

# EXPORT, ECONOMIC GROWTH, AND EXCHANGE RATE: A DYNAMIC PANEL ANALYSIS

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**ABSTRACT:** *This study aims to analyze the relationship between net export value, national income (GDP), and the rupiah exchange rate against the dollar. The existence of a causal relationship between exports and economic growth indicates a relationship between net exports and future economic growth. The study uses panel data on 38 trading partner countries of Indonesia during the 2015 - 2018 period. This study will use the dynamic panel method, where a variable is not only determined by the variables at the same time, but also by the previous time. This method is characterized by the lag of the dependent variable which correlates with the residuals among the independent variables. The dynamic panel data regression method is not only to determine short-term effects, but also long-term effects. Based on the estimation results of the Arellano Bond Generalized Method of Moment (GMM), during the research period GDP had a significant positive effect on net exports, the exchange rate had a significant negative effect on net exports. Furthermore, the results of the short-term and long-term elasticity approaches, the short-term elasticity for GDP was 0.465 and long-term elasticity was 0.426. The short-term elasticity of the exchange rate was -24,940 and the long-term elasticity was -22,865. Exports had a positive effect on economic growth, and there was a feedback between the complexity of exports and economic growth.*

**Keywords:** Net exports, GDP, exchange rates

## INTRODUCTION

Indonesia is a country that adheres to an open economic system by trading with other countries through exports and imports. Exports not only generate foreign exchange but also show trade productivity [1]. One of the problems of international trade is the influence of the exchange rate, especially the rupiah against the US dollar. Net exports represent the difference between exports and imports.

The economic growth of a country is determined by the national income of a country. Net export is one of the calculations of national income through the expenditure approach. Alleyne and Lorde [2] conducted a study using the GDP per capita variable, the percentage of trade to GDP, the exchange rate. The results showed that GDP per capita had a positive effect on international trade, while the exchange rate had a negative effect on international trade.

Export and foreign trade activities will benefit and increase national income, which in turn will increase the amount of output and the rate of economic growth [3, 4, 5]. Export upgrading has a positive and significant effect on economic growth and the causality analysis shows the feedback effect causality between exports and economic growth [6, 7].

The indirect contribution provided by the export sector will encourage and enhance the development of investment from within and outside the country. In accordance with the macroeconomic theory which states that net exports can be used as a tool for economic growth (the engine of growth).

There is a causal relationship between exports and economic growth and net exports as a growth tool. This shows a relationship between net exports and future economic growth, considering that if net exports are positive then it will obtain an additional foreign exchange that can be used as an investment in the coming period. Conversely, if net exports are negative, it will reduce economic growth.

Economic growth is an increase in economic activity in generating income in a certain period. There is a relationship between last year's net exports and a country's income. This study will analyze the relationship between net exports and national income (GDP), the previous year's net exports and the exchange rate. The dependent variable lags as one of the regressors in the study, so this study will use dynamic panel data regression.

Dynamic panel data regression is a panel data regression method where the independent variable is the lag of the dependent variable. The dynamic panel data regression model in this study is estimated using the Arellano Bond first difference GMM method to obtain consistent and efficient estimates. The dynamic panel data regression method is not only to determine the short-run effect but also the long-run effect [3, 6].

Economic growth in the context of a country's economy is a measure of the achievement of that country's economy. Salvatore stated that international trade activities (export-import) can be an engine of growth. Therefore, an assessment of the relationship between net exports and economic growth, the exchange rate is very important. One of the drivers of economic growth is international trade.

## RESEARCH METHOD

### A. Type and Data Source

The type of data that will be used in this research is export, national income (GDP), buying exchange rate. The data used is secondary data which is quantitative data. Secondary data used is panel data or time-series data cross (cross-sectional and time series). This study uses time-series data for four years from the 2015-2018 period and the number of cross-sections of 38 Indonesian trade partner countries. The data source comes from the Indonesian Ministry of Trade and the World Bank for 2015 - 2018.

### B. Population and Sampling Techniques

The population in this study includes non-oil and gas export and import partner countries of Indonesia from 2015 - 2018. The sampling technique is by purposive sampling.

The criteria for selecting samples are as follows:

1. Indonesia's non-oil and gas export and import partner countries
2. Non-oil and gas export and import partner countries that have bilateral free trade agreements
3. Indonesia's non-oil and gas export and import partner countries that do not have bilateral free trade agreements

The limitations or definitions of the variables used in this study are as follows:

1. Trade volume is the amount of non-oil and gas exports and imports. The trade volume in this study is the number of exports and imports in million USD in 2015-2018. The data is obtained from Indonesian export and

- import statistics published by the Indonesian Ministry of Trade. The calculation will use the net export data in USD.
- GDP or Gross Domestic Product is a measure of a country's national income. GDP in this study is the real GDP of each country for the 2015-2018 periods in USD. Data obtained from World Bank publications.
  - The exchange rate in this study is the exchange rate of the rupiah against the dollar in the buying rate.

**C. Analysis Method**

**Dynamic Panel Data Regression**

Dynamic panel data regression is a panel data regression method where the independent variable is the lag of the dependent variable. The background is a fixed-effect model and random effect using variance-covariance residual structure. If there is a lag from the dependent variable as an independent variable, then there is a correlation between the dependent and residual variables. The method proposed by Arellano da Bond assumes there is a correlation between the dependent and residual variables [8, 9]. The dynamic panel method is characterized by a lag of the dependent variable which correlates with the residuals among the independent variables. This causes the OLS estimator to be biased and inconsistent. In the dynamic regression model, the lag of the dependent variable is included as one of the regressors. The dynamic panel data regression model in this study is estimated using the Arellano Bond first difference GMM method to obtain consistent and efficient estimates.

**Dynamic Panel Data Model**

$$y_{it} = \rho_i y_{it-1} + z_{it}\gamma + c_i + \mu_{it}$$

Where  $\mu_{it}$  is a residual with a mean equal to zero and a certain variant  $z_{it}$  is a matrix of exogenous variables set and  $y_{it}$  is predetermine (exogenous variable derived from endogenous variables. To overcome several models is proposed;

**AR Model (1)**

$$y_{it} = \rho_1 y_{it-1} + z_{it}\gamma + c_i + \mu_{it}$$

AR (1) model, if we assume exogenous variables ( $y_{it}$  and  $z_{it}$ ) are uncorrelated then OLS (fixed effect) or GLS (random effect) ([8]) can be used.

If the AR (1) model violates the assumption so that exogenous variables ( $y_{it}$  and  $z_{it}$ ) are correlated with  $\mu_{it}$ , then the AR (1) model is transformed by first difference and it can be solved with OLS and GLS estimators.

$$\Delta y_{it} = \rho_i \Delta y_{it} + \Delta z_{it}\gamma + \Delta \mu_{it}$$

**Arellano Bond Model**

$$y_{it} = \alpha_1 y_{it-1} + \dots + y_{it-p} \alpha_p + x_{it\beta_1} + z_{it}\beta_2 + c_i + \mu_{it}$$

$x_{it}$  = matrix forexogenous variable

$z_{it}$  = matrix for predetermine variable

$c_i$  = random effect

Arellano-Bond suggested  $\Delta y_{it-2}$  as the instrument of  $\Delta y_{it-1}$ . This procedure produces an efficient estimator.

**Dynamic Model Specification**

$$X_{it} = B_0 + \beta_1 GDP_{it} + \beta_2 KB_{it} + \delta X_{it-1} + \varepsilon_{it}$$

Explanation:

$X_{it}$  = Net export (USD)

GDP = Gross Domestic Bruto (USD)

KB = Exchange Rate (USD)

$X_{it-1}$  = Net export t-1(USD)

$B_0$  = Constanta

$\beta_i, \delta$  = Coefficient

$\varepsilon$  = residual

Estimation is done in natural log form and the advantage of the dynamic panel model is that we can find out the short-term and long-term effects. In the dynamic case, whether or not the long-term impact occurs. Analysis of the long-run impact of GDP on X. Dynamic panel data regression model, the coefficient  $\beta$  is the short-run effect of the change in X. While the long-run effect on the change in X. In the dynamic panel data regression model, the coefficient  $\beta$  is also the short-run effect of the change in X. While the long-

term effect on X is  $\frac{\beta}{1-\delta}$

This research begins with the selection of the best panel data estimation regression technique between the Common Effect Model, Fixed Effect Model, and the Random Effect Model using the Chow test and Hausman test. Furthermore, the classical assumption test is carried out. The classical assumption test must be fulfilled. In this study, the independent variables must be normally distributed. The GMM Arellano-Bond dynamic panel data regression estimation, the independent residual is the residual from the first difference on 2<sup>nd</sup> order should be no autocorrelation. Furthermore, the significance test of the parameters used to determine whether there is a relationship in the model.

**DISCUSSION**

**A. Estimation Results**

The results of the classical assumption test, the heteroscedasticity test obtained the Chi-Square count (4.228336) < Chi Square table (7.814728) at the 5% significance level. The hypothesis:

Ho: The model does not experience heteroscedasticity problems

Ha: The model has heteroscedasticity problems

So rejecting Ho, the model experienced heteroscedasticity problems in the equation.

The results of the autocorrelation test estimate obtained Chi Square count (63.20312) > Chi Square table (5.99) at the 5% significance level. The results of the autocorrelation problem test show that there was no autocorrelation problem in the equation.

Based on the regression technique selection, Fixed Effect Model was the best technique in this study. Furthermore, the estimation was done using GMM Arellano-Bond by using Eviews 10 as follows;

$$X_{it} = B_0 + \beta_1 GDP_{it} + \beta_2 KB_{it} + \delta X_{it-1} + \varepsilon_{it}$$

The estimation result can be seen on Table 1.

**Table 1. Estimation Results for Net Export, GDP and Exchange Rate**

Variable	Coefficient	Std. Error	t-Test	Prob.
C	247.6367	29.40770	8.420811	0.0000
LNGDP	0.464696	0.044588	10.42202	0.0000
LNKB	-24.94013	3.166922	7.875196	0.0000
LN(-1)	-0.090750	0.034007	2.668565	0.0088

R<sup>2</sup> Coefficient = 0.525726

The coefficient of determination R<sup>2</sup> = 0.5257, it means that the variation of the GDP, exchange rate, and net exports in year t-1 in explaining the variation of the net export

variable was 52.57% and the remaining 47.43% was explained by other factors that were not included in this study.

Based on the significance test of the GDP variable, the exchange rate obtained a probability value of 0.000 at a significance level of 5% and degree of freedom = 152. This indicated that GDP and the exchange rate had a significant effect on net exports. The significance test for the variable net exports in period t-1 obtained a value of 0.0088. This indicated that net exports in period t-1 had a significant effect on net exports. Data estimation was done by using natural logs. The coefficient obtained can explain the level of elasticity. When the coefficient <1, it means inelastic, the increase in net exports was smaller than the increase in GDP. The exchange rate elasticity coefficient <1 which means that it was inelastic with a negative sign, the increase in the exchange rate was greater than the decrease in net exports.

**Short and Long Term Effects**

The advantage of the dynamic panel model is that it can determine the short-run effect and the long-run effect. The elasticity results are obtained in Table 2.

**Table 2. Short term elasticity, long term elasticity.**

Variable	Prob.	Short-term elasticity	Long-term elasticity
C	0.0000		
LNGDP	0.0000	0.464696	0.426033
LNKB	0.0000	-24.94013	22.8655
LNK(-1)	0.0088		

After obtaining the model, the short-term and long-term elasticity can be found. The calculation result of the GDP elasticity coefficient was positive and the exchange rate elasticity coefficient was negative. It was appropriate that net exports can be used as a tool for economic growth (the engine of growth). The short-run elasticity of GDP was 0.464696. This explains that an increase in GDP of 1 percent will increase net exports in the short term by 0.46 percent. In the long run, 1 percent increase in GDP will increase net exports by 0.43 percent.

The exchange rate elasticity coefficient was negative and significant. This was consistent with the Mundell-Fleming theory which states that the exchange rate had a negative effect, so the higher the exchange rate, the lower the net exports. The short-term elasticity of the exchange rate was -24.94013. This explained that an increase in the exchange rate of 1 percent will reduce net exports in the short term by 24.65 percent. In the long run, a 1 percent increase in GDP will reduce net exports by 22.86 percent.

**B.** The regression results show that the GDP of each country had a positive and significant effect on net exports in Indonesia. These results prove that the larger the size of a country as assessed from GDP, the greater the amount of trade that was carried out. GDP was the net value of the final goods and services produced by various economic activities of a country. The increase of economic activity will increase the production of goods and services by the community.

Export companies as providers of goods and services will also experience an increase if economic growth increases. The increase in exports indicated that the demand for goods and services from abroad was greater than the demand for

goods from within the country. Countries that have high economic activities will import raw materials and capital goods in large quantities to support the production process in a country. Production activities in large numbers allow a country to have a large market share. An increase in output causes an increase in economic growth. The foreign trade of a country was determined by the request of the trading partner country depending on the income of the trading partner country.

The depreciation of the rupiah exchange rate against the dollar gave a positive effect. The depreciation in the rupiah exchange rate against foreign currencies (US \$) allows exporters to offer goods at lower prices, thereby increasing competitiveness abroad. The increased competitiveness will encourage an increase in export income. The rupiah exchange rate against the US \$ partially had a significant and negative effect on Indonesia's net exports. If the exchange rate depreciates, the price of exported goods abroad will be cheaper and the price of imported goods will become more expensive. So that exports were smaller than imports and net exports will experience a decline. Vice versa, the appreciation of the exchange rate will cause Indonesia's foreign trade to increase. So it can be concluded that exports have a significant negative effect on the exchange rate.

The elasticity approach to exchange rate determination (elasticity approach to exchange rate determination) that the exchange rate was determined by the balance between exports and imports. The exchange rate will depreciate if the value of exports was less than imports, and the exchange rate will appreciate if exports were greater than imports. This was consistent with the Mundell-Fleming theory which stated that the exchange rate had a negative effect, the higher the exchange rate the lower the net exports. The depreciation of the exchange rate had implications for purchasing power due to price hikes that cause a decline in economic growth.

The results showed that the exchange rate coefficient on net exports was significant and negative. GDP had a significant and positive effect on net exports. If GDP increases, net exports increase, and vice versa.

Theoretically, the exchange rate was determined by the supply and demand for US dollars in a country's trade. The country exports, the country will receive revenue in the form of US dollars, so that there were enough US dollars available, US dollars will be used to demand US dollars.

The result of this research was that there was a negative relationship between the exchange rate and net exports. An export surplus can increase the availability of US dollars, but in Indonesia, it strengthens the exchange rate of US dollars against the rupiah. Indonesia, especially the industrial sector, still relies on capital goods, raw materials and imported materials in an effort to boost exports so that the demand for US dollars was high. Export upgrading had a positive effect on economic growth, and there was feedback between the complexity of exports and economic growth.

### I. Implication and Suggestion

Exports are an important part of international trade. The strategy taken is to change the industrialization strategy from an import substitution industry to an export promotion industry. It is expected that the strategy will enable exports to encourage economic growth. The ability to produce export goods still uses capital goods, raw materials, and materials imported from abroad so that exportability is influenced by import needs. This affects the contribution of exports to economic growth. For this reason, it is necessary to make efforts to import substitution for goods that can be produced domestically.

On the other hand, international trade is influenced by the endowment factor of each country. Indonesia is a country that has a large enough workforce so that the exported commodities are labor-intensive industrial products. Indonesia's export performance is influenced by the GDP of each partner country. Indonesia is an exporting country therefore Indonesia needs to know the commodity needs of the trading destination country. To increase the competitiveness of Indonesian commodities in international trade, it is necessary to improve the quality of export goods.

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