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The Effect of Investment and Export on Manufacturing Industry in Indonesia

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Abstract

Over the past decades, Indonesia's manufacturing industry has developed from a significant growth engine. The manufacturing sector is the biggest contributor to economic growth in Indonesia. Still and all, its contribution has declined in the past years. Furthermore, Indonesia now faces a transformed global trading environment from its heyday; faced with fierce competition from free trade agreements with countries and regions around the world. The need for investment as triggering factor of manufacturing industry development has a very important role. In addition to investment, an increase in export could boost national economic growth. One of the key strategies to improve the economic fundamentals is to restructure and strengthen the country's export performance. This study aims to analyze the effect of investment and export on manufacturing industry in Indonesia by using econometrics error correction model (ECM) and subsequently to analyze the impact both variables on manufacture sector of output and household income by using an Input Output model. This study uses secondary data from BPS, such as investment, export, manufacturing GDP in the period $Q_1$2004–$Q_1$2018 and Input Output Table Indonesia 2010. The findings of the study suggest that export influence GDP positively and significantly. While investment has positive effect and yet insignificant. The changes of investment and export lead to enhance output and household income enjoyed the most by chemicals and refined petroleum products sectors.

Keywords: manufacturing industry, investment, export, error correction model, input output analysis

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Received: 7 August 2018
Accepted: 15 September 2018
Published: 22 October 2018

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the ICE-BEES 2018 Conference Committee.

1. Introduction

Manufacturing industry plays a strategic role in development economy in Indonesia. This industry plays a role in job creation which is quite significant although still lower than absorption manpower on agriculture, forestry and fishing sector. This sector also

able to provide foreign exchange from export activities through labor-intensive industries, capital- intensive, to the needs of knowledge and technology-high based.

National economic growth has strongly linked to the contribution of manufacturing. This industry becomes a prime mover for the Indonesian economy. In 2013, the contribution of manufacturing industry was 21.03 percent; increased to 21.08 percent in 2014; 20.99 percent in 2015; 20.51 percent in 2016; and 20.16 percent in 2017. The growth rate of manufacturing in 2017 accelerated to 4.27 percent compared to 4.26 percent in 2016 [1].

Since 1960, the development of manufacturing industry has continued to increase with an average of 7.42 percent. The dynamics of the industrial sector generally moves in line with economic growth. This is also in line with the increase of the manufacturing industry's contribution to GDP in 1960-2004, with the highest value in 2004, the role of manufacturing industry reached 24.23 percent. After 2004, the contribution of the manufacturing industry continued to decline. According to Winardi et al [2], the decline in the performance of manufacturing industry is caused by four main problems, which are: (1) low national industrial competitiveness; (2) the national industrial structure is not strong and deep; (3) still concentrated industrial activities in Java; and (4) limited industrial infrastructure in the form of industrial estate.

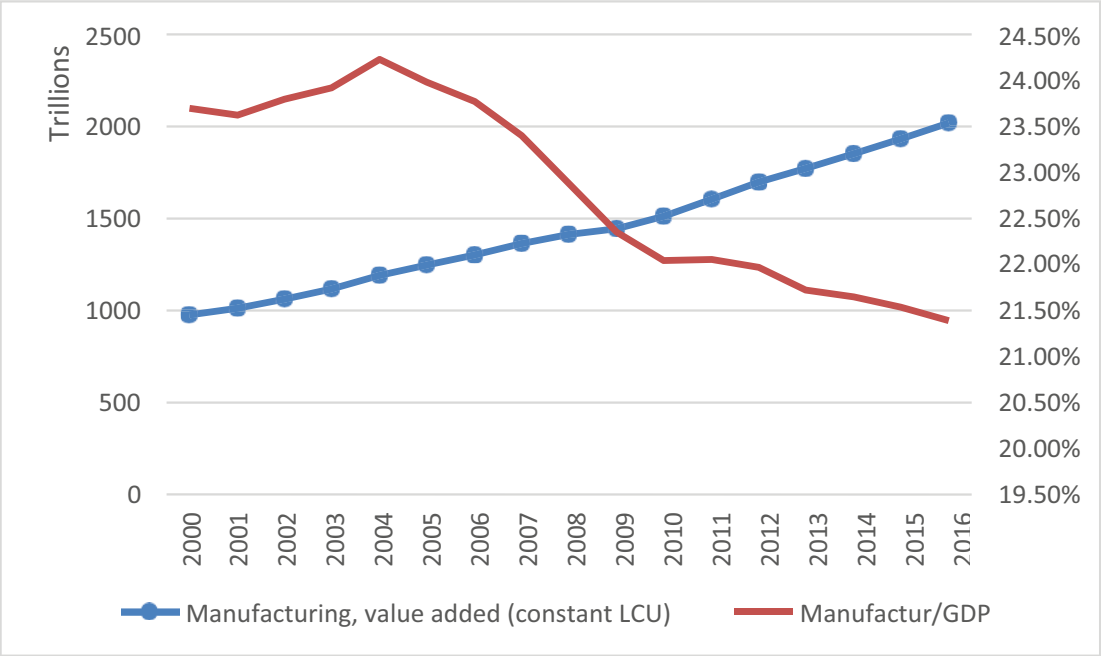

Figure 1: The development of manufacturing industry. Source: [3].

Manufacturing industry plays a dominant role over other sectors of the total export in Indonesia. Only export of manufacturing industry sectors experienced positive

growth in 2016. Export of manufacturing industry sectors also has the largest contribution (76.11 percent) with a value of US$ 110.50 billion of total exports [4]. The export value of manufacturing in Indonesia in Q_1 2004 – Q_1 2018 on average continue to increase by 2.38 percent.

The decline of export value can be seen throughout 2011, 2012 and 2015 due to the depreciation of rupiah and the uncertainty of foreign exchange rates (FED) determination and the impact of the global economic crisis, resulting in falling world commodity prices [5]. Even the export value in each sector always decline after 2011, also coupled by the deficit of trade balance in 2012-2014. This is caused by the global economic condition, the economic conditions of export destination countries and the rupiah exchange rate.

As for the flow if investment in the manufacturing industry actually experienced a high growth with an average value that reached 51.71 percent, with the lowest decline that is in Q_2 2004 reached to 85 percent. Overall manufacturing industry became the main objective of Foreign Direct Investment inflows, relatively stable with the size of about one third of the total. This is similar to Domestic Investment; manufacturing industry has a composition of 43 percent in the last 10 years [6].

In Q_4 2017 there were 4.898 Domestic Investment Projects (DIP) realizations with an investment value of Rp 67.65 trillion. This investment was dominated by the manufacturing sector (38.70 percent). Meanwhile, in the same period Foreign Investment Projects (FIP) realizations were 13.877 projects with an investment value of 8.36 billion US$. This investment totally dominated by the manufacturing sector (31.90 percent) [7].

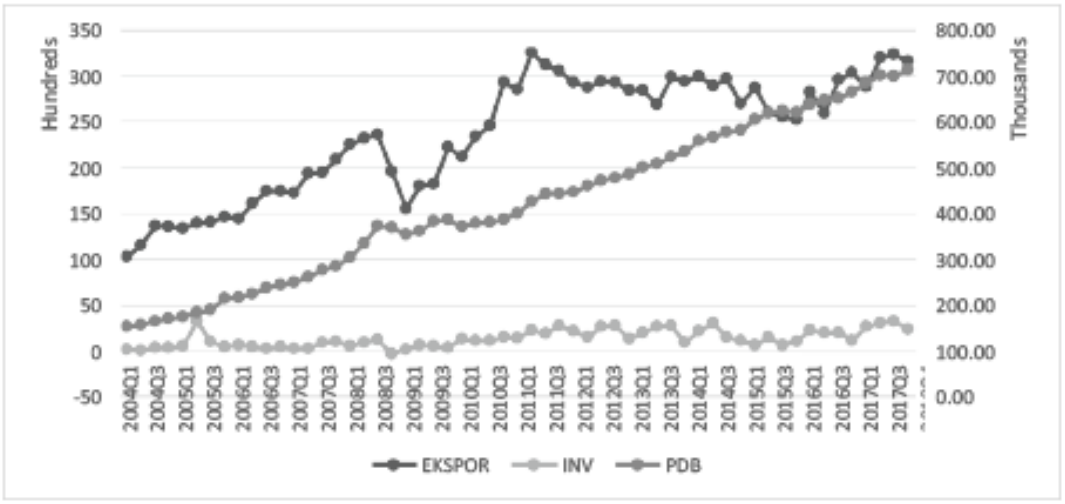

Figure 2: The development of export, investment and GDP of manufacturing sector in Indonesia. Source: [6, 8].

Based on the issues above, this research attempts to analyze the effect of investment and export on manufacturing industry – which is measured by the GDP of manufacturing industry – in Indonesia by using an econometrics error correction model (ECM), a theoretical approach that used to estimate the short-run and long-term effects of a time series variable with another time series variables. Subsequently, the study analyzes the impact of both investment and export changes on manufacture sector of output and household income by using an Input Output model. The advantage of this Input-Output model is its ability to estimate direct and indirect impacts within inter-sectoral linkages framework comprehensively.

This study is expected to contribute to the existing literature on the effect of investment and export on manufacturing industry in Indonesia both short and long term and the impact of both investment and export changes on manufacture sector within inter-sectoral linkages framework.

2. Literature Review

[9] revealed that there is long-term relationship between foreign direct investment with GDP and export volume with GDP using data for the period 2000-2010 from 15 countries making direct investment in Turkey.

[10] suggested that there is significant long-run relationship between investment and economic growth in Romania, but export and growth was statistically insignificant.

[11] suggested that there are positively significant relationship between economic growth, export growth export instability and gross fixed capital formation (investement) in India during the period 1971-2005.

[12] examined the correlation between export, investment, economic growth of manufacturing industry in 22 developing countries in the 1998-2006 period and suggests that high-tech manufacturing industry export and investment have a positive and significant effect on growth.

[13] suggested that foreign direct investment inflows has contributed to GDP of the Ten Southeast Asian member nations which together constitute ASEAN by using data from 1980 until 2015.

[14] suggested that foreign direct investment has a significant positive effect on economic growth using ECM. On the basis of the analysis, it is suggested that to enhance the role of FDI in Indonesia's economic growth, the government should encourage the participation of foreign-owned enterprises (FOEs) in export-oriented industries and encourage the use of domestic inputs.

[15] indicated that form 1995 to 2000, the manufacturing industry expanded the share of production, strengthened export orientation, and lowered import dependency. However, these phenomena appear to have resulted primarily from slump in growth factors other than export demand as well as sharp declines in the value of rupiah. This study shows that the current decrease of investment is a bottleneck in industrialization and indicates an urgent need for Indonesia to improve the investment environment, particularly for foreign investors.

And [16] investigated the relationship between domestic investment and economic growth in Malaysia using data for the period between 1960 and 2015 and reveal that there is a positive effect of domestic investment and export on economic growth in the long run term, however there is no relationship between domestic investment and economic growth in the short run term.

3. Methodology

3.1. The effect of investment and export on economic growth: Error correction model (ECM) approach

It is possible to have evidence of long-run causality, but not short-run causality and vice-versa. Cointegration further indicates that causality exists between the series of identified variables but it fails to reveal the direction of the casual relationship. In the case of multivariate causality tests, the testing of long-run causality between two variables is problematic as it is not possible to determine which explanatory variable is causing the causality through the error correction term.

[17] suggest that if cointegration exists between two variables in the long-run, then, there must be either uni- or bi-directional Granger-causality between these variables. Engle and Granger illustrate that the cointegrating variables be represented by the error correction mechanism representation described earlier. In other words, according to Granger, if there is evidence of cointegration between two or more variables, then a valid error correction should exist between the two variables. ECM is a useful theoretical approach to estimate the short- run and long-term effects of a time series variable with other time series variables.

We start from the short-term regression, if Y_t and X_t integrate in first order and cointegrated, then a simple OLS estimation equation is:

$$Y_t = \beta_0 + \beta_1 X_t + u_t$$

Now let's write the general dynamic relationship between y and x:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \alpha_1 y_{t-1} + u_t$$

If Y_t and X_t are cointegrated and individual I(1) variable with cointegrated vector (1, $-\beta_0$,$-\beta_1$), the general form of ECM can be expressed as:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \alpha_1 (Y_{t-1} - -\beta_0 - -\beta_1 X_{t-1}) + v_t$$

Or can be written as:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \alpha_1 u_{t-1} + v_t$$

Where $\Delta X_t = X_t - X_{t-1}$ and u_{t-1} error correction variable of previous period. This is the characteristic specification of "error correction", where changes in one variable are related to changes in other variables, as well as the gap between the variables in the previous period.

The application of this approach in this study through the cointegration test stage of both independent and dependent variables and through unit root test on the long term equation residuals on the three research variables. Cointegration test is done by using the Engle- Granger (EG) and Augment Engle-Granger (ARG) test [18]. If each variable is integrated, then the ECM form in this study is:

$$\Delta PDB_t = \beta_0 + \beta_1 \Delta INV_t + \beta_1 \Delta EXPORT_t + \alpha_1 u_{t-1} + v_t$$

Where PDB_t is the rate of GDP at period t in billion rupiah, INV_t is the investment flow in million US$ and $EXPORT_t$ is the export value in period t in thousand US$, v_t is the error term white noise and u_{t-1} is the lag value of the correction error term from previous period. Period of data used is quarterly data since Q1-2004 until Q1-2018, data used sourced from Bank of Indonesia and Statistics Ministry of Trade.

3.2. The impact of investment and export changes on national and sectoral output: Input-output analysis approach

The following description is fundamental information in Input Output (IO) analysis which is described by [19]:

> *"The fundamental information used in IO analysis concerns the flows of products from each industrial sector, considered as a producer, to each of the sectors, itself and others, considered as consumers. The basic information from which an IO model is developed is contained in an interindustry transactions table."*

[20] explained that IO analysis is an economic tool that determines the connection between industrial sectors in the economy. They also mentioned that IO tables describe the inputs of commodity that are employed by each industrial sector to generate its output, the commodities made by each industrial sector, and the utilization of commodities by final consumers.

The Input-Output analysis in this study is used to stimulate how much the output on manufacture sector changes as a result of changes in investment and export in manufacturing industry sector.

The shock used is coefficient from the development of the short-run ECM empirical equation simulation and the value of each variable in the last year (Q1-2018). GDP changes in manufacturing industry that are affected by changes in investment and export of manufacturing industry are used as basis of determining how much sectoral output changes.

To estimate investment and export changes in manufacturing industry on sectoral output, following equation describes this model [21]:

$$\Delta X = (1 - A) - 1\Delta Y$$

Where ΔX, *(1-A)-1* and ΔY are matrices of output changes of sectors, Leontief inverse and final demand (including investment and export) of sectors, respectively.

To estimate the changes on sectoral household income, calculated by following equation [21]:

$$\Delta H = H_R(1 - A) - 1\Delta Y$$

Where ΔH and H_R are matrices of output changes of sectors and household income coefficient of sectors, respectively.

Secondary data from the Central Bureau of Statistics (BPS) Indonesia is used in this research. This data is in form of Input-Output Table Indonesia 2010 based on domestic transaction of basic producer price because it is the latest data available [22].

4. Results and Discussion

4.1. Error correction model (ECM) analysis

4.1.1. Unit root test and Johansen cointegration test result

The result of the stationary test of Augmented Dickey–Fuller (ADF), Phillips–Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) can be seen in Table 1. The result of unit

root test stated that with ADF approach, each variable states not stationer with different probability levels, except in the investment variable receiving the hypothesis at 1 percent significance on the PP and KPSS method. Then applied the root unit test on the first difference orde which states each variable has stationer at 1 percent significance level on each test method.

Table 1: Unit Root Test.

Variable		Level			First Difference	
	ADF	PP	KPSS	ADF	PP	KPSS
PDB	0.399909	0.719041	0.918634	-3713576***	-8531483***	0.145036***
EXPORT	-1782575	-1769980	0.801928	-8979091***	-8979091***	0.110145***
INV	-1774142	-3502303**	0.719576***	-9113595***	-1765497***	0.337188
** donate significance level 5%						
*** donate significance level 1%						

The Johansen Cointegration Test was applied in this study because the maximum likelihood framework involved is known to have superior statistical properties to the traditional Engle and Granger approach based on residual level. The result of the Johansen Cointegration Test showed that the null hypothesis of no cointegrating relationship versus the alternative of one that there is cointegrating relationship is rejected at the 5 percent level of significance, and it is concluded that there is a single cointegrating vector (see Table 2).

Table 2: Johansen Cointegration Test Result.

Hypothesized No. CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None*	0.316754	44.38002	35.19275	0.0039
At most 1*	0.289381	23.43054	20.26184	0.0177
At most 2*	0.080928	4.641475	9.164546	0.3250
1. Model test for cointegration between real GDP, investment and export of manufacturing sector.				
2. CE(s) means cointegration equation(s).				

4.1.2. Regression result for the relationship between export, investment and economic growth in manufacturing industry

Table 3 shows the regression results for long-run equilibrium relationship between investment, export and GDP in manufacturing industry. The export coefficient is significant, showing that export has a positive long-term effect on GDP [as suggested by 11,23], while investment shows has positive effect long term yet insignificant [as suggested by 24-25].

Table 3: The long-run relationship between investment, export and GDP in manufacturing industry.

Variable	Result
Constanta	-103637.3**
	(-2155336)
INV	0.297139
	(0.017395)
EXPORT	2.221250***
	(8.823193)
R2	0.734550
Adj R2	0.724718
F	7.471393
DW Statistic	0.210171
JB Test	0.866568
ARCH LM Test	0.0000
** donate significance level 5%	
*** donate significance level 1%	

OLS regression output results:

$$PDB = -103637.293783 + 0.297139009586 * INV + 22.212500645 * \text{EXPORT}$$

In the long term, the manufacturing investment variables has an effect of 0.29 percent, which means if manufacturing investment grows by 1 million USD will affect the increase in manufacturing GDP by 0.29 percent. While the manufacturing export has an effect of 22.21 percent, meaning that if the growth of manufacturing export grew by 1 thousand USD will affect the increase in manufacturing GDP by 22.21 percent.

As Table 4 shows the ECM model results. The coefficient u_{t-1} in the model is significant, implying that investment and export jointly give an effect in short-term on GDP. The coefficient u_{t-1} is also called the 'speed of adjustment coefficient', measuring the short-run deviation of economic growth from the long-run equilibrium level. From the ECM estimation result, shows the same effects as the long-run model, that export has a positive and significant effect on GDP, while investment shows positive and yet insignificant.

ECM regression output result:

$$\text{D(PDB)} = 9278.90515513 + 0.191138352233 * D(\text{INV}) + 1.67544811202 * D(\text{EKSPOR}) - 0.0215621924274 * \text{RES\_OLS}(-1)$$

In the short term, the manufacturing investment variable has an effect of 0.19 percent, which means manufacturing investment grows by 1 thousand USD will affect the

Table 4: The short-run relationship between investment, export and GDP in manufacturing industry (ECM).

Variable	Result
Constanta	9278.905***
	7.436121
INV	0.191138
	0.130828
EXPORT	1.675448**
	2.499846
Ut-1	-0.021562
	-1.478686
R2	0.127845
Adj R2	0.077529
F	0.0066374
DW Statistic	1.577115
JB Test	0.486738
ARCH LM Test	0.2822
** donate significance level 5%	
*** donate significance level 1%	

increase in manufacturing GDP by 0.19 percent. While the manufacturing export has an effect of 1.67 percent, meaning that if the growth of manufacturing export grew by 1 million USD will affect the increase in manufacturing GDP by 1.67 percent.

4.2. Input-output analysis

The first step is to define the data of this study. Adjusted and aggregated IO table of Indonesia 2010 is used as data. The second step is to describe the main manufacturing industry sectors used in this study (3rd – 26th sectors) (see Table 5). The next step is to conduct the calculation in order to know the impacts of modification of final demand on output sectoral. The scenarios of final demand modification used in this study are described in Table 6.

From the simulation results in Table 7, it is seen that chemicals, flour milling industry and refined petroleum products sectors are the highest three that have the greatest output impact. This means that if there is an increase in investment or exports in manufacturing sectors then

the most affected on output are those three sectors. And the 4th rank until 10th are paper, paper products and cardboard sector; other food industry sector; machine, electrical machinery and apparatus sector; yarn spinning sector; basic iron and steel

Table 5: Input-Output 40 Sectors Classification.

Code	Definition
1	Agriculture, Forestry and Fishing
2	Mining and Quarrying
3	Food Processing and Preserving Industry
4	Vegetable and Animal Oils and Fats
5	Rice Milling Industry
6	Flour Milling Industry
7	Sugar Factory
8	Other Food Industry
9	Beverages
10	Tobacco Products
11	Yarn Spinning
12	Textile, Wearing Apparel and Leather
13	Bamboo, Wood and Rattan Products
14	Paper, Paper Products and Cardboard
15	Fertilizer and Pesticide
16	Chemicals
17	Refined Petroleum Products
18	Rubber and Plastic Products
19	Other Non-Metallic Mineral Products
20	Cement
21	Basic Iron and Steel
22	Nonferrous Basic Metal
23	Fabricated Metal Products
24	Machine, Electrical Machinery and Apparatus
25	Transport Equipment and its repair
26	Other Products not elsewhere classified
27	Electricity and Gas
28	Water Supply, Sewerage, Waste Management and Remediation Activities
29	Construction
30	Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles
31	Transportation and Storage
32	Accommodation and Food Service Activities
33	Information and Communication
34	Financial and Insurance Activities
35	Real Estate Activities
36	Business Activities
37	Public Administration and Defense; Compulsory Social Security
38	Education
39	Human Health and Social Work Activities
40	Other Services Activities

Table 6: The shock scenario.

Explanation	Value
Manufacturing growth by 1 Thousand USD investment increase (percent)	0.19
Investment in Q1 2018 (Thousand USD)	2389.11
Manufacturing growth by 1 Million USD export increase (percent)	1.67
Export in Q1 2018 (Million USD)	31451.5

sector; vegetable and animal oils and fats sector; and rubber and plastic products sector, respectively.

Table 7: Ten sectors that have the greatest impact on output due to investment and export changes.

No.	Sector Code	Sector	Impact due to investment changes (Million US$)	Impact due to export changes (Million US$)
1.	16	Chemicals	938.6484461	108315.6791
2.	6	Flour Milling Industry	817.2585151	94307.84384
3.	17	Refined Petroleum Products	738.1294822	85176.72029
4.	14	Paper, Paper Products and Cardboard	703.5441471	81185.73296
5.	8	Other Food Industry	677.4903374	78179.24411
6.	24	Machine, Electrical Machinery and Apparatus	669.5762727	77265.99772
7.	11	Yarn Spinning	668.5319894	77145.49228
8.	21	Basic Iron and Steel	649.6165555	74962.73888
9.	4	Vegetable and Animal Oils and Fats	623.8197150	71985.90309
10.	18	Rubber and Plastic Products	605.4591579	69867.17993

In Table 8, it can be seen that the highest three sectors which have the greatest impact on household income are chemicals sector, transport equipment and its repair sector and tobacco products sector. This means that if there is an increase in investment or exports in manufacturing sectors then the most affected on household income are those three sectors. These high-impact sectors also have higher household income coefficients than other sectors, indicating that these sectors are relatively more labor-intensive than other sectors. And the 4th rank until 10th are refined petroleum products sector; beverages sector; cement sector; textile, wearing apparel and leather sector; paper and paper products and cardboard sector; fertilizer and pesticide sector; and machine, electrical machinery and apparatus sector, respectively.

Table 8: Ten sectors that have the greatest impact on household income due to investment and export changes.

No.	Sector Code	Sector	Impact due to investment changes (Million US$)	Impact due to export changes (Million US$)
1.	16	Chemicals	107.9589320	12457.96026
2.	25	Transport Equipment and its repair	92.7273259	10700.30353
3.	10	Tobacco Products	91.5590563	10565.49063
4.	17	Refined Petroleum Products	89.5038167	10328.32551
5.	9	Beverages	85.2860557	9841.61544
6.	20	Cement	81.7779391	9436.79505
7.	12	Textile, Wearing Apparel and Leather	79.4345384	9166.37747
8.	14	Paper, Paper Products and Cardboard	74.6590209	8615.30489
9.	15	Fertilizer and Pesticide	69.638157	8035.92047
10.	24	Machine, Electrical Machinery and Apparatus	67.0509004	7737.36306

5. Conclusion

In this research, the relationship between investment, export and GDP in manufacturing industry has been examined empirically. Based on stationery and cointegration test result suggests that each variable significantly stationer and cointegrated. Both the OLS and the error correction model (ECM) suggests that export influence GDP positively and significantly. While investment has positive effect and yet insignificant.

The direct and indirect impacts of changes in investment and export in manufacturing sectors on output sectoral enjoyed the most by chemicals, flour milling industry and refined petroleum products sectors. This means that if there is an increase in investment or exports in manufacturing sectors then the most affected on output are those three sectors.

While the direct and indirect impacts of changes in investment and export on household income sectoral enjoyed the most are by chemicals sector, transport equipment and its repair sector and tobacco products sector. This means that if there is an increase in investment or exports in manufacturing sectors then the most affected on household income are those three sectors.

We can see that chemicals sector and refined petroleum products sector are form manufacturing sector that included in ten lists of the highest rank both on output and household income impact. This means that both sectors have the highest multiplier

effect because the changes of investment and exports in manufacturing sectors on output and household income among other manufacturing sectors.

On the contrary, these sectors which enjoyed the most this positive impact are also the most vulnerable sectors when there is event of investment and export contraction that leads to a decrease in output and household income in those sectors.

It is necessary to point out the limitations of the regression analysis. In reality, there are many other variables (e.g., political stability, inflation and external economic effects) that influence the relationship between investment flow and economic growth. However, these variables have not been considered due to lack of data and the particular modelling approach adopted.

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