

Declining Rate of Return on Capital and the Role of Intangibles in Japan and Korea

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Outline

■Japan

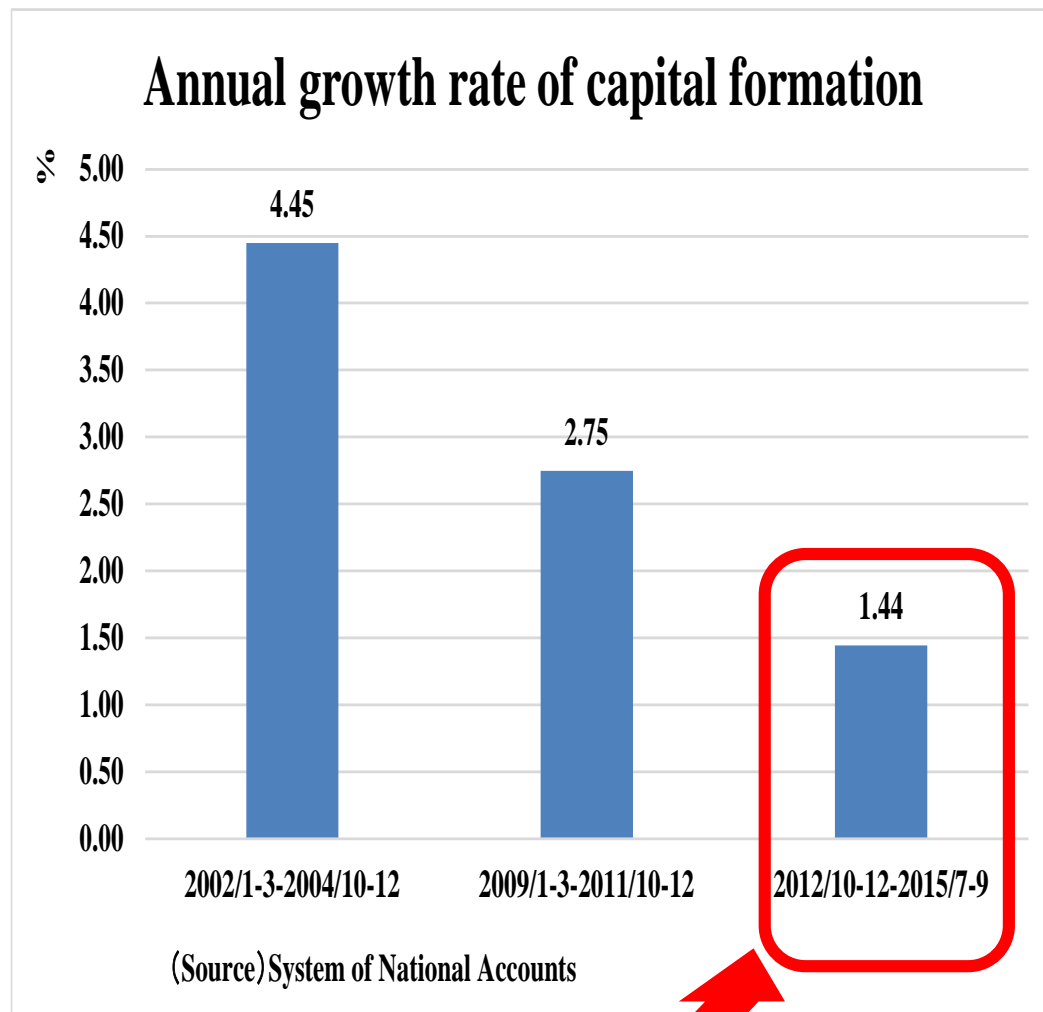
1. Weak capital formation and slow economic growth
2. Related literatures
3. Low rate of return on capital
4. Estimating the Factor Price Frontier
5. Summary

■Korea

1. Falling rate of return on capital
2. Estimating the Factor Price Frontier
3. Summary

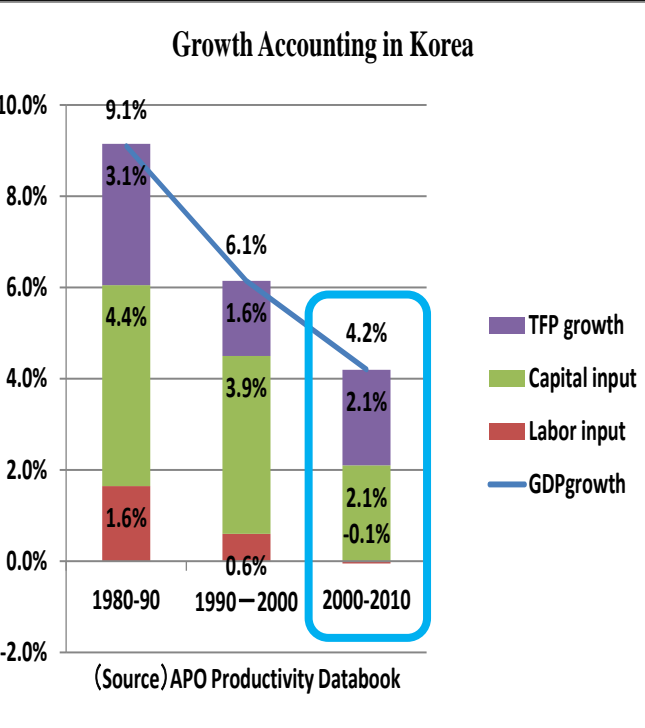
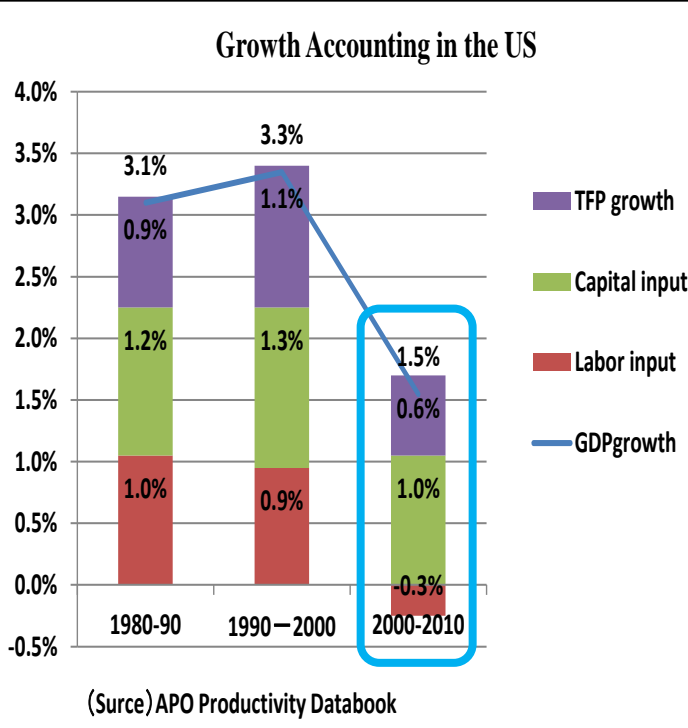
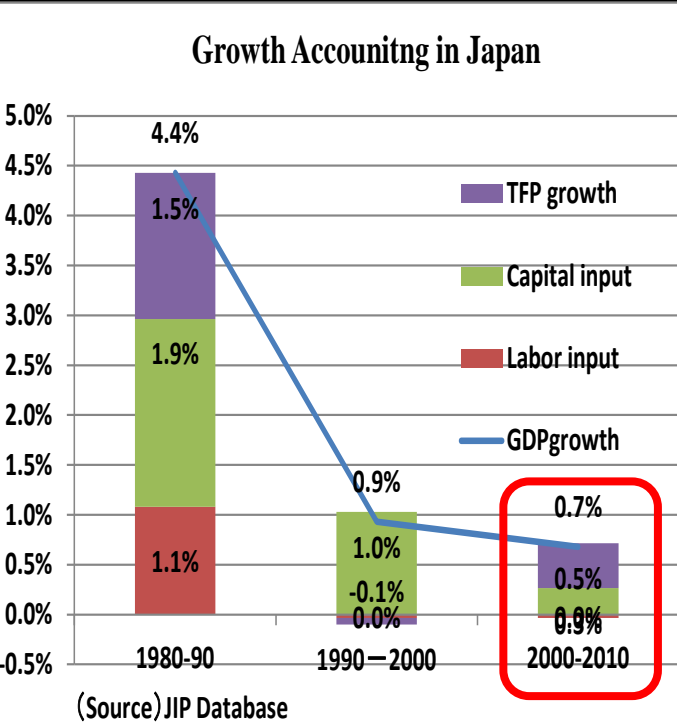
1. Weak capital formation leads to slow economic growth in Japan

- Despite of Abenomics, the Japanese economic growth is still low.
- A major factor of low economic growth during Abenomics is **low growth rate in capital formation**.
- Comparing growth in capital formation in Abenomics with the past two recovery periods, **growth rate in capital formation in Abenomics is the lowest**.



1. Weak capital formation leads to slow economic growth in Japan (contd.)

- Slow capital formation leads to low economic growth in Japan.
- Although many Japanese people think that low population growth is responsible for the low economic growth in Japan, the contributions of labor input to economic growth in the US and major East Asian countries are also low.
- The higher contributions of **capital input** to economic growth in those countries lead to the gap in economic growth in the 2000s among Japan and the US and the major East Asian countries.

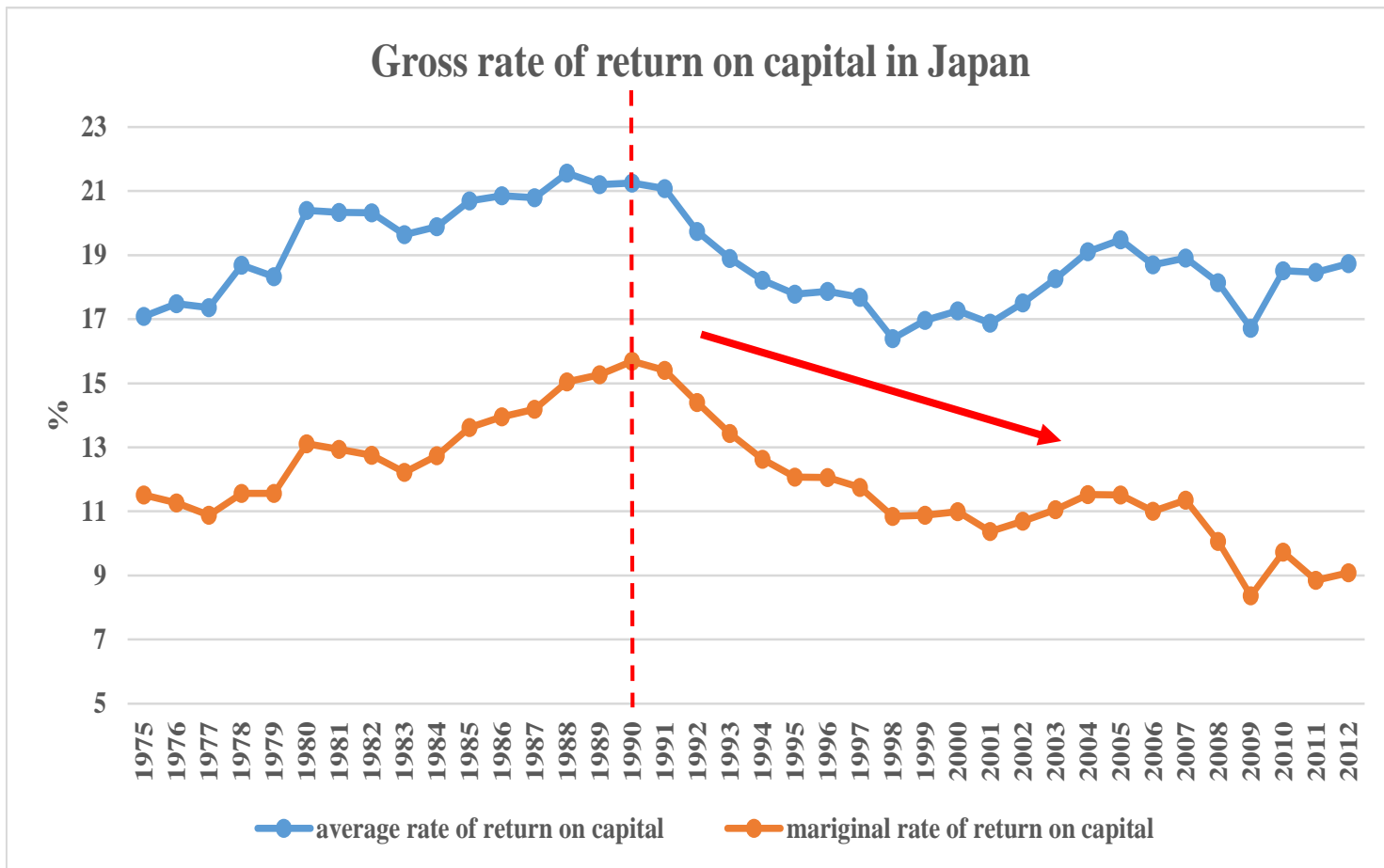


2. Related literatures

- **Summers (2013, 2015)**
 - ✓ The decline in capital formation and real interest rate have led to the slow growth rate in advanced countries.
- **Ando, Christeris, and Miyagawa (2002), Hayashi (2006), and Fukao (2012)**
 - ✓ The inefficiency of capital which led to the low real interest rate and profit rate.
- **Miyagawa (2004, 2005)**
 - ✓ High labor share in the 1990s decreased corporate profit rate.
- **Murase and Ando (2014)**
 - ✓ Under zero bound interest rate, firms prefer liquidity to fixed capital due to the weak governance.
- **Benigno and Fornaro (2015)**
 - ✓ A stagnation trap where large output gap and low potential growth rate coexist under pessimistic expectation.

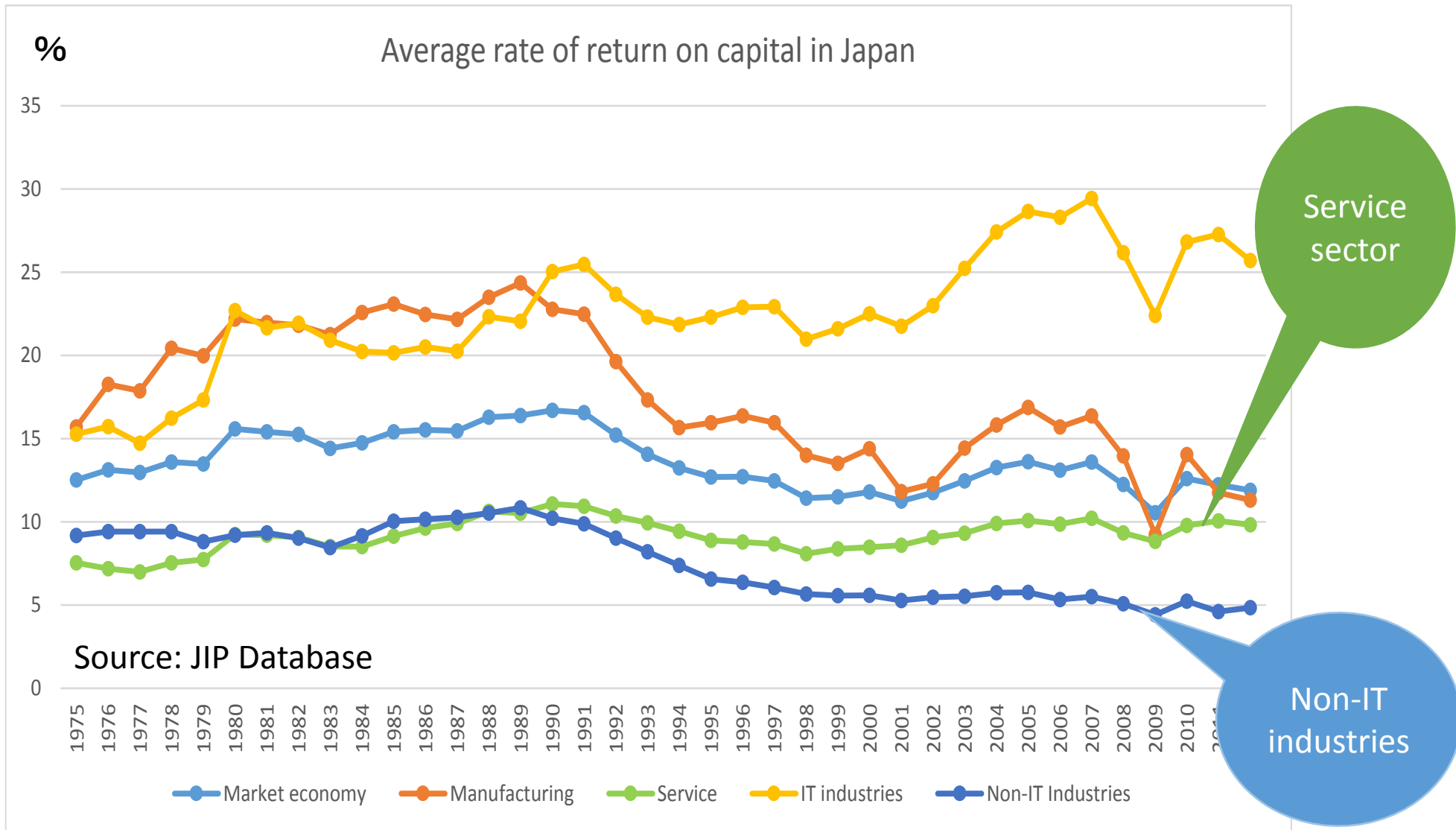
3. Why has the rate of return on capital declined?

- Although Abenomics tried to stimulate capital formation by expanding monetary policy, its policy has not been successful.
- Ando, Christelis, and Miyagawa (2003), Miyagawa (2004, 2005) and Fukao (2012) pointed out that **a major factor of low capital formation is caused by the low rate of return on capital.**
- Rate of return on capital in Japan has declined since the collapse of the bubble economy.



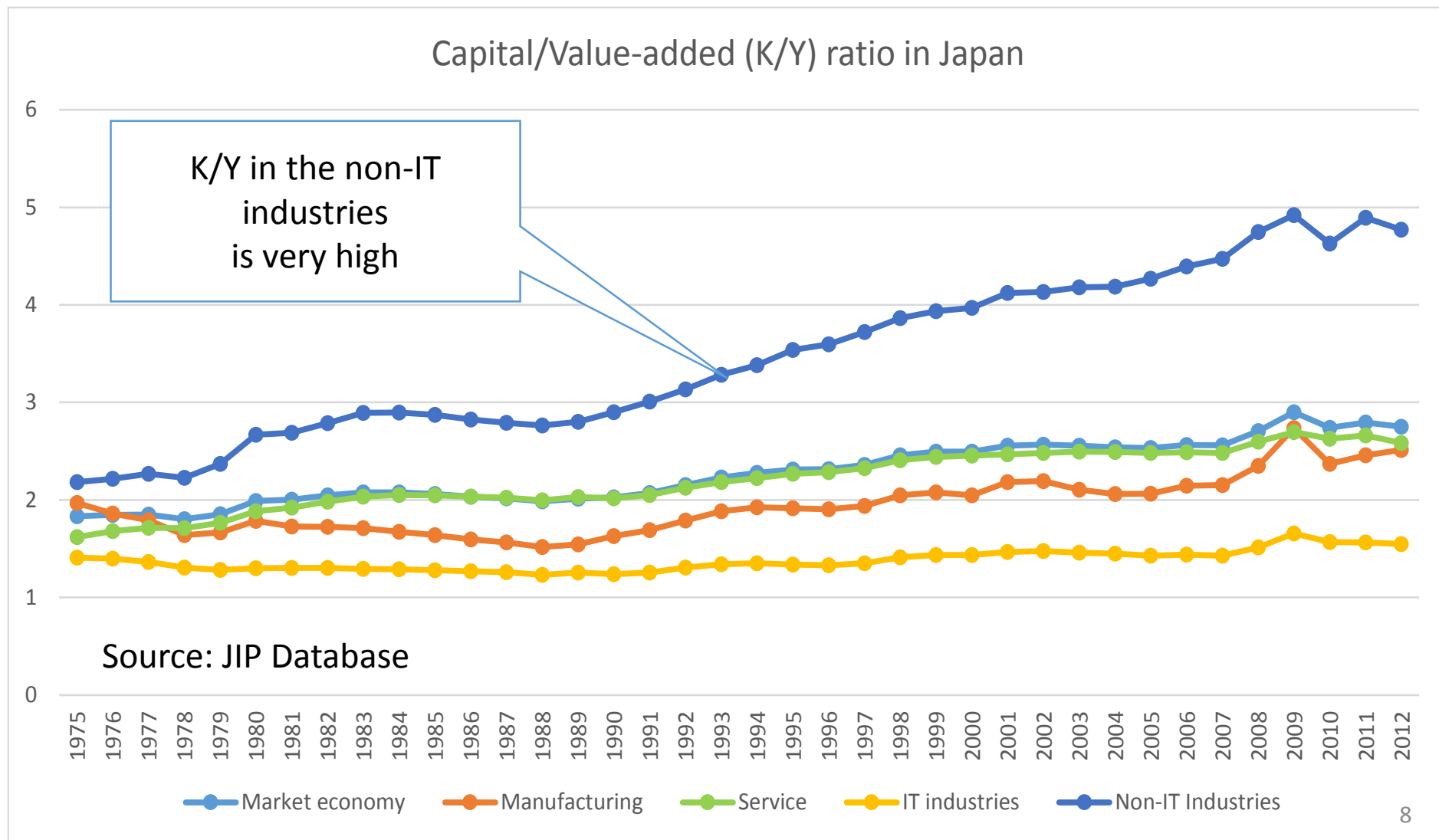
3. Why has the rate of return on capital declined? (contd.)

- In particular, rate of return in the **service sector** and **non-IT industries** are very low.

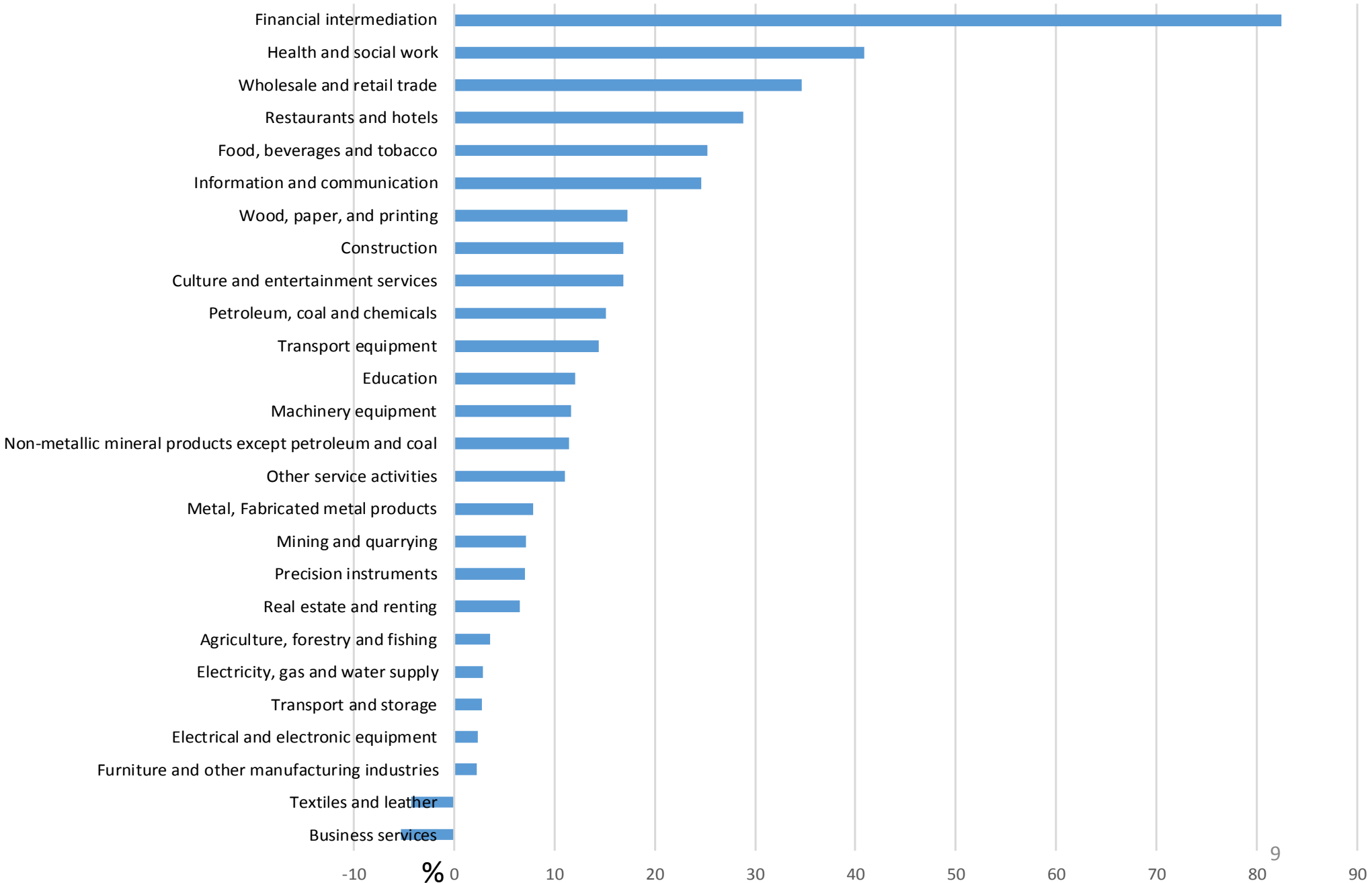


3. Why has the rate of return on capital declined? (contd.)

- Fukao (2012) emphasized that increasing **capital/value added ratio (K/Y)** induced low rate of return on capital.



Average rate of return on capital by industry in Japan (2012)



4. Factor Price Frontier Estimation

- Low rate of return on capital?

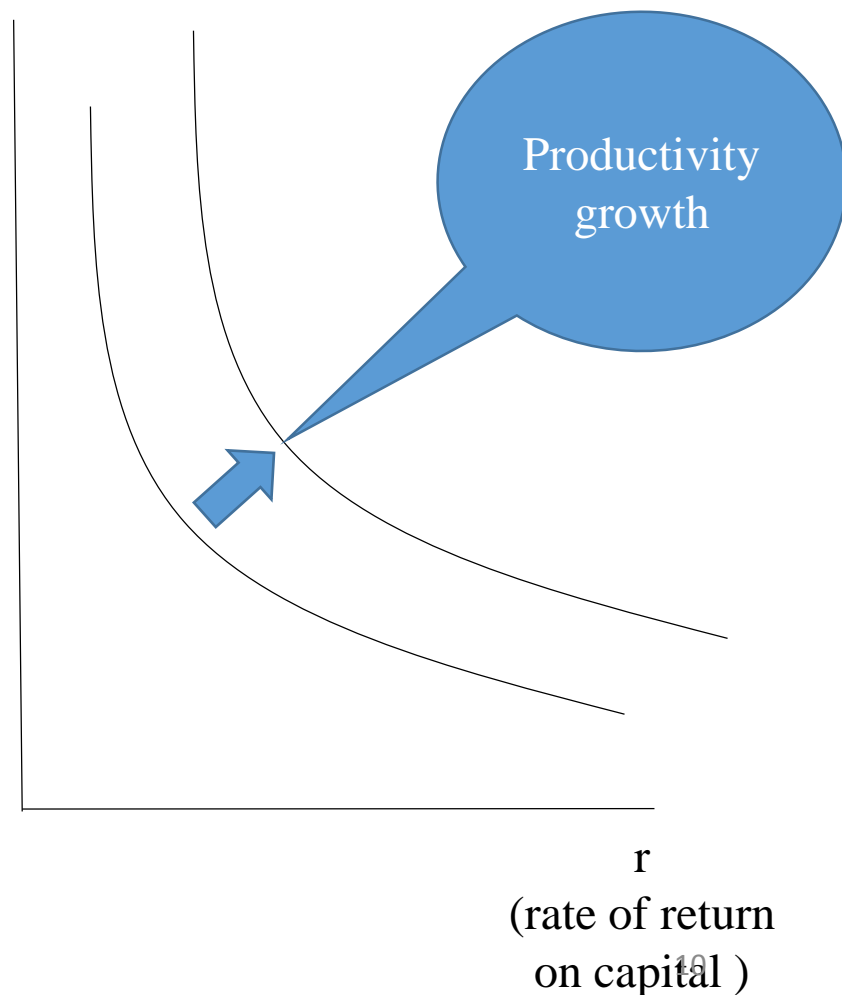
w
(wage
rate)

⇒ Estimate factor price frontier

(w high ⇔ r low)

- Furthermore, productivity shifts the frontier?
- We assume that the technological factor is positively correlated with **intangibles such as IT, R&D and other intangibles.**

Factor Price Frontier



4. Factor Price Frontier Estimation (contd.)

- Data

- JIP 2015 database from 1985 to 2012

- The equation accounting for factor price frontier

$$\ln r_{jt} = \text{const.} + a_1 \ln w_{jt} + a_2 \ln\left(\frac{IT_{jt}}{K_{jt}^{IT}}\right) + a_3 \ln\left(\frac{RD_{jt}}{K_{jt}^{RD}}\right) + a_4 \ln\left(\frac{HR_{jt}}{K_{jt}^{HR}}\right) + \mu_j + \eta_t + \varepsilon_{jt}$$

- Dependent variables

- r_{marginal} (marginal rate of return on capital)
= Capital share \times (Value added / Net capital stock)
- r_{average} (average rate of return on capital)
= (Operating surplus + Consumption of fixed capital) / Net capital stock

- Independent variables

- w (wage rate) = Labor share \times value added / Man-hours
- $IT, RD \ \& \ HR$ = IT investments, R&D investments & Investments in Human Resources
- $K_{IT}, K_{RD} \ \& \ K_{HR}$ = IT capital stock, R&D capital stock and Assets in HR

Results: Market economy using average (r)

Market economy

Dependent variable: Average rate of return on capital

	(1)		(2)	
	Coef.	Std. Err	Coef.	Std. Err
ln w	-0.131	0.053 **	-1.211	0.060 ***
ln IT/K_{IT}	0.168	0.103	0.239	0.087 ***
ln RD/K_{RD}	-0.141	0.051 ***	-0.136	0.043 ***
ln HR/K_{HR}	0.438	0.116 ***	0.295	0.098 ***
ln Y			1.320	0.050 ***
Constant	2.742	0.206 ***	-14.917	0.689 ***
	Fixed-effects model		Fixed-effects model	
Number of obs	1,773		1,762	
Number of groups	70		70	
Prob > F	0		0	
R-sq:				
within	0.3095		0.5171	
between	0.1964		0.0001	
overall	0.0747		0.0235	

- Higher real wage (w) is associated with lower rate of return on capital (r)

- Larger investments in IT and Human Resources (HR) lead to higher (r)

- Not stable results for the impacts of R&D investments on (r)

Results: Market economy using marginal (r)

Market economy

Dependent variable: Marginal rate of return on capital

	(1)		(2)	
	Coef.	Std. Err	Coef.	Std. Err
ln w	0.491	0.052 ***	-0.664	0.058 ***
ln IT/K _{IT}	0.071	0.103	0.147	0.083 *
ln RD/K _{RD}	-0.181	0.051 ***	-0.176	0.041 ***
ln HR/K _{HR}	0.361	0.116 ***	0.205	0.094 **
ln Y			1.412	0.048 ***
Constant	1.651	0.206 ***	-17.246	0.663 ***
	Fixed-effects model		Fixed-effects model	
Number of obs	1,773		1,762	
Number of groups	70		70	
Prob > F	0		0	
R-sq:				
within	0.3174		0.5534	
between	0.2334		0.0077	
overall	0.2323		0.0525	

Almost the same results as the case using average (r)

Results: IT industries

IT industries

Dependent variable: Average rate of return on capital

	(1)		(2)	
	Coef.	Std. Err	Coef.	Std. Err
ln w	-0.085	0.077	-1.189	0.084 ***
ln IT/K _{IT}	0.434	0.152 ***	0.457	0.128 ***
ln RD/K _{RD}	-0.231	0.071 ***	-0.245	0.060 ***
ln HR/K _{HR}	0.338	0.166 **	0.206	0.140
ln Y			1.368	0.068 ***
Constant	2.688	0.311 ***	-15.828	0.957 ***
	Fixed-effects model		Fixed-effects model	
Number of obs	1,025		1,014	
Number of groups	40		40	
Prob > F	0		0	
R-sq:				
within	0.3366		0.5396	
between	0.2487		0.0033	
overall	0.0815		0.0319	

Almost the same results as the case of market economy

But HR investment ratio are not significant in the case of controlling for output level

Results: Non-IT industries

Non-IT industries

Dependent variable: Average rate of return on capital

	(1)		(2)	
	Coef.	Std. Err	Coef.	Std. Err
ln w	-0.119	0.075	-1.140	0.084 ***
ln IT/K _{IT}	-0.070	0.141	0.027	0.116
ln RD/K _{RD}	-0.050	0.073	-0.019	0.061
ln HR/K _{HR}	0.715	0.173 ***	0.471	0.144 ***
ln Y			1.292	0.072 ***
Constant	2.941	0.286 ***	-14.257	0.988 ***
	Fixed-effects model		Fixed-effects model	
Number of obs	748		748	
Number of groups	30		30	
Prob > F	0		0	
R-sq:				
within	0.307		0.5282	
between	0.099		0.0079	
overall	0.1188		0.0182	

Almost the same results as for the all sample case

IT and R&D investment do not contribute to a higher rate of return on capital

5. Summary: Japan

- **Rate of return on capital has declined** since the collapse of the bubble economy.
- In particular, the rate of return on capital in **the non-IT industries** is very low due to the **high capital/value added ratio**.
- **“Low rate of return on capital \Leftrightarrow High wage”** is confirmed.
- **IT and R&D investments have negative or not significant effect** on the rate of return on tangible capital especially in the case of **non-IT industries**.

⇒ Firms might not be fully utilizing the performance of IT facilities and the stock of R&D investments in their production process.

*⇒ As Chun et, al (2015) pointed out, Japanese firms should utilize **complementary effects** between tangibles and intangibles to raise rate of return on capital.*

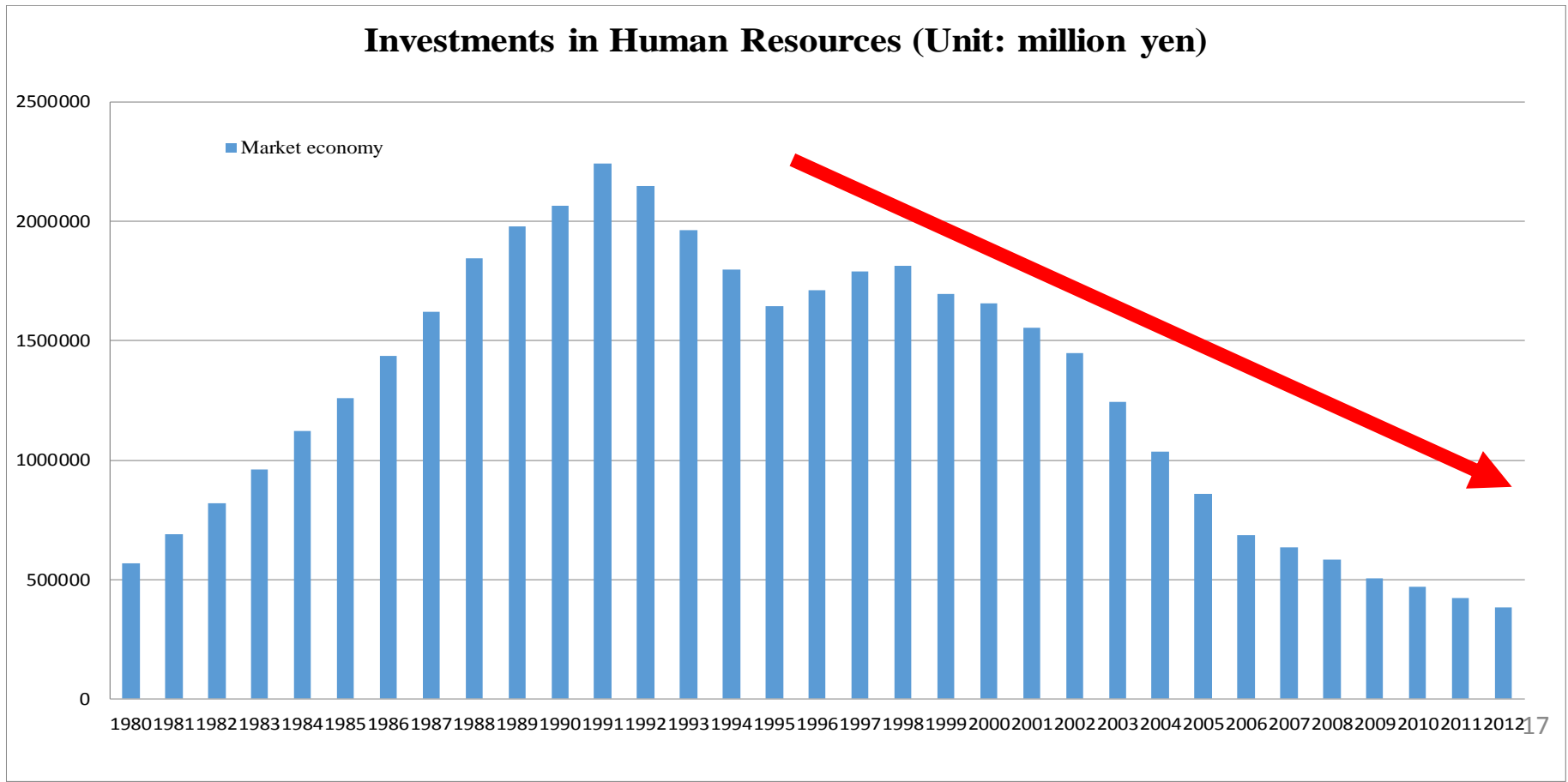
5. Summary: Japan (contd.)

- Investments in Human Resources shifts up the factor price frontier in the results for the market economy

I.e., Smaller HR investments → Lower rate of return on capital

⇒ *Smaller HR investments since the late 1990s might generate low (r)*

⇒ ***The Japanese government should support accumulation in human resources***



JIPcode	JIP Industry name	MKT-NMKT	MFG-SER	IT-NIT	KIPcode	KIP industry name
1	Rice, wheat production	Market economy		Non-IT	1	Agriculture, forestry and fishing
2	Miscellaneous crop farming	Market economy		Non-IT	1	Agriculture, forestry and fishing
3	Livestock and sericulture farming	Market economy		Non-IT	1	Agriculture, forestry and fishing
4	Agricultural services	Market economy		Non-IT	1	Agriculture, forestry and fishing
5	Forestry	Market economy		Non-IT	1	Agriculture, forestry and fishing
6	Fisheries	Market economy		Non-IT	1	Agriculture, forestry and fishing
7	Mining	Market economy		Non-IT	2	Mining and quarrying
8	Livestock products	Market economy	Manufacturing	Non-IT	3	Food, beverages and tobacco
9	Seafood products	Market economy	Manufacturing	IT	3	Food, beverages and tobacco
10	Flour and grain mill products	Market economy	Manufacturing	IT	3	Food, beverages and tobacco
11	Miscellaneous foods and related products	Market economy	Manufacturing	Non-IT	3	Food, beverages and tobacco
12	Prepared animal foods and organic fertilizers	Market economy	Manufacturing	Non-IT	3	Food, beverages and tobacco
13	Beverages	Market economy	Manufacturing	Non-IT	3	Food, beverages and tobacco
14	Tobacco	Market economy	Manufacturing	Non-IT	3	Food, beverages and tobacco
15	Textile products	Market economy	Manufacturing	IT	4	Textiles and leather
16	Lumber and wood products	Market economy	Manufacturing	Non-IT	5	Wood, paper, and printing
17	Furniture and fixtures	Market economy	Manufacturing	IT	13	Furniture and other manufacturing industries
18	Pulp, paper, and coated and glazed paper	Market economy	Manufacturing	Non-IT	5	Wood, paper, and printing
19	Paper products	Market economy	Manufacturing	Non-IT	5	Wood, paper, and printing
20	Printing, plate making for printing and bookbinding	Market economy	Manufacturing	IT	5	Wood, paper, and printing
21	Leather and leather products	Market economy	Manufacturing	IT	4	Textiles and leather
22	Rubber products	Market economy	Manufacturing	IT	6	Petroleum, coal and chemicals
23	Chemical fertilizers	Market economy	Manufacturing	IT	6	Petroleum, coal and chemicals
24	Basic inorganic chemicals	Market economy	Manufacturing	IT	6	Petroleum, coal and chemicals
25	Basic organic chemicals	Market economy	Manufacturing	Non-IT	6	Petroleum, coal and chemicals
26	Organic chemicals	Market economy	Manufacturing	Non-IT	6	Petroleum, coal and chemicals
27	Chemical fibers	Market economy	Manufacturing	IT	6	Petroleum, coal and chemicals
28	Miscellaneous chemical products	Market economy	Manufacturing	Non-IT	6	Petroleum, coal and chemicals
29	Pharmaceutical products	Market economy	Manufacturing	IT	6	Petroleum, coal and chemicals
30	Petroleum products	Market economy	Manufacturing	Non-IT	6	Petroleum, coal and chemicals
31	Coal products	Market economy	Manufacturing	Non-IT	6	Petroleum, coal and chemicals
32	Glass and its products	Market economy	Manufacturing	Non-IT	7	Non-metallic mineral products except petroleum and coal
33	Cement and its products	Market economy	Manufacturing	Non-IT	7	Non-metallic mineral products except petroleum and coal
34	Pottery	Market economy	Manufacturing	IT	7	Non-metallic mineral products except petroleum and coal
35	Miscellaneous ceramic, stone and clay products	Market economy	Manufacturing	Non-IT	7	Non-metallic mineral products except petroleum and coal
36	Pig iron and crude steel	Market economy	Manufacturing	Non-IT	8	Metal, Fabricated metal products

JIPcode	JIP Industry name	MKT-NMKT	MFG-SER	IT-NIT	KIPcode	KIP industry name
37	Miscellaneous iron and steel	Market economy	Manufacturing	Non-IT	8	Metal, Fabricated metal products
38	Smelting and refining of non-ferrous metals	Market economy	Manufacturing	IT	8	Metal, Fabricated metal products
39	Non-ferrous metal products	Market economy	Manufacturing	Non-IT	8	Metal, Fabricated metal products
40	Fabricated constructional and architectural metal products	Market economy	Manufacturing	IT	8	Metal, Fabricated metal products
41	Miscellaneous fabricated metal products	Market economy	Manufacturing	IT	8	Metal, Fabricated metal products
42	General industry machinery	Market economy	Manufacturing	IT	9	Machinery equipment
43	Special industry machinery	Market economy	Manufacturing	IT	9	Machinery equipment
44	Miscellaneous machinery	Market economy	Manufacturing	IT	9	Machinery equipment
45	Office and service industry machines	Market economy	Manufacturing	IT	9	Machinery equipment
46	Electrical generating, transmission, distribution and industrial machinery	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
47	Household electric appliances	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
48	Electronic data processing machines, digital and analog	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
49	Communication equipment	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
50	Electronic equipment and electric measuring instruments	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
51	Semiconductor devices and integrated circuits	Market economy	Manufacturing	Non-IT	10	Electrical and electronic equipment
52	Electronic parts	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
53	Miscellaneous electrical machinery equipment	Market economy	Manufacturing	IT	10	Electrical and electronic equipment
54	Motor vehicles	Market economy	Manufacturing	Non-IT	12	Transport equipment
55	Motor vehicle parts and accessories	Market economy	Manufacturing	Non-IT	12	Transport equipment
56	Other transportation equipment	Market economy	Manufacturing	IT	12	Transport equipment
57	Precision machinery & equipment	Market economy	Manufacturing	IT	11	Precision instruments
58	Plastic products	Market economy	Manufacturing	Non-IT	6	Petroleum, coal and chemicals
59	Miscellaneous manufacturing industries	Market economy	Manufacturing	IT	13	Furniture and other manufacturing industries
60	Construction	Market economy	Service	Non-IT	15	Construction
61	Civil engineering	Market economy	Service	Non-IT	15	Construction
62	Electricity	Market economy	Service	Non-IT	14	Electricity, gas and water supply
63	Gas, heat supply	Market economy	Service	IT	14	Electricity, gas and water supply
64	Waterworks	Market economy	Service	Non-IT	14	Electricity, gas and water supply
65	Water supply for industrial use	Market economy	Service	Non-IT	14	Electricity, gas and water supply
66	Waste disposal	Market economy	Service	Non-IT	14	Electricity, gas and water supply
67	Wholesale	Market economy	Service	IT	16	Wholesale and retail trade
68	Retail	Market economy	Service	IT	16	Wholesale and retail trade
69	Finance	Market economy	Service	IT	19	Financial intermediation
70	Insurance	Market economy	Service	IT	19	Financial intermediation
71	Real estate	Market economy	Service	Non-IT	20	Real estate and renting
72	Housing	Non-Market economy				

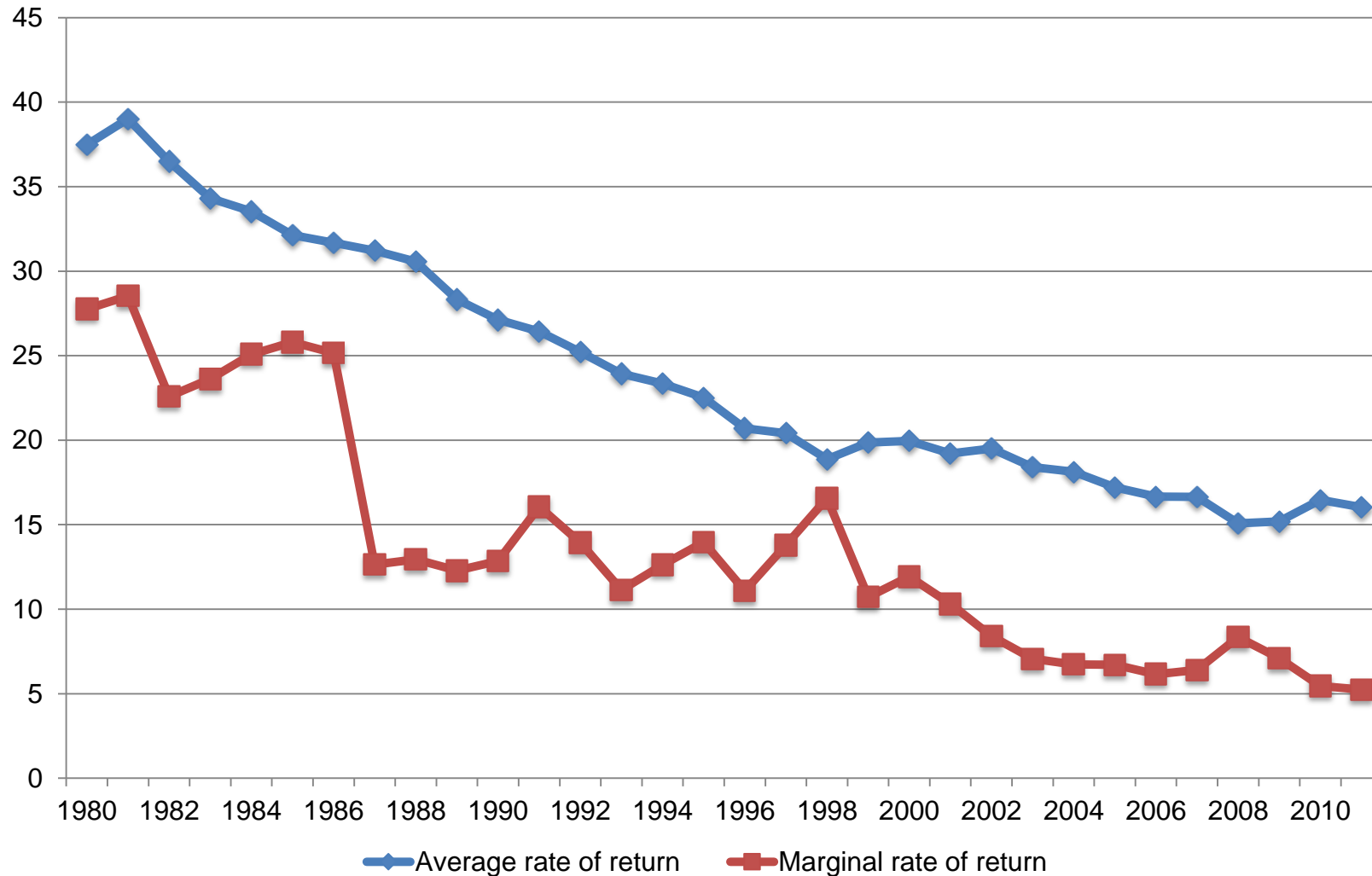
JIPcode	JIP Industry name	MKT-NMKT	MFG-SER	IT-NIT	KIPcode	KIP industry name
73	Railway	Market economy	Service	Non-IT	18	Transport and storage
74	Road transportation	Market economy	Service	Non-IT	18	Transport and storage
75	Water transportation	Market economy	Service	Non-IT	18	Transport and storage
76	Air transportation	Market economy	Service	Non-IT	18	Transport and storage
77	Other transportation and packing	Market economy	Service	Non-IT	18	Transport and storage
78	Telegraph and telephone	Market economy	Service	IT	21	Information and communication
79	Mail	Market economy	Service	IT	21	Information and communication
80	Education (private and non-profit)	Non-Market economy			24	Education
81	Research (private)	Market economy	Service	Non-IT	23	Public administration and defense
82	Medical (private)	Non-Market economy			25	Health and social work
83	Hygiene (private and non-profit)	Non-Market economy			25	Health and social work
84	Other public services	Non-Market economy			23	Public administration and defense
85	Advertising	Market economy	Service	IT	22	Business services
86	Rental of office equipment and goods	Market economy	Service	IT	20	Real estate and renting
87	Automobile maintenance services	Market economy	Service	IT	22	Business services
88	Other services for businesses	Market economy	Service	IT	22	Business services
89	Entertainment	Market economy	Service	Non-IT	26	Culture and entertainment services
90	Broadcasting	Market economy	Service	IT	21	Information and communication
91	Information services and internet-based services	Market economy	Service	IT	21	Information and communication
92	Publishing	Market economy	Service	IT	21	Information and communication
93	Video picture, sound information, character informat	Market economy	Service	IT	21	Information and communication
94	Eating and drinking places	Market economy	Service	IT	17	Restaurants and hotels
95	Accommodation	Market economy	Service	Non-IT	17	Restaurants and hotels
96	Laundry, beauty and bath services	Market economy	Service	IT	27	Other service activities
97	Other services for individuals	Market economy	Service	Non-IT	27	Other service activities
98	Education (public)	Non-Market economy			24	Education
99	Research (public)	Non-Market economy			23	Public administration and defense
100	Medical (public)	Non-Market economy			25	Health and social work
101	Hygiene (public)	Non-Market economy			25	Health and social work
102	Social insurance and social welfare (public)	Non-Market economy			25	Health and social work
103	Public administration	Non-Market economy			23	Public administration and defense
104	Medical (non-profit)	Non-Market economy			25	Health and social work
105	Social insurance and social welfare (non-profit)	Non-Market economy			25	Health and social work
106	Research (non-profit)	Non-Market economy			23	Public administration and defense
107	Other (non-profit)	Non-Market economy			25	Health and social work
108	Activities not elsewhere classified	Non-Market economy			23	Public administration and defense

Korea

- Falling rate of return on tangible capital
 - Accumulation of tangible capital
- Estimating the Factor Price Frontier
 - 26 Industries in the market economy, 1980-2011
 - Roles of intangibles in the rate of return on tangible capital
- Summary

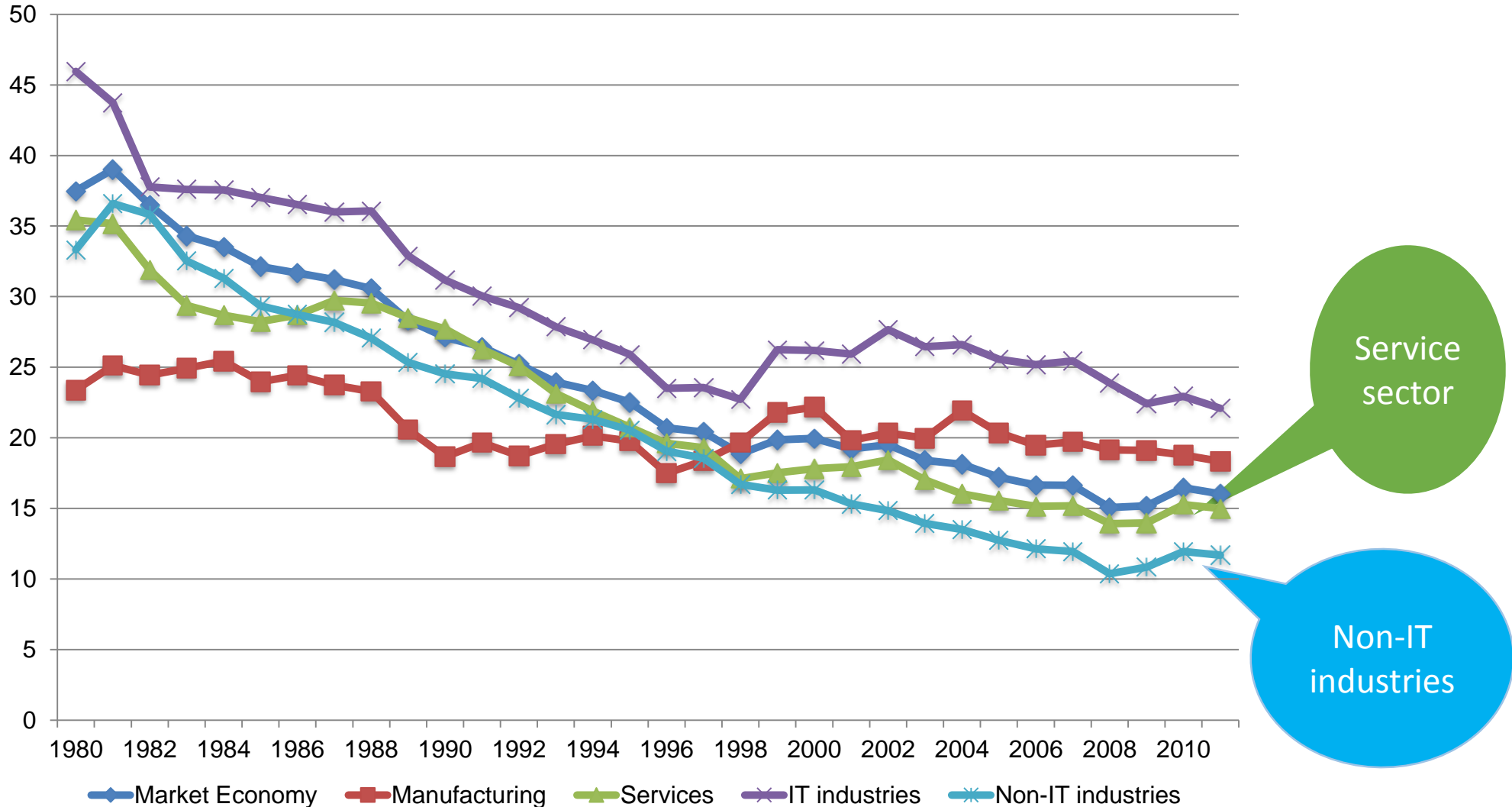
Declining Rate of Return on Capital in Korea

Average rate of return (internal) vs. Marginal rate of return (external)

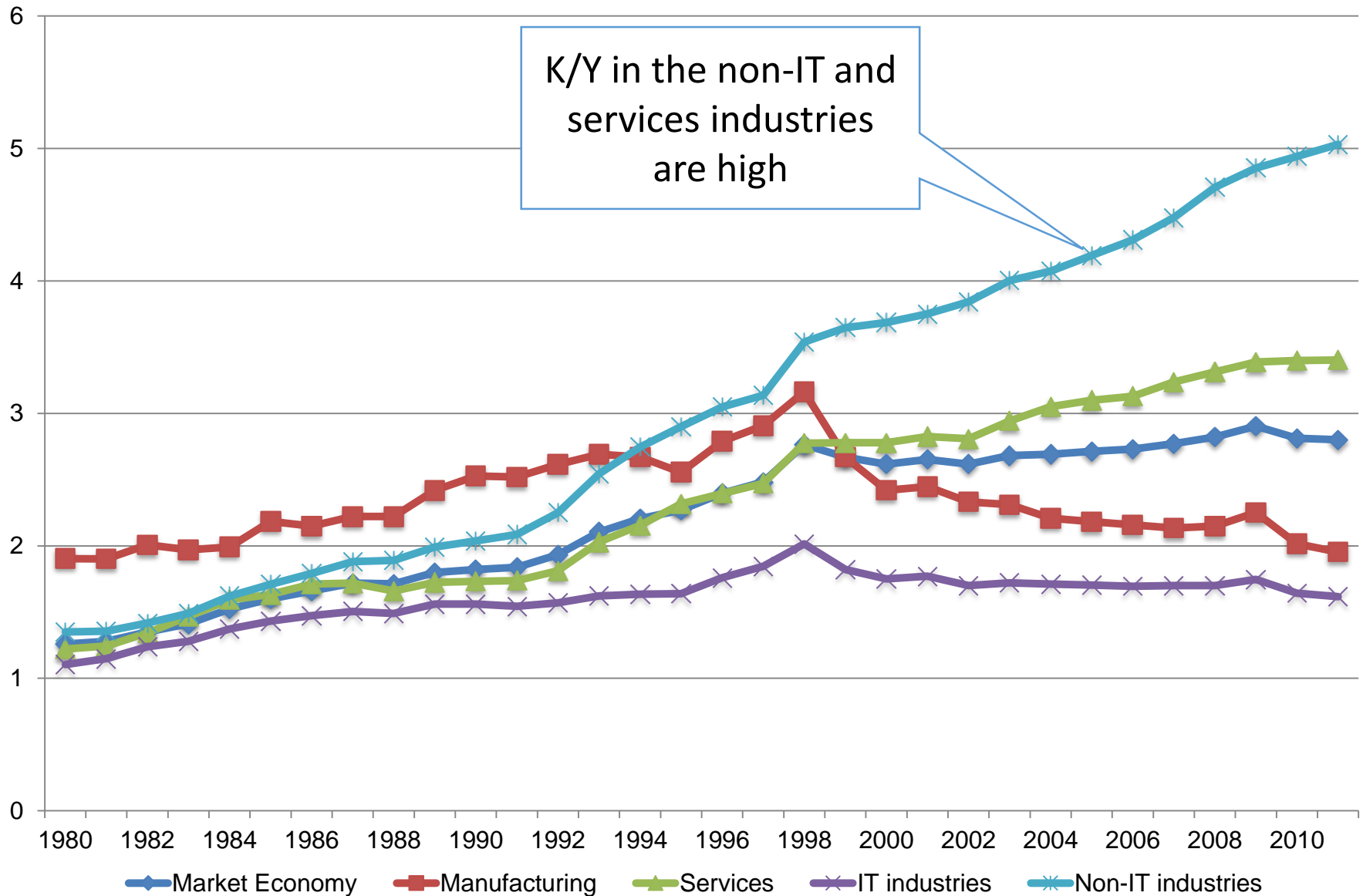


Rate of Return on Capital by Industry

- Rates of return in **service** and **non-IT industries** are lower than those in manufacturing and IT industries.

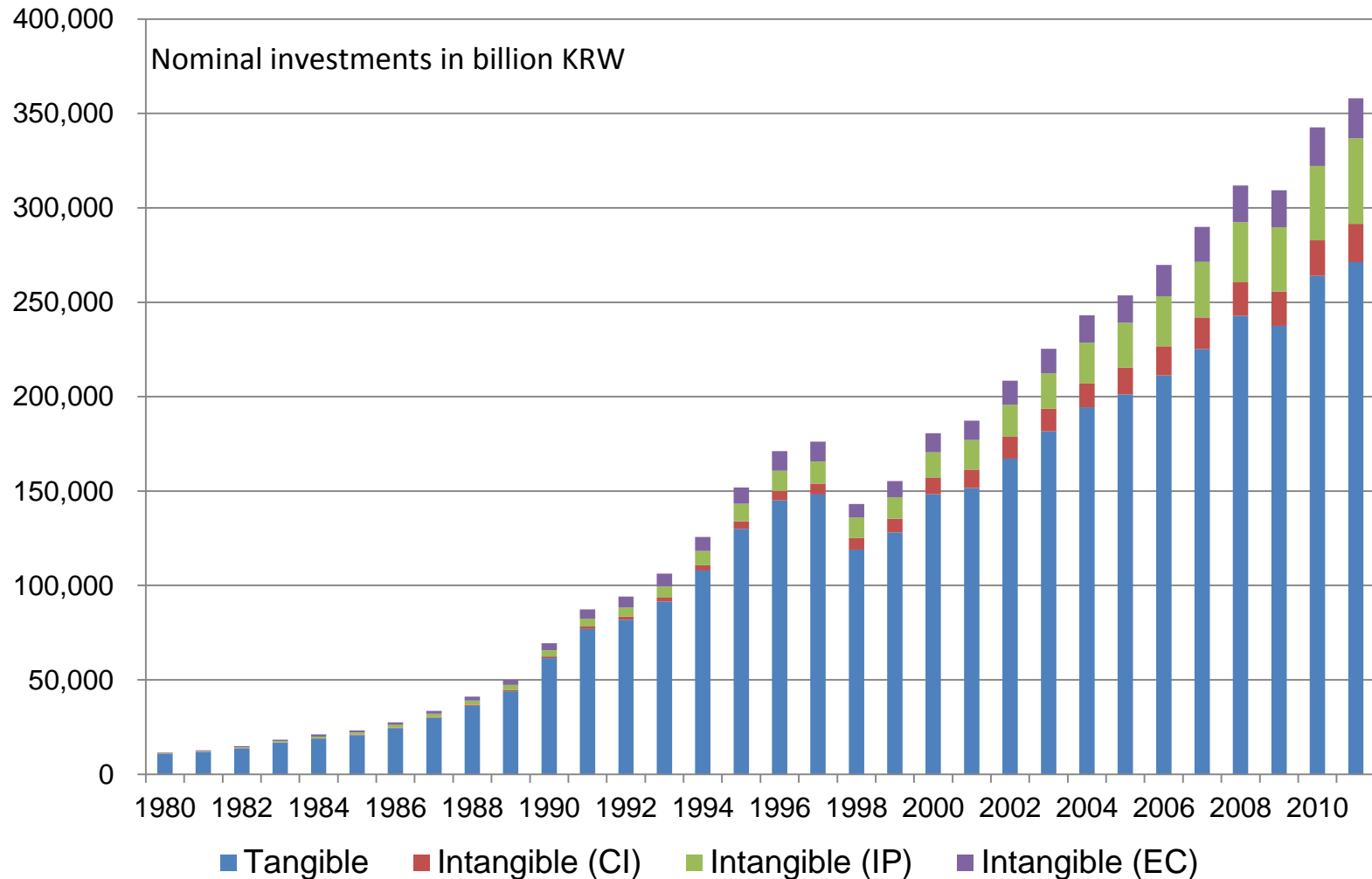


Rising Capital-Output (value-added) Ratio



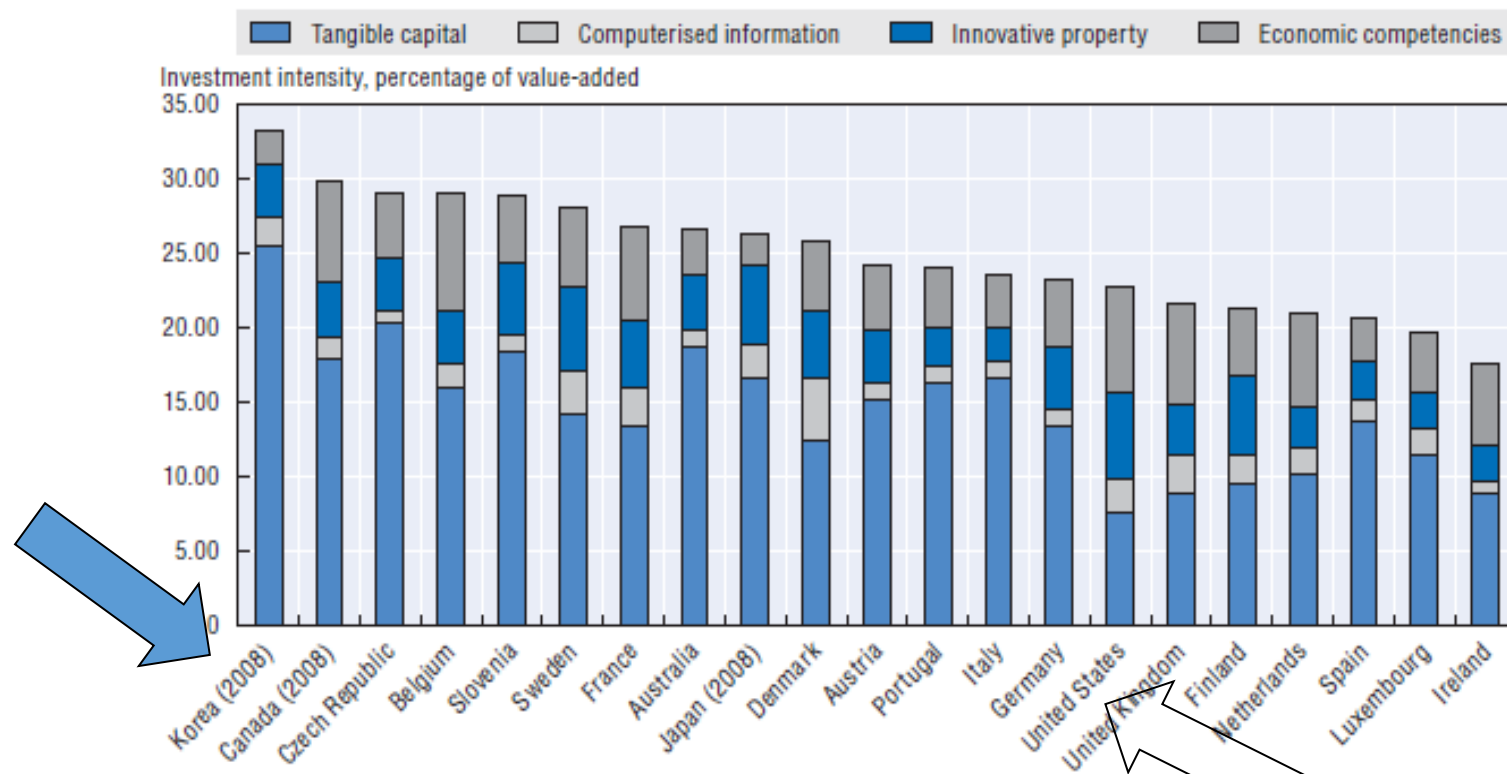
Tangible vs. Intangible Investments

- Low ratio of intangible to tangible Investments



Tangible and CHS Intangible Investments as Percentage of Value-added (OECD, 2013)

Figure 0.2. Business investment in KBC and tangible capital, 2010 (% of market sector value added)



Note: Figures refer to the market economy, which excludes real estate, public administration, health and education, with the exception of Korea, where figures refer to the whole economy.

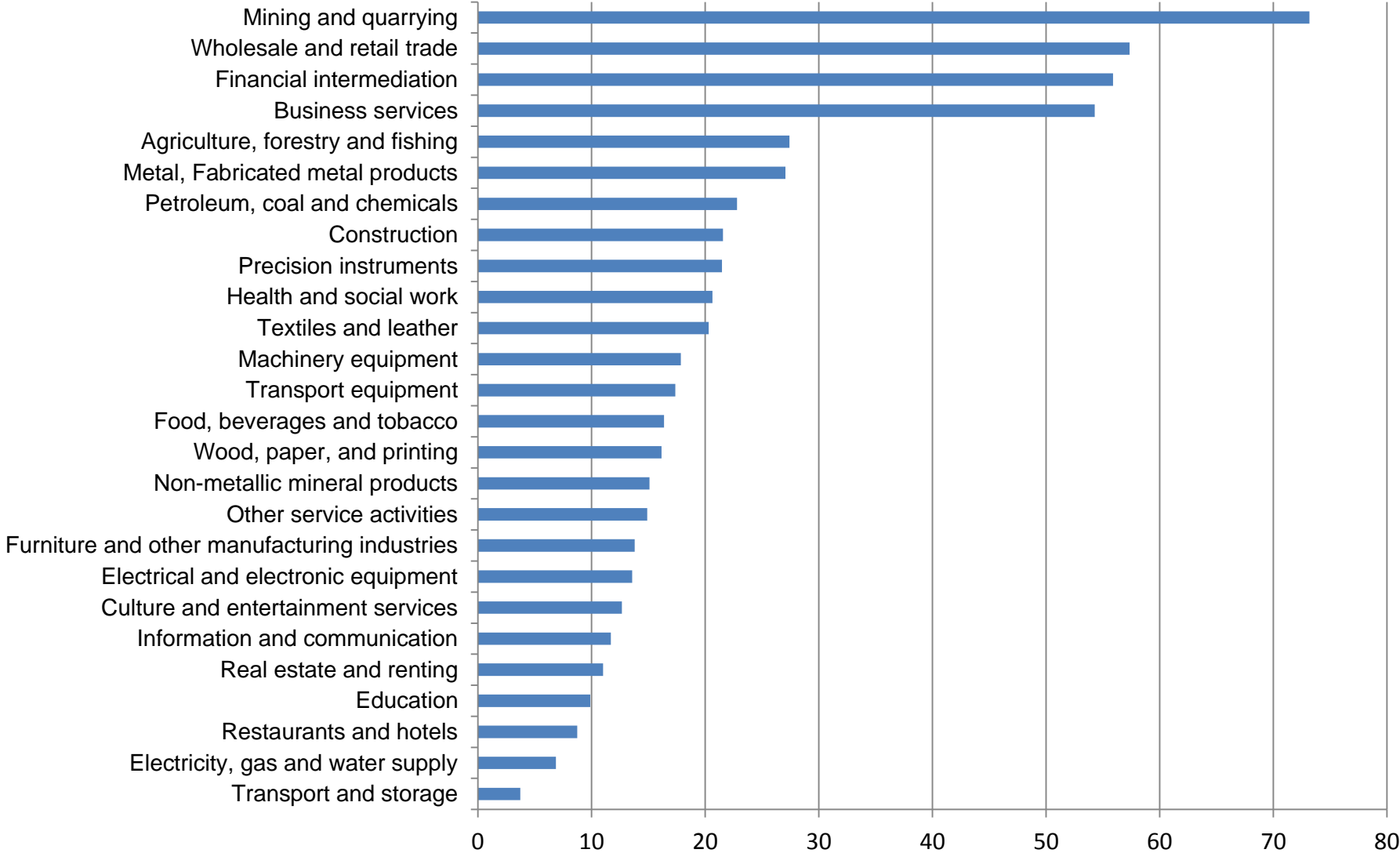
Source: Based on INTAN-Invest (www.intan-invest.net, KBC investment for EU27 and United States), OECD Main Science and Technology Indicators (www.statast.oecd.org, Korea, Luxembourg and Portugal market-sector value added and Korea tangible investment), National Accounts from Eurostat (<http://ec.europa.eu/eurostat>, Austria, Denmark, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Spain and Sweden tangible investment), Australian Innovation System Report (2012, KBC investment), National Accounts from the Australian Bureau of Statistics (www.abs.gov.au, value added and tangible investment), the Japanese Industrial Productivity (JIP) Database (www.rieti.go.jp/en/database/JIP2011/ all data for Japan), Chun et al. (2012) (Korea KBC investment), and Baldwin et al. (2012, all data for Canada), accessed June 2013.

• Industry Classification

- Market economy (26)
- Manufacturing (11), Services (12)
- IT (13), Non-IT(13)

No.	Industry name	MFG-SER	IT-NIT
1	Agriculture, forestry and fishing		Non-IT
2	Mining and quarrying		Non-IT
3	Food, beverages and tobacco	Manufacturing	Non-IT
4	Textiles and leather	Manufacturing	Non-IT
5	Wood, paper, and printing	Manufacturing	Non-IT
6	Petroleum, coal and chemicals	Manufacturing	IT
7	Non-metallic mineral products	Manufacturing	IT
8	Metal, Fabricated metal products	Manufacturing	Non-IT
9	Machinery equipment	Manufacturing	IT
10	Electrical and electronic equipment	Manufacturing	IT
11	Precision instruments	Manufacturing	Non-IT
12	Transport equipment	Manufacturing	IT
13	Furniture and other manufacturing	Manufacturing	IT
14	Electricity, gas and water supply		Non-IT
15	Construction		Non-IT
16	Wholesale and retail trade	Services	IT
17	Restaurants and hotels	Services	Non-IT
18	Transport and storage	Services	Non-IT
19	Financial intermediation	Services	IT
20	Real estate and renting	Services	Non-IT
21	Information and communication	Services	IT
22	Business services	Services	IT
23	Education	Services	IT
24	Health and social work	Services	IT
25	Culture and entertainment services	Services	IT
26	Other service activities	Services	Non-IT

Average Rate of Return on Capital by Industry (2011)



Factor Price Frontier Estimation

- Specification: Same as the Japanese model

$$\ln r_{jt} = \text{const.} + a_1 \ln w_{jt} + a_2 \ln\left(\frac{IT_{jt}}{K_{jt}^{IT}}\right) + a_3 \ln\left(\frac{RD_{jt}}{K_{jt}^{RD}}\right) + a_4 \ln\left(\frac{HR_{jt}}{K_{jt}^{HR}}\right) + \mu_j + \eta_t + \varepsilon_{jt}$$

- Data

- KIP 2014 database from 1980 to 2011

- Dependent variables

- r_{marginal} (marginal rate of return on capital)
- r_{average} (average rate of return on capital)

- Independent variables

- w (wage rate)
- $IT, RD \ \& \ HR$ = IT investments, R&D investments & Investments in Human Resources
- K_{IT}, K_{RD} and K_{HR} = IT capital stock, R&D capital stock and Assets in HR

Results

	(1) Market	(2) Market	(3) MFG	(5) Services	(6) IT	(7) Non-IT
In w	-0.066** (0.027)	-0.174*** (0.035)	0.079* (0.044)	-0.268*** (0.036)	-0.094** (0.042)	-0.147*** (0.034)
In IT/KIT	-0.015 (0.065)	0.019 (0.063)	0.445*** (0.133)	0.045 (0.090)	0.148 (0.113)	-0.185** (0.082)
In RD/KRD	-0.028* (0.014)	-0.030** (0.014)	-0.112 (0.069)	-0.017 (0.016)	-0.111*** (0.018)	0.064*** (0.018)
In HR/KHR	0.059 (0.037)	0.030 (0.036)	0.241*** (0.079)	0.121** (0.054)	0.220*** (0.061)	-0.048 (0.049)
In Y		0.212*** (0.042)				
Obs.	832	832	352	352	416	416
Adj. R2	0.752	0.764	0.650	0.791	0.776	0.783

Results: Definition of CHS Intangibles

Innovative property (IP) = Scientific R&D + non-scientific R&D

Economic competencies (EC) = Brand equity + Human resources + Other firm-specific resources

	(1) Market	(2) Market	(3) MFG	(4) Services	(5) IT	(6) Non-IT
In w	-0.070** (0.028)	-0.178*** (0.034)	0.066 (0.043)	-0.287*** (0.034)	-0.046 (0.041)	-0.157*** (0.035)
In IT/K _{IT}	-0.057 (0.062)	-0.024 (0.061)	0.411*** (0.137)	0.004 (0.082)	0.086 (0.124)	-0.135* (0.077)
In IP/K _{IP}	0.108** (0.046)	0.126*** (0.045)	-0.165** (0.069)	0.170** (0.067)	0.072 (0.100)	0.146*** (0.053)
In EC/K _{EC}	0.187** (0.089)	0.139* (0.084)	0.483** (0.196)	0.421*** (0.129)	0.485*** (0.145)	-0.099 (0.097)
In Y		0.211*** (0.041)				
Obs.	832	832	352	352	416	416
Adj. R2	0.753	0.765	0.643	0.799	0.755	0.781

Summary

- Rate of return on tangible capital in Korea has declined as the accumulation of tangible capital
 - In particular, rates of return in service and non-IT industries are lower than those in manufacturing and IT industries.
- Innovative property (IP) and Economic competencies (EC) shift up the factor price frontier (i.e., raise the rate of return on tangible capital), suggesting complementary effects between tangibles and intangibles.
 - Heterogeneity in the role of various types of intangibles
 - To raise the rate of return, IP (or R&D) is more effective in non-IT industries and EC (or HR) is more effective in IT-industries; IP and EC is more effective in service industries and EC is more effective in manufacturing industries.