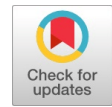# Using Multiplier Analyses in Analyzing the Roles of Japanese Industrial Sectors

Ubaidillah Zuhdi, Teguh Herlambang, Nasori Nasori

ABSTRACT--- The purpose of this study is to analyze the roles of industrial sectors in the Japanese national economy by using simple output multiplier, and simple household income multiplier, the analysis tools in Input-Output (IO) analysis. The analysis period of the study is 2011. The results show that, on the period of analysis, manufacturing sector had the highest simple output multiplier value. Therefore, one can argue that an additional final demand for the sector would generate the most attractive effect to the Japanese economy by using the multiplier on the period of analysis. Conversely, the lowest value of the multiplier was owned by the real estate sector in 2011. On the other hand, from the point of view of simple household income multiplier, the highest value was owned by the construction sector on the analysis period. This result indicates that an additional yen of final demand for the sector would generate the highest new household income on the period of analysis. On the contrary, as with the previous multiplier, the real estate sector had the lowest simple household income multiplier value in 2011.

Keywords: Industrial sectors, National economy, IO analysis, Japan.

I. INTRODUCTION

There is no doubt that industry is an important aspect in the economy. Manufacturing, for example, has a role as an engine of growth until now [1]. In Romania, after 2000, the intensity of the process of deindustrialization decreased and this condition permitted manufacturing to remain the backbone of the Romanian industry and the overall economy [2].

Service sector has an important role in the economy too. It generates a direct and significant contribution to GDP and job creation, and provides critical inputs for the rest of the economy, thus having a significant impact on the overall investment condition, which is an essential factor of growth and development [3]. Besides, the sector is the biggest and fastest growing sector in the economy of the world, accounting the highest share in total output and employment in the most developed countries [4]. The contribution of

service sector to GDP of India is 59.29%, higher than primary (13.68%) and secondary sectors (27.03%) [5].

Above explanations show the previous studies that investigate the roles of industrial sectors. The research focuses on overall industrial sectors especially in one specific country, however, is still needed. The research will generate a comprehensive view regarding the roles of industrial sectors in the economy of specific country. The current study is conducted in order to fulfill the gap on the topic in industry.

The purpose of the study is to analyze the roles of industrial sectors in the Japanese national economy. The study employs Input-Output (IO) analysis as an analysis tool. More specifically, the study uses simple output multiplier, and simple household income multiplier as analysis devices. The analysis period of the study is 2011. The rest of this paper is described as follows. Section 2 scientifically explains the methodology of the study. Section 3 shows the results of calculations. The discussions for the results are also conducted on the section. The next section, section 4, describes the conclusions of the study, and suggested future studies.

II. METHODOLOGY

This section scientifically explains the methodology of the current study. The first step of the methodology is to describe the data used. The study uses the Japanese IO table for 2011 as data. The table consists of thirteen industrial sectors, and uses producer's price. The source of the data is [6]. The second step is to explain the Japanese industrial sectors used in this study. Table I shows those sectors.

The third step is to conduct the calculations using simple output multiplier, and simple household income multiplier. Reference [7] describes the equations of both multipliers as follows

$$m(o)_j = \sum_{i=1}^{n} l_{ij} \qquad (1)$$

$$m(h)_j = \sum_{i=1}^{n} a_{n+1,i} l_{ij} \qquad . \qquad (2)$$

The former model explains the simple output multiplier while the latter one describes the simple household income multiplier. More specifically, $m(o)_j$, $m(h)_j$, $a_{n+1,i}$, n, and l_{ij} are simple output multiplier for sector j, simple household income multiplier for sector j, labor-input coefficients, the number of analyzed sectors, and a matrix of sector-to-sector multipliers, respectively. The next step is to analyze the roles of industrial sectors in the Japanese economy on the

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period of analysis. Conclusions of the study, and suggested further researches are described on the final step.

Table I. 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

Source: [8]

III. RESULTS AND FINDINGS

Table II shows the top five Japanese industrial sectors viewed from the values of simple output multiplier. The analysis period of the table is 2011. Reference [7] explains that an output multiplier for sector j is the total value of production in all industrial sectors of the economy that is needed in order to fulfill a currency's worth of final demand for the output of sector j. The reference also describes that, for the simple output multiplier, the total value of production is coming from the households exogenous model.

Table II. Top Five Japanese Industrial Sectors Viewed from the Values of Simple Output Multiplier, 2011

No.	Sector Number	Sector Name	Simple Output Multiplier
1	3	Manufacturing	2.769
2	5	Electricity, gas, and water supply	2.625
3	4	Construction	2.268
4	1	Agriculture, forestry, and fishery	2.210
5	2	Mining	2.181

Based on the information in the table, manufacturing sector has the highest simple output multiplier value. The value is 2.769. The value indicates that in order to satisfy a yen's worth of final demand for manufacturing sector's output, all Japanese sectors need to produce the products which the total value is ¥2.769. One can argue that, by using the calculation results of simple output multiplier, an additional final demand for the sector would generate the most attractive effect to the economy of Japan on the analysis period.

Fig. 1 show the values of simple output multiplier of all Japanese industrial sectors used in this study. The figure uses 2011 as an analysis period too. On the analysis period, the lowest value was owned by the real estate sector. Based on the information in the figure, one can say that Japanese service sectors had the low values on the period of analysis.

On the other hand, Table III describes the top five Japanese industrial sectors viewed from the values of simple household income multiplier. As with the previous table, this table analyzes Japanese industrial sectors in 2011. The multiplier is applied to explain the economic impacts of new final demand as measured by new households income by using households exogenous model [7].

Based on the information in the table, the highest value is owned by the sector number 4, construction. The value is 0.646. The value explains that, on the analysis period, an additional yen of final demand for the construction sector would generate ¥0.646 of new household income, when all direct and indirect impacts were changed into yen estimates of income.

Fig. 2 describes the values of simple household income multiplier of Japanese industrial sectors in 2011. The interesting result can be seen on sector 8, real estate. As with the previous multiplier, the sector had the lowest value on the analysis period from the point of view of simple household income multiplier. Therefore, one can argue that the sector was the most sluggish Japanese industrial sector on the period of analysis.

Previous study explains that, by using 89 Japanese industrial sectors, the most attractive sectors from the point of view of simple output multiplier for 1995, 2000, and 2005 were office supplies, office supplies, and motor vehicles, respectively [9]. On the other hand, another previous study shows that, by using 89 Japanese industrial sectors, and the point of view of simple household income multiplier, the most fascinating sectors for 1995, 2000, and 2005 were education, social security, and social security [10]. The current study provides the other point of view regarding the discussed aspects. One can say that the natural disasters happened in Japan in 2011 gave the important impacts on the emergence of the viewpoint.
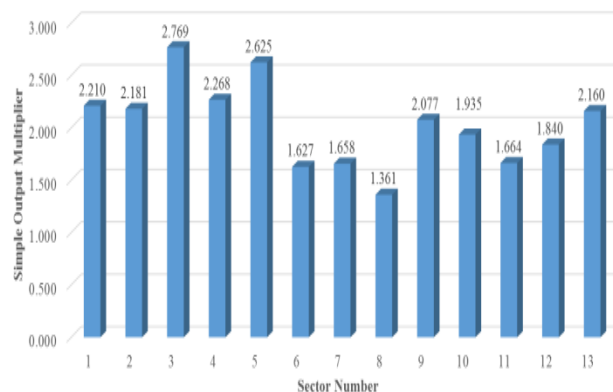

Figure 1. The Values of Simple Output Multiplier of Japanese Industrial Sectors, 2011

Table III. Top Five Japanese Industrial Sectors Viewed from the Values of Simple Household Income Multiplier, 2011

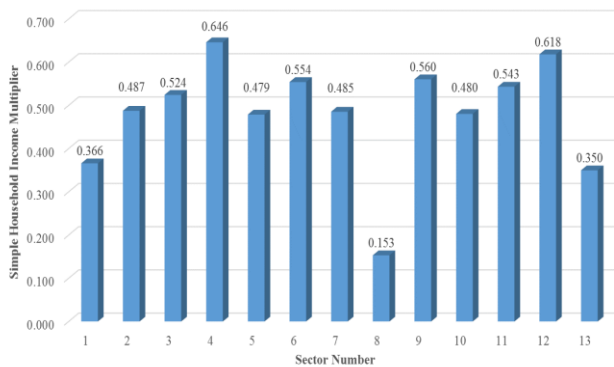| No.	Sector Number	Sector Name	Simple Household Income Multiplier
1	4	Construction	0.646
2	12	Services	0.618
3	9	Transport and postal services	0.560
4	6	Commerce	0.554
5	11	Public administration	0.543

Figure 2. The Values of Simple Household Income Multiplier of Japanese Industrial Sectors, 2011

IV. CONCLUSIONS AND FURTHER RESEARCHES

This study analyzes the roles of Japanese industrial sectors in the national economy by using IO analysis. More specifically, the current study employs simple output multiplier, and simple household income multiplier as analysis tools. The analysis period of the study is 2011.

The results show that, on the period of analysis, manufacturing sector had the highest simple output multiplier value. Therefore, one can argue that an additional final demand for the sector would generate the most attractive effect to the Japanese economy by using the multiplier on the period of analysis. On the contrary, the lowest value of the multiplier was owned by the real estate sector in 2011.

On the other hand, from the point of view of simple household income multiplier, the highest value was owned by the construction sector on the analysis period. This result indicates that an additional yen of final demand for the sector would generate the highest new household income on the period of analysis. Conversely, as with the previous multiplier, the real estate sector had the lowest simple household income multiplier value in 2011.

The current study continues the previous studies in terms of analyzing the roles of Japanese industrial sectors in the national economy by using simple output multiplier, and simple household income multiplier. However, the study uses the aggregated 2011 Japanese IO table as data. One can argue that more detailed information, in terms of more detailed Japanese industrial sectors, will generate more detailed results. Therefore, as a further research, the study proposes the same discussion by using the disaggregated Japanese IO table for 2011.

The other suggested further research from the study is to extend the period of analysis, such as 1985-2011. This extension will generate a more comprehensive understanding of the roles of industrial sectors in the Japanese economy. For example, the extension will show the patterns of Japanese industrial sectors in terms of simple output multiplier and simple household income multiplier values.

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