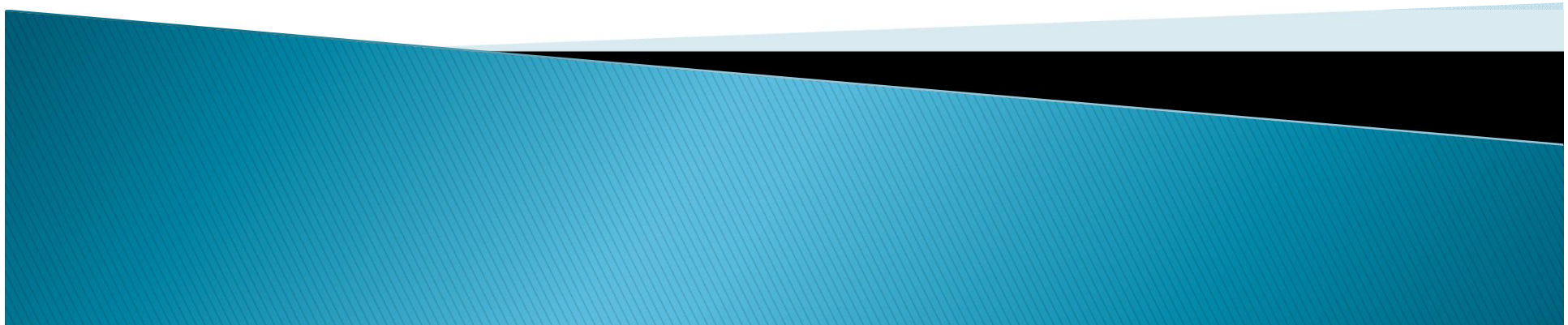


Intangible Investment, Innovation and Productivity
NISTEP, January 27, 2012

Preliminary Results from Japan–Korea Joint Research on Intangible Investment at the 2–digit Industry Level: **KOREAN DATA**

Hyunbae Chun
Sogang University



Motivation

- ▶ In the knowledge based economy, intangible assets become more crucial in the production process
- ▶ Corrado, Hulten, & Sichel (hereafter CHS; 2006, 2009) provide a broad definition of intangible asset



CHS Definition of Intangibles

- ▶ Computerized Information (CI)
 - Mainly computer software
- ▶ Innovative Property (IP)
 - Scientific R&D, non-scientific R&D (R&D in financial industry, copyrights & license costs, and new architectural & engineering designs)
- ▶ Economic Competencies (EC)
 - Brand equity (advertising expenses)
 - Firm-specific resources (job training and consulting costs)



International Collaboration of Intangible Data based on CHS

▶ Individual country

- Fukao, Miyagawa & others (2009) for Japan
- Chun and others (2011) for Korea
- Marrano, Hakel & Wallis (2009) for UK
- Barnes & McClure (2009) for Australia
- Van Rooijeen–Horsten (2008) for Netherlands

▶ International Collaboration

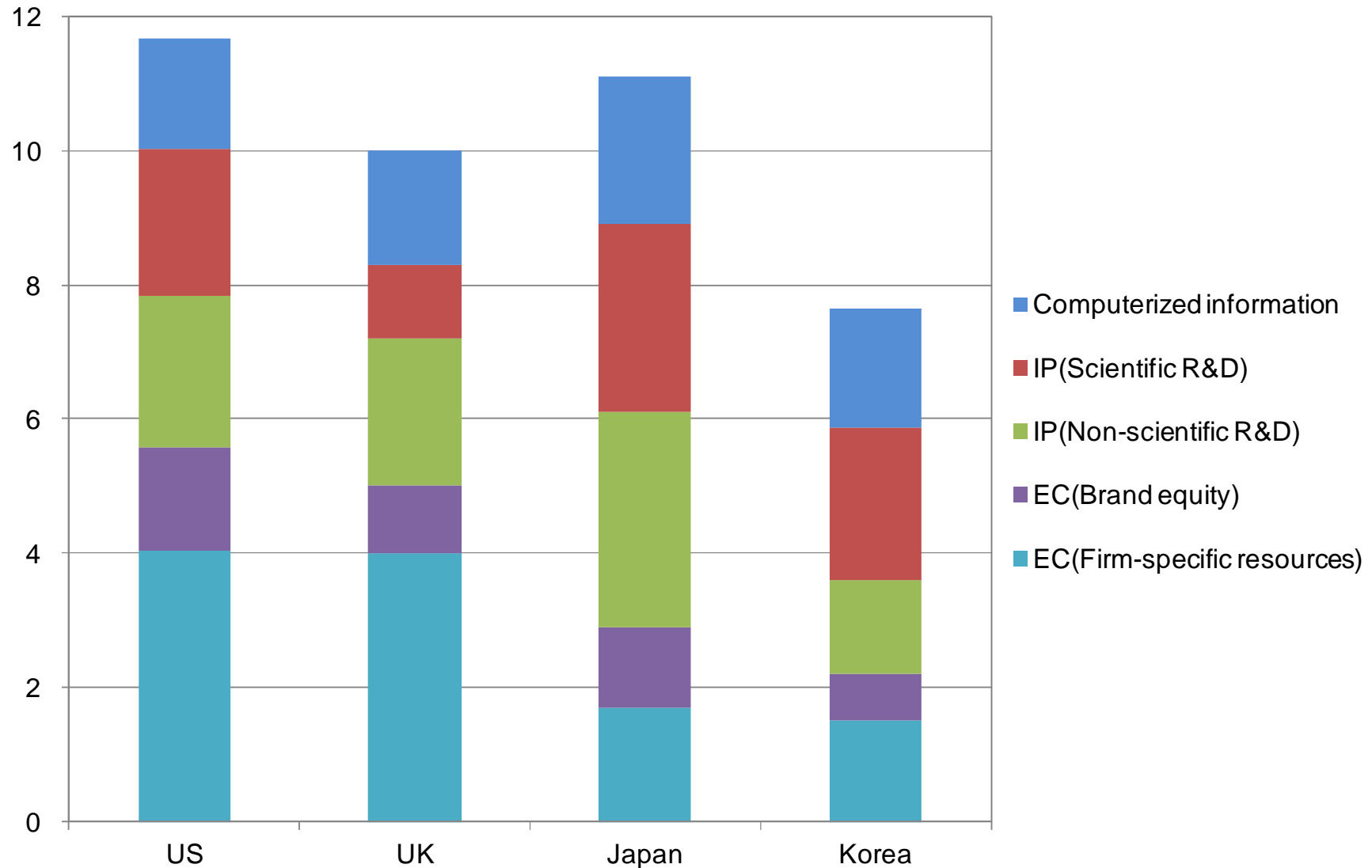
- Haskel & others' *Coinvest* project for European Countries
- Miyagawa & others' collaboration with Chun & others for Japanese and Korean aggregate & industry–level data

Share of Intangible Investment in GDP: US, UK, Japan, and Korea

	U.S. 2000-'03	U.K. 2004	Japan 2000-'05	Korea 2000-'05
Computerized information	1.6	1.7	2.2	1.8
Innovative property	4.5	3.2	6.0	3.7
(a) Scientific R&D	2.2	1.1	2.8	2.3
(b) Non-scientific R&D	2.3	2.2	3.2	1.4
Economic competencies	5.6	5.0	2.9	2.1
(a) Brand equity	1.5	1.0	1.2	0.7
(b) Firm-specific resources	4.0	4.0	1.7	1.5
Total	11.7	10.0	11.1	7.6

Sources: Corrado, Hulten, & Sichel (2009) for US;
Marrano, Haskel & Wallis (2009) for UK;
Fukao, Miyagawa, Mukai, Shinoda, & Tonogi (2009) for Japan.

Share of Intangible Investment in GDP: US, UK, Japan, and Korea



Toward Industry-level data

- ▶ Need industry-level datasets because differences in the level and composition of intangibles might be explained by sectoral difference across countries
 - A higher intangible intensity in advance countries (than in developing countries) might reflect a larger share of intangible intensive industries such as durable manufacturing, financial, and IT services
 - A high scientific R&D intensity in the aggregate economy might reflect a larger share of durable goods and ICT industries



Toward Industry-level data

- ▶ Korean and Japanese researchers agree to construct intangible datasets for 27 industries
 - Unified definition of industry-level intangibles between Japan and Korea
 - KIP: 72 industries and JIP: 108 industries
 - 27 industries based on the industry classification of the Korean National Accounts (following ISIC rev. 4)



Looking at Korean Industry-level data

- ▶ Sectoral differences: manufacturing vs. services
- ▶ Heterogeneity in composition of intangibles across industries
 - Scientific R&D to develop a better machine
 - Production development cost for new financial products
 - Advertising costs in food and beverage industries
 - Job training costs for workers in the software industry

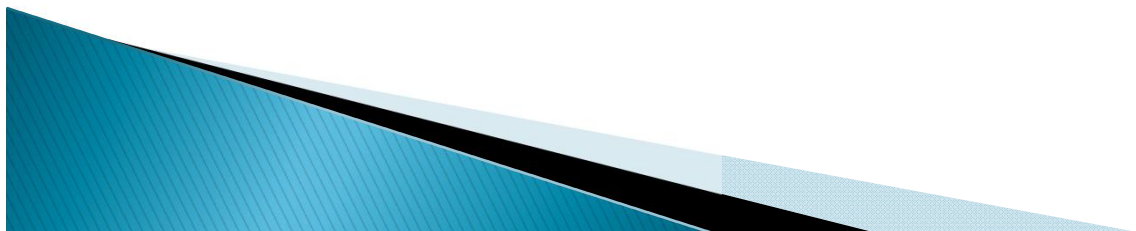


27-Industry Classification

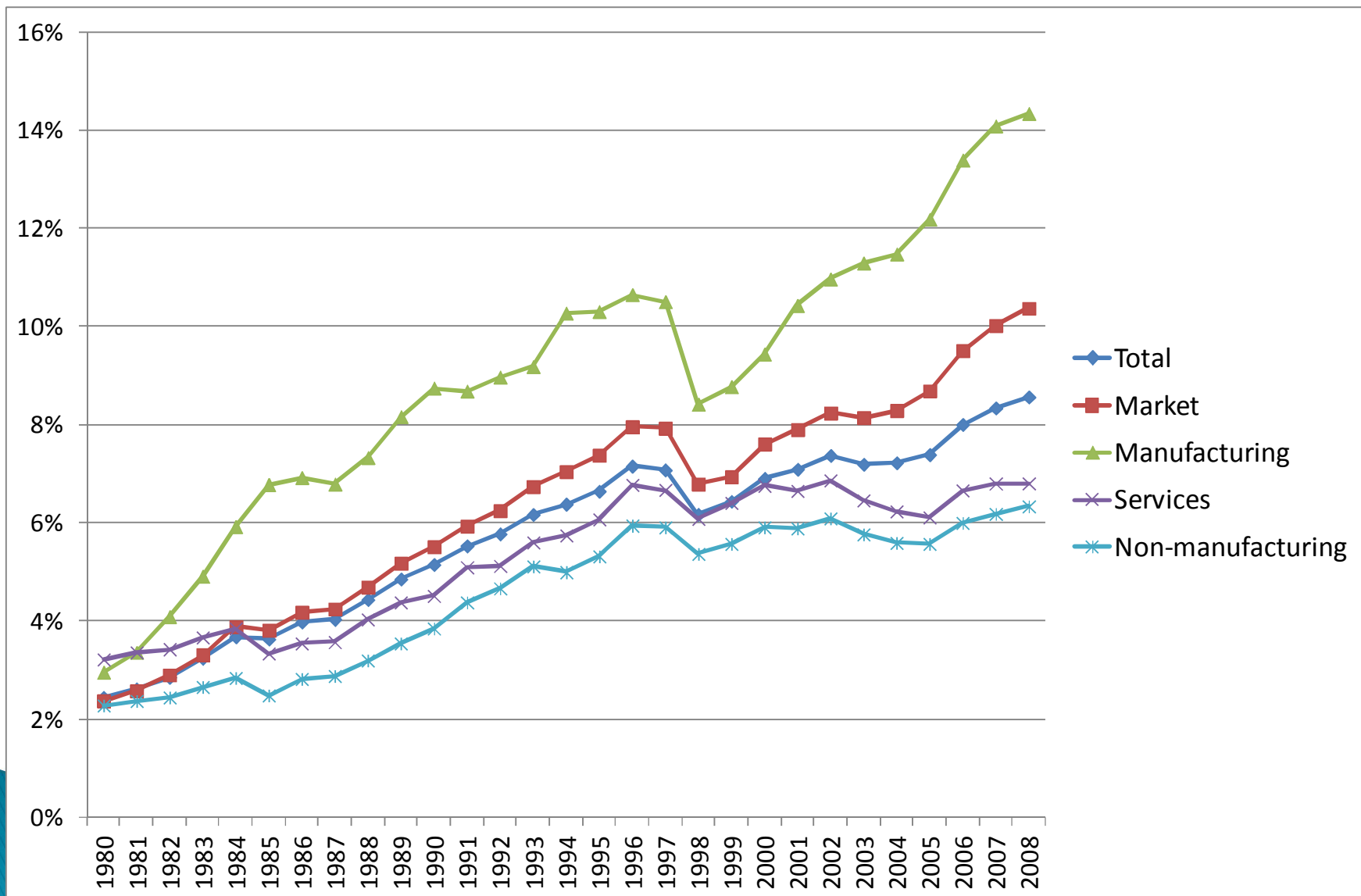
No	Industry	No	Industry
1	Agriculture, forestry and fishing	14	Electricity, gas and water supply
2	Mining and quarrying	15	Construction
3	Food, beverages and tobacco	16	Wholesale and retail trade
4	Textiles and leather	17	Restaurants and hotels
5	Wood, paper, and printing	18	Transport and storage
6	Petroleum,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

Industry Classification

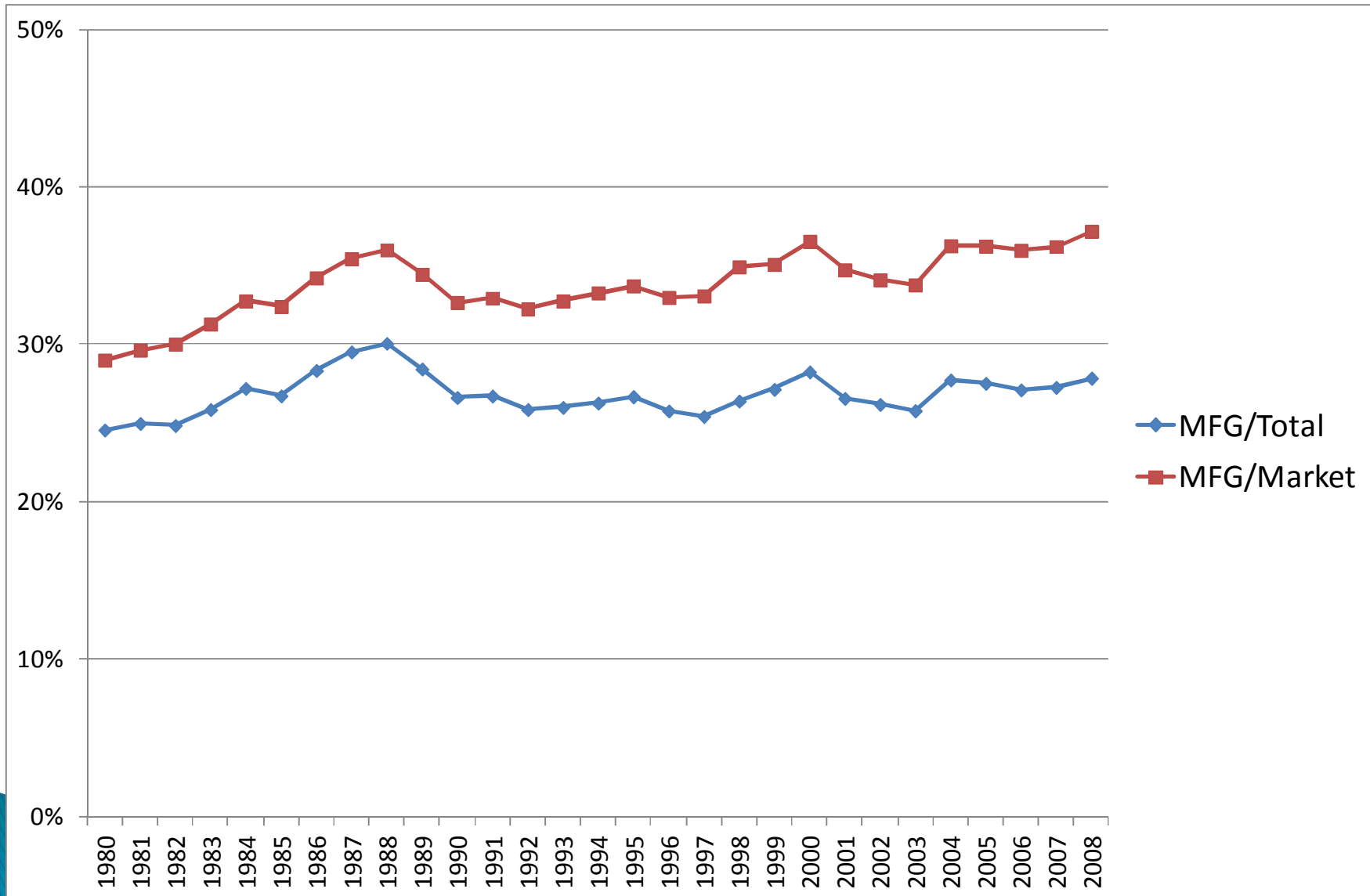
- ▶ Total Economy: 1–27
- ▶ Market Economy: excl. Real estate (20), Public administration (23), Education (24), Health and social work (25)
- ▶ Manufacturing: 3–13
- ▶ Services: 16–27
- ▶ Non-manufacturing: 1–2, 14–27



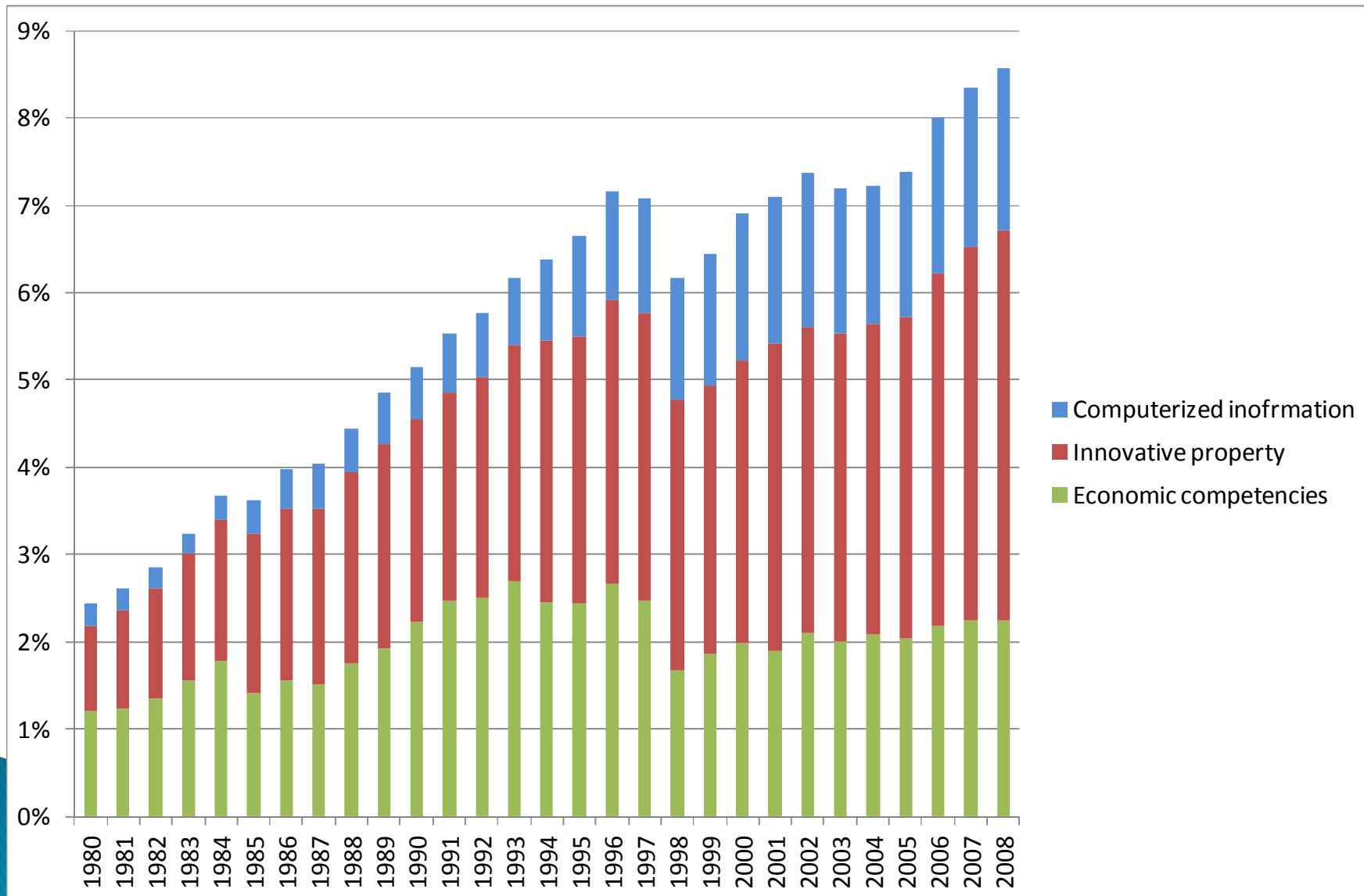
Intangible Investment by Sector: Korea (percentage of GDP)



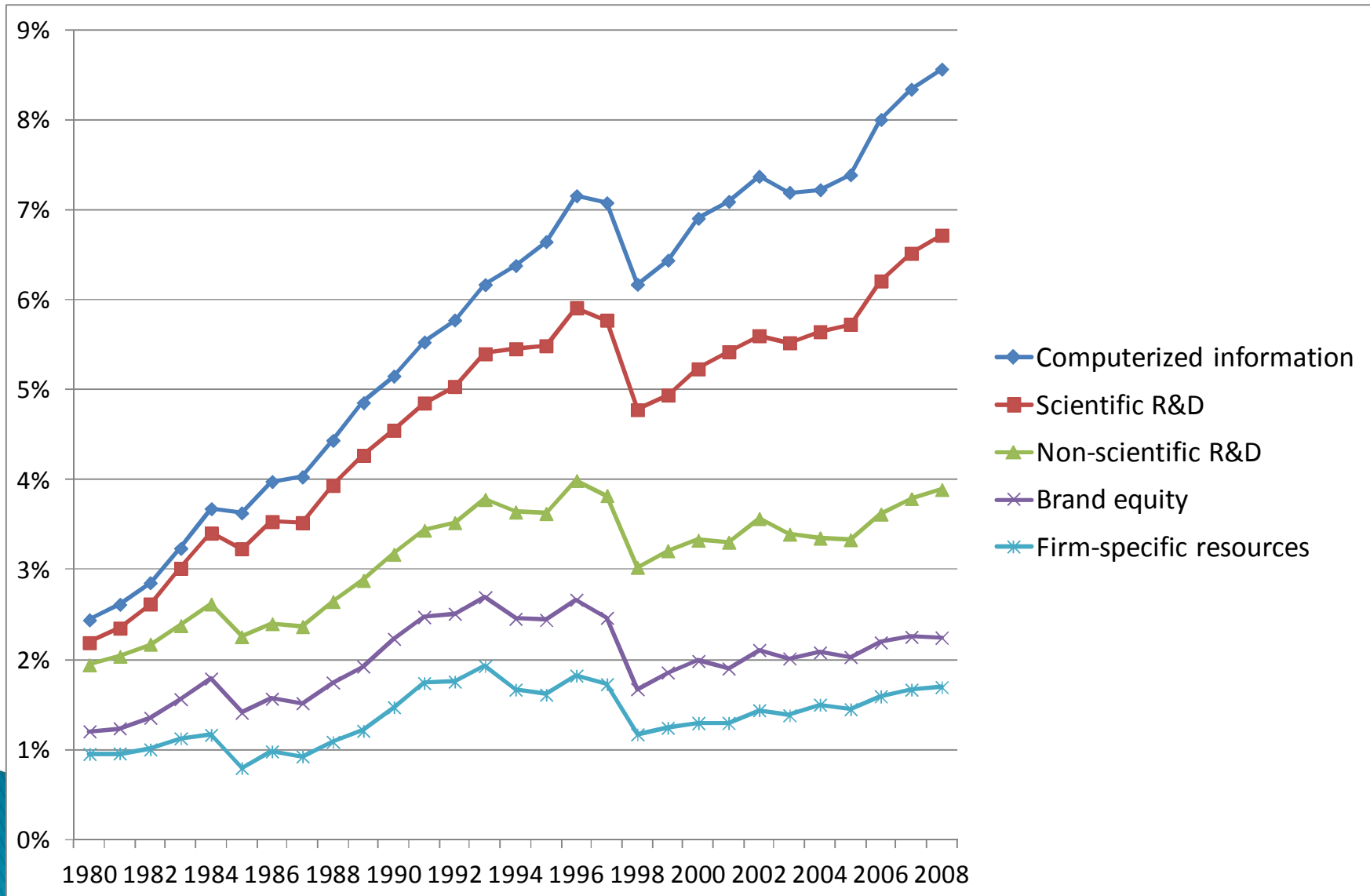
Share of Manufacturing



Intangible Investment by Type: Total Economy



Intangible Investment by Type: Total Economy

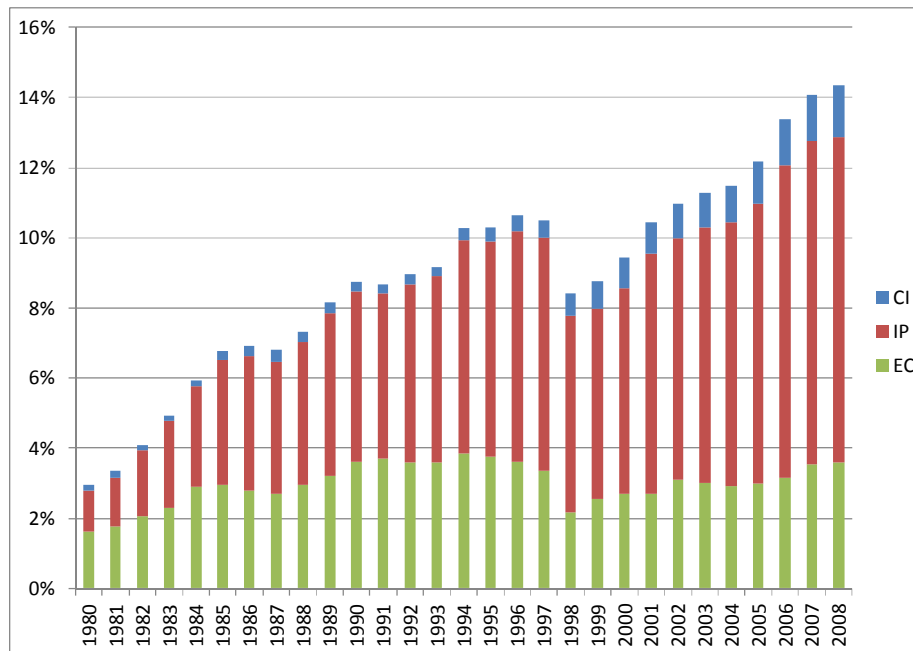


Manufacturing versus Services

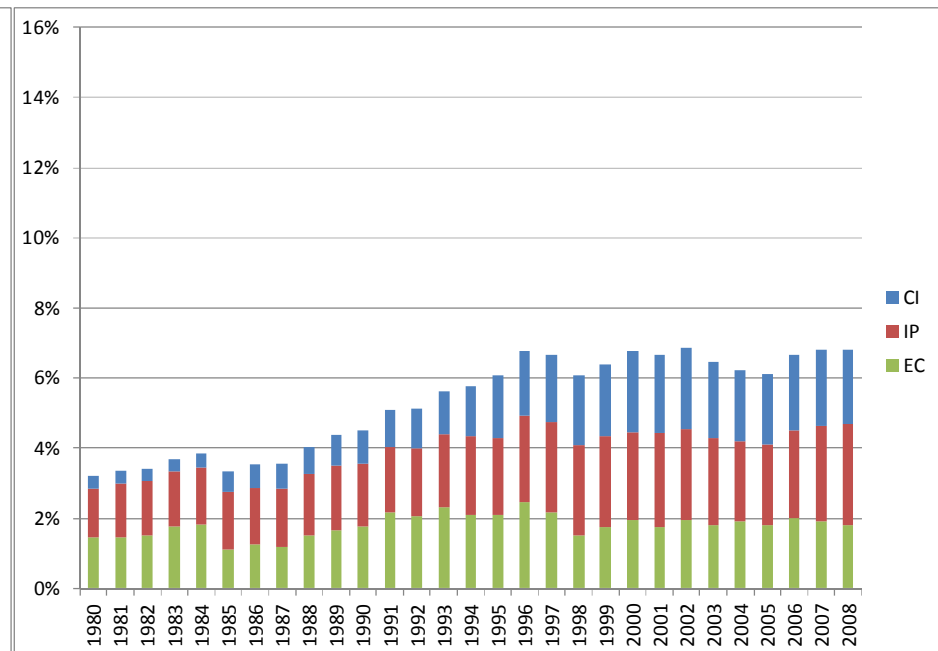
	1981–1990	1991–2000	2001–2008	1981–2008
Total				
CI	0.4%	1.1%	1.7%	1.0%
IP	1.8%	3.0%	3.8%	2.8%
EC	1.6%	2.3%	2.1%	2.0%
Total	3.8%	6.4%	7.6%	5.9%
Manufacturing				
CI	0.2%	0.5%	1.2%	0.6%
IP	3.3%	5.7%	8.0%	5.5%
EC	2.7%	3.3%	3.1%	3.0%
Total	6.3%	9.5%	12.3%	9.2%
Services				
CI	0.6%	1.7%	2.1%	1.4%
IP	1.7%	2.3%	2.6%	2.1%
EC	1.5%	2.1%	1.9%	1.8%
Total	3.8%	6.0%	6.6%	5.4%

Intangible Investment by Type: Manufacturing versus Services

Manufacturing



Services



Intangible investment (percent of VA) in Korea: 27 industries

No	Industry	1980	1990	2000	2008
1	Agriculture, forestry and fishing	0.1%	0.2%	0.2%	0.3%
2	Mining and quarrying	1.3%	2.9%	4.4%	5.7%
3	Food, beverages and tobacco	4.7%	10.8%	10.2%	16.9%
4	Textiles and leather	1.8%	4.2%	4.0%	5.2%
5	Wood, paper, and printing	4.9%	3.4%	3.8%	5.1%
6	Petroleum, coal and chemicals	3.0%	11.6%	9.4%	12.7%
7	Non-metallic mineral products	1.1%	3.4%	2.3%	3.4%
8	Metal, Fabricated metal products	1.6%	2.8%	2.7%	4.3%
9	Machinery equipment	4.1%	9.1%	12.6%	13.6%
10	Electrical and electronic equipment	4.3%	18.7%	14.2%	29.5%
11	Precision instruments	1.4%	7.6%	9.7%	21.3%
12	Transport equipment	4.6%	9.3%	13.0%	12.1%
13	Furniture and other manufacturing industries	2.5%	5.4%	6.4%	5.3%
14	Electricity, gas and water supply	1.7%	1.8%	5.0%	13.7%
15	Construction	1.3%	4.1%	3.1%	3.1%
16	Wholesale and retail trade	1.3%	1.9%	4.1%	3.6%
17	Restaurants and hotels	5.1%	3.7%	1.5%	1.3%
18	Transport and storage	1.3%	1.5%	3.3%	2.6%
19	Financial intermediation	9.3%	15.0%	22.5%	23.0%
20	Real estate and renting	2.2%	3.9%	5.0%	2.3%
21	Information and communication	4.1%	5.1%	11.3%	16.1%
22	Business services	6.7%	8.9%	7.3%	6.3%
23	Public administration and defense	3.4%	3.8%	4.8%	3.7%
24	Education	2.8%	3.6%	4.5%	4.2%
25	Health and social work	1.9%	1.9%	2.2%	2.3%
26	Culture and entertainment services	2.3%	3.1%	4.7%	8.3%
27	Other service activities	2.4%	2.1%	4.3%	5.7%
	Total Economy	2.4%	5.2%	6.9%	8.5%

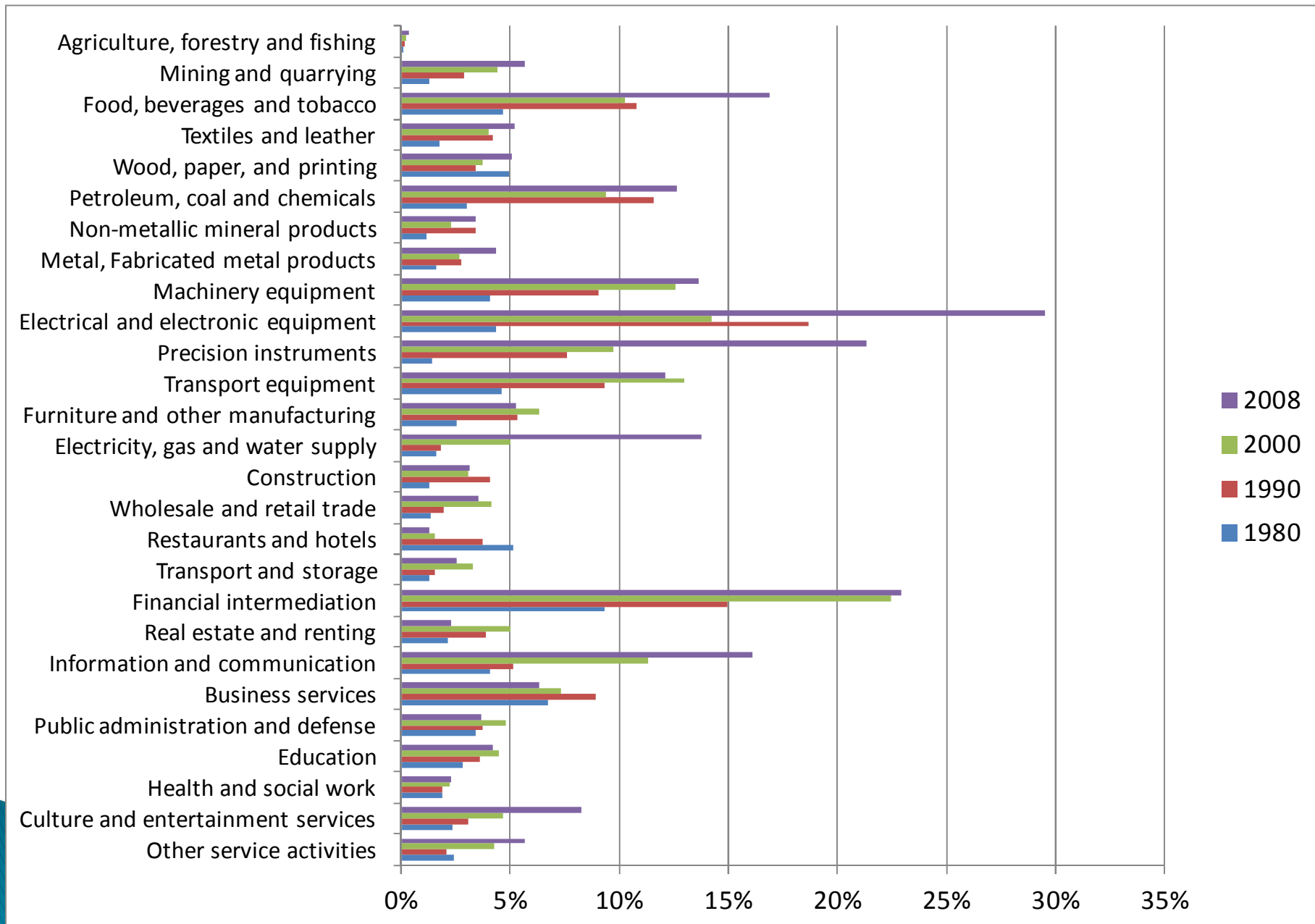
Intangible investment (percent of VA) : 27 industries

No	Industry	1980	1990	2000	2008
1	Agriculture, forestry and fishing	0.1%	0.2%	0.2%	0.3%
2	Mining and quarrying	1.3%	2.9%	4.4%	5.7%
3	Food, beverages and tobacco	4.7%	10.8%	10.2%	16.9%
4	Textiles and leather	1.8%	4.2%	4.0%	5.2%
5	Wood, paper, and printing	4.9%	3.4%	3.8%	5.1%
6	Petroleum, coal and chemicals	3.0%	11.6%	9.4%	12.7%
7	Non-metallic mineral products	1.1%	3.4%	2.3%	3.4%
8	Metal, Fabricated metal products	1.6%	2.8%	2.7%	4.3%
9	Machinery equipment	4.1%	9.1%	12.6%	13.6%
10	Electrical and electronic equipment	4.3%	18.7%	14.2%	29.5%
11	Precision instruments	1.4%	7.6%	9.7%	21.3%
12	Transport equipment	4.6%	9.3%	13.0%	12.1%
13	Furniture and other manufacturing	2.5%	5.4%	6.4%	5.3%

Intangible investment (percent of VA) : 27 industries

No	Industry	1980	1990	2000	2008
14	Electricity, gas and water supply	1.7%	1.8%	5.0%	13.7%
15	Construction	1.3%	4.1%	3.1%	3.1%
16	Wholesale and retail trade	1.3%	1.9%	4.1%	3.6%
17	Restaurants and hotels	5.1%	3.7%	1.5%	1.3%
18	Transport and storage	1.3%	1.5%	3.3%	2.6%
19	Financial intermediation	9.3%	15.0%	22.5%	23.0%
20	Real estate and renting	2.2%	3.9%	5.0%	2.3%
21	Information and communication	4.1%	5.1%	11.3%	16.1%
22	Business services	6.7%	8.9%	7.3%	6.3%
23	Public administration and defense	3.4%	3.8%	4.8%	3.7%
24	Education	2.8%	3.6%	4.5%	4.2%
25	Health and social work	1.9%	1.9%	2.2%	2.3%
26	Culture and entertainment services	2.3%	3.1%	4.7%	8.3%
27	Other service activities	2.4%	2.1%	4.3%	5.7%
	Total Economy	2.4%	5.2%	6.9%	8.5%

Intangible investment (percent of VA) in Korea: 27 industries



Intangible investment (percent of VA) by Types, 2000–2008

No	Industry	CI	IP	EC	Total
1	Agriculture, forestry and fishing	0.0%	0.1%	0.1%	0.3%
2	Mining and quarrying	0.0%	4.7%	0.3%	5.0%
3	Food, beverages and tobacco	2.0%	2.4%	7.8%	12.2%
4	Textiles and leather	0.7%	1.2%	2.9%	4.7%
5	Wood, paper, and printing	0.9%	1.6%	2.1%	4.6%
6	Petroleum, coal and chemicals	1.0%	5.3%	3.8%	10.1%
7	Non-metallic mineral products except petroleum & coal	0.2%	1.6%	1.3%	3.1%
8	Metal, Fabricated metal products	0.3%	1.4%	1.8%	3.4%
9	Machinery equipment	1.3%	7.8%	4.0%	13.1%
10	Electrical and electronic equipment	1.9%	17.4%	3.5%	22.7%
11	Precision instruments	1.8%	9.0%	2.2%	13.0%
12	Transport equipment	0.9%	10.4%	1.7%	13.0%
13	Furniture and other manufacturing industries	0.8%	2.0%	2.2%	5.0%
14	Electricity, gas and water supply	4.3%	1.2%	1.6%	7.1%
15	Construction	0.5%	1.1%	1.5%	3.1%
16	Wholesale and retail trade	1.1%	0.9%	1.9%	3.9%
17	Restaurants and hotels	0.1%	0.2%	1.1%	1.4%
18	Transport and storage	0.5%	0.5%	1.7%	2.7%
19	Financial intermediation	3.5%	14.1%	2.6%	20.1%
20	Real estate and renting	3.2%	0.1%	0.3%	3.6%
21	Information and communication	4.8%	3.4%	5.5%	13.7%
22	Business services	2.5%	2.4%	1.4%	6.3%
23	Public administration and defense	1.2%	0.4%	2.5%	4.2%
24	Education	2.8%	0.8%	1.0%	4.6%
25	Health and social work	1.1%	0.3%	0.8%	2.3%
26	Culture and entertainment services	1.4%	1.8%	3.6%	6.8%
27	Other service activities	0.9%	3.3%	0.8%	5.0%
	Total Economy	1.7%	3.8%	2.1%	7.6%

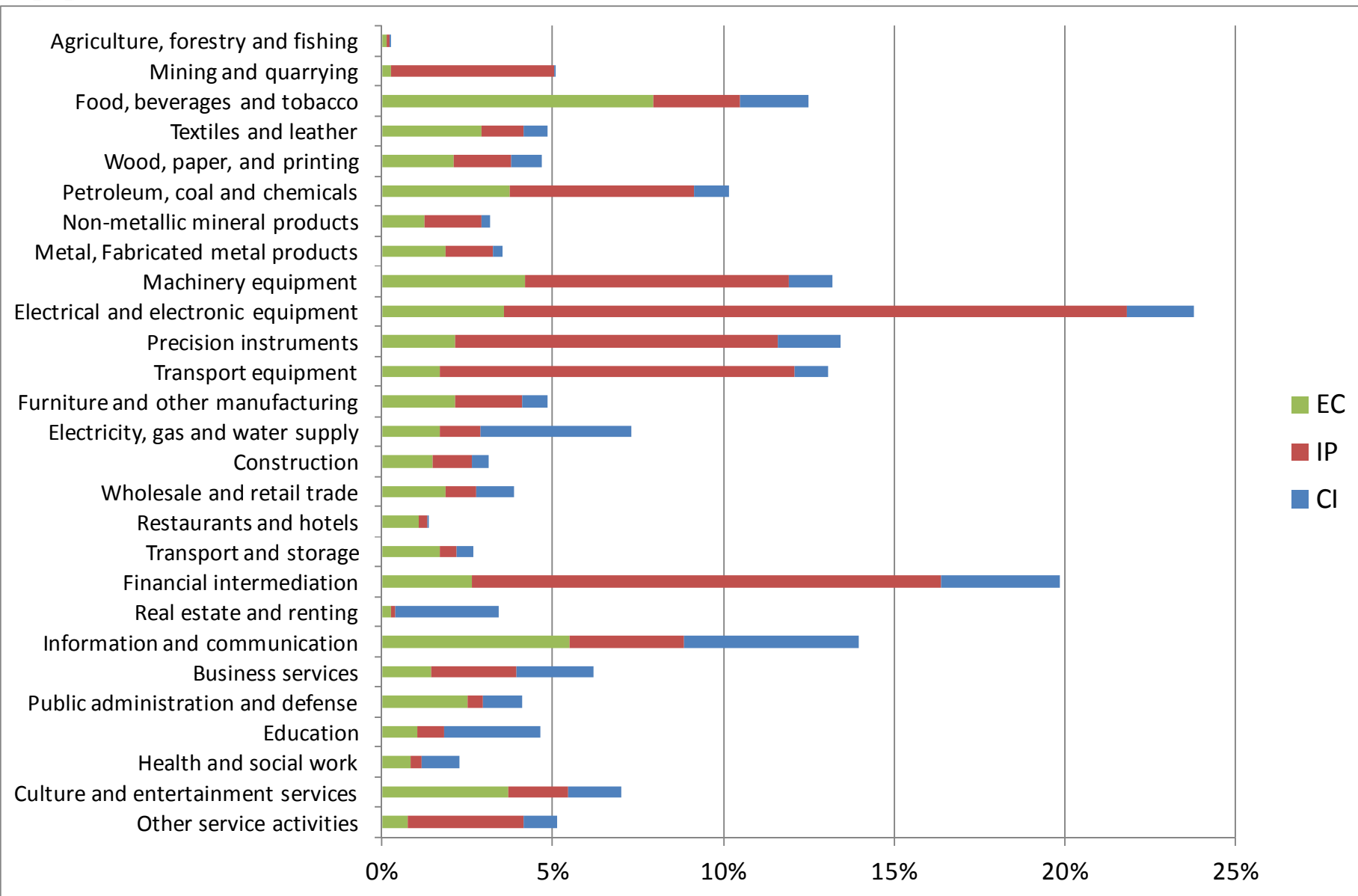
Intangible investment by Types, 2000–2008

No	Industry	CI	IP	EC	Total
1	Agriculture, forestry and fishing	0.0%	0.1%	0.1%	0.3%
2	Mining and quarrying	0.0%	4.7%	0.3%	5.0%
3	Food, beverages and tobacco	2.0%	2.4%	7.8%	12.2%
4	Textiles and leather	0.7%	1.2%	2.9%	4.7%
5	Wood, paper, and printing	0.9%	1.6%	2.1%	4.6%
6	Petroleum, coal and chemicals	1.0%	5.3%	3.8%	10.1%
7	Non-metallic mineral products	0.2%	1.6%	1.3%	3.1%
8	Metal, Fabricated metal products	0.3%	1.4%	1.8%	3.4%
9	Machinery equipment	1.3%	7.8%	4.0%	13.1%
10	Electrical and electronic equipment	1.9%	17.4%	3.5%	22.7%
11	Precision instruments	1.8%	9.0%	2.2%	13.0%
12	Transport equipment	0.9%	10.4%	1.7%	13.0%
13	Furniture and other manufacturing	0.8%	2.0%	2.2%	5.0%

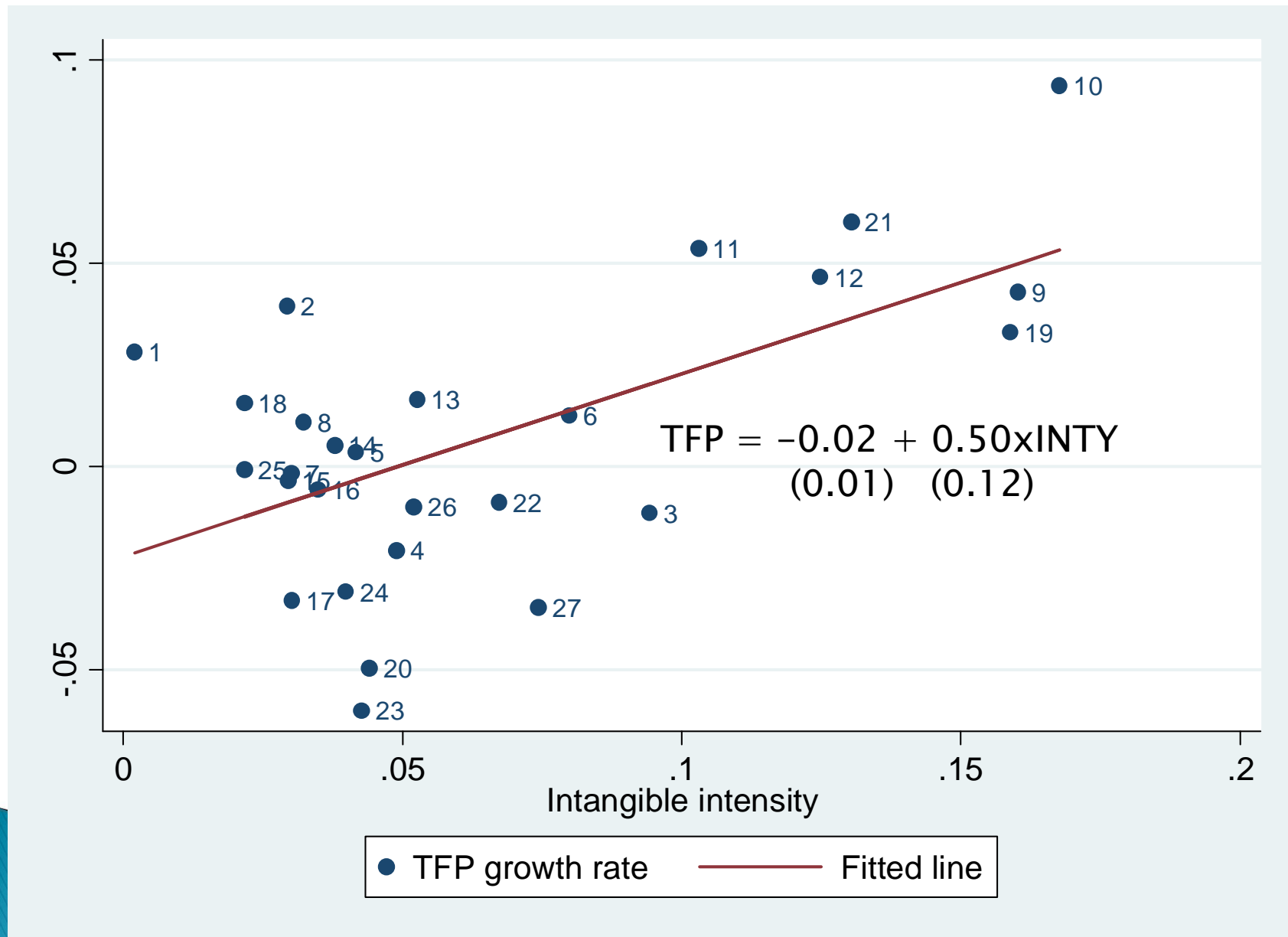
Intangible investment by Types, 2000–2008

No	Industry	CI	IP	EC	Total
14	Electricity, gas and water supply	4.3%	1.2%	1.6%	7.1%
15	Construction	0.5%	1.1%	1.5%	3.1%
16	Wholesale and retail trade	1.1%	0.9%	1.9%	3.9%
17	Restaurants and hotels	0.1%	0.2%	1.1%	1.4%
18	Transport and storage	0.5%	0.5%	1.7%	2.7%
19	Financial intermediation	3.5%	14.1%	2.6%	20.1%
20	Real estate and renting	3.2%	0.1%	0.3%	3.6%
21	Information and communication	4.8%	3.4%	5.5%	13.7%
22	Business services	2.5%	2.4%	1.4%	6.3%
23	Public administration and defense	1.2%	0.4%	2.5%	4.2%
24	Education	2.8%	0.8%	1.0%	4.6%
25	Health and social work	1.1%	0.3%	0.8%	2.3%
26	Culture and entertainment services	1.4%	1.8%	3.6%	6.8%
27	Other service activities	0.9%	3.3%	0.8%	5.0%
	Total Economy	1.7%	3.8%	2.1%	7.6%

Intangible Investment (percent of VA) by type in Korea: 27 industries, 20001–2008



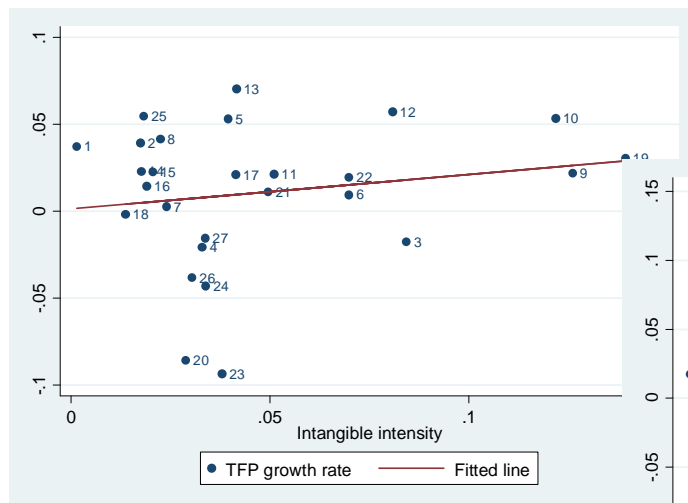
A Positive Correlation between TFP growth and Intangible investment, 1981–2008



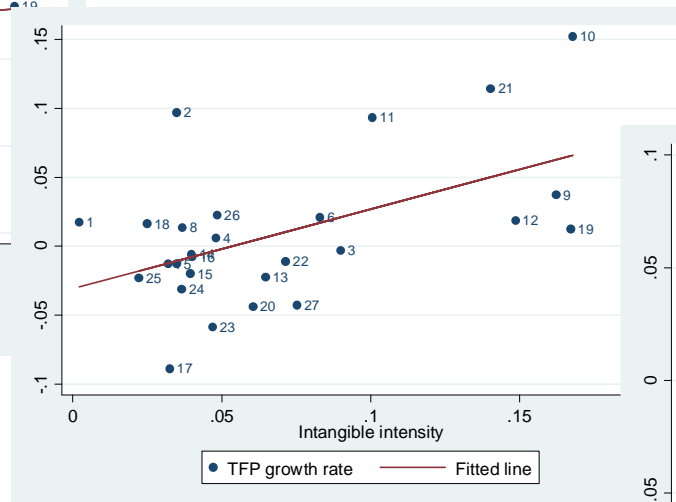
Correlations between TFP growth and Intangible investment

- ▶ Insignificant correlation in the 1980s
- ▶ Significant and positive correlations in the 1990s and 2000s

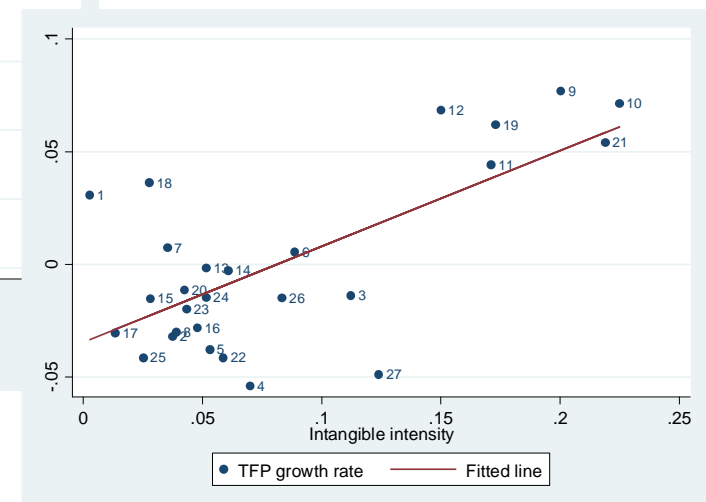
1981–1990



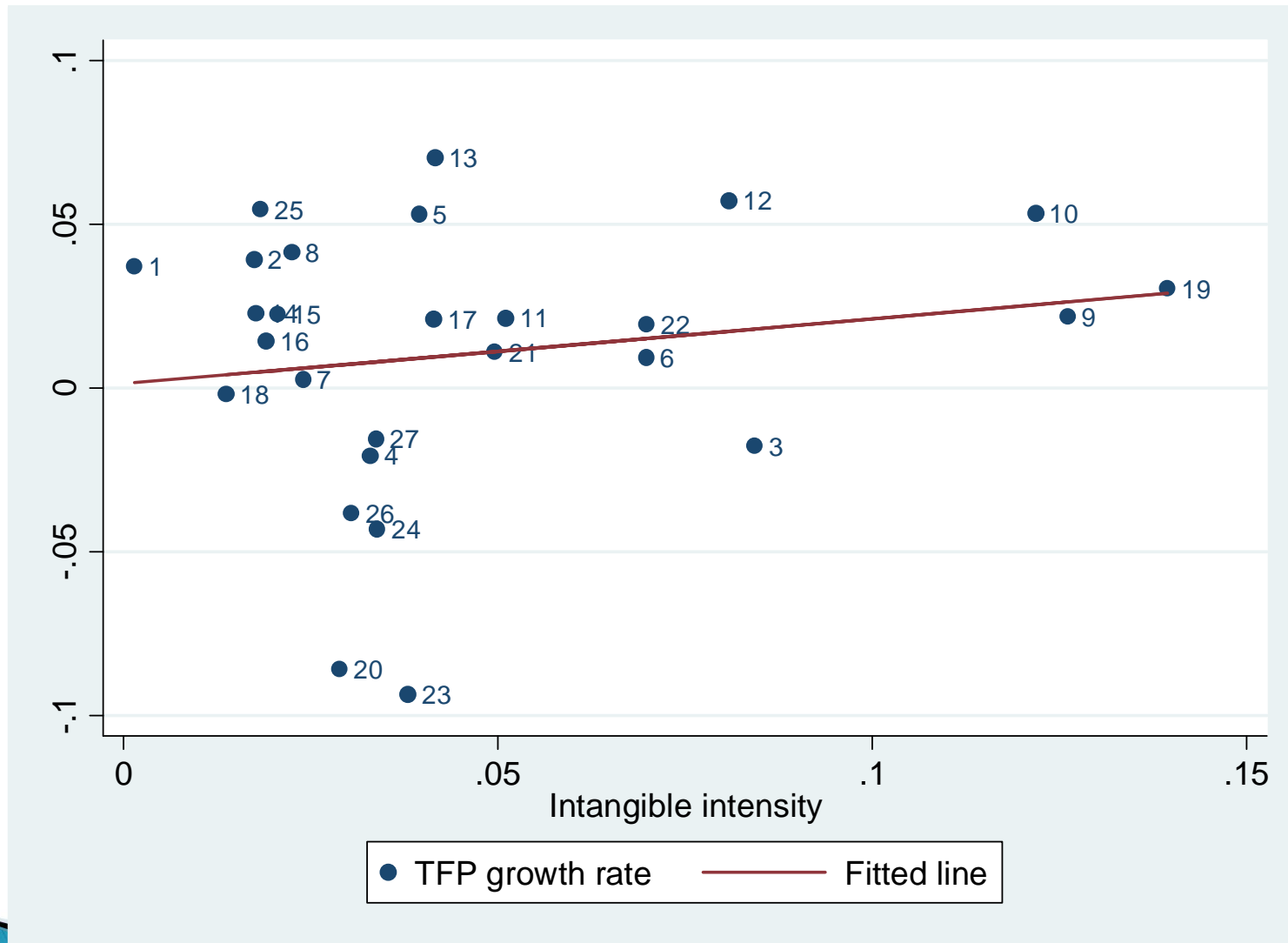
1991–2000



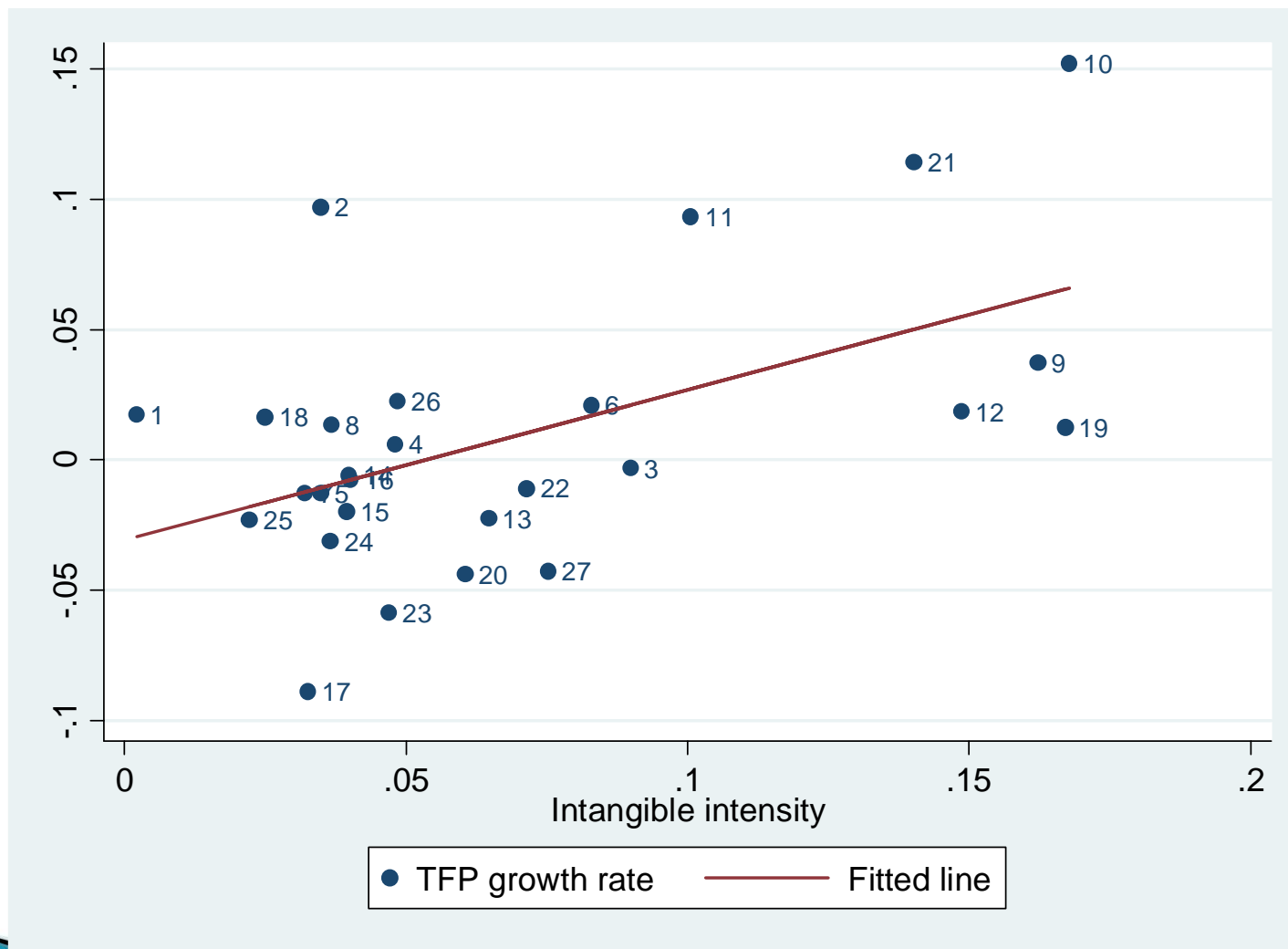
2001–2008



1981-1990

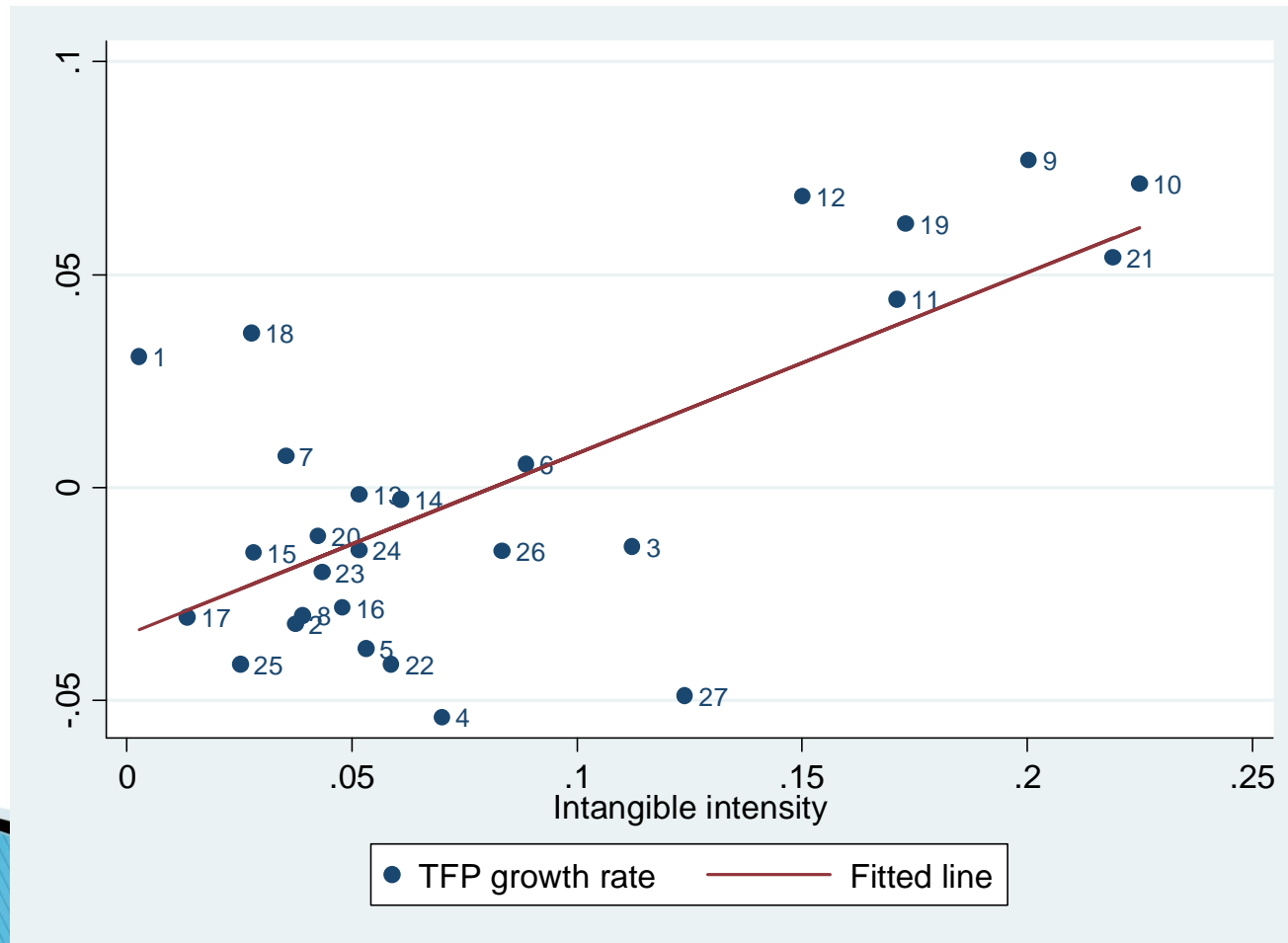


1991-2000



Correlations between TFP growth and Intangible investment in the 2000s

- ▶ Increased TFP growth gap between intangible intensive and intangible less-intensive industries
- 2001–2008



Next Step

- ▶ Construct stock variables
 - Deflators
 - Depreciation rate
- ▶ Growth accounting analysis
 - Tangible versus intangible investments
 - Manufacturing versus services
- ▶ Investigating
 - The role of intangible investment in the production structure: substitutability or complementarity
 - Relationship between intangibles and productivity growth



Next Step

- ▶ Construct stock variables
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