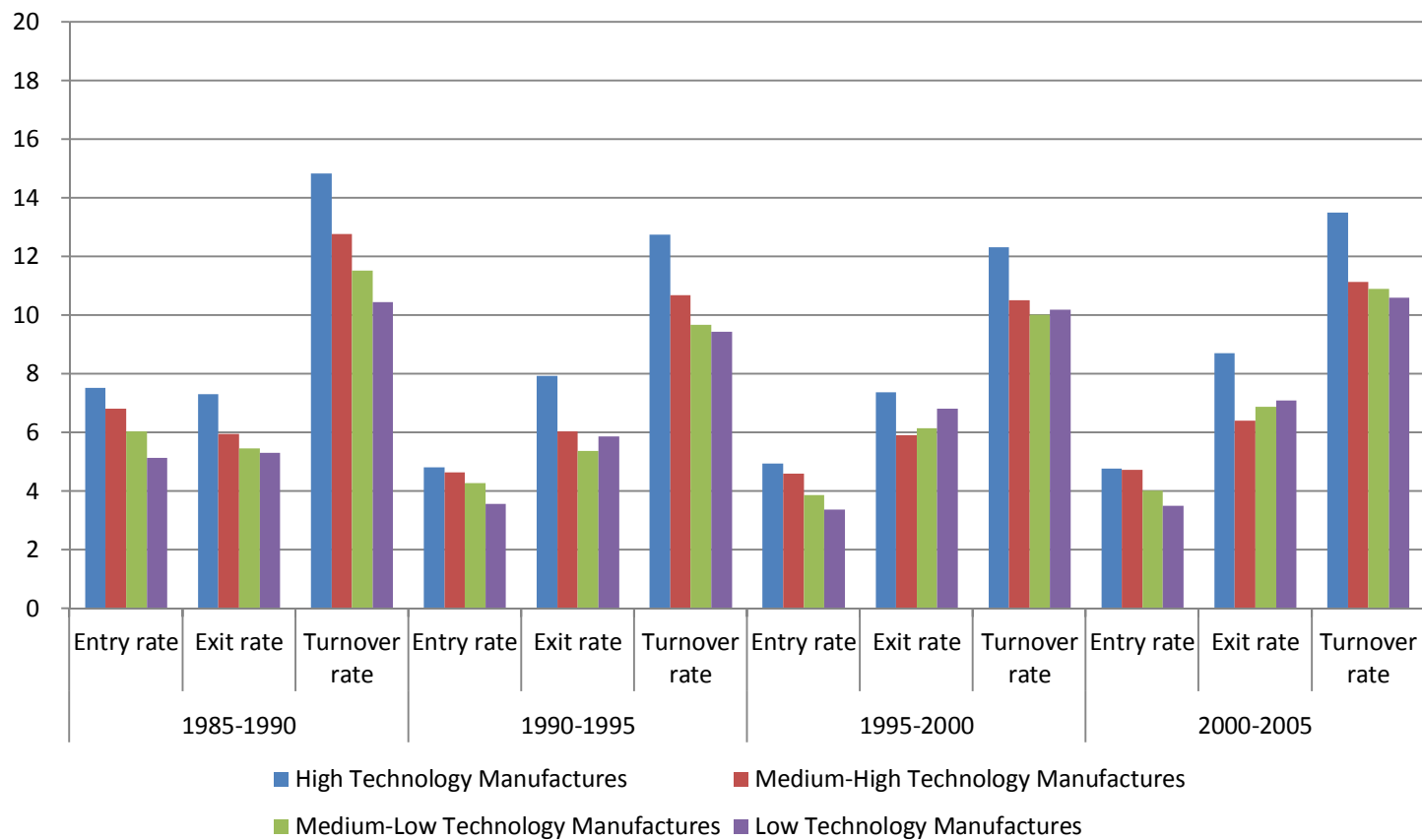
- **Entry Regulation and Firm Dynamics**
 - “ Entry regulation reduces entry rate
 - “ Entry regulation reduces exit rate
- **Firm Dynamics and Economic Performance**
 - “ Entry raises employment and TFP growth
 - “ Exit raises (output and) TFP growth

(Ahn, 2006)

Firm Dynamics: Japan

Entry, Exit, and Turnover Rates

(%, annualized, 1985-2005)



Firm Dynamics: Japan

Entry, Exit, and Turnover Rates

(%, annualized, 1985-2005)

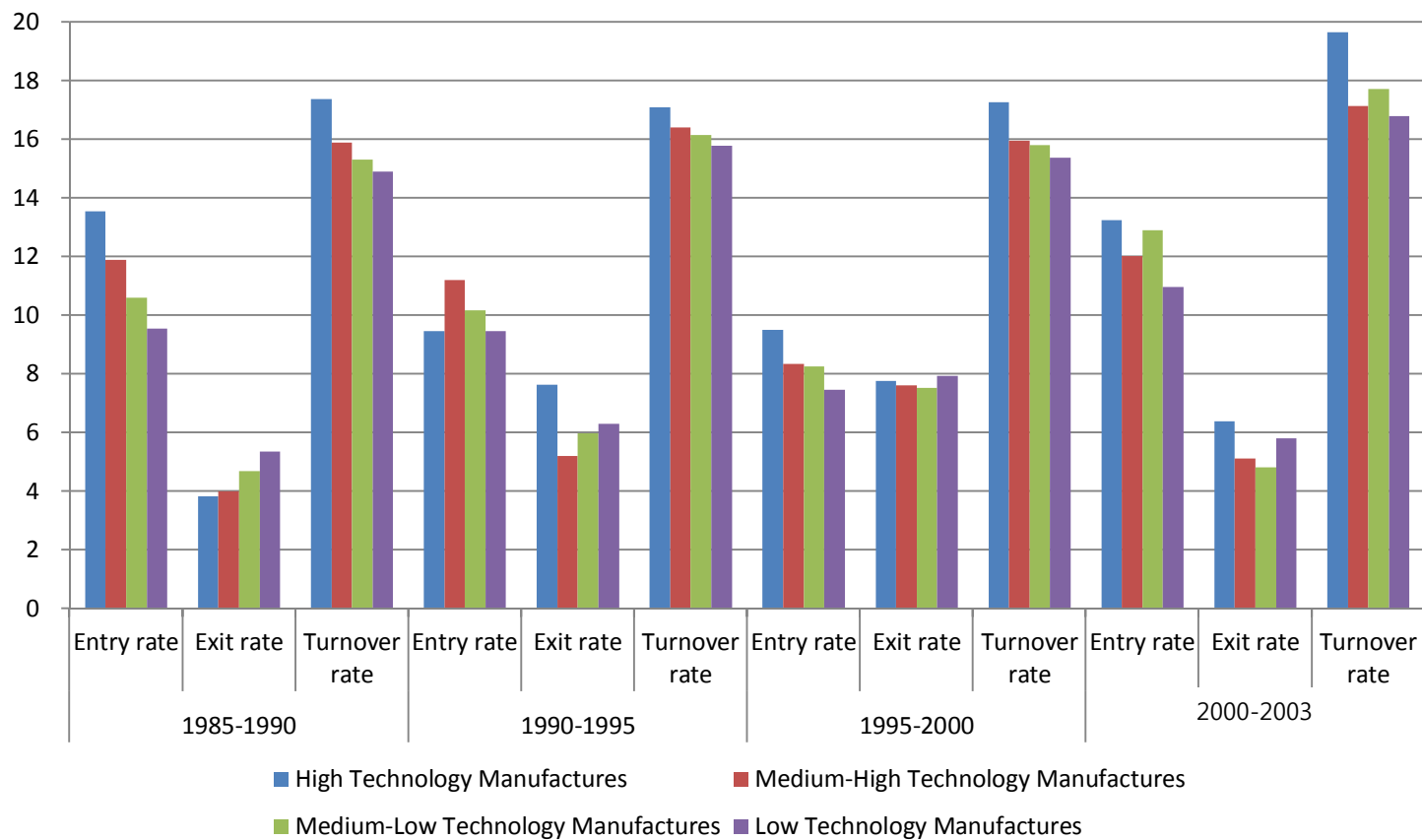
		High Technology Manufacturing	Medium-High Technology Manufacturing	Medium-Low Technology Manufacturing	Low Technology Manufacturing
1985-1990	Entry rate	7.5	6.8	6.1	5.1
	Exit rate	7.3	6.0	5.5	5.3
	Turnover rate	14.9	12.8	11.5	10.5
1990-1995	Entry rate	4.8	4.6	4.3	3.6
	Exit rate	7.9	6.0	5.4	5.9
	Turnover rate	12.8	10.7	9.7	9.4
1995-2000	Entry rate	4.9	4.6	3.9	3.4
	Exit rate	7.4	5.9	6.2	6.8
	Turnover rate	12.3	10.5	10.0	10.2
2000-2005	Entry rate	4.8	4.7	4.0	3.5
	Exit rate	8.7	6.4	6.9	7.1
	Turnover rate	13.5	11.2	10.9	10.6

Source: Author's calculations based on *Census of Manufactures*.

Firm Dynamics: Korea

Entry, Exit, and Turnover Rates

(%, annualized, 1985-2003)



Firm Dynamics: Korea

Entry, Exit, and Turnover Rates

(%, annualized, 1985-2003)

		High Technology Manufacturing	Medium-High Technology Manufacturing	Medium-Low Technology Manufacturing	Low Technology Manufacturing
1985-1990	Entry rate	13.6	11.9	10.6	9.6
	Exit rate	3.8	4.0	4.7	5.4
	Turnover rate	17.4	15.9	15.3	14.9
1990-1995	Entry rate	9.5	11.2	10.2	9.5
	Exit rate	7.6	5.2	6.0	6.3
	Turnover rate	17.1	16.4	16.2	15.8
1995-2000	Entry rate	9.5	8.3	8.3	7.5
	Exit rate	7.8	7.6	7.5	7.9
	Turnover rate	17.3	16.0	15.8	15.4
2000-2003	Entry rate	13.3	12.0	12.9	11.0
	Exit rate	6.4	5.1	4.8	5.8
	Turnover rate	19.7	17.1	17.7	16.8

Source: Author's calculations based on *Mining and Manufacturing Survey*.

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Major Problems in Productivity Dynamics

- *Creative destruction* plays a very important role for productivity growth and innovation by enhancing:
 - “ The expansion or entry of high productivity firms
 - “ The contraction or exit by low productivity firms
- Productivity growth driven by *creative destruction* is impeded due to:
 - “ High entry costs
 - “ High levels of taxation
 - “ Labor market rigidity
 - “ ...

Regulatory Costs of Entry are Sizable

Japan-Korea-USA Comparison (1999)

Number of procedures that a start-up has to comply with in order to obtain legal status	Japan	Korea	USA	Average of 85 countries
Safety and health	0	0	0	0.34
Environment	0	0	0	0.14
Taxes	2	2	1	2.04
Employment	2	4	1	1.94
Screening	7	7	2	6.04
Time (business days; a week has 5 business days and a month has 22.)	26	27	4	47.4
Cost (share of per capita GDP 1999)	11.6%	16.3%	0.5%	47.1%
Time + Cost (share of per capita GDP 1999)	22.0%	27.1%	1.7%	66.0%
Dollar Amount of Time + Cost	\$ 7,094	\$ 2,298	\$ 517	\$ 5,428
Per capita GDP 1999	\$ 32,230	\$ 8,490	\$ 30,600	\$ 8,226

Source: Djankov, et al. (2002), "The Regulation of Entry", *Quarterly Journal of Economics*, 117: 1-37

Barriers to Economic Activity

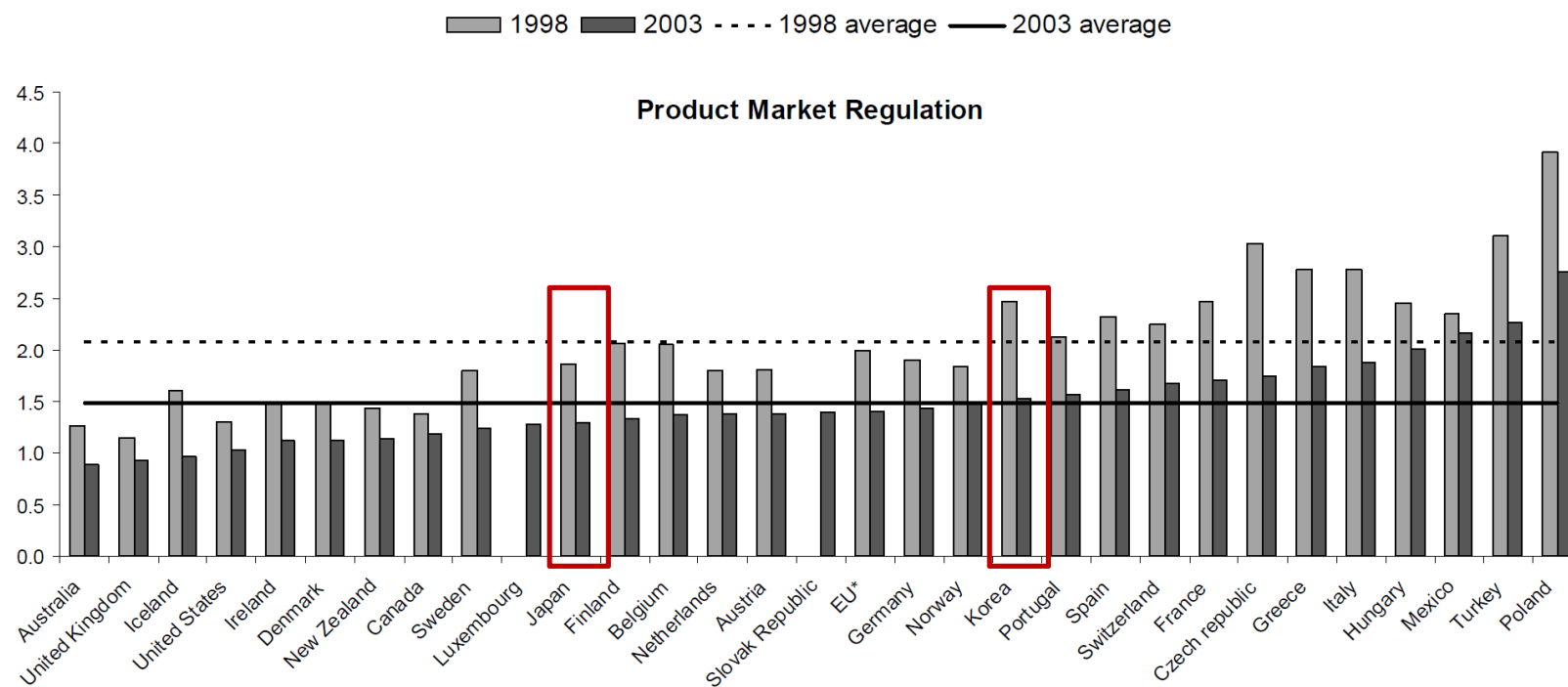
Japan-Korea-USA Comparison (2005 and 2010)

	Japan		Korea		USA	
	2005	2010	2005	2010	2005	2010
Ease of doing business index (1=most business-friendly regulations)	-	20	-	15	-	4
Start-up procedures to register a business (number)	11	8	10	8	6	6
Time required to start a business (days)	31	23	17	13	6	6
Time to resolve insolvency (years)	0.6	0.6	1.5	1.5	1.5	1.5
Total tax rate (%)	53.1	48.6	36.4	29.8	46.0	46.8

Source: World Bank, *Doing Business* (2011)

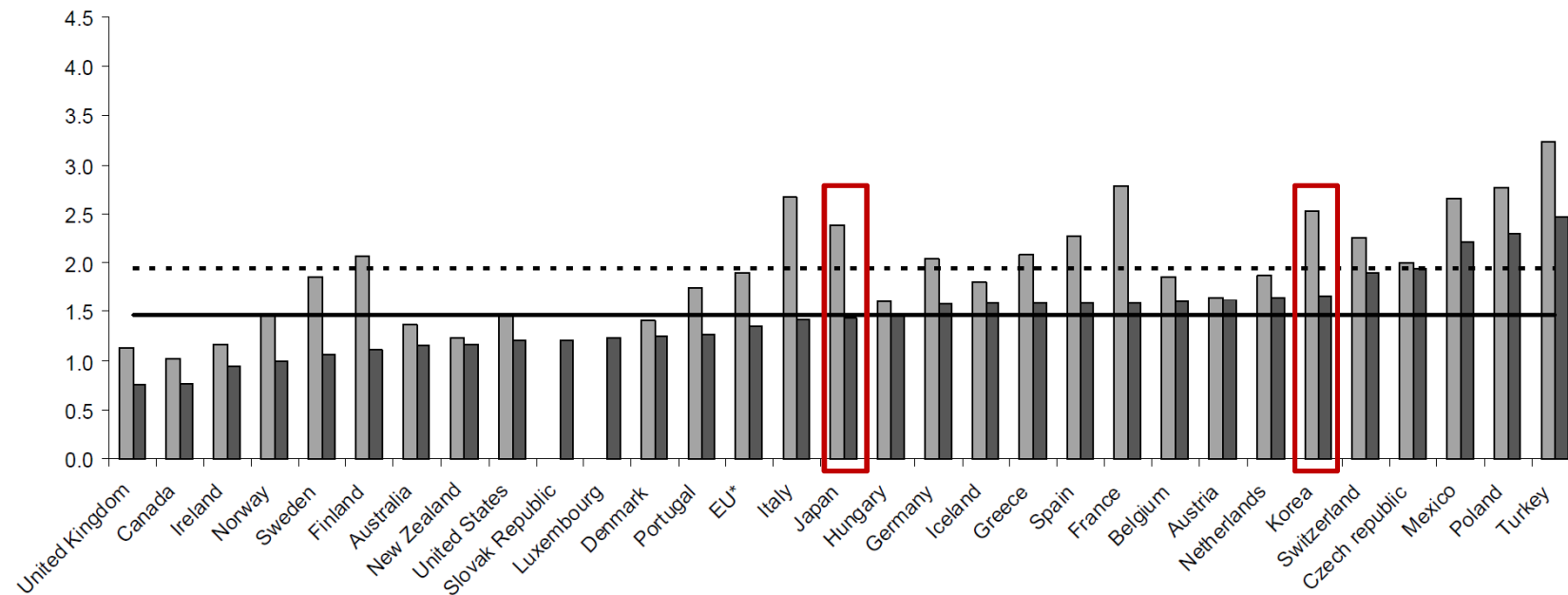
OECD *Product Market Regulation* Indicator

1998 and 2003



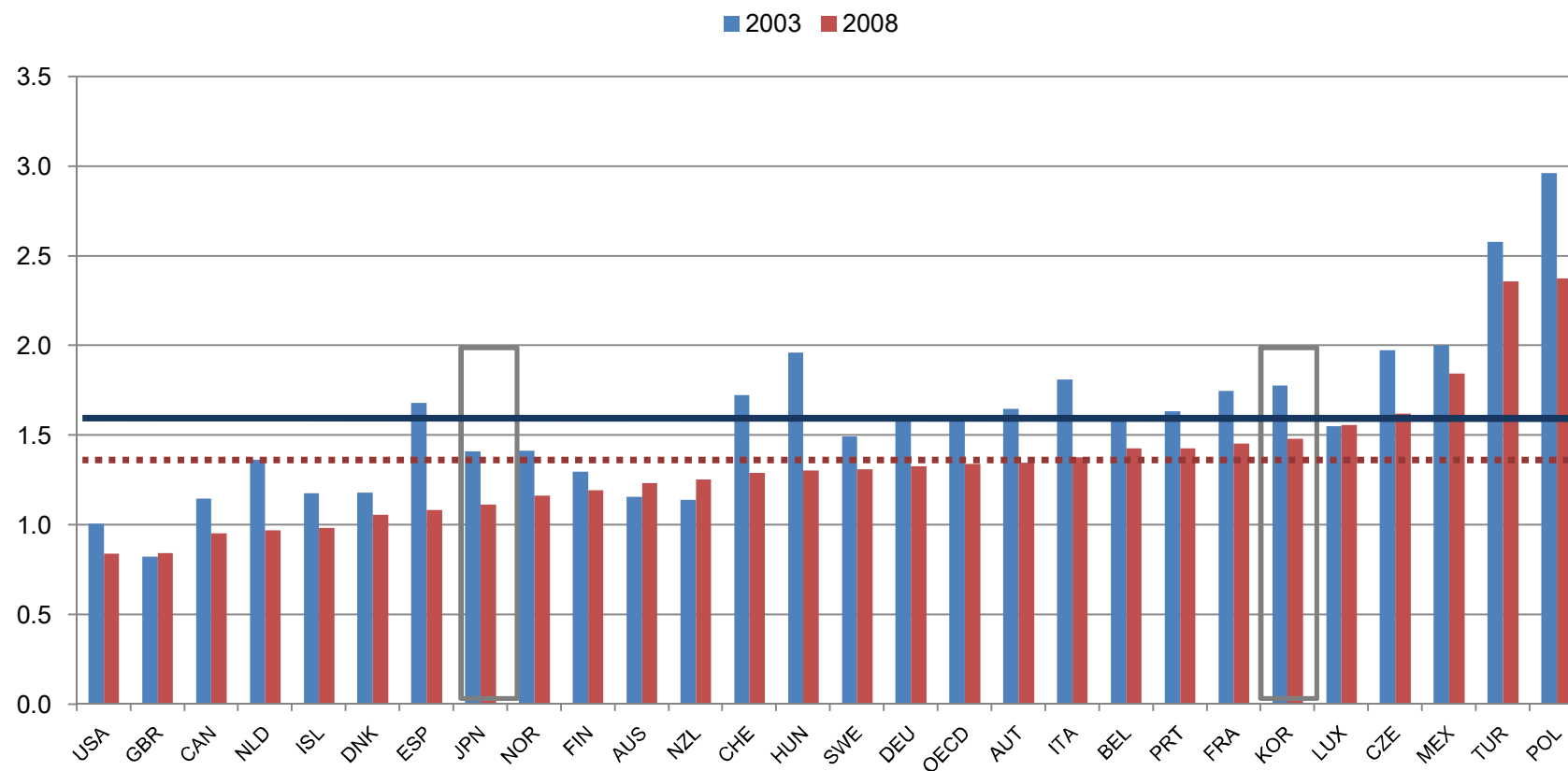
OECD *Product Market Regulation* Indicator

Barriers to Entrepreneurship (1998 and 2003)



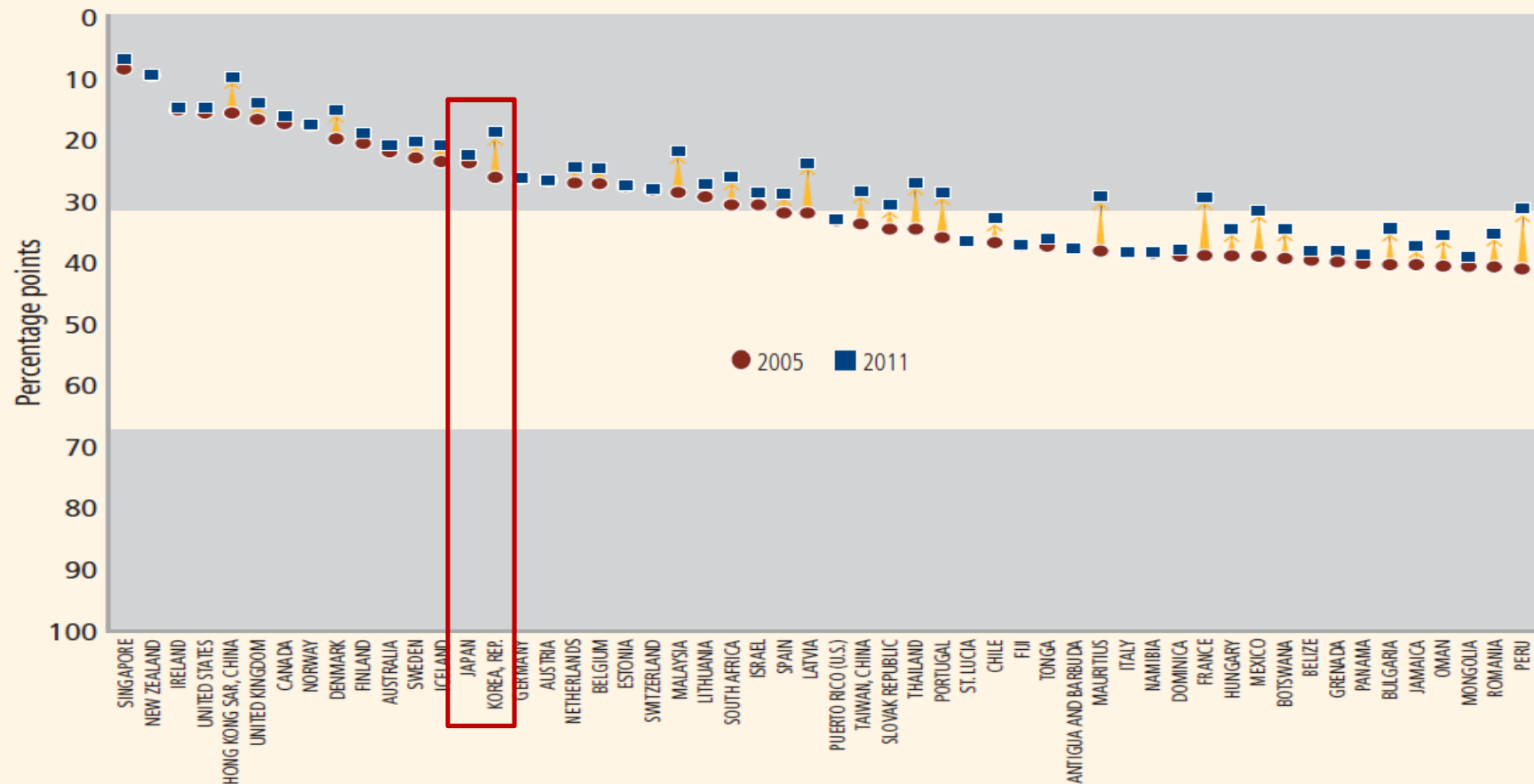
OECD *Product Market Regulation* Indicator

2003 and 2008



World Bank *Doing Business* Indicator

FIGURE 1.8 In the past 6 years 163 economies moved closer to the frontier in regulatory practice
Distance to frontier, 2005 and 2011



Manufacturing to Services

- Services account for **over 60% of total economic activity** in most OECD countries.
 - “ Service sector growth has outpaced overall economic growth in the OECD area, a trend which is expected to continue.
- Services are **a growing source of employment** in the OECD area
 - “ Demand for highly skilled white-collar workers is rising, although services are also an important source of low-skilled jobs.
- Increased **trade and investment in services** is an important vehicle for growth and competition.
 - “ Technological advances are increasing the tradability of services.
 - “ Liberalization of markets is providing an environment more conducive to international competition.

(OECD, 2000)

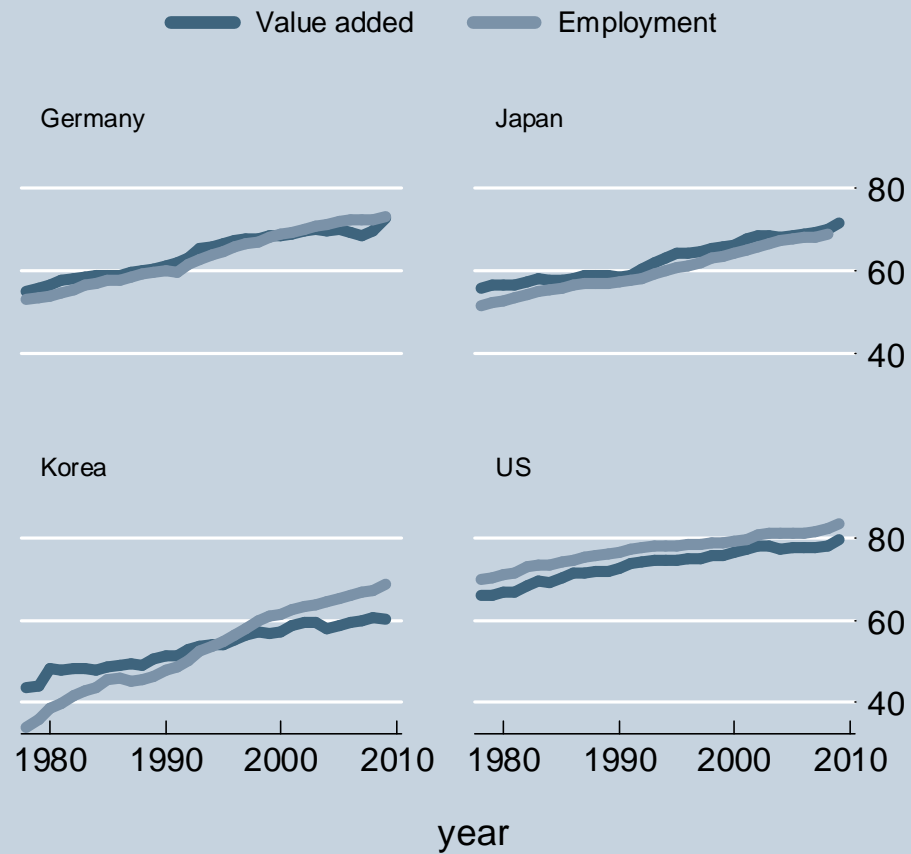
Policy Issues for Services

- The role of services in economic growth and job creation calls for greater government attention to improving services' performance.
 - “ This implies [reforms to domestic regulation, liberalization of international trade and investment](#), and [a reorientation of relevant government programs](#) to meet the needs of service industries more effectively.
- Many of the barriers to service sector development are not found at the border between countries, but are rather of a domestic nature.
 - “ Domestic [regulation](#) is one of the principal factors [limiting growth and competition in services](#).
- Services continue to be poorly covered in most basic statistics.
 - “ To improve understanding of service processes and performance, and to design policies that are better suited to the characteristics of the service sector, [better and more comprehensive data](#) are needed.

(OECD, 2000)

Manufacturing to Services

Service Sector relative to Total Economy



Investment and Innovation in Services

