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The ranks of Indonesian and Japanese industrial sectors: A further study

Ubaidillah Zuhdi

Faculty of Management and Economics, Gdansk University of Technology, Gdansk 80-233, Poland

zuhdi@zie.pg.gda.pl

Abstract. The purpose of the current study is to extend the previous study which analyzes the industrial sectors ranks of specific countries. More specifically, the study aims to conduct a further analysis regarding the ranks by using the new data as well as new analysis periods. The study focuses on the cases of Indonesia and Japan. In this study, the analysis period of the Indonesian case is 2010 while for the case of Japan is 2011. Using the previous study as a reference, the study employs the Input-Output (IO) approach as an analysis device. As with the previous study, the results of this study show that the orders of the ranks depend on the methods used. Nevertheless, from the results, one can argue that the electricity and gas industry was a leading sector in the Indonesian economy in 2010. On the other hand, for the case of Japan, the competitive sector in the Japanese economy in 2011 was the manufacturing industry. In terms of the leading sectors, the current study is different from the previous one.

1. Introduction

Industrial sectors are important parts in the economic activities of one country. The importance of sectors can be seen on both macro and micro levels. Therefore, analyzing the industries of a particular country can be an alternative way to know the outlook of its economic situations. Further, the recommendations for improving the economic conditions of the country might be generated from the analysis.

The examples of previous studies which focus on the analysis are [1], [2], [3], [4], [5], and [6]. To the best of my knowledge, after learning the studies, the research which the topic is to determine the ranks of the industrial sectors of countries is still needed. The research is required in order to get the insight about the competitive sectors in the economic activities of focused countries. The current study attempts to fulfill the gap.

The purpose of the study is to extend the previous study which analyzes the industrial sectors ranks of specific countries. More specifically, the study aims to conduct a further analysis regarding the ranks by using the new data as well as new analysis periods. The study focuses on the cases of Indonesia and Japan. In this study, the analysis period of the Indonesian case is 2010 while for the case of Japan is 2011. Using the previous study as a reference, the study employs the Input-Output (IO) approach as an analysis device.

2. Methodology

The methodology of this study refers to the previous study which was conducted by [7]. The first step of the methodology is to expose the data sources. The data sources of this study are the 2010 Indonesian IO table, and Japanese IO table for 2011. The former table is obtained from [8] while the latter one is from [9]. The second step is to explore the industrial sectors of Indonesia and Japan used in this study. Tables 1 and 2 show the industries for the cases of Indonesia and Japan, respectively. The former table consists of seventeen industrial sectors while the latter one is thirteen industries.

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The third step is to conduct the calculations in order to determine the ranks of the industrial sectors of discussed countries on the analyzed periods. The methods of backward and forward linkages, the analysis tools in the IO analysis, are employed in the calculations. Both linkages describe the relationship between a particular industrial sector and other industries. More specifically, the backward linkage focuses on the demands of the specific industry on other industrial sectors. These demands appear as a consequence of the industry as a purchaser in the economy. On the other hand, the forward linkage explains the consequence of the industrial sector as a seller.

The methods are suitable for specifying the ranks of industrial sectors on the specific time period. [10] affirm this argument through the following statement:

"*Measures have been proposed to quantify such backward and forward linkages, or economic "connectedness." Comparisons of the strengths of backward and forward linkages for the sectors in a single economy provide one mechanism for identifying "key" or "leading" sectors in that economy (those sectors that are most connected and therefore, in some sense, most "important") and for grouping sectors into spatial clusters.*"

One can argue that if the backward linkage value of sector *a* is higher than that of sector *b*, then sector *a* gives more beneficial effect because of the higher capability of the sector in attracting the economy through its demands. The similar argument which uses the supplier's point of view can be utilized in analyzing the forward linkage values of two or more industries.

This study applies two forms for each linkage, namely "direct" and "total". These forms can be seen on both demand-side and supply-side IO models. [11] propose the concepts of the former form on both models. To summarize, this form only indicates the straightforward impacts of the demands and supplies of one particular industry. Further, [10] explain the concept of the form on the backward linkage by using the following equation:

$$BL(d)_j = \sum_{i=1}^{n} a_{ij} \tag{1}$$

where $BL(d)_j$, a_{ij}, and n are the direct backward linkage of sector *j*, the direct input coefficient, and the number of industrial sectors, respectively. One can calculate a_{ij} by dividing the value of interindustry sale from sector *i* to sector *j* by the total outlay of sector *j*. On the other hand, [12] describes the concept of the form on the forward linkage through the following equation:

$$F(d)_i = \sum_{j=1}^{n} a_{ij} \tag{2}$$

where $F(d)_i$ is the direct forward linkage of sector *i*. Both equations use the demand-driven IO model as a base. The using of row sums in describing the direct forward linkage of the specific sector in the model is also mentioned by [10].

The insight of the "total" form on the backward linkage in the demand-driven IO model is proposed by Rasmussen (1957) in [10] while [10] explain this on the forward linkage. To summarize, the form describes the straightforward and indirect effects of the demands and supplies of one specific industry. [10] explore the former insight by using the following equation:

$$BL(t)_j = \sum_{i=1}^{n} l_{ij} \tag{3}$$

where $BL(t)_j$ and l_{ij} are the total backward linkage of sector *j*, and Leontief inverse or the total requirements matrix, respectively. The latter insight, on the other hand, is explained by [12] by using the following equation:

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$$F(d+i)_i = \sum_{j=1}^{n} \alpha_{ij} \tag{4}$$

where $F(d+i)_i$ and α_{ij} are the total forward linkage of sector *i*, and Leontief inverse matrix, respectively. As with equations (1) and (2), the equations (3) and (4) also use the demand-driven IO model as a base.

[10] mention that the Ghosh inverse is suggested as a better tool in explaining the total forward linkage. As a consequence, the supply-driven IO model is a suitable device for analyzing the forward linkage. [10] describe the following equations in representing the linkage which uses the model:

$$FL(d)_i = \sum_{j=1}^{n} b_{ij} \tag{5}$$

$$FL(t)_i = \sum_{j=1}^{n} g_{ij} \tag{6}$$

where $FL(d)_i$, $FL(t)_i$, b_{ij}, and g_{ij} are the direct forward linkage of sector *i*, the total forward linkage of sector *i*, the coefficients matrix in a supply-driven IO model, and the Ghosh inverse, respectively. In this study, all above equations are implemented in the calculations step. The next step is to analyze the ranks of Indonesian and Japanese industrial sectors on the analysis periods. Conclusions of this study, and suggestions for further researches are explained on the final step.

Table 1. Indonesian industrial sectors used in this study.

Sector Number	Sector Name
1	Agriculture, forestry, and fishing
2	Mining and quarrying
3	Manufacturing
4	Electricity and gas
5	Water supply, sewerage, waste management, and remediation activities
6	Construction
7	Wholesale and retail trade; repair of motor vehicles and motorcycles
8	Transportation and storage
9	Accommodation and food service activities
10	Information and communication
11	Financial and insurance activities
12	Real estate activities
13	Business activities
14	Public administration and defence; compulsory social security
15	Education
16	Human health and social work activities
17	Other services activities

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Table 2. Japanese industrial sectors used in this study.

Sector Number	Sector Name
1	Agriculture, forestry, and fishery
2	Mining
3	Manufacturing
4	Construction
5	Electricity, gas, and water supply
6	Commerce
7	Finance and insurance
8	Real estate
9	Transport and postal services
10	Information and communications
11	Public administration
12	Services
13	Activities not elsewhere classified

3. Results and analysis

Tables 3 and 4 describe the ranks of Indonesian industrial sectors on the analysis period which are viewed from the calculations results using direct and total backwards linkages, respectively. On the other hand, tables 5 and 6 expose the ranks which are viewed from the results using direct and total forwards linkages, respectively. Meanwhile, the results using the supply-driven IO model for the Indonesian case are explored in tables 7 and 8. The analysis then focuses on the top five sectors of each result. More specifically, one can argue that the sector number 4, electricity and gas, was a leading sector in the Indonesian economy in 2010 because it appears as one of the top five sectors in tables 3 – 8. In other words, on the analysis period, the sector had beneficial effects in the Indonesian economy.

Tables 9 and 10 expose the ranks of Japanese industrial sectors on the analysis period which are viewed from the results of calculations using direct and total backwards linkages, respectively. Meanwhile, tables 11 and 12 describe the ranks which are viewed from the results using direct and total forwards linkages, respectively. On the other hand, the results using the supply-driven IO model for the Japanese case are explored in tables 13 and 14. As with the previous case, the top five sectors on each result are also viewed in the analysis of the Japanese issue. Based on the analysis, one can say that the sector number 3, manufacturing, was a leading sector in the Japanese economy in 2011 because it appears as one of the top five sectors in almost all tables which explain the ranks. In other words, on the analysis period, the sector had beneficial effects in the Japanese economy.

Table 3. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (1).

Sector Number	Sector Name	Calculated Value
4	Electricity and gas	0.765
6	Construction	0.649
3	Manufacturing	0.635
8	Transportation and storage	0.575
16	Human health and social work activities	0.545
9	Accommodation and food service activities	0.542

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17	Other services activities	0.497
13	Business activities	0.405
14	Public administration and defence; compulsory social security	0.375
10	Information and communication	0.375
15	Education	0.348
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.330
11	Financial and insurance activities	0.273
2	Mining and quarrying	0.264
1	Agriculture, forestry, and fishing	0.192
12	Real estate activities	0.172
5	Water supply, sewerage, waste management, and remediation activities	0.171

Table 4. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (2).

Sector Number	Sector Name	Calculated Value
4	Electricity and gas	2.889
6	Construction	2.300
8	Transportation and storage	2.184
3	Manufacturing	2.150
16	Human health and social work activities	2.071
17	Other services activities	1.996
9	Accommodation and food service activities	1.994
13	Business activities	1.774
14	Public administration and defence; compulsory social security	1.752
10	Information and communication	1.695
15	Education	1.688
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	1.651
11	Financial and insurance activities	1.486
2	Mining and quarrying	1.472
1	Agriculture, forestry, and fishing	1.357
12	Real estate activities	1.349
5	Water supply, sewerage, waste management, and remediation activities	1.348

Table 5. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (3).

Sector Number	Sector Name	Calculated Value
3	Manufacturing	2.740
4	Electricity and gas	0.565
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.542
10	Information and communication	0.462
1	Agriculture, forestry, and fishing	0.426
2	Mining and quarrying	0.374
8	Transportation and storage	0.362
11	Financial and insurance activities	0.359
17	Other services activities	0.297
6	Construction	0.268

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13	Business activities	0.260
9	Accommodation and food service activities	0.168
16	Human health and social work activities	0.088
14	Public administration and defence; compulsory social security	0.071
5	Water supply, sewerage, waste management, and remediation activities	0.049
15	Education	0.043
12	Real estate activities	0.038

Table 6. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (4).

Sector Number	Sector Name	Calculated Value
3	Manufacturing	6.436
1	Agriculture, forestry, and fishing	2.309
4	Electricity and gas	2.217
2	Mining and quarrying	2.203
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	2.072
10	Information and communication	1.767
8	Transportation and storage	1.614
11	Financial and insurance activities	1.606
13	Business activities	1.450
17	Other services activities	1.427
6	Construction	1.410
9	Accommodation and food service activities	1.236
14	Public administration and defence; compulsory social security	1.114
16	Human health and social work activities	1.107
12	Real estate activities	1.068
5	Water supply, sewerage, waste management, and remediation activities	1.068
15	Education	1.052

Table 7. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (5).

Sector Number	Sector Name	Calculated Value
13	Business activities	0.820
4	Electricity and gas	0.720
2	Mining and quarrying	0.677
11	Financial and insurance activities	0.673
1	Agriculture, forestry, and fishing	0.656
3	Manufacturing	0.654
5	Water supply, sewerage, waste management, and remediation activities	0.638
10	Information and communication	0.574
8	Transportation and storage	0.503
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.417
17	Other services activities	0.355
9	Accommodation and food service activities	0.244
16	Human health and social work activities	0.142
12	Real estate activities	0.129

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6	Construction	0.088
14	Public administration and defence; compulsory social security	0.084
15	Education	0.051

Table 8. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (6).

Sector Number	Sector Name	Calculated Value
4	Electricity and gas	2.801
13	Business activities	2.598
2	Mining and quarrying	2.458
1	Agriculture, forestry, and fishing	2.367
5	Water supply, sewerage, waste management, and remediation activities	2.300
11	Financial and insurance activities	2.298
3	Manufacturing	2.186
10	Information and communication	2.108
8	Transportation and storage	1.890
7	Wholesale and retail trade; repair of motor vehicles and motorcycles	1.758
17	Other services activities	1.586
9	Accommodation and food service activities	1.369
12	Real estate activities	1.233
16	Human health and social work activities	1.218
6	Construction	1.165
14	Public administration and defence; compulsory social security	1.163
15	Education	1.071

Table 9. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (1).

Sector Number	Sector Name	Calculated Value
5	Electricity, gas, and water supply	0.730
3	Manufacturing	0.715
13	Activities not elsewhere classified	0.601
2	Mining	0.553
4	Construction	0.548
1	Agriculture, forestry, and fishery	0.515
9	Transport and postal services	0.497
10	Information and communications	0.474
12	Services	0.384
7	Finance and insurance	0.342
11	Public administration	0.317
6	Commerce	0.315
8	Real estate	0.194

Table 10. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (2).

Sector Number	Sector Name	Calculated Value
3	Manufacturing	2.769
5	Electricity, gas, and water supply	2.625
4	Construction	2.268
1	Agriculture, forestry, and fishery	2.210
2	Mining	2.181
13	Activities not elsewhere classified	2.160
9	Transport and postal services	2.077
10	Information and communications	1.935
12	Services	1.840
11	Public administration	1.664
7	Finance and insurance	1.658
6	Commerce	1.627
8	Real estate	1.361

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Table 11. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (3).

Sector Number	Sector Name	Calculated Value
3	Manufacturing	1.664
12	Services	1.197
9	Transport and postal services	0.772
10	Information and communications	0.417
6	Commerce	0.364
2	Mining	0.335
7	Finance and insurance	0.312
5	Electricity, gas, and water supply	0.289
11	Public administration	0.227
8	Real estate	0.203
4	Construction	0.170
1	Agriculture, forestry, and fishery	0.155
13	Activities not elsewhere classified	0.080

Table 12. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (4).

Sector Number	Sector Name	Calculated Value
3	Manufacturing	5.629
12	Services	3.379
9	Transport and postal services	2.455
6	Commerce	1.871
10	Information and communications	1.767
2	Mining	1.763
5	Electricity, gas, and water supply	1.582
7	Finance and insurance	1.521
8	Real estate	1.363
1	Agriculture, forestry, and fishery	1.336
4	Construction	1.297
11	Public administration	1.261
13	Activities not elsewhere classified	1.151

Table 13. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (5).

Sector Number	Sector Name	Calculated Value
2	Mining	31.701
13	Activities not elsewhere classified	1.003
1	Agriculture, forestry, and fishery	0.887
5	Electricity, gas, and water supply	0.690
3	Manufacturing	0.668
9	Transport and postal services	0.645
10	Information and communications	0.552
7	Finance and insurance	0.517
6	Commerce	0.378
12	Services	0.360
4	Construction	0.186
8	Real estate	0.167
11	Public administration	0.029

Table 14. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (6).

Sector Number	Sector Name	Calculated Value
2	Mining	82.632
1	Agriculture, forestry, and fishery	3.276
13	Activities not elsewhere classified	3.072
9	Transport and postal services	2.722
5	Electricity, gas, and water supply	2.597
3	Manufacturing	2.583
10	Information and communications	2.087
7	Finance and insurance	1.970
6	Commerce	1.837
12	Services	1.755
4	Construction	1.358
8	Real estate	1.329
11	Public administration	1.089

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4. Conclusions and further researches

This study, as a continuation study of the previous one, determines the ranks of Indonesian and Japanese industries by using the analysis methods in the IO analysis, backward and forward linkages, and new data as well as new analysis periods for the focused countries. As with the previous study, the results of the current study show that the orders of the ranks depend on the methods used. Nevertheless, from the results, one can argue that the electricity and gas industry was a leading sector in the Indonesian economy in 2010. On the other hand, for the Japanese case, the sector which had the beneficial effects in the Japanese economy in 2011 was the manufacturing industry. In terms of the leading sectors, the current study is different from the previous one.

The suggested further research from the current study is to expand the analyzed industrial sectors for each analyzed country. This suggestion is mentioned in order to get the deeper understanding regarding the economic conditions of analyzed countries on the specific period of analysis, especially about the ranks of their industries. This deeper understanding might be useful in determining the prioritized sectors on their economic activities in the future. The other suggested further research is to expand the area of analysis using the same methodology so the industrial sectors ranks of, for example, the specific region can also be analyzed. One of the examples is to expand the analysis for the other ASEAN countries.

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