

The Measurement of Intangible Investment by Industry and Its Role in Productivity Improvements in Japan

**Presented at the workshop on Intangible Investment, Innovation,
and Productivity
at the National Institute of Science and Technology Policy
(NISTEP), Tokyo**

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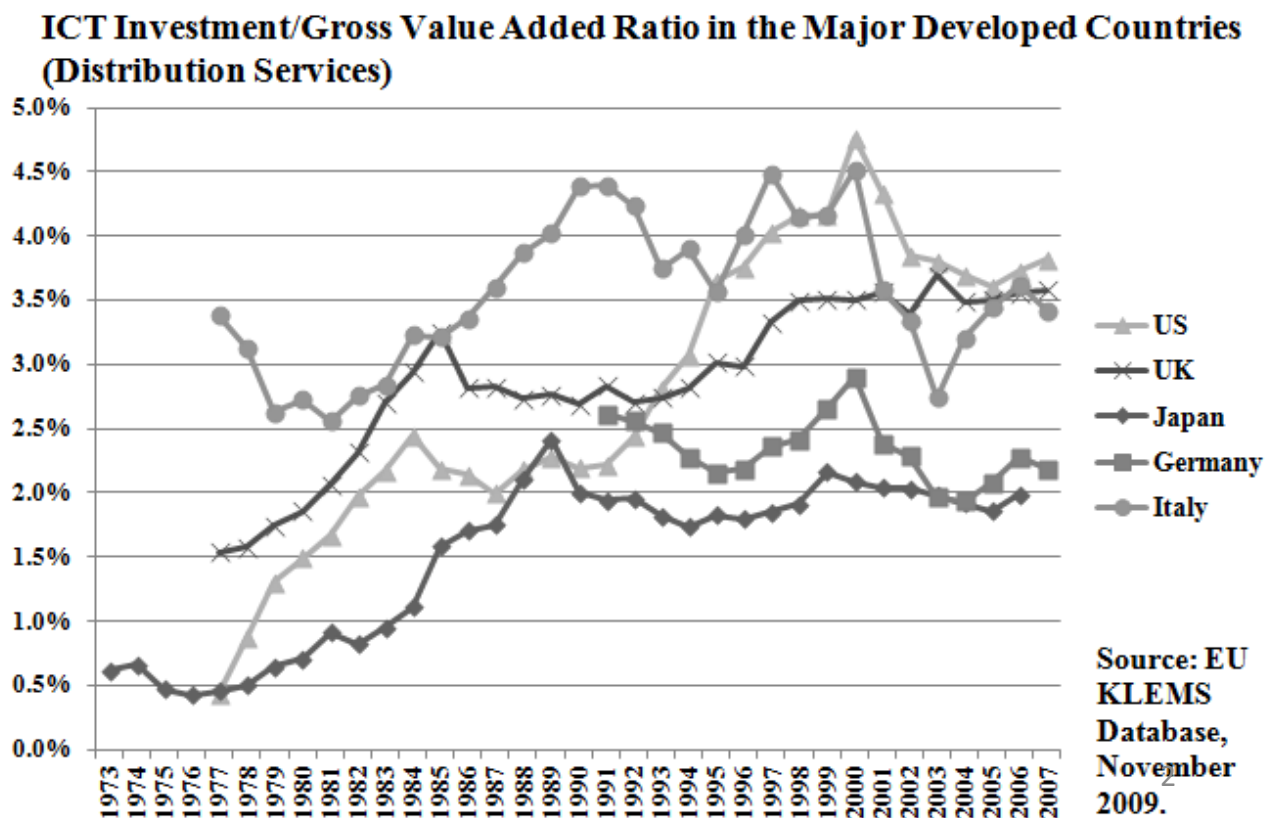
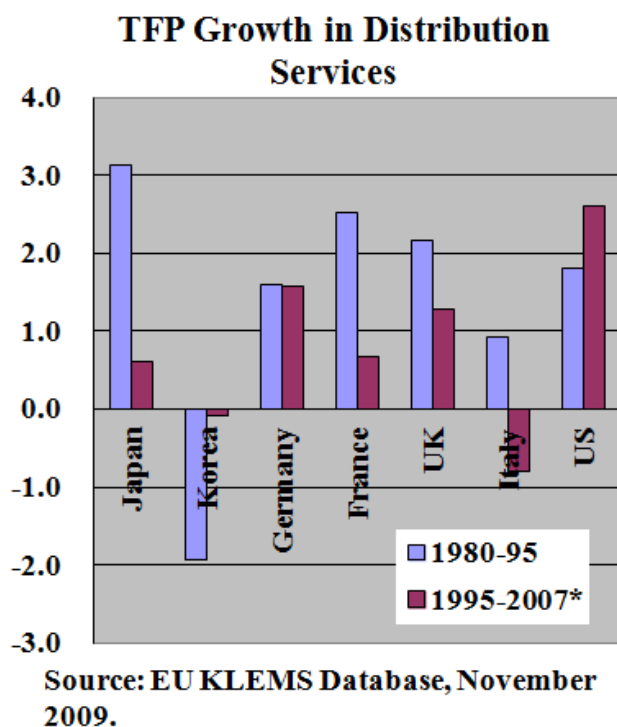
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1. Motivation

TFP growth in Japan's service sector has been low since 1995. Analyses based on the EU KLEMS Database, such as Fukao et al. (2011), suggest that the ICT revolution in Japan has been incomplete, partly because of the low level of ICT investment. Probably the stagnation of Japan's TFP growth in many sectors can also be explained by the low level of intangible investment.



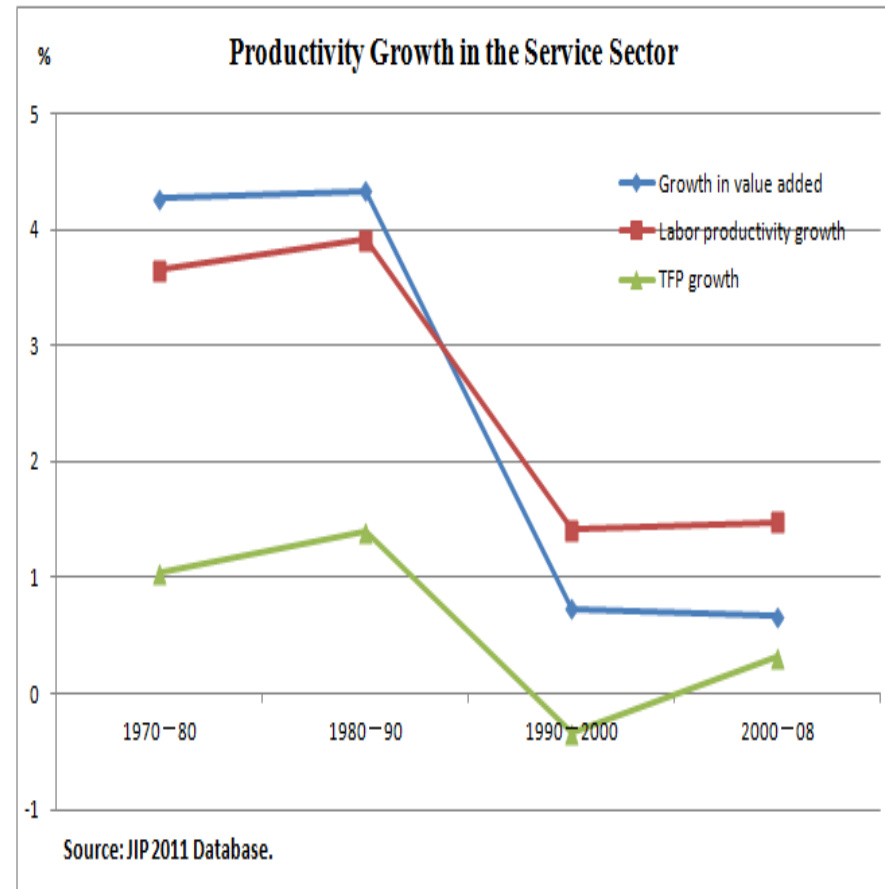
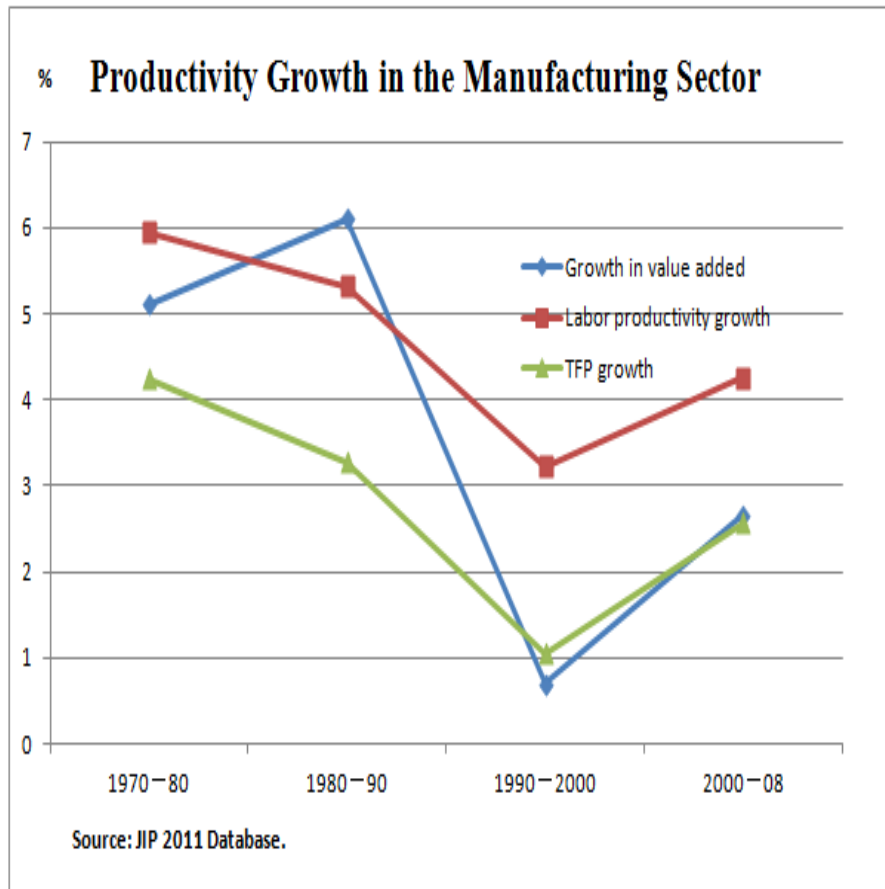
1. Motivation (contd.)

- “ Corrado, Hulten, and Sichel (2005, 2009) estimated the aggregate intangible investment in the US.**
- “ Following CHS, many economists estimated the aggregate intangible investment in advanced countries (e.g., Marrano, Haskel, and Wallis (2009) for the UK, Fukao et al. (2009) for Japan, Delbecque and Bounfour (2011) for France and Germany, Pyo, Chun, and Rhee (2011) for Korea).**

1. Motivation (contd.)

- “ ***Puzzle:*** Although intangible investment in Japan is higher than in other advanced countries, economic growth and productivity growth in Japan are not.
- “ ***Observation:*** There is a productivity gap between the manufacturing sector and the service sector.
- “ ***Hypothesis:*** The effect of intangible assets on productivity depends on the industry structure.
- “ To investigate the above hypothesis, we need more detailed industry-level data on intangibles.

1. Motivation (contd.)



2. Estimation of Japan's Intangible Investment by Industry

“ **Using the framework of Corrado, Hulten, and Sichel (2005, 2009), we estimate annual sectoral intangible investment in Japan's market economy for 1980-2008 for the following categories:**

Computerized information

Custom and packaged software

Own account software

Innovative property

Science and engineering R&D

Mineral exploitation

Copyright and license costs (spending for the development of entertainment and artistic originals, usually leading to a copyright or license)

Other product development, design, and research expenses

Economic competencies

Brand equity

Firm specific human capital

Organizational structure

“ **We used the JIP 2011 Database (<http://www.rieti.go.jp/en/database/JIP2011/index.html>) and other statistics. JIP 2011 consists of 108 industries (manufacturing sector: 52 industries; service sector: 33 industries).**

2. Estimation of Japan's Intangible Investment by Industry (contd.)

- “ Our estimate of total annual spending on intangible assets in Japan for the period 2001-2008 is about 42 trillion yen on average. This estimate is lower than that obtained by Fukao et al. (2009) because our analysis covers only the market economy (Fukao et al. (2009) consider the total economy, including the non-market sector). Annual capital spending on intangibles is about 38 trillion yen in the same period.**
- “ However, the total spending/GVA ratio is 10.7% (the total capital spending/GVA ratio is 9.6%), which is similar to the corresponding estimates in Fukao et al. (2009).**

2. Estimation of Japan's Intangible Investment by Industry (contd.)

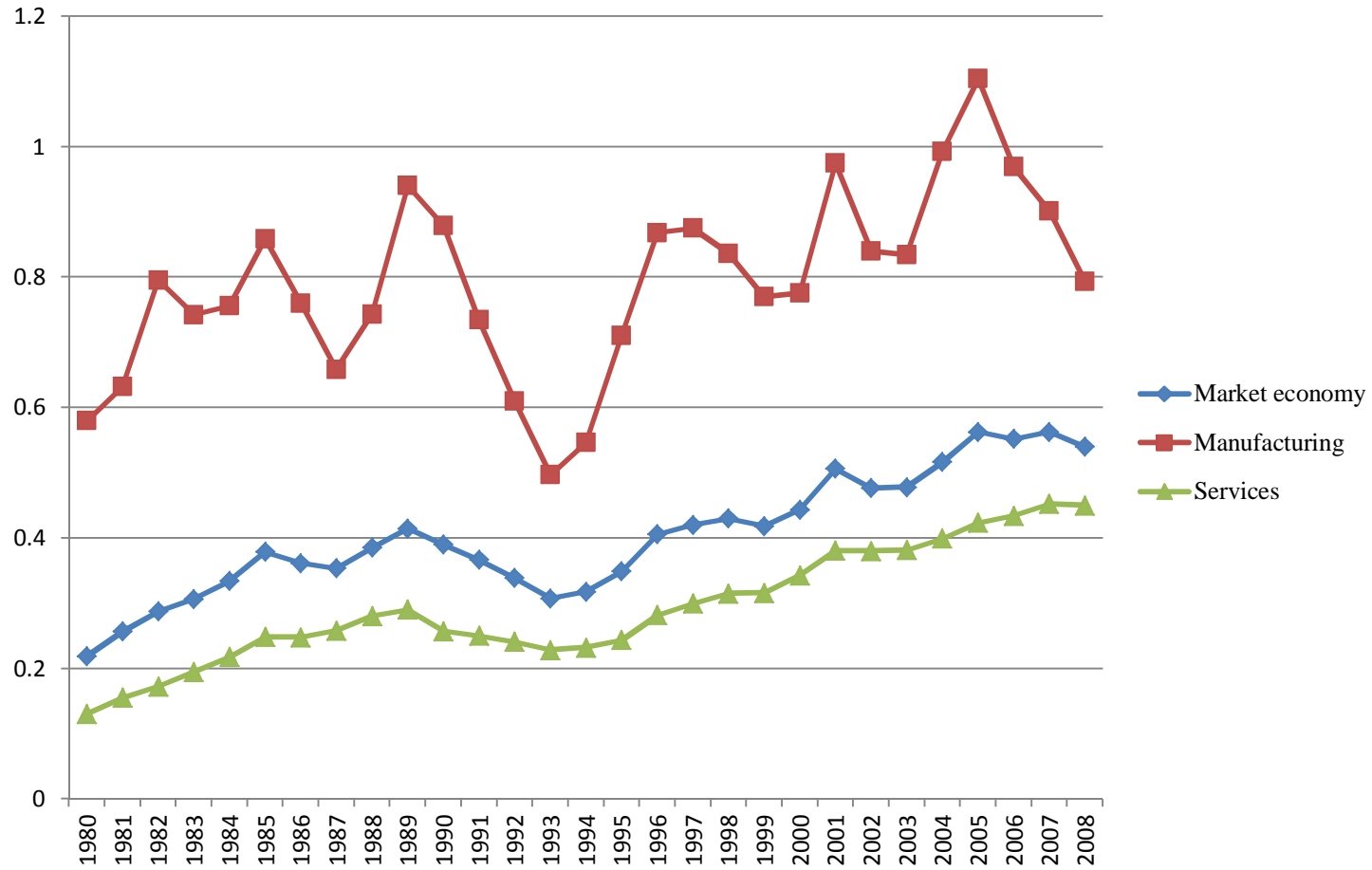
- “ The intangible investment/GVA ratio in the manufacturing sector is higher than that in the service sector, as already indicated by Fukao et al. (2009) indicated.**
- “ The intangible/tangible investment ratio in the manufacturing sector is also higher than that in the service sector.**

Estimated Spending on Intangible Assets in Japan

| | | Market Economy | | Manufacturing | | Service | |
|-----------|--------------------------|-----------------|--------------|-----------------|---------------|-----------------|--------------|
| | | (billion yen) | GDP share | (billion yen) | GDP share | (billion yen) | GDP share |
| 1991-2000 | Computerized information | 4,986 | 1.2 | 1,530 | 1.2 | 3,445 | 1.3 |
| | | (4,986) | (1.2) | (1,530) | (1.2) | (3,445) | (1.3) |
| | Innovative property | 19,218 | 4.7 | 12,164 | 9.5 | 7,003 | 2.6 |
| | | (19,058) | (4.6) | (12,164) | (9.5) | (6,844) | (2.5) |
| | Economic competencies | 12,985 | 3.2 | 3,831 | 3.0 | 8,592 | 3.2 |
| | (9,364) | (2.3) | (2,615) | (2.0) | (6,233) | (2.3) | |
| | Total | 37,189 | 9.1 | 17,525 | 13.7 | 19,040 | 7.1 |
| | | (33,408) | (8.1) | (16,309) | (12.7) | (16,522) | (6.1) |
| 2001-2008 | Computerized information | 8,227 | 2.1 | 2,654 | 2.2 | 5,546 | 2.1 |
| | | (8,227) | (2.1) | (2,654) | (2.2) | (5,546) | (2.1) |
| | Innovative property | 20,804 | 5.3 | 11,994 | 10.3 | 8,782 | 3.3 |
| | | (20,606) | (5.2) | (11,994) | (10.3) | (8,584) | (3.2) |
| | Economic competencies | 13,143 | 3.3 | 3,791 | 3.3 | 9,037 | 3.3 |
| | (8,959) | (2.3) | (2,497) | (2.1) | (6,191) | (2.3) | |
| | Total | 42,174 | 10.7 | 18,439 | 15.8 | 23,365 | 8.7 |
| | | (37,792) | (9.6) | (17,145) | (14.6) | (20,321) | (7.6) |

* Capital spending on intangibles is shown in parenthesis.

Intangible/Tangible Investment Ratio



2. Estimation of Japan's Intangible Investment by Industry (contd.)

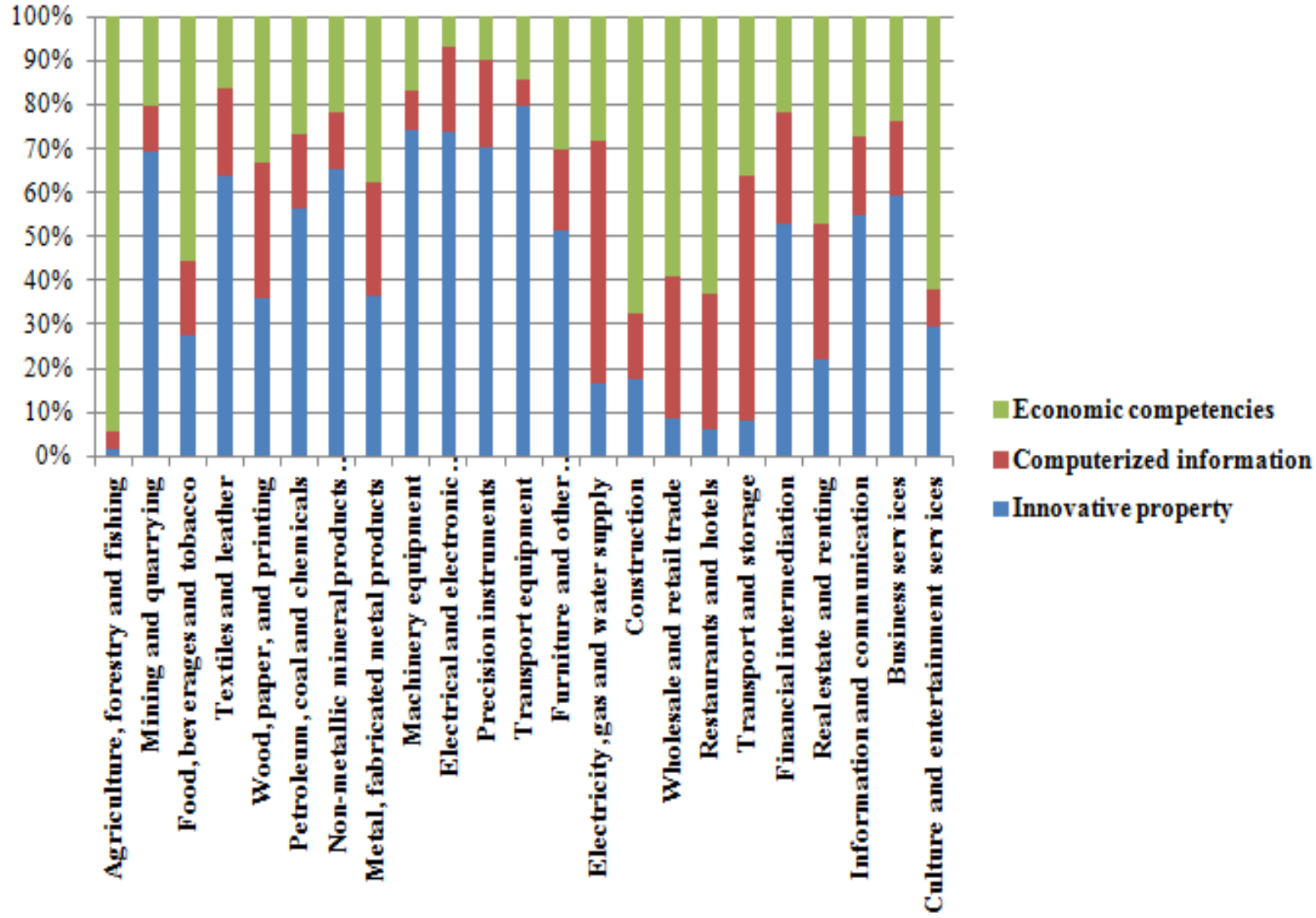
” Some industry-level findings

- (1) Industries with a high expenditure/GVA ratio: chemical industry, machinery industries, financial intermediation, and information and communication industry.**
- (2) Expenditure on innovative property makes up the largest share of intangible investment in the above industries.**

Expenditure on Intangibles/GVA Ratio by Industry

| Industry name | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2008 |
|---|--------|--------|--------|--------|--------|--------|--------|
| Agriculture, forestry and fishing | 2.11% | 1.95% | 2.12% | 2.68% | 3.12% | 2.56% | 4.53% |
| Mining and quarrying | 36.29% | 41.13% | 37.28% | 51.85% | 50.37% | 24.44% | 11.50% |
| Food, beverages and tobacco | 3.96% | 5.65% | 7.49% | 7.80% | 8.16% | 8.54% | 7.79% |
| Textiles and leather | 4.60% | 5.43% | 6.93% | 8.80% | 10.41% | 11.83% | 16.85% |
| Wood, paper, and printing | 3.73% | 5.19% | 5.84% | 6.84% | 7.99% | 8.18% | 9.86% |
| Petroleum, coal and chemicals | 13.13% | 15.63% | 18.77% | 20.16% | 23.00% | 20.74% | 22.51% |
| Non-metallic mineral products except petroleum and coal | 4.55% | 6.88% | 7.64% | 8.86% | 9.31% | 6.44% | 8.35% |
| Metal, fabricated metal products | 6.67% | 5.61% | 6.15% | 7.12% | 7.73% | 7.58% | 6.78% |
| Machinery equipment | 6.73% | 7.64% | 8.87% | 11.66% | 14.03% | 13.32% | 12.93% |
| Electrical and electronic equipment | 18.47% | 21.45% | 23.44% | 24.37% | 29.58% | 34.75% | 42.71% |
| Precision instruments | 12.55% | 18.77% | 22.96% | 32.69% | 39.26% | 48.16% | 36.84% |
| Transport equipment | 10.68% | 12.80% | 17.13% | 17.64% | 20.94% | 20.97% | 20.83% |
| Furniture and other manufacturing industries | 8.90% | 12.96% | 13.02% | 16.54% | 29.06% | 15.45% | 18.71% |
| Electricity, gas and water supply | 1.93% | 2.77% | 4.25% | 4.47% | 5.85% | 6.51% | 8.93% |
| Construction | 2.41% | 3.36% | 3.47% | 3.90% | 4.32% | 3.69% | 3.34% |
| Wholesale and retail trade | 3.90% | 5.47% | 6.16% | 5.66% | 6.63% | 5.64% | 5.38% |
| Restaurants and hotels | 2.51% | 3.81% | 4.77% | 4.22% | 5.01% | 5.55% | 4.93% |
| Transport and storage | 2.32% | 2.13% | 2.63% | 2.90% | 3.26% | 4.85% | 4.69% |
| Financial intermediation | 11.55% | 14.79% | 12.05% | 15.76% | 19.00% | 20.15% | 25.46% |
| Real estate and renting | 0.70% | 0.97% | 1.09% | 1.20% | 1.29% | 1.24% | 1.24% |
| Information and communication | 5.90% | 11.23% | 18.01% | 15.08% | 20.69% | 21.10% | 21.95% |
| Business services | 4.72% | 6.33% | 7.94% | 7.53% | 9.86% | 9.37% | 10.87% |
| Culture and entertainment services | 4.31% | 6.78% | 4.73% | 5.90% | 6.39% | 5.88% | 5.25% |

Components of Spending on Intangibles by Industry (2008)



3. The Impact of Intangible Assets on Productivity Growth

“ To examine the impact of intangible assets on productivity growth, we estimate the following function (in this estimation, we examine the external effect of intangibles):

$$\frac{\Delta TFP_{j,t}}{TFP_{j,t}} = \lambda_j + \rho_I \frac{\Delta I^I_{j,t-1}}{Q_{j,t-1}},$$

“ **I^I**: intangible investment (**I(T)**: total intangible investment, **I(E)**: intangible investment in economic competencies, **I(I)**: intangible investment in innovative property, **I(C)**: intangible investment in computerized information, **Q**: gross output)

3. The Impact of Intangible Assets on Productivity Growth (contd.)

” Estimation results

- (1) In the market economy, total intangible investment has a positive and significant impact on productivity growth.**
- (2) When we decompose total intangible investment into the three components and use them as explanatory variables, investment in innovative property has a positive and significant impact on productivity growth.**

3. The Impact of Intangible Assets on Productivity Growth (contd.)

- (3) When we divide the sample period into two subperiods (1981-1995 and 1996-2008), the impact of intangible assets on TFP in the latter period is more significant than in the former period.**
- (4) The result implies that the role of intangible assets after the IT revolution is more important than before the IT revolution, as many economists have pointed out.**

3. The Impact of Intangible Assets on Productivity Growth (contd.)

(5) We find that the effect of total intangible investment on TFP growth is positive and significant.

(6) However, for the service sector, we are not able to find clear evidence of a positive and significant effect of intangible investment on TFP growth.

4. Agenda for the Next Step

“ On measurement

- (1) Harmonization of industry classification: our industry classification (27 industry classification) is consistent with the Korean industry classification.→ Comparing the role of intangible assets in economic performance between Japan and Korea.**
- (2) Unresolved measurement issues in Corrado, Hulten and Sichel (2005): on the job training, the specification of firm-specific skills in off the job training, and the measurement of expenditures in organizational structure using remuneration of executives.**

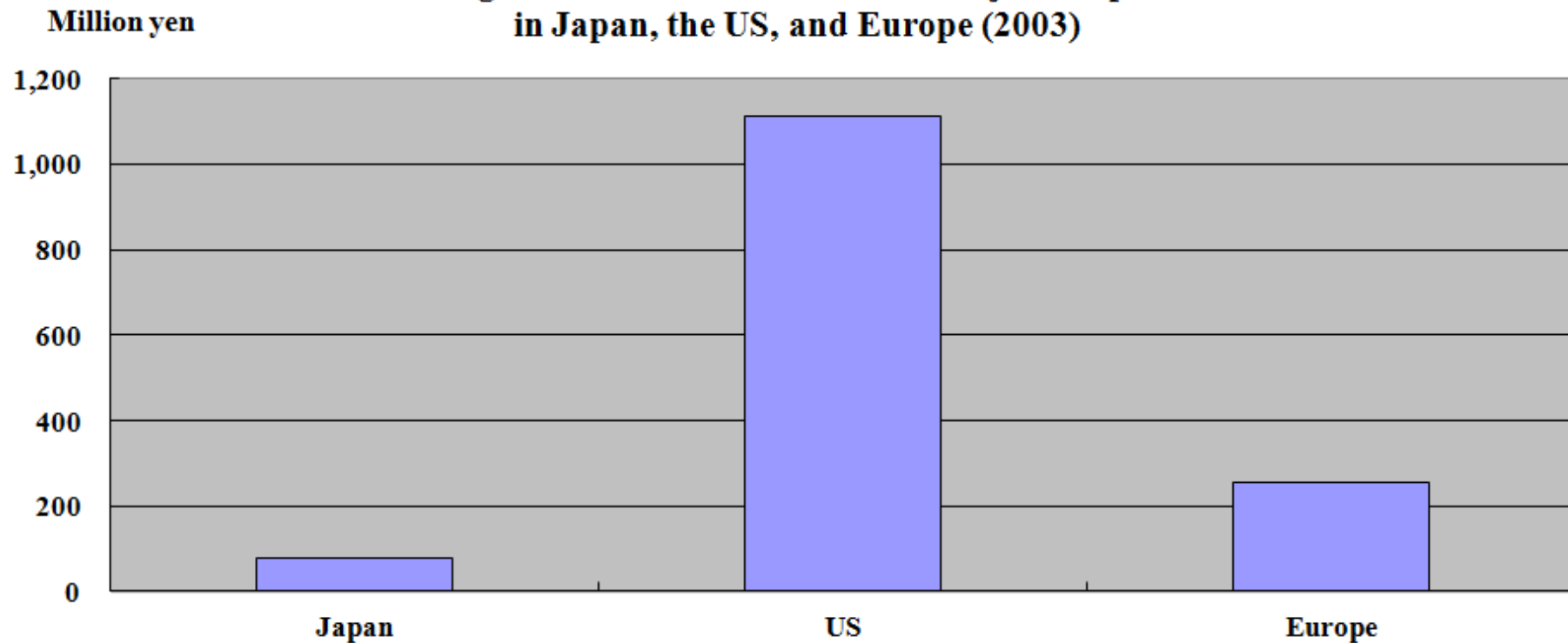
Growth Accounting with Intangibles in Japan and Korea

(%)

| | Japan | | Korea | |
|---------------------------|---------|-----------|---------|-----------|
| | 1990-97 | 1998-2004 | 1990-97 | 1998-2004 |
| Labor productivity growth | 2.11 | 1.73 | 6.05 | 4.17 |
| Capital deepening | 1.55 | 1.01 | 2.16 | 0.79 |
| Tangible assets | 1.19 | 0.75 | 1.79 | 0.38 |
| Intangible assets | 0.36 | 0.25 | 0.37 | 0.41 |
| TFP Growth | 0.56 | 0.72 | 3.89 | 3.38 |

Source Miyagawa and Takizawa (2011)

**Average Remuneration of CEOs in major companies
in Japan, the US, and Europe (2003)**



Source: "Guidelines for the Remuneration of CEOs" published by the Japan Executives Association."

Note: The data for Japan are taken from a list of high tax payers who worked as CEOs for one of the 100 highest-valued firms in Japan. For the US and Europe, we used data on the remuneration of CEOs in firms with sales of more than 1 trillion yen.

4. Agenda for the Next Step (contd.)

” On analysis

- (1) Growth accounting including intangibles by industry**
- (2) Estimation of production function including intangible assets → Measurement of rate of return on intangibles.**
- (3) Examination of the complementarity between intangibles and tangible IT assets.**

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Appendix 1: Measurement of Intangible Investment by Industry (1)

| | | | |
|--------------------------|------------------------------|-----|--|
| Computerized information | | | |
| | Custom and packaged software | 108 | We used data on custom and packaged software investment from the JIP Database 2011 (JIP asset classification no. 38). |
| | Own account software | 108 | We estimated the ratio of the number of system engineers (SEs) and programmers to the number of total workers by industry using the <i>Population Census</i> . Multiplying this ratio by the number of total workers in the JIP Database 2011, we obtained the number of SEs and programmers by industry. The <i>Census</i> data are available every five years. For other years, we estimated the ratio by linear interpolation. To obtain the total wage bill for SEs and programmers, we multiplied the estimated number of SEs and programmers by the average wage for SEs and programmers. The wage data are taken from the <i>Basic Survey on Wage Structure</i> . We did not take account of expenditures other than labor costs. The total wage bill thus obtained is used as the expenditure for in-house software development, except in the case of the information service industry. |
| | | | |

Appendix 1: Measurement of Intangible Investment by Industry (2)

| Innovative property | | | |
|---------------------|---|-----|--|
| | Science and engineering R&D | 108 | Data on R&D expenditures were obtained from the <i>Survey of Research and Development</i> . However, the survey does not cover R&D in most service sectors before 2000. Using service sector expenditure on R&D outsourcing, which is available in the JIP Database 2011, we extrapolated service sector R&D expenditure backwards. because such expenditure is already included in investment in tangible assets. Leasing costs were also excluded in calculating Because the survey is conducted on a fiscal-year basis, the values are then converted to a calendar-year basis. |
| | Mineral exploitation | 1 | Because expenditures of mineral exploitation are allocated to only mining industry, we follow the estimation by Fukao, et, al (2009). The Mining Industry Handbook and the Establishment and Enterprise Survey provide data on expenses for mineral exploitation (the total expenses for geological investigation). Combined the above two surveys with FCFM, we estimate expenditures of mineral exploitation. |
| | Copyright and license costs (spending for the development of entertainment and artistic originals, usually leading to a copyright or .. | 108 | Except for industries nos. 72 (housing) and 108 (industries not elsewhere classified), intangible investment in copyright and license costs is assumed to consist of the input from the publishing industry (JIP industry no. 92) and the video picture, sound information, character information production and distribution industry (JIP industry no. 93). |

Appendix 1: Measurement of Intangible Investment by Industry (3)

| | | |
|---|---|---|
| <p>Other product development, design, and research expenses</p> | <p>108 (2 for product development in service)</p> | <p>We estimated outsourced investment and in-house investment separately. In the case of outsourcing of design (including machine design and architectural design) and display, we estimated intangible investment by using the sales data of these industries from the <i>Survey of Selected Service Industries</i> and the input from the “other services for businesses” industry (JIP industry no. 88). The survey is conducted every three years. We calculated the ratio of the sales of these industries (taken from the <i>Survey of Selected Service Industries</i>) to the nominal output of the “other services for businesses” industry (JIP industry no. 88; taken from the JIP 2011 Database) for each year that the survey was conducted. The ratio for years in which the survey was not conducted is obtained by linear interpolation. Sales in each year were estimated by multiplying this ratio by the nominal output of the “other services for businesses” industry in the JIP 2011 Database. Because the <i>Survey of Selected Service Industries</i> is a sample survey, we adjusted the estimated value of sales by using the number of firms taken from the <i>Establishment and Enterprise Survey</i>. Intangible investment in this category is assumed to consist of the sales of these industries estimated from the <i>Survey of Selected Service Industries</i> multiplied by the ratio of the number of firms in these industries in the <i>Establishment and Enterprise Survey</i> to the number of firms in these industries in the <i>Survey of Selected Service Industries</i>. In the case of in-house expenditures, we only estimated in-house designing. Specifically, we estimated the ratio of the number of designers to the total number of workers for each industry using the <i>Population Census</i>. We then obtained the number of designers in each industry by multiplying this ratio by the total number of workers in each industry taken from the JIP Database 2011. The <i>Census</i> data are available every five years. For other years, we estimated the ratio by linear interpolation. To obtain the total wage bill, we multiplied the estimated number of designers by the average wage of designers, taking the wage data from the <i>Basic Survey on Wage Structure</i>. We did not take account of any other expenditures apart from labor costs for the calculation of in-house expenditure. As for the estimation in product development in financial service, we followed Corrado, Hulten, and Sichel (2005) and assumed that 20 percent of intermediate inputs produced by the financial industry (JIP industry no. 69) and the insurance industry (JIP industry no. 70) can be regarded as expenditures in intangible assets. These expenditures are treated as those in financial sector and insurance industry respectively.</p> |
|---|---|---|

Appendix 1: Measurement of Intangible Investment by Industry (4)

| | | | |
|-----------------------|-----------------------------|-----|---|
| Economic competencies | | | |
| | Brand equity | 108 | For investment in brand equity, we used the input from the advertising industry (JIP industry no. 85) from the JIP Database 2011. |
| | Firm specific human capital | 108 | We estimated the ratio of off-the-job training costs to total labor costs from the <i>General Survey on Working Conditions</i> by industry. Multiplying this ratio by the total labor costs in the JIP Database 2011, we obtained the off-the-job training costs expensed by firms by industry. For the opportunity cost of off-the-job training in terms of working hours lost, we used the results obtained by Ooki (2003). Using micro-data of the Japan Institute for Labour Policy and Training's <i>Survey on Personnel Restructuring and Vocational Education/Training Investment in the Age of Performance-based Wage Systems</i> (Gyoseki-shugi Jidai no Jinji Seiri to Kyoiku/Kunren Toshi ni Kansuru Chosa), Ooki calculated the average opportunity cost ratio of off-the-job training to direct firm expenses for training in 1998 for the whole business sector. The value was 1.51. We used this value to estimate the opportunity cost. |
| | Organizational structure | 108 | We assumed that 9% of the remuneration of executives is counted as intangible investment in organizational structure. The figure is based on the observation by Robinson and Shimizu (2001) that about 9% of the total working time of executives is spent on organizational reform and restructuring. We calculated the ratio of the remuneration of executives to value added using the <i>Financial Statements Statistics of Corporations by Industry</i> published by the Ministry of Finance. We then obtained the expenditure on organizational structure by industry by multiplying this ratio with the value added by industry taken from the JIP Database 2011. |

Appendix 2: Harmonization of industry classifications (1)

| JIP Classification | | Korean Classification | |
|--------------------|---|-----------------------|--|
| 1 | Rice, wheat production | 1 | Agriculture, forestry and fishing |
| 2 | Miscellaneous crop farming | 1 | Agriculture, forestry and fishing |
| 3 | Livestock and sericulture farming | 1 | Agriculture, forestry and fishing |
| 4 | Agricultural services | 1 | Agriculture, forestry and fishing |
| 5 | Forestry | 1 | Agriculture, forestry and fishing |
| 6 | Fisheries | 1 | Agriculture, forestry and fishing |
| 7 | Mining | 2 | Mining and quarrying |
| 8 | Livestock products | 3 | Food, beverages and tobacco |
| 9 | Seafood products | 3 | Food, beverages and tobacco |
| 10 | Flour and grain mill products | 3 | Food, beverages and tobacco |
| 11 | Miscellaneous foods and related products | 3 | Food, beverages and tobacco |
| 12 | Prepared animal foods and organic fertilizers | 3 | Food, beverages and tobacco |
| 13 | Beverages | 3 | Food, beverages and tobacco |
| 14 | Tobacco | 3 | Food, beverages and tobacco |
| 15 | Textile products | 4 | Textiles and leather |
| 16 | Lumber and wood products | 5 | Wood, paper, and printing |
| 17 | Furniture and fixtures | 13 | Furniture and other manufacturing industries |
| 18 | Pulp, paper, and coated and glazed paper | 5 | Wood, paper, and printing |
| 19 | Paper products | 5 | Wood, paper, and printing |
| 20 | Printing, plate making for printing and bookbinding | 5 | Wood, paper, and printing |
| 21 | Leather and leather products | 4 | Textiles and leather |
| 22 | Rubber products | 6 | Petroleum, coal and chemicals |
| 23 | Chemical fertilizers | 6 | Petroleum, coal and chemicals |
| 24 | Basic inorganic chemicals | 6 | Petroleum, coal and chemicals |
| 25 | Basic organic chemicals | 6 | Petroleum, coal and chemicals |
| 26 | Organic chemicals | 6 | Petroleum, coal and chemicals |
| 27 | Chemical fibers | 6 | Petroleum, coal and chemicals |
| 28 | Miscellaneous chemical products | 6 | Petroleum, coal and chemicals |
| 29 | Pharmaceutical products | 6 | Petroleum, coal and chemicals |
| 30 | Petroleum products | 6 | Petroleum, coal and chemicals |
| 31 | Coal products | 6 | Petroleum, coal and chemicals |

Appendix 2: Harmonization of industry classifications (2)

| | | | |
|----|--|----|---|
| 32 | Glass and its products | 7 | Non-metallic mineral products except petroleum and coal |
| 33 | Cement and its products | 7 | Non-metallic mineral products except petroleum and coal |
| 34 | Pottery | 7 | Non-metallic mineral products except petroleum and coal |
| 35 | Miscellaneous ceramic, stone and clay products | 7 | Non-metallic mineral products except petroleum and coal |
| 36 | Pig iron and crude steel | 7 | Non-metallic mineral products except petroleum and coal |
| 37 | Miscellaneous iron and steel | 7 | Non-metallic mineral products except petroleum and coal |
| 38 | Smelting and refining of non-ferrous metals | 7 | Non-metallic mineral products except petroleum and coal |
| 39 | Non-ferrous metal products | 7 | Non-metallic mineral products except petroleum and coal |
| 40 | Fabricated constructional and architectural metal products | 8 | Metal, fabricated metal products |
| 41 | Miscellaneous fabricated metal products | 8 | Metal, fabricated metal products |
| 42 | General industry machinery | 9 | Machinery equipment |
| 43 | Special industry machinery | 9 | Machinery equipment |
| 44 | Miscellaneous machinery | 9 | Machinery equipment |
| 45 | Office and service industry machines | 10 | Electrical and electronic equipment |
| 46 | Electrical generating, transmission, distribution and industrial apparatus | 10 | Electrical and electronic equipment |
| 47 | Household electric appliances | 10 | Electrical and electronic equipment |
| 48 | Electronic data processing machines, digital and analog computer equipment and accessories | 10 | Electrical and electronic equipment |
| 49 | Communication equipment | 10 | Electrical and electronic equipment |
| 50 | Electronic equipment and electric measuring instruments | 10 | Electrical and electronic equipment |
| 51 | Semiconductor devices and integrated circuits | 10 | Electrical and electronic equipment |
| 52 | Electronic parts | 10 | Electrical and electronic equipment |
| 53 | Miscellaneous electrical machinery equipment | 10 | Electrical and electronic equipment |
| 54 | Motor vehicles | 12 | Transport equipment |
| 55 | Motor vehicle parts and accessories | 12 | Transport equipment |
| 56 | Other transportation equipment | 12 | Transport equipment |
| 57 | Precision machinery & equipment | 11 | Precision instruments |
| 58 | Plastic products | 6 | Petroleum, coal and chemicals |
| 59 | Miscellaneous manufacturing industries | 13 | Furniture and other manufacturing industries |

Appendix 2: Harmonization of industry classifications (3)

| | | | |
|----|--------------------------------------|----|------------------------------------|
| 60 | Construction | 15 | Construction |
| 61 | Civil engineering | 15 | Construction |
| 62 | Electricity | 14 | Electricity, gas and water supply |
| 63 | Gas, heat supply | 14 | Electricity, gas and water supply |
| 64 | Waterworks | 14 | Electricity, gas and water supply |
| 65 | Water supply for industrial use | 14 | Electricity, gas and water supply |
| 66 | Waste disposal | 14 | Electricity, gas and water supply |
| 67 | Wholesale | 16 | Wholesale and retail trade |
| 68 | Retail | 16 | Wholesale and retail trade |
| 69 | Finance | 19 | Financial intermediation |
| 70 | Insurance | 19 | Financial intermediation |
| 71 | Real estate | 20 | Real estate and renting |
| 72 | Housing | 20 | Real estate and renting |
| 73 | Railway | 18 | Transport and storage |
| 74 | Road transportation | 18 | Transport and storage |
| 75 | Water transportation | 18 | Transport and storage |
| 76 | Air transportation | 18 | Transport and storage |
| 77 | Other transportation and packing | 18 | Transport and storage |
| 78 | Telegraph and telephone | 21 | Information and communication |
| 79 | Mail | 21 | Information and communication |
| 80 | Education (private and non-profit) | 24 | Education |
| 81 | Research (private) | 27 | Other service activities |
| 82 | Medical (private) | 25 | Health and social work |
| 83 | Hygiene (private and non-profit) | 25 | Health and social work |
| 84 | Other public services | 23 | Public administration and defense |
| 85 | Advertising | 22 | Business services |
| 86 | Rental of office equipment and goods | 20 | Real estate and renting |
| 87 | Automobile maintenance services | 22 | Business services |
| 88 | Other services for businesses | 22 | Business services |
| 89 | Entertainment | 26 | Culture and entertainment services |

Appendix 2: Harmonization of industry classifications (4)

| | | | |
|-----|---|----|------------------------------------|
| 90 | Broadcasting | 21 | Information and communication |
| 91 | Information services and internet-based services | 21 | Information and communication |
| 92 | Publishing | 21 | Information and communication |
| 93 | Video picture, sound information, character information production and distribution | 21 | Information and communication |
| 94 | Eating and drinking places | 17 | Restaurants and hotels |
| 95 | Accommodation | 17 | Restaurants and hotels |
| 96 | Laundry, beauty and bath services | 26 | Culture and entertainment services |
| 97 | Other services for individuals | 26 | Culture and entertainment services |
| 98 | Education (public) | 24 | Education |
| 99 | Research (public) | 27 | Other service activities |
| 100 | Medical (public) | 25 | Health and social work |
| 101 | Hygiene (public) | 25 | Health and social work |
| 102 | Social insurance and social welfare (public) | 25 | Health and social work |
| 103 | Public administration | 23 | Public administration and defense |
| 104 | Medical (non-profit) | 25 | Health and social work |
| 105 | Social insurance and social welfare (non-profit) | 25 | Health and social work |
| 106 | Research (non-profit) | 27 | Other service activities |
| 107 | Other (non-profit) | 25 | Health and social work |
| 108 | Activities not elsewhere classified | 27 | Other service activities |