

Conference Paper

The Analysis of Manufacturing Sector in Indonesia

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Abstract

The development of sustainable manufacturing industries is the strategy and policy of Indonesia government. The purpose of this research to examine and analyze the impact of labor, capital, material, and energy consume in 2012-2015 to output of manufacturing industries sector based on 2 digits code. The other purpose is to analyze and examine the factor affecting the output of manufacturing industries sector and Total Factor Productivity. The methods that used in this research is regression with panel data and TFP OLS. The result show that labor, capital, material, and energy consume have significant positive effect to output of manufacturing industries sector, while the TFP result is positive.

Keywords: regression of panel data, Total Factor Productivity, labor, capital, material, energy consume, output manufacturing industries sector

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1. Introduction

The development of sustainable manufacturing industry is the strategy of growth and government policy in every country. This development become the strategy because this manufacture is one of the sector that has forward and backward linkages inter-sector, so from the development manufacturing industry, the developing country that want higher growth will reach developed country status at last (Loto, 2012). The other reason is manufacturing industry can built investment in higher and faster way (Kurniati and Yanfitri, 2010). Investment movement will affect the productivity of industry because there will be has the process of knowledge transfer such as technology that will help the development of industry in bigger scale. The development of manufacturing industry always become the most priority in Indonesia. It is because manufacturing industry considered as leader sector that can push other sector, like agriculture and services sector, although manufacturing sector still has weakness especially in Indonesia.

The important issues related to the manufacturing industry sector in Indonesia is the problem of possible disparities in the level of efficiency and productivity of each sub-sector of the manufacturing industry in Indonesia. (Lestari and Isnina, 2017).

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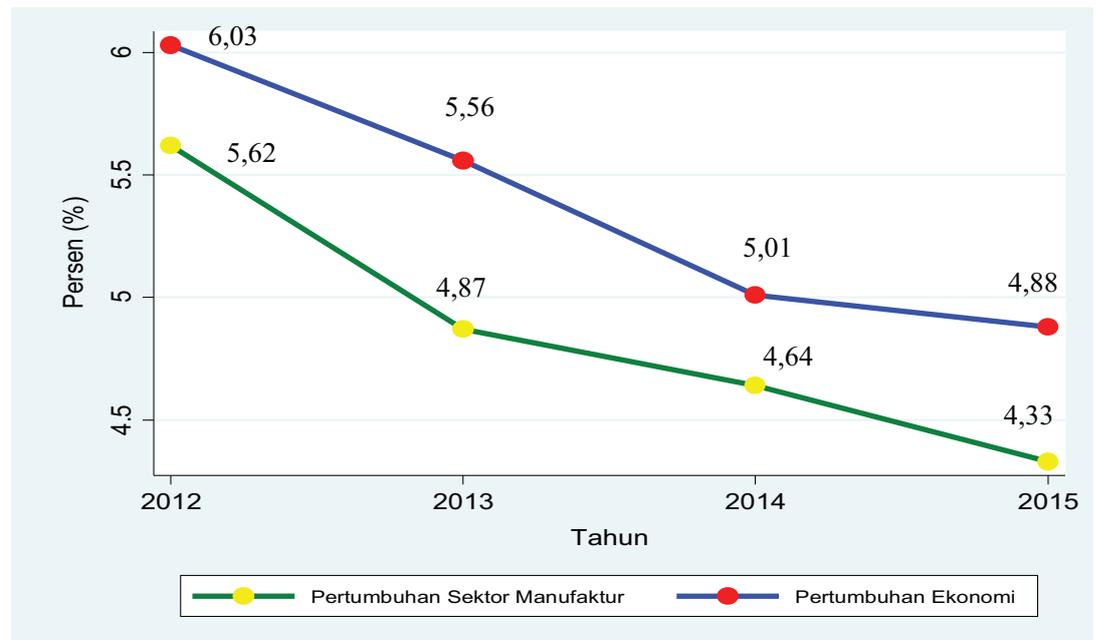


Figure 1: Industry Growth and Economy Growth during 2012-2015 (Source: Bank of Indonesia, 2016 (processed)).

Figure 1 shows the development of industrial sector growth and economic growth during the 2012-2015 period. Based on Figure 1 economic growth above the growth of the industrial sector. Figure 1 also shows that the growth of the industrial sector and economic growth has decreased. This condition indicates that during the period 2012-2015, the Indonesian state experienced a slowdown in the industrial sector and economic growth. Indonesia's economic growth slowdown is due to slowing growth in the manufacturing sector.

Table 1 shows the distribution of manufacturing industry sub-sectors to Indonesia's GDP during the 2014-2015 period. Table 1 shows that the highest contributing food and beverage industry continues to increase every year. The magnitude of the contribution of the food and beverage industry to Indonesia's GDP formation from 2014-2015 is 5.32 percent, and 5.61 percent. This condition shows that people's income is used more to buy food and drinks.

The development of the manufacturing industry requires the availability of inputs such as labor, capital, land and technology. These

inputs must be in the production process in the industrial sector, so that industrial development can be carried out. Other factors for accelerating industrial development are policies and regulations that build an investment climate, as well as adequate infrastructure such as electricity supply.

TABLE 1: The Distribution of Subsector Manufacture Industry to GDP in Indonesia during 2012-2015 (percentage).

Manufacturing Industry Sub-sector	2014	2015
Coal, Oil and Gas Refinery Industries	3,19	2,78
Food and Beverage Industries	5,32	5,61
Tobacco Processing Industry	0,91	0,94
Textile and Clothing Industries	1,32	1,21
Leather, Leather Goods and Footwear Industries	0,27	0,27
Wood, Wood and Cork Products and Woven Goods from Bamboo, Rattan and others Industries	0,72	0,68
Sub Sektor Industri Manufaktur	2014	2015
Paper and Paper, Printing and Recording Media Reproduction Industries	0,8	0,76
Chemical, Pharmaceutical and Obarry Industries	1,7	1,82
Rubber, Goods from Rubber and Plastics Industries	0,76	0,75
Non-Metal Excavation Goods Industry	0,73	0,72
Basic Metal Industry	0,78	0,78
Metal Goods, Computers, Electronic Items, Optics; and Electrical Equipment Industries	1,87	1,97
Machinery and Equipment Industries	0,31	0,32
Transportation Equipment Industry	1,96	1,91
Furniture Industry	0,27	0,27
Other Processing Industries; Machine and Equipment Repair and Installation Services	0,18	0,18
Source: BPS, 2016 (processed)		

Based on the production function, labor as a variable input while capital as a fixed input (Nicholson, 2002:160). Labor input as a variable input because it can be changed in the short and long term, while capital as a fixed input because capital can only be changed in the long run. Changes in labor and capital inputs have a positive impact on the company's output. Raw materials are the basis used for the beginning of the production process. The production process cannot be separated from the availability of raw materials.

The smooth process of production with adequate raw material inventory will produce output in accordance with the production plan (Maryaningsih et.al, 2014). Based on that, the raw material with output has a unidirectional relationship. Other than that, the productin cannot be held if there isn't material. In addition, inputs from consumption, especially electricity, are also important factors in the production process. Electrical

energy needs for the industrial sector must be fulfilled, because electricity is one of the main factors in the production process, so that electrical energy has a positive impact on the output of the industrial sector (Wiharja and Natalia, 2013).

2. Literature Review

2.1. Manufacturing industry

The definition of the processing industry according to the Central Statistics Institution (2015) is the activity of converting basic materials (raw materials) into finished / semi-finished goods and / or goods of less value to items of higher value, either mechanically, chemically, by machine or by hand. The three main sectors that form Indonesia's GDP, namely the manufacturing industry, the agricultural sector and the trade sector. The average contribution of the three main sectors is the manufacturing industry at 21.13 percent, the agricultural sector at 13.39 percent, and the trade sector at 13.29 (BPS, 2016). These three main sectors contribute the most from all sectors in the formation of GDP in Indonesia.

2.2. Production function

The production function is the relationship between the factors of production (input) and the level of production (output) created. Nicholson and Snyder (2008: 150) state that the production function reflects the company's technical knowledge about how to use inputs to produce output. The relationship between input and output in the production process is illustrated in the production function. It is assumed that there are four types of inputs, namely Capital (K), Labor (L), then the production function is:

$$Q = f(K, L). \quad (1)$$

In the case of fixed proportions, the substitution elasticity is zero ($\sigma = 0$). This illustrates that there is no substitution between inputs, so that to increase the amount of output, the number of inputs is needed in the same proportion. In the Cobb-Douglas function, substitution elasticity is divided into three types ($\sigma = 1$, $\sigma > 1$, $\sigma < 1$). Mathematically simple, the Cobb-Douglas production function is as follows:

$$Q = f(K, L) = AK^aL^b, \quad (2)$$

where Q is output, A is technology, K is capital, L is labor, A, a and b are positive constants. This function is widely applied because it is in logarithmic form, the function

becomes linear. The linear function form of the Cobb-Douglas production function is as follows:

$$\ln Q = \ln A + a \ln K + b \ln L, \quad (3)$$

where the constant a is the output elasticity of K input and b is the output elasticity of L input.

Evans and Hunt (2009: 117) explain that there is a development in the production function by adding two factors of production, energy (E) and material or raw material (M). The functional relationship between output, technology, capital, labor, energy and material is as follows:

$$y = f(K, L, E, M)$$

The notation illustrates that energy is used as input that is combined with other production factors (technology, capital, labor and material). According to Wing in Evans and Hunt (2009: 344), each industry has five possible substitutions in the input. These possibilities are substitutions between the primary factor (KL) and intermediate input (EM), the substitution between capital and labor, the substitution between energy and material, inter-fuel substitution and substitution between intermediate inputs.

2.3. Total factor productivity (TFP)

Some assume that TFP cannot be used as a measurement to indicate the existence of technological progress. Those who believe this include Jorgenson and Griliches (1967) and Hulten (2000) in Utama (2011: 41) argue that TFP only measures "free lunches" which are related to the technological progress that occurs. TFP can be zero or even negative even though technological change occurs.

For example, they assume that everything related to the provision and implementation of technological progress that we want to do is a development cost (w). Technological progress causes a change in the marginal product that is equal to v . Under these conditions there will be three possibilities that occur is:

1. If $w > v$, it is likely that the company is reconsidering (not done) to do the technological change because what will happen is $TFP < 0$.
2. If $w = v$ then the company can cover all development costs because it is proportional to the marginal product value resulting from technological changes, so that what happens is $TFP = 0$.

3. If $w < v$ then the profit will be obtained so that $TFP > 0$.

The measurement of TFP growth is more appropriate than just measuring the amount of TFP. This is because TFP growth can more reflect changes in output over time that cannot be explained by changes in input combinations used in a production process (Khan, 2006: 8).

Some differences in views regarding the meaning of TFP, in this paper the author assumes that TFP is an approach that can be used to determine productivity growth due to technological changes that occur. In general, the method most often used in measuring total factor productivity is the growth accounting method. In the growth accounting method, a production function model is used to measure how the relationship and the influence of each input on output growth in a production process.

Productivity measurement (TFP) using this method approach allows us to decompose the source of output growth into the growth of inputs (capital, raw materials and labor) and also changes in the TFP.

3. Methodology

This study uses 24 cross-sectional data based on the 2-digit ISIC code in Indonesia, while the time series data for the period 2012-2015. The method used is panel data regression. Panel data regression is a regression method that uses time series data and cross section data (Gujarati and Porter, 2012: 236). This study uses 24 cross-sectional data based on the 2-digit ISIC code in Indonesia, while the time series data for the period 2012-2015. The method used is panel data regression. Panel data regression is a regression method that uses time series data and cross section data (Gujarati and Porter, 2012: 236).

The variable used is the output of the manufacturing industry as the dependent variable. Independent variables consist of capital, labor, raw materials, and electricity consumption.

In general, the models used are as follows:

3.1. Panel regression model

3.1.1. Pool least square (PLS)

The panel data model for PLS is as follows: (Gujarati, 2012:640)

$$Y_{it} = \alpha_1 + \alpha_2 X_{2it} + \alpha_3 X_{3it} + \dots + \beta_n X_{nit} + U_{it} \quad (4)$$

3.1.2. Fixed effect(FEM)

The panel data model for FEM is as follows: (Gujarati, 2012:643)

$$Y_{it} = \alpha_1 + \alpha_2 D_2 + \dots + \alpha_n D_n + \beta_2 X_{2it} + \dots + \beta_n X_{nit} + U_{it} \quad (5)$$

3.1.3. Random effect (REM)

The panel data model for REM is as follows: (Gujarati, 2012:645)

$$Y_{it} = \alpha_1 + \beta_2 X_{2it} + \dots + \beta_n X_{nit} + U_{it} + \epsilon_{it} \quad (6)$$

This study refers to the research of Bekhet and Harun (2011), but for the analysis model and distinguished method. The analysis model used in this study is a dynamic panel data regression model. Following is the panel data regression model:

$$\ln(Y)_{it} = \alpha + \beta_2 \ln(L)_{it} + \beta_3 \ln(K)_{it} + \beta_4 \ln(BB)_{it} + \beta_5 \ln(E)_{it} + u_{it}$$

Information:

YI = Output of 2-digit Manufacturing Industry Sector (in thousand rupiah)

L = Labor (Soul)

K = Capital (in thousand rupiah)

BB = Raw Materials

E = electricity consumption

u = error term

Ln = natural logarithm

α = intercept

$\beta_1.. \beta_3$ = coefficient of independent variables

3.2. Total factor productivity (TFP)

Based on the above equation, in this study to determine the magnitude of TFP growth, the following equation is used:

$$\frac{\Delta TFP}{TFP} = \frac{\Delta Y}{Y} - \beta_1 \frac{\Delta X_1}{X_1} - \beta_2 \frac{\Delta X_2}{X_2} - \dots - \beta_5 \frac{\Delta X_5}{X_5}$$

where:

$\frac{\Delta TFP}{TFP}$: TFP growth

$\frac{\Delta Y}{Y}$: Output of Industry growth

$\frac{\Delta X_n}{X_n}$: Growth in the use of industrial production inputs

β_n : The coefficient of the estimation results of OLS calculations

4. Results

4.1. PLS and FEM test

Determination of the best model between PLS (Pooled Least Square) and FEM (Fixed Effect Model) is used by Chow test. Following are the redundant fixed effect test results for selecting the best model between PLS or FEM:

4.1.1. Hypothesis

H0: PLS

H1: FEM

$\alpha = 5\%$

4.1.2. Criteria

H0 is rejected if the test Chow prob is <5%

H0 is accepted if the Chow prob is $\geq 5\%$

4.1.3. Conclusion

Chow test prob = 0.0000

So, H0 is rejected because the Chow test prob (0.0000) is <5% so the FEM model is the best for this regression. After that, FEM with REM being tested.

4.2. FEM and REM test

Determination of the best model between Fixed Effect Model and Random Effect Model is used by Hausman test. Here are the results of the Hausman test for selecting the best model between FEM or REM:

4.2.1. Hypothesis

H0: Random Effect Model (REM)

H1: Fixed Effect Model (FEM)

$\alpha = 5\%$

4.2.2. Criteria

H0 is rejected if the Hausman prob is $<5\%$

H0 is accepted if Hausman prob $\geq 5\%$

4.2.3. Conclusion

Hausman prob = 0.1467

So, H0 is rejected because Hausman prob (0.1467) $>5\%$ so REM is the best selected model.

TABLE 2: REM Estimation Results with Dependent Variables of Manufacturing Sector Output.

Independent Variables	Coefisien	Probability
InL	0,32	0.000
InK	0,07	0.013
InBB	0,31	0,000
Lne	0,17	0.003
Constanta	-0,13	0.894
Prob > Chi2		0.000

Table 2 shows the results of the selected REM model. Based on Table 2 it can be concluded that labor, capital, raw materials, and electricity consumption have a significant effect on the output of the manufacturing industry sector. Table 2 also shows that the coefficient of labor, capital, raw materials, and electricity consumption has a positive sign, meaning that all independent variables have a positive impact on the

output of the manufacturing industry sector. Simultaneous results can be seen in prob > chi². The prob value > chi² is less than 5 percent, so that simultaneously labor, capital, raw materials, and electricity consumption have a significant effect on the output of the manufacturing industry sector.

4.3. Total factor productivity (TFP)

Total factor productivity is considered a very comprehensive measure of productivity and efficiency. This measure explains changes in production caused by changes in the quantity of inputs used, changes in technology, capacity utilization and quality of production factors.

Table 4.2. shows that codes 10 through 33 have a positive TFP average value. This result gives meaning that the Indonesian manufacturing industry has been able to combine various kinds of inputs in the production process to achieve the expected results efficiently. The TFP value in each sector that has more than 1 indicates that the total productivity factor of the sector has increased. The average TFP value is the highest in code 17, the paper industry, while the TFP value is the lowest in the industry with code 25, which is metal goods. Positive results indicate that the manufacturing sector in Indonesia has been able to produce production by including other supporting inputs, such as technology.

5. Conclusions

5.1. Conclusions

Based on the estimation results it can be concluded that:

1. The partial estimation results (t test) show labor, capital, raw materials, and electricity consumption have a significant effect on the output of the manufacturing industry sector, while the simultaneous results (prob > chi² test) show labor, capital and electricity consumption significant to the output of the manufacturing industry sector.
2. The estimation results using TFP show that codes 10 through 33 have a positive TFP average value. This result gives meaning that the Indonesian manufacturing industry has been able to combine various kinds of inputs in the production process to achieve the expected results efficiently.

TABLE 3: Total Factor Productivity Results.

Kode	Tahun				rata-rata
	2012	2013	2014	2015	
10	0.88710	1.77352	1.74103	0.74713	1.28719
11	1.07924	0.87267	0.86999	1.29967	1.03039
12	1.74553	0.72457	0.84476	1.16567	1.12013
13	1.00855	0.89942	0.94703	1.78784	1.16071
14	0.24737	0.95860	1.00059	1.58367	0.94756
15	1.16848	1.03950	1.33500	2.00668	1.38742
16	1.25664	0.95326	1.39893	2.04494	1.41344
17	1.42853	1.05302	1.94109	1.85986	1.57063
18	1.21376	0.71255	0.87906	1.45900	1.06609
19	1.50344	1.10722	1.20162	1.44478	1.31427
20	1.26677	0.93797	0.21766	1.39520	0.95440
21	1.48647	0.80930	1.02995	1.26441	1.14753
22	0.65730	0.84540	0.76397	3.57964	1.46158
23	0.86236	1.43993	0.81956	0.70606	0.95698
24	0.74960	1.14072	0.84337	0.80994	0.88591
25	0.73782	0.02405	0.88125	0.86876	0.62797
26	0.61119	1.15494	0.86963	0.73632	0.84302
27	0.71556	1.30140	0.82253	0.79139	0.90772
28	0.65050	1.35220	0.77023	0.69355	0.86662
29	0.60650	1.18042	0.77698	0.82269	0.84665
30	0.65632	1.13481	1.00729	0.13873	0.73429
31	0.92840	1.18357	1.48159	0.26369	0.96431
32	0.96353	0.43550	0.93918	0.69788	0.75902
33	1.43027	0.97795	1.12661	0.62450	1.03983

Information:

10: food; 11: drinks; 12: tobacco; 13: textiles; 14: ready-made clothes; 15: leather and footwear; 16: wood; 17: paper; 18: printing; 19: coal products; 20: chemicals; 21: pharmacy; 22: rubber; 23: non-metallic excavation; 24: base metal; 25: metal goods; 26: computers and electronic goods; 27: electrical equipment; 28: machinery and equipment; 29: motorized vehicles; 30: other conveyances; 31: Furniture; 32: other processing; 33: repair services.

5.2. Suggestion

Based on the conclusions it is recommended as follows:

1. It is hoped that the Indonesian government will improve infrastructure to develop the quality and smoothness of the manufacturing industry in Indonesia.

2. It is expected that future research can look at different aspects such as entering wage variables.

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