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An application of the GMM model on economic growth in Indonesia

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Abstract

This study empirically examines the effects of money supply, exports, and interest rates on economic growth in Indonesia via a Generalized Method of Moment (GMM) model. As a result, the use of Instrumental Variables (IV) is valid for the model and that all variables have a significant effect, with a one percent significance level. Money supply and exports have a positive effect on economic growth and interest rates have a negative effect on economic growth. In conclusion, the implementation of an effective monetary policy, one that uses interest rates well, is necessary to maintain the stability of the money supply.

Keywords: Money, Supply, Export, Rate, Growth.

Una aplicación del modelo GMM sobre el crecimiento económico en Indonesia

Resumen

Este estudio examina empíricamente los efectos de la oferta monetaria, las exportaciones y las tasas de interés sobre el crecimiento

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económico en Indonesia a través de un modelo de Método Generalizado de Momento (GMM). Como resultado, el uso de variables instrumentales (IV) es válido para el modelo y que todas las variables tienen un efecto significativo, con un nivel de significancia de uno por ciento. La oferta monetaria y las exportaciones tienen un efecto positivo en el crecimiento económico y las tasas de interés tienen un efecto negativo en el crecimiento económico. En conclusión, la implementación de una política monetaria efectiva, una que utilice bien las tasas de interés, es necesaria para mantener la estabilidad de la oferta monetaria.

Palabras clave: dinero, oferta, exportación, tasa, crecimiento.

1. INTRODUCTION

The financial sector and exports are areas identified as the main boosters of economic growth in a country. The better economic growth in a country, the better the economic performance of this country will be (GOKMENOGLU ET AL., 2015). Facing the challenges associated with economic performance in a country naturally requires money. Aggregate behavior in terms of money in an economy determines the development of that economy's fundamental macroeconomic factors, such as foreign exchange reserves, economic growth, and inflation. Therefore, the money supply takes on an important role as an analytical tool in making policy in order to create a strong economy (NAGAHISARCHOGHAEI ET AL., 2018). The activity of an economy is slow or even constant if the money supply is insufficient, and if there is a surplus of money, the economic balance would be disrupted, for example, in the production of goods and services.

The importance of the role of the money supply has drawn the attention of many researchers in several countries, such as GOKMENOGLU ET AL. (2015) ADENIYI ET AL. (2015), JEDIDIA ET AL. (2014), ASLAM (2016), CHUDE & PATRICIA (2016), ANWAR & SUN (2011). These researchers have conducted similar research on the influence of financial development, focusing on the effect of the money supply on a country's economic growth. Financial development increases economic growth directly and indirectly through its effects on domestic capital accumulation and productivity.

The government regulates the money supply by controlling interest rates. ETALE & AYUNKU (2016) claimed that the interest rate is inversely proportional to a country's economic growth. Economic activity is strongly influenced by money supply, thus increasing the interest rates, so when economic activity is lower, economic growth also decreases. On the other hand, if interest rates are lowered, the level of money circulation will increase and affect economic activities, and will, therefore, lead to economic growth. In contrast to the studies mentioned above, Lee & Werner found that interest rates have a positive relationship with economic growth. Interest rates follow the trend of a country's GDP. Income increases will increase the demand for real money balance, which will lead to increased interest rates. The increase in revenue shows a strong GDP. The interest rate is one of the main instruments of economic policy.

Various studies have shown that exports have a positive relationship with economic growth, such as research conducted by DRITSAKI (2013), HYE ET AL. (2013) AND CHANG ET AL. (2013). These studies found that exports created advantages for a country in terms of its population and employment, improvement of living standards, reducing inflation, boosting business energy, stimulating marketing development, and others. Increasing the volume of exports will improve economic growth in a country. If exports can create economic growth, then it is necessary for the country to expand their export activities. Thus exports have an important role in stimulating economic growth. However, not all studies show similar results. As expressed by Quaicoe, exports had a negative effect on economic growth. This negative effect was due to the exports of processed industrial products, which have a low value so that exporting products, even when in large amounts, will decrease a country's economic growth when the capital issued or the volume of imported goods is higher than that of exported goods.

In Indonesia, the money supply and the gross domestic product (GDP) increased from the year 2005 to 2017. Exports experienced fluctuation from the year 2005 to 2017. Within this period, the value of exports was highest in 2011. The highest-value export sector is manufacturing, specifically, textile products. In this period, the interest rate fluctuated as well, with the lowest interest rates in general in the year 2017.

Based on the background described above, the authors are interested in conducting research on the influence of money supply, interest rates, and exports on economic growth in Indonesia. This study is very important for the small open economy such as Indonesia to achieve higher economic growth by controlling domestic variables and to prevent a relatively big fluctuation of export as an external factor.

2. METHODOLOGY

This research is focused on money supply, interest rates, and exports in Indonesia. Quarterly data from 2005 to 2017 were used. The variables examined were as follows: the amount of money in circulation (JUB), interest rates (SK), exports (EX), and variable gross domestic product (GDP) as a proxy for economic growth. The overall data were obtained from reports published by the Central Board of Statistics, the Bank Indonesia, and the World Bank (GHOSHAL, 2015).

This research method used the Generalized Method of Moment (GMM) approach. The GMM method produces unbiased, consistent, and efficient estimations. Theoretically stated that the Generalized Method of Moment (GMM) cannot be used when the number of instrumental variables is greater than the number of parameters analyzed.

According to INDRA (2009), there are several advantages to using GMM. First, the method is a common estimator, which provides a useful framework for comparison and assessment. Second, it allows researchers to perform the estimation in more detail in the long-term as well as the short-term, and to overcome violations of assumptions in regression analysis.

However, the GMM method also has some drawbacks. A GMM estimation is asymptotically efficient with large sample size, but less efficient if the sample size is limited (finite), and this sometimes requires estimators to implement software that supports the GMM approach (INDRA, 2009).

The test specification model used is the Sargan's Test, which tests an instrument's validity. Sargan's test is used to find out if estimated parameters were exceeded in instrumental variables (overidentifying restrictions). Sargan's test and the statistical hypothesis test are defined by the equations (1).

H_0: Overidentifying restrictions: the estimation model is valid

H_1: Overidentifying restrictions: the estimation model is invalid

$$S = \hat{v}'Z\left(\sum_{i=1}^{N} Z_i'\hat{v}_i\hat{v}_i'Z_i\right)^{-1}Z'\hat{v}\sim X^2_{L-(k+1)} \quad \text{.....(1)}$$

With:

$\hat{v}$ = Error from model estimation

The result H_o is rejected if the statistical value test results (S) are higher than in the table Chi-Square (X^2) p-value <α (INDRA, 2009).

Research using this GMM method has been conducted by many researchers in other countries, yet in Indonesia, it is rarely used. This method is used because it is potentially more powerful than the existing methods because it contains no errors in the variables.

For interest rates, the variable used was 1/SK, or the reciprocal as stated by (ETALE & AYUNKU, 2016). The reciprocal model equation can be written as follows:

$$Y_i = \beta_1 + \beta_2 \left[\frac{1}{X_i}\right] + \mu_i \quad \text{.....(2)}$$

In this model, the variable X is non-linear, because this variable is entered into the model in reverse or reciprocal. In this model β1 and β2 are linear. Therefore, this model is a linear regression model. This model has a few characteristics: If X increases to infinity, the value will be close to zero (Note: β2 is a constant number) and Y will be

close to the limit or asymptotic value. Therefore, this equation model has entered the asymptotic value or limit value to be taken by the dependent variable when the value of X is increased to infinity.

So the model used in this study can be described as follows:

$$GDP_t = \beta_0 + \beta_1 JUB_i + \beta_2 \left[\frac{1}{SK}\right]_t + \beta_3 EX_t + \epsilon_t \quad \text{.....(3)}$$

In the above equation, GDP is the gross domestic product, JUB is the money supply, 1/SK is interest rates, EX is the export, β_1, β_2, and β_3 are the estimated parameters, i is the coefficient, and t is the time series (SIMAMORA ET AL., 2019).

3. RESEARCH FINDINGS AND DISCUSSION

The instrumental variable test is used to see the connection between the instrumental variables and the variables used in the study, in order to see if the data fits with the hypothesis. Stock stated that a weak instrument can cause problems in the estimation of GMM. A weak instrument appears when the instrument in a weak Instrumental Variable (IV) regression is correlated with the endogenous variables. In the General Method of Moments (GMM), a weak instrument is related to other weak instruments from some or all unknown parameters. A weak identification tends to point to GMM statistics

with a non-normal distribution, even in large samples, so the conclusion could be a misleading GMM estimation.

Table 1. Instrument Test Result

Crag-Donald F-Stat	TSLS Critical Value (relative bias)		Critical values (size)	
	Percent	**Value**	**Percent**	**Value**
13.63534	5 %	11.04	10%	16.87
	10%	7.56	15%	9.93
	20%	5.57	20%	7.54
	30%	4.73	25%	6.28
SIC-based	-7566270			
HQIC-based	-5.187385			
Relevant MSC	54.28232			

Source: Output Eviews Result, 2018

This research uses six instrument ranks, i.e., variable interest rates (SK), inflation (IF), foreign exchange reserves (CD), investment (INV), imports (M), and constant (C) as a complementary instrument. The results of the test instrument are shown in Table 1, showing that the Cragg-Donald F-stat is 13.63534 and the Stock-Yogo value is 9.93, where a value of 15 percent means that the instrumental variables used

are in accordance with the existing theory, and have a significant effect.

The Endogeneity Variable test, the results of which are seen below in Table 2, shows that the difference in J-Stats has a value 8.213521, with a probability of 0.0165. Where the probability result is smaller than 0.05, this means that the money supply and exports are both endogenous variables. Research undertaken by COLACCHIO & DAVANZATI (2017) shows that the money supply is an endogenous variable. A description of money supply in an economy and a determination whether it is endogenous or exogenous is crucial to the proper formulation of macroeconomic policy and theory. The study stated that the policy of monetary authorities in major countries in the world assumes that money supply is an endogenous variable and interest rates are exogenous.

Table 2. Money Supply and Exports Endogeneity Test Result

Difference in J-Stats	Value	df	Probability
	8.213521	2	0.0165

J-statistic summary:

	Value
Restricted J-statistic	8.621283
Unrestricted J-Statistic	0.407762

Source: Eview Output Result, 2018

The estimation result test of GMM is shown in Table 3. In the GMM model, R-square is not used as a statistical standard for

determining whether or not the model is good; rather, the J-value statistic (J-Stat) is used to assess the validity of the Instrumental Variables (IV) used in the model. By using the rank of 6 for the instrument or IV, the value of the J-prob is 0.845262, greater than 0.05, showing that the use of the GMM model is valid.

Table 3. GMM Estimation Result

Variable	Coefficient	T-Stat	Prob
Constanta	-61.19188	-2.707602	0.0094
JUB	2.575438	9.446374	0.0000
EX	0.093433	4.157056	0.0001
1/SK	-64.50031	-3.986811	0.0002
Instrument Rank	6		
Prob J-Stat	0.845262		

Source: Eview Output Result, 2018

Based on the test results in Table 3, the money supply has a positive and significant effect, with a significance level of one percent, on economic growth. This means that when the money supply increases by one billion dollars, economic growth will increase by 2.575438 percent and vice versa. The results fit with research conducted by ASLAM (2016), who conclude that the money supply has a positive relationship with economic growth. This test means that when money supply increases, so do economic growth, because money supply improves economic activity in the community and results in good output and increases in earned income. These increases in earned income will boost economic growth in Indonesia.

Exports have a positive and significant effect on economic growth, with a significance level of one percent. This means that when exports increase one thousand USD, economic growth will increase by 0.093433 percent and vice versa. Studies that support these research results have been conducted by DRITSAKI (2013) HYE, ET AL. (2013) AND CHANG ET AL. (2013). A country's exports will boost foreign exchange reserves and increase government tax revenue. Foreign exchange reserves can be used to pay government debts and taxes are used for public spending, including repairing roads, building bridges, opening jobs, and other activities to help economies and also increase incomes and reduce unemployment. n the end, these activities will boost economic growth in Indonesia.

Interest rates have a negative and significant effect on economic growth, with a significance level of one percent. When interest rates rise one percent, economic growth will be reduced by 64.50031 percent. These results are in line with research by ETALE AND AYUNKU (2016), who stated that interest rates have a negative effect on economic growth. According to the liquidity preference theory, interest rates continually adjust themselves in order to balance the money supply with money demand. If interest rates are at another level, society will seek to adjust their portfolio assets and consequently boost interest rates to a balanced level.

When the money supply is increased, Bank Indonesia controls the supply by raising interest rates. The community will respond by buying securities, which offer interest, or by saving money to earn interest. Economists will lower their investment activity because the interest rate is higher.Lower investment means economic activity will be reduced, which can cause an economic downturn. Of course, this will have an impact on the economy in Indonesia. Investment declines, product manufacturing decreases; revenues fall, and so does economic growth.

As confirmed by research from KIM AND SHI (2018), China took a similar approach, responding to an increasing money supply by raising interest rates. The determinants of interest rates are inflation and money growth. When money growth increases, certainly inflation will increase, and the government will respond by raising interest rates to attract money circulation in the market.

4. CONCLUSION

Based on the results of this study, it can be concluded from the endogenous variable test results that the money supply and exports are endogenous variables. The test results of six instrumental variables, interest rate, inflation, foreign exchange

reserves, imports, and investment, show that the instrumental variables are valid. The GMM test results show that the money supply has a significant and positive effect, exports have a significant and positive effect, and interest rates have a significant and negative effect on economic growth in Indonesia. Thus, the implementation of an effective monetary policy, one that uses interest rates well, is necessary to maintain the stability of the money supply. It is recommended that the government avoid issuing new money, which will eliminate the function and role of interest rates as an economic controller.

The limitations of the study are excluding the important variables such as capital stocks, labor force, and technological achievement. The gross capital formation can be used as a proxy for capital stock, and the data are available. However, the labor force is only available in quarterly data, meanwhile the data of technology achievement are not available at all. For further research, it is suggested to include capital stock data, hence the growth model become more comprehensive.

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