



World KLEMS Growth and Productivity Accounts Japan: sources and notes

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Introduction

The current release of the World KLEMS files for Japan are based on the recently released 2012 version of the Japan Industrial Productivity (JIP) Database¹. This dataset uses its own industry classification, distinguishing 108 industries, covering the whole of the Japanese economy. The source data from the JIP database has been mapped to the World KLEMS industry list which is based on the third revision of the International Standardized Industry Classification (ISIC Rev. 3), based on a many to one industry concordance. It should be noted that although the JIP databases follow the standard growth accounting approach also followed in EU KLEMS, see O'Mahony, Mary and Marcel P. Timmer (2009)², there is one important difference. In JIP, rental prices of capital are determined with the ex-ante rate of return. Consequently, multi-factor productivity growth is determined based on the cost shares of inputs.³ The World KLEMS accounts stick to the method used by JIP and results are fully comparable across the two databases. For an ex-post calculation of capital services and MFP, and a mapping into ISIC rev. 4, see the Japan file on the website of the [EU KLEMS](#) database.

The next sections will explain the adjustments that have been made to map the JIP industries to the ISIC Rev. 3 industry list, as well as the mapping of capital assets in the JIP database to the broad capital asset classification used in EU KLEMS and World KLEMS.

1 Industry mapping and aggregation

This section covers the main issues in mapping the JIP industries to the World KLEMS industry list.

The JIP database consists of 108 industries, shown in **appendix table 1**. Each of these industries is mapped to a KLEMS ISIC Rev. 3 industry, according to the mapping in the appendix table. The source

¹ For this version of the Japanese EU KLEMS files, the [2012 version of the JIP database](#) has been used.

² O'Mahony, Mary and Marcel P. Timmer (2009), '[Output, Input and Productivity Measures at the Industry Level: the EU KLEMS Database](#)', *Economic Journal*, 119(538), pp. F374-F403

³ Detailed notes on the construction of the JIP database are available in the following document: <http://www.rieti.go.jp/jp/publications/dp/07e003.pdf>

data has been aggregated to the ISIC Rev. 3 industry list and variables on price developments, labour productivity, average hours worked and average wages paid have been derived. Data in nominal values are aggregated by simple summation. Volumes and price indices are aggregated using a Tornqvist⁴ aggregation procedure, using the corresponding nominal variable as weights. The same aggregation method is used to calculate sector aggregates available in the World KLEMS industry list from the bottom up, to ensure that the indices of the industry aggregates are consistent with their underlying industries. In the JIP database, data for nominal values and volumes are available, but not prices. Price deflators are derived implicitly from the volumes and the nominal data at the most detailed level of industries in ISIC Rev. 3.

For Value Added (VA) only the nominal values are given in JIP. Therefore the volume growth of VA has been directly estimated from the volume growth of Gross Output (GO) and Intermediate Inputs (II), at the JIP level of industries, using:

$$dQ_{VA} = dQ_{GO} \frac{\overline{GO}}{\overline{VA}} - dQ_{II} \frac{\overline{II}}{\overline{VA}}$$

Where dX indicates a logarithmic growth rate and \bar{X} a period average. The industry subscript is suppressed to facilitate exposition. The resulting VA volume growth is aggregated in the same way as the other variables to arrive at the ISIC Rev. 3 level of industries.

For some industries no detailed JIP industry data was available and the mapping is incomplete. These include (industry codes refer to ISIC Rev. 3 codes):

- Industry 28 (Fabricated metal) includes the values for industry 313 (Insulated wire).
- Industry 29 (MACHINERY, NEC) includes part of industry 28 and the whole of industry 323 (Radio and television receivers).
- Industry 50 (Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel) now includes a part that was mapped to industry 72 in the concordance table previously used. The aggregate JIP industry is described as 'Automobile maintenance services' and it is not clear that any parts of this industry should be in 72.
- Industries 17t18 (Textiles and textile) and 33 (Medical, precision and optical instruments) are now reported as aggregates only. No further split is available for these industries.

2 Aggregation of assets

This section provides details on the specific methods applied to aggregate the data on investments and capital stocks from the JIP database to an asset list that is consistent with EU KLEMS. **Appendix table 2** shows the mapping of JIP assets to KLEMS assets.

The JIP database provides asset by industry investment matrices in current and constant prices for each year for the 1970-2009 period. Furthermore it provides capital stock in constant prices. From

⁴ The Tornqvist aggregation approach uses annual moving weights based on averages of adjacent points in time. For more information on this procedure see the general EU KLEMS methodology [document](#).

the investment data in current and constant prices, the investment deflators have been derived implicitly. The JIP database uses deflators that are specific to each asset, but do not vary by industry. Therefore we have aggregated these asset deflators to the level of the KLEMS assets, using the nominal values of total investment by asset as weights. Nominal investment data is aggregated by simple summation over industries and assets, using the mapping tables in appendix tables 1 and 2. The nominal values of investment at the ISIC Rev. 3 level for KLEMS assets are then deflated using the calculated asset investment deflators at the KLEMS asset level.

For the capital stocks the same asset by industry matrices are available. The capital stocks are first deflated to express stocks in current prices. These values are aggregated by simple summation to the ISIC Rev. 3 industry list and the KLEMS asset list and then deflated using the investment deflators.

3 Further notes on growth accounting

The JIP database provides a full decomposition of Output Growth (GO_Q) into the growth contributions of Labour Composition (GOConLC), Hours worked (GOConH), aggregate Capital Services (GOConK), and Intermediate Inputs (GOConII), for each of the 108 JIP industries. These growth contributions have been aggregated to the ISIC Rev. 3 list, using Gross Output as weights.

The JIP database also shows the decomposition of Value Added growth (VA_Q) into the growth contributions of Labour Composition (VAConLC), Hours worked (VAConH), and aggregate Capital Services (VAConK) by broad sectors. These values have been recalculated from the JIP database for all 108 industries and aggregated to the ISIC Rev. 3 list. No attempt was made to harmonize between the labour and capital services at the ISIC Rev. 3 level and the growth accounting variables at the ISIC Rev. 3 level as all values are aggregated bottom-up from the 108 JIP industries.

The growth accounting results in the World KLEMS file are identical to the JIP decompositions at the lowest level of industries. However, for sector aggregates results in the World KLEMS file deviate from the results in the JIP database for a number of reasons. In the JIP database the growth accounting exercise is being done at the sector aggregate level. This is different from the approach taken in the World KLEMS file, where growth accounting is being done at the most detailed industry level and results for industry aggregates are calculated by aggregating from the bottom-up. This implies that the JIP results include reallocation effects, which are not included in the estimates from World KLEMS. Furthermore, the growth contributions in World KLEMS are aggregated using Value Added weights: these weights differ from the nominal weights with which the individual factor inputs (capital and labour services) are being aggregated to the sectoral level.

Although the JIP database readily provides data on capital services growth, the methods employed to compute aggregate capital services deviate from the methods of construction in the EU KLEMS database. The main differences being an Ex-Ante approach to the rate of return on capital assets and the use of different asset depreciation rates. In addition, the JIP database provides no split of capital services into the services for ICT and Non-ICT assets. In the [EU KLEMS database](#) new files are available for Japan that are also based on the source data in the 2012 version of the JIP database but for which the Ex-Post EU KLEMS growth accounting method has been applied. However, these files are presented in the new ISIC Rev. 4 industry classification.

Appendix Table 1

Japan JIP-ISC Rev. 3 many to one industry concordance			
JIP list	ISIC rev 3	JIP Description	KLEMS description
1	1	Rice, wheat production	Agriculture
2	1	Miscellaneous crop farming	Agriculture
3	1	Livestock and sericulture farming	Agriculture
4	1	Agricultural services	Agriculture
5	2	Forestry	Forestry
6	B	Fisheries	FISHING
7	C	Mining	MINING AND QUARRYING
8	15	Livestock products	Food and beverages
9	15	Seafood products	Food and beverages
10	15	Flour and grain mill products	Food and beverages
11	15	Miscellaneous foods and related products	Food and beverages
12	15	Prepared animal foods and organic fertilizers	Food and beverages
13	15	Beverages	Food and beverages
14	16	Tobacco	Tobacco
15	17+18	Textile products	Textiles and textile
16	20	Lumber and wood products	WOOD AND OF WOOD AND CORK
17	36	Furniture and fixtures	Manufacturing nec
18	21	Pulp, paper, and coated and glazed paper	Pulp, paper and paper
19	21	Paper products	Pulp, paper and paper
20	22x	Printing, plate making for printing and	Printing and reproduction
21	19	Leather and leather products	Leather, leather and footwear
22	25	Rubber products	Rubber and plastics
23	24x	Chemical fertilizers	Chemicals excluding pharmaceuticals
24	24x	Basic inorganic chemicals	Chemicals excluding pharmaceuticals
25	24x	Basic organic chemicals	Chemicals excluding pharmaceuticals
26	24x	Organic chemicals	Chemicals excluding pharmaceuticals
27	24x	Chemical fibers	Chemicals excluding pharmaceuticals
28	24x	Miscellaneous chemical products	Chemicals excluding pharmaceuticals
29	244	Pharmaceutical products	Pharmaceuticals
30	23	Petroleum products	Coke, refined petroleum and nuclear fuel
31	23	Coal products	Coke, refined petroleum and nuclear fuel
32	26	Glass and its products	OTHER NON-METALLIC MINERAL
33	26	Cement and its products	OTHER NON-METALLIC MINERAL
34	26	Pottery	OTHER NON-METALLIC MINERAL
35	26	Miscellaneous ceramic, stone and clay products	OTHER NON-METALLIC MINERAL
36	27	Pig iron and crude steel	Basic metals
37	27	Miscellaneous iron and steel	Basic metals
38	27	Smelting and refining of non-ferrous metals	Basic metals
39	28	Non-ferrous metal products	Fabricated metal
40	28	Fabricated constructional and architectural	Fabricated metal
41	28	Miscellaneous fabricated metal products	Fabricated metal
42	29	General industry machinery	MACHINERY, NEC
43	29	Special industry machinery	MACHINERY, NEC
44	29	Miscellaneous machinery	MACHINERY, NEC
45	30	Office and service industry machines	Office, accounting and computing machinery
46	31x	Electrical generating, transmission, distribution and industrial apparatus	Other electrical machinery and apparatus nec
47	29	Household electric appliances	MACHINERY, NEC
48	30	Electronic data processing machines, digital	Office, accounting and computing machinery
49	322	Communication equipment	Telecommunication equipment
50	33	Electronic equipment and electric measuring	Medical, precision and optical instruments
51	321	Semiconductor devices and integrated circuits	Electronic valves and tubes
52	321	Electronic parts	Electronic valves and tubes
53	31x	Miscellaneous electrical machinery equipment	Other electrical machinery and apparatus nec

Japan JIP-ISIC Rev. 3 many to one industry concordance (continued)

JIP list	ISIC rev 3	JIP Description	KLEMS description
54	34	Motor vehicles	Motor vehicles, trailers and semi-trailers
55	34	Motor vehicle parts and accessories	Motor vehicles, trailers and semi-trailers
56	35	Other transportation equipment	Other transport equipment
57	33	Precision machinery & equipment	Medical, precision and optical instruments
58	25	Plastic products	Rubber and plastics
59	36	Miscellaneous manufacturing industries	Manufacturing nec
60	F	Construction	CONSTRUCTION
61	F	Civil engineering	CONSTRUCTION
62	40x	Electricity	Electricity supply
63	402	Gas, heat supply	Gas supply
64	41	Waterworks	WATER SUPPLY
65	41	Water supply for industrial use	WATER SUPPLY
66	90	Waste disposal	Sewage and refuse disposal, sanitation and similar
67	51	Wholesale	Wholesale trade and commission trade, except of motor
68	52	Retail	Retail trade, except of motor vehicles and motorcycles;
69	65	Finance	Financial intermediation, except insurance and pension
70	66	Insurance	Insurance and pension funding, except compulsory social
71	70	Real estate	Real estate activities
72	70	Housing	Real estate activities
73	60	Railway	Other Inland transport
74	60	Road transportation	Other Inland transport
75	61	Water transportation	Other Water transport
76	62	Air transportation	Other Air transport
77	63	Other transportation and packing	Other Supporting and auxiliary transport activities;
78	64	Telegraph and telephone	POST AND TELECOMMUNICATIONS
79	64	Mail	POST AND TELECOMMUNICATIONS
80	M	Education (private and non-profit)	EDUCATION
81	73	Research (private)	Research and development
82	N	Medical (private)	HEALTH AND SOCIAL WORK
83	L	Hygiene (private and non-profit)	PUBLIC ADMIN AND DEFENCE; COMPULSORY
84	91	Other public services	Activities of membership organizations nec
85	741t4	Advertising	Legal, technical and advertising
86	71	Rental of office equipment and goods	Renting of machinery and equipment
87	50	Automobile maintenance services	Sale, maintenance and repair of motor vehicles and
88	745t8	Other services for businesses	Other business activities, nec
89	92	Entertainment	Recreational, cultural and sporting activities
90	92	Broadcasting	Recreational, cultural and sporting activities
91	72	Information services and internet-based	Computer and related activities
92	221	Publishing	Publishing
93	92	Video picture, sound information, character	Recreational, cultural and sporting activities
94	H	Eating and drinking places	HOTELS AND RESTAURANTS
95	H	Accommodation	HOTELS AND RESTAURANTS
96	93	Laundry, beauty and bath services	Other service activities
97	93	Other services for individuals	Other service activities
98	M	Education (public)	EDUCATION
99	73	Research (public)	Research and development
100	N	Medical (public)	HEALTH AND SOCIAL WORK
101	L	Hygiene (public)	PUBLIC ADMIN AND DEFENCE; COMPULSORY
102	N	Social insurance and social welfare (public)	HEALTH AND SOCIAL WORK
103	L	Public administration	PUBLIC ADMIN AND DEFENCE; COMPULSORY
104	N	Medical (non-profit)	HEALTH AND SOCIAL WORK
105	N	Social insurance and social welfare (non-	HEALTH AND SOCIAL WORK
106	73	Research (non-profit)	Research and development
107	91	Other (non-profit)	Activities of membership organizations nec
108	N.A.	Activities not elsewhere classified	

Appendix Table 2

Asset concordance		
JIP assets	KLEMS assets	KLEMS description
1. Farm	OCon	Total non-residential construction
2. Other furniture	OMach	Other machinery and equipment
3. Nuclear fuel	OCon	Total non-residential construction
4. Household appliances	OMach	Other machinery and equipment
5. Other fabricated metal products	OMach	Other machinery and equipment
6. Steam engines and turbines	OMach	Other machinery and equipment
7. General industrial machinery, including materials handling equipment	OMach	Other machinery and equipment
8. Instruments	OMach	Other machinery and equipment
9. Mining and oil field machinery	OMach	Other machinery and equipment
10. Chemical machinery	OMach	Other machinery and equipment
11. Metalworking machines	OMach	Other machinery and equipment
12. Agricultural machinery, except tractors	OMach	Other machinery and equipment
13. Special industrial machinery	OMach	Other machinery and equipment
14. Photocopiers and related equipment	IT	Computing equipment
15. Office computing, and accounting machinery	IT	Computing equipment
16. Service industry machinery	OMach	Other machinery and equipment
17. Household electric appliances (excluding VTRs and applied electronic equipment)	OMach	Other machinery and equipment
18. Computers and peripheral equipment	IT	Computing equipment
19. Communications equipments for business purpose	CT	Communications equipment
20. VTRs and applied electronic equipment	CT	Communications equipment
21. Electricity transmission and distribution apparatus	OMach	Other machinery and equipment
22. Electric lighting fixtures and apparatus	OMach	Other machinery and equipment
23. Passenger cars	TraEq	Transport equipment
24. Trucks, buses, and truck trailers	TraEq	Transport equipment
25. Motorcycles and bicycles	TraEq	Transport equipment
26. Other transport equipment	TraEq	Transport equipment
27. Ships and boats	TraEq	Transport equipment
28. Internal combustion engines	OMach	Other machinery and equipment
29. Railroad equipment	TraEq	Transport equipment
30. Aircraft	TraEq	Transport equipment
31. Other equipments	OMach	Other machinery and equipment
32. Residential construction	RStruc	Residential structures
33. Non-residential construction	OCon	Total non-residential construction
34. Other (private non-residential structures)	OCon	Total non-residential construction
35. Railroad replacement tracks	OCon	Total non-residential construction
36. Construction of electric plants	OCon	Total non-residential construction
37. Construction for electronic communication	OCon	Total non-residential construction
38. Custom software	Soft	Software
39. Other business services	Other	Other assets