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RESEARCH ARTICLE OPEN ACCESS

ASSESSING HOW ENERGY TRADE SHAPES INDONESIA'S FOREIGN EXCHANGE RESERVES

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Abstract: Foreign exchange reserves are the guardians of macroeconomic stability and the country's financial system in supporting Indonesia's economic recovery. This research aims to examine the impact of rising Oil and Gas Exports (Export MIGAS) and Non-Oil and Gas Imports (Import Non-MIGAS) on Indonesia's foreign exchange reserves, as well as the prospects for these variables in the future. This study uses data from 2006-2021 obtained from the Badan Pusat Statistik (BPS). This study uses an analysis using the Ordinary Least Square (OLS) Model, and the Error Correction Model (ECM) method through the Augmented Dickey-Fuller test. Tests include stationarity, cointegration, Adjusted R-squared, t-test, and f-test. This study applies a research method that focuses on analyzing Indonesia's gas export and non-oil import data over the past 16 years as part of an evaluation of the country's foreign exchange reserves. The results of the study state that Export MIGAS and Non-Oil and Gas Imports (Import Non-MIGAS) have no influence on Indonesia's foreign exchange reserves in the short term, while in the long term, Export MIGAS have a negative influence on foreign exchange reserves and Import Non-MIGAS) have a positive influence on Indonesia's foreign exchange reserves.
Keywords: Exports, Imports, Indonesia's Foreign Exchange Reserves

Abstrak: Cadangan devisa merupakan penjaga stabilitas makroekonomi dan sistem keuangan negara dalam mendukung pemulihan ekonomi Indonesia. Penelitian ini bertujuan untuk menguji dampak kenaikan Ekspor Minyak dan Gas Bumi (Ekspor MIGAS) dan Impor Non-Migas (Impor Non-MIGAS) terhadap cadangan devisa Indonesia, serta prospek dari variabel-variabel tersebut di masa mendatang. Penelitian ini menggunakan data dari tahun 2006-2021 yang diperoleh dari Badan Pusat Statistik (BPS). Penelitian ini menggunakan analisis dengan menggunakan Model Ordinary Least Square (OLS), dan metode Error Correction Model (ECM) melalui uji Augmented Dickey-Fuller. Pengujian meliputi stasioneritas, kointegrasi, Adjusted R-squared, uji-t, dan uji-f. Penelitian ini menerapkan metode penelitian yang

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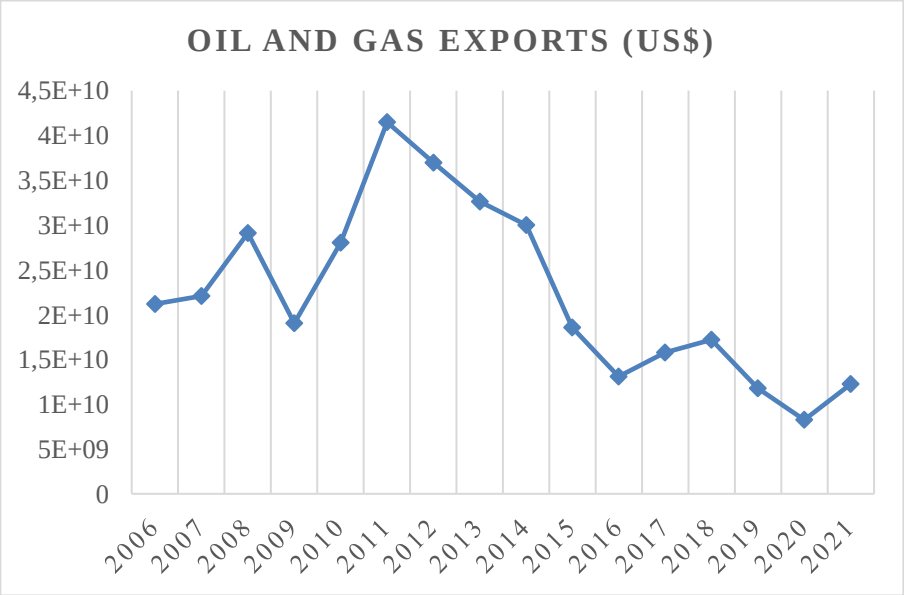
berfokus pada analisis data ekspor gas dan impor non-minyak Indonesia selama 16 tahun terakhir sebagai bagian dari evaluasi cadangan devisa negara. Hasil dari penelitian tersebut menyatakan bahwa Ekspor MIGAS dan Impor Non-Migas (Impor Non-MIGAS) tidak memiliki pengaruh terhadap cadangan devisa Indonesia dalam jangka pendek, sedangkan dalam jangka panjang, Ekspor MIGAS memiliki pengaruh negatif terhadap cadangan devisa dan Impor Non-MIGAS memiliki pengaruh positif terhadap cadangan devisa Indonesia.
Kata Kunci: Ekspor, Impor, Cadangan Devisa Indonesia

INTRODUCTION

Post-pandemic economic recovery, one of the main indicators to increase foreign exchange reserves and resilience of Indonesia's external sector, the government focuses on the government system and policymaking in Indonesia. Through initiatives such as import substitution plans, countries are considering lowering their imports to promote locally produced goods (Okyere, 2020). The law on import exports in Indonesia has been explained in the Regulation of the Minister of Trade of the Republic of Indonesia Number 17 of 2021 concerning Exporters and Importers (Republik, Nomor and Indonesia, 2021). To reduce forecasting and policy errors, modelers need a stable import request function (Arize and Malindretos, 2012). It is sometimes considered that the absence of certain variables of the import demand function leads to instability.



Source: Badan Pusat Statistik (2023)

Chart 1. Expansion of Indonesian Oil and Gas Export

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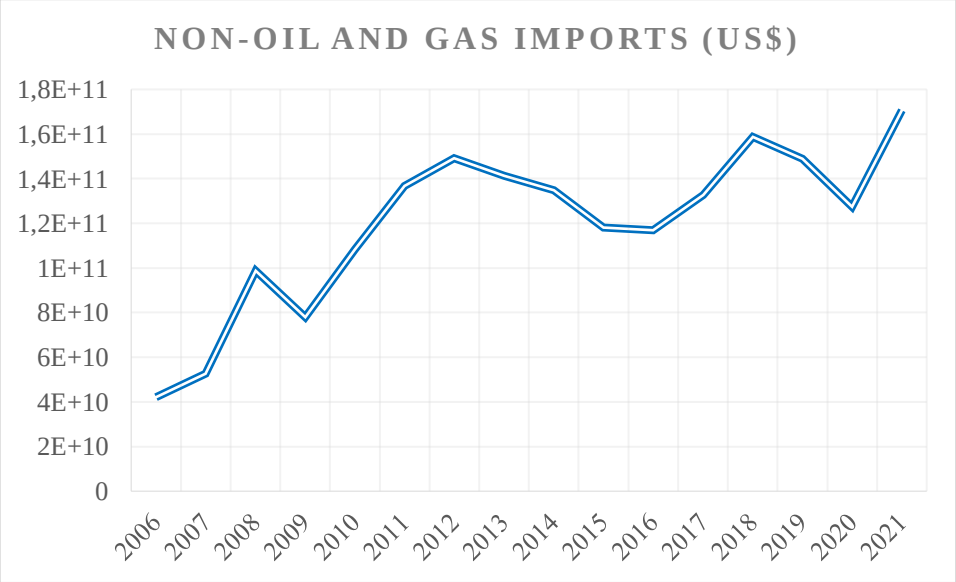
The following is oil and gas export data from 2006-2021 which is a fairly long decline for 5 years (2012-2016) in the range of 36 trillion dollars to 13 trillion dollars. The trade balance of Indonesia's exports experienced high growth, the trade balance surplus in April 2022 showed the value of Oil and Gas Exports (Export MIGAS) of US$ 7.56 billion and export performance in April 2022 of US$ 27.32 billion, an increase of 3.11% compared to exports in March 2022 (Central Statistics Agency). Meanwhile, Indonesia's imports decreased in April 2022 to reach US$ 19.76 billion or 10.01% compared to the value of imports in March 2022. Exports provide greater income and profits. Alternatively, the government reduced dependence on local markets because the expansion of international markets would only result in a decrease in local customers (Dickey and Fuller, 1979). The increasing trade balance surplus in September 2022 was influenced by the strengthening components of Indonesia's exports and imports.



Source: Badan Pusat Statistik (2023)

Chart 2. Expansion of Indonesian Non-Oil and Gas Import

The chart above shows an increase in Non-Oil and Gas Imports (Import Non MIGAS) for 3 years (2009-2012), and in the following years it has decreased and increased to date but the growth can still be well controlled. According to data from the Badan Pusat Statistik (BPS), there was a 38.17% increase in the value of Export MIGAS, while Indonesia's Import Non MIGAS also rose by 15.73% compared to the previous year. The ability of exports and imports to influence a country's social and economic development is still a topic of debate for several reasons. (Wu Jiying et al., 2020). Exports of products and services are seen as engines of

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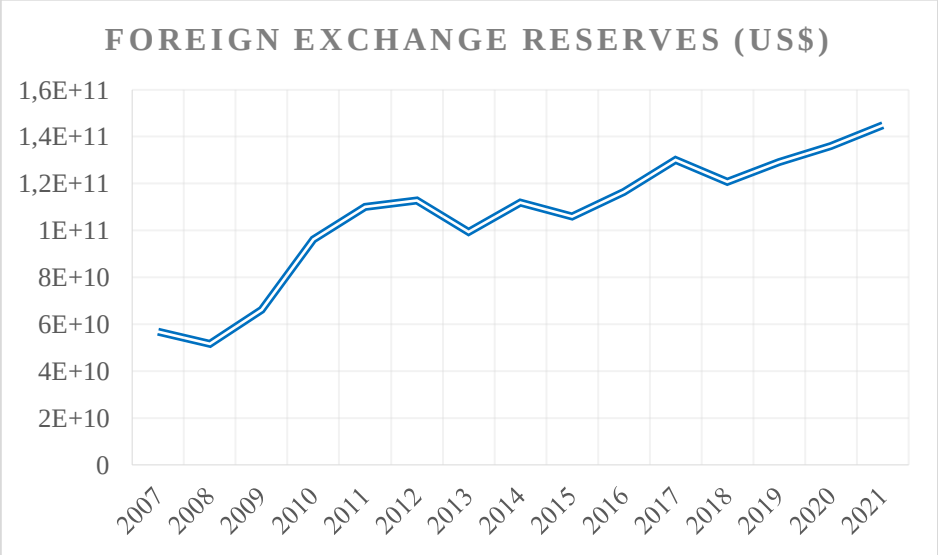
economic and social progress, and exporters must innovate and improve to maintain market dominance. Imports, on the contrary, generally indicate the inability of the state to meet its own needs. Imports, as opposed to exports, cause the local currency to leave the country and worsen the trade balance, which in turn slows economic growth (Bakari and Mabrouki, 2017). The country's level of foreign exchange reserves serves as a real foundation for bridging the national balance of payments deficit, maintaining the exchange rate, and ensuring the stability of the world's reputation for the country as an indicator of the country's level of economic and financial strength (Chen *et al.*, 2007).



Source: Badan Pusat Statistik (2023)

Chart 3. Growth of Foreign Exchanges Reserves

The chart of foreign exchange reserves in Indonesia shows that the growth of foreign exchange reserves has a good surge from 2008-2012, and another increase from 2018-2021 to 2022. Foreign exchange reserves have many supporting sectors, one of which is export and import and supporting other sectors.

The study aims to: first, observe the evolution of Export MIGAS and Import Non MIGAS in Indonesia from 2006 to 2021. Second, to assess how much influence these two variables have on Indonesia's foreign exchange reserves. Third, to forecast the short- and long-term impact of Export MIGAS and Non-Oil and Gas Imports (Import Non MIGAS) on Indonesia's foreign exchange reserves, especially in the context of economic recovery during the pandemic. Long-term predictions can be used as an illustration of Indonesia's future economic conditions in preparing for unexpected economic conditions.

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THEORETICAL FRAMEWORK AND EMPIRICAL STUDIES

Foreign Exchange Reserves

The most dependable criteria in determining where Indonesia's foreign exchange reserves originate from is the growth of those reserves as a result of exports and other forms of international commerce. The foreign exchange surplus, which represents the government's funding and development resources, would increase as a result of the 30% share of exports and imports in the national revenue (Anwar, Djamal and Nurbayani, 2019). The central bank and monetary authority own or control assets known as foreign exchange reserves (foreign exchange reserves), which can be used in an emergency at any time. These resources are various foreign exchange reserves, the vast majority of which are used worldwide. In addition, foreign exchange reserves serve as a form of state-owned savings and may be utilized to pay off foreign debt (Laksono and Tarmidi, 2021). As foreign exchange reserves are a component of national savings, their growth and quantity may be used to gauge a country's credibility in the world's financial markets concerning its monetary policies.

Oil and Gas Export Contributions

Using economies of scale through the development of particular exports based on a nation's comparative advantage may promote faster growth. while access to international markets may result in rising profits, home markets are too small to attain optimal size (Giles and Williams, 2000). The possibility of a feedback connection between output and exports is intriguing.

An intriguing possibility is a feedback link between output and exports. According to (Eaton, 1986), a perspective that export growth can occur due to the realization of scale efficiency from productivity gains. Furthermore, an increase in exports can lead to a reduction in costs, which in turn can create greater productivity gains.

Non-oil and Gas Import Contribution

The fundamental import model that was developed for this context begins with the presumption that the volume of imports is controlled by an overt optimization problem that seeks to achieve an equilibrium between two distinct objectives (Moran, 1989): (i) The intention to reduce current import deviations from the long-run equilibrium import level while dealing with foreign exchange limitations. (ii) The intention to reduce the variances between actual imports and the intended import level in the short term. It is expected that the economic

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authorities would flexibly give import licenses to reduce the expenses associated with deviating from both the long-run and short-run intended levels.

To figure out the typical import function using information from developing nations (Hemphill, 1974): (1) the conduct attributed to less developed nations in theories of global commerce. (2) The reinvestment of foreign cash by less developed nations in research on the consequences of changes in the volume of US aid. (3) The two-gap programming models of economic growth's foreign exchange restriction.

Actions are required in this nation to lower the income coefficient to less than or equal to unity, according to the applicable policy consequences. Import demand management must be seen as a component of a thorough stabilization strategy, which is crucial. Imports should be used to either fill production gaps at home or to alter the character and content of domestic output as part of this endeavor.

HYPOTHESIS DEVELOPMENT

Regarding the technological progress of economic growth, there is a difference between the two. In the Marshallian Model, when developing a growth model, technical advances can be avoided or even introduced, but overall growth must still be explained. Export MIGAS are one form of export growth in general. Exports are considered a factor that drives the economy to a stable state that is desirable for expansion. Technical progress, oil, and gas exports, all contribute to expanding a country's foreign exchange reserves to be more stable as the economy moves through economic transitions.

H1: Oil and Gas Exports (Export MIGAS) on Indonesia's Foreign Exchange Reserves.

The reason for the inclusion of Non-Oil and Gas Imports (Import Non MIGAS) in the model is to evaluate whether Non-Oil and Gas Imports (Import Non MIGAS) play a crucial role in the growth of Indonesia's foreign exchange reserves. There is an expectation that import demand may increase along with the growth of foreign exchange reserves, and vice versa. Based on Marshallian demand theory, the model assumes zero homogeneity in the levels of GDP, import prices, and foreign exchange reserves, which indicates that there is no distortion in the perception of the value of money.

H2: Non-Oil and Gas Imports (Import Non MIGAS) on Indonesia's Foreign Exchange Reserves

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RESEARCH METHODS

This study utilizes secondary data from the Central Bureau of Statistics (BPS) for 16 years, from 2006 to 2021, which is presented in a time series format. The data taken includes Oil and Gas Exports (Export MIGAS), Non-Oil and Gas Imports (Import Non MIGAS), and Indonesia's total foreign exchange reserves. To analyze these three variables, the study uses the Error Correction Model (ECM) method to measure short-term and long-term impacts, with the prerequisite that the data is not stationary at the absolute level, but has stationary properties in integration and cointegration of variables. The model applied is:

Ordinary Least Square (OLS) Model:

Log(Foreign Exchange= $\beta 0 + \beta 1$ Log (Oil and Gas Export) $+\beta 2$ LOG (Non-oil and Gas Import) $+ \varepsilon$

Error Correction Model (ECM) Model:

D{Log(Foreign Exchange)}= $\beta 0 + \beta 1$D{Log(Oil and Gas Export)}+ $\beta 2$D{Log(Non-oil and Gas Import)}+ ECT (-1) + e

Which means:

Log(Foreign Exchange) = Foreign Exchange Reserves

Log(Oil and Gas Export) = Oil and Gas Export

Log(Impor Non Migas) = Non-oil and Gas Import

$\beta 0$ = Constant

$\beta 1$, $\beta 2$ = Coefficient

D = Difference, Xt – Xt-1

ε = Error Term

ECT (-1) = Error Correction Term

DATA ANALYSIS AND DISCUSSIONS

Before knowing the results of the short-term and long-term Error Correction Model (ECM) model estimates, the stages carried out are stationer tests and cointegration tests. Stationary testing is an important stage in Error Correction Model (ECM) testing. This involves ensuring that the selected variable meets the requirements of stationaries. Stationer testing using the Augmented Dickey-Fuller (ADF) method (Dickey & Fuller, 1979). The results of the ADF test will help determine whether the variable is stationary or not, which is the basic

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condition for building an econometric model. The ADF test returns the t-statistical and p-values, which are used to determine whether the null hypothesis (a non-stationary variable) is rejected or accepted. If the null hypothesis is rejected, then the variable is stationary. Based on Table 1, all variables have a prob value of > 0.05, meaning that all variables are not stationary at a degree of level, so H0 is accepted.

Table 1. Stationary test with Augmented Dickey-Fuller at degree level

Variable	ADF test statistics	Test Critical Value			Prob	Information
		1%	5%	10%		
LOG Foreign Exchange	-2.381327	-3.95915	-3.081002	-2.68133	0.1625	No Stationer
LOG Oil and Gas Exports	-1.054099	-3.95915	-3.081002	-2.68133	0.7045	No Stationer
LOG Non-Oil and Gas Imports	-2.943533	-3.95915	-3.081002	-2.68133	0.0637	No Stationer

Source: Processed Data (2023)

If the results of the Augmented Dickey-Fuller (ADF) test show that the variable is not stationary at the level, then the next stage is to differencing the variable to make it stationary (Enders, 2014). To perform differencing using the ADF test at the first differences level to ensure that all stationer variables are at the first differences level. Based on Table 2, all variables have a prob value of < 0.05, meaning that all stationer variables have a first difference level. Then H1 is accepted.

Table 2. Stationary test with Augmented Dickey-Fuller at first difference degree

Variable	ADF test statistics	Test Critical Value			Prob	Information
		1%	5%	10%		
LOG Foreign Exchange	-3.907898	-4.00443	-3.098896	-2.69044	0.0119	Stationer
LOG Oil and Gas Exports	-3.53613	-4.05791	-3.11991	-2.7011	0.0246	Stationer
LOG Non-Oil and	-3.926615	-4.05791	-3.11991	-2.7011	0.0125	Stationer

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Gas Imports	

Source: Processed Data (2023)

After the stationer test is carried out, the next stage is the cointegration test with the ADF test method. Cointegration Test with Augmented Dickey-Fuller (ADF) method is one of the methods for testing cointegration between variables. It involves performing stationarity tests on the residuals of the linear regression between variables (Phillips and Ouliaris, 1990; Enders, 2014). If the residual linear regression is stationary, then the variable is cointegrated. Based on Table 3, the stationer residual is at the level degree, meaning the residual regression of the cointegration of the stationer. After stationer and cointegration testing are carried out, long-term and short-term testing is carried out.

Table 3. Test stationer at residual at degree level

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.674016	0.0170
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

Source: Processed Data (2023)

Long-term testing using Ordinary Least Squares (OLS) in error correction (ECM) models is the process of validating the ECM model's ability to predict long-term relationships between free and bound variables. (Enders, 2014). In this test, OLS is used to perform parameter estimation from the ECM model. According to the results from Table 4, the long-run test shows that Oil and Gas Exports (Export MIGAS) have a significant and negative influence on foreign exchange reserves, characterized by a probability <0.05 and a t-statistic value of -2.617909. On the other hand, Non-Oil and Gas Imports (Import Non MIGAS) have a significant and positive influence on foreign exchange reserves, as evidenced by the probability <0.05 and the t-statistic value of 8.402300. The adjusted r-squared value of 0.842506 explains that the model has the ability of 84.2506% to predict the long-term relationship between Export MIGAS, Non-Oil and Gas Imports (Import Non MIGAS), and foreign exchange reserves. The F-value of 41.12100 also indicates the suitability of the model estimation in a long-term context.

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Table 4. Long-term estimation results on ECM models

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGEKSPORMIGAS	-0.219835	0.083973	-2.617909	0.0213
LOGIMPORNONMIGAS	0.822200	0.097854	8.402300	0.0000
C	12.51790	1.895338	6.604576	0.0000
R-squared	0.863506	Mean dependent var		18.38234
Adjusted R-squared	0.842506	S.D. dependent var		0.373908
S.E. of regression	0.148387	Akaike info criterion		-0.810626
Sum squared resid	0.286243	Schwarz criterion		-0.665766
Log-likelihood	9.485009	Hannan-Quinn criter.		-0.803208
F-statistic	41.12100	Durbin-Watson stat		2.037765
Prob(F-statistic)	0.000002			

Source: Processed Data (2023)

Based on the results from Table 5, the short-term test of the ECT (-1) value shows that the probability value is less than 0.05. According to Astuti & Ayuningtyas (2018), the significance of the ECT probability indicates the validity of the ECM model in the short term. However, the test results show that Export MIGAS and Non-Oil and Gas Imports (Import Non MIGAS) do not have a significant impact on foreign exchange reserves. This is reinforced by the fact that the probability values for Export MIGAS and Non-Oil and Gas Imports (Import Non MIGAS) exceed 0.05 ($p > 0.05$). The adjusted r-squared level is 0.373242, which indicates that the model has an ability of 37.3242% to predict the short-term relationship between Export MIGAS, Non-Oil and Gas Imports (Import Non MIGAS), and foreign exchange reserves. The F-value of 3.779057 also indicates the suitability of the short-run estimation of the model.

Table 5. Short-term estimation results on the ECM model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGEKSPORMIGAS)	0.256790	0.181963	1.411218	0.1858
D(LOGIMPORNONMIGAS)	-0.075602	0.267099	-0.283049	0.7824
ECT(-1)	-0.724659	0.244790	-2.960333	0.0130
C	0.100210	0.042178	2.375892	0.0368
R-squared	0.507547	Mean dependent var		0.081637
Adjusted R-squared	0.373242	S.D. dependent var		0.142886
S.E. of regression	0.113120	Akaike info criterion		-1.297550

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Sum squared resid	0.140758	Schwarz criterion	-1.108736
Log-likelihood	13.73162	Hannan-Quinn criter.	-1.299561
F-statistic	3.779057	Durbin-Watson stat	2.040987
Prob(F-statistic)	0.043741		

Source: Processed Data (2023)

CONCLUSION, SUGGESTION, AND LIMITATION

Based on the results of the analysis and review of the theory it can be concluded that; First, data from the *Badan Pusat Statistik* (BPS) shows that the growth of Oil and Gas Exports (Export MIGAS), non-foreign exchange imports, and foreign exchange reserves are quite stable, increasing and decreasing in the range of 2-5 years. The long-term positive impact of Non-Oil and Gas Imports (Import Non MIGAS) on a country's foreign exchange reserves can occur if the country can optimize the potential of human resources and diversify the economy by expanding the non-oil and gas export sector. To optimize the long-term positive impact of Non-Oil and Gas Imports (Import Non MIGAS) on foreign exchange reserves, the country needs to invest in the education and training sector to improve human resource potential. The country also needs to develop policies that encourage the development of diverse economic sectors and provide incentives for entrepreneurs to invest in these sectors. Therefore, it can strengthen the country's long-term economic resilience and improve people's welfare. Specifically, Export MIGAS show a negative impact on foreign exchange reserves in the long run, while Non-Oil and Gas Imports (Import Non MIGAS) have a positive impact on Indonesia's foreign exchange reserves in the long run.

The long-term negative impact of Export MIGAS on foreign exchange reserves may occur if the economy does not diversify and continues to rely on these natural resources as a source of foreign exchange earnings. To reduce the long-term negative impact of Export MIGAS on foreign exchange reserves, the country needs to diversify its economy and develop other sectors that have the potential to increase foreign exchange earnings. The state also needs to invest in research and technology development that can increase production efficiency and reduce the use of fossil fuels. In addition, the country also needs to pay attention to environmental issues and develop policies that encourage sustainable and environmentally friendly production. By doing so, the country can reduce dependence on certain natural resources and increase long-term economic resilience. Third, in the short term, Export MIGAS

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and Non-Oil and Gas Imports (Import Non MIGAS) are not significant for Indonesia's foreign exchange reserves, this is because the rise and fall of Export MIGAS and Non-Oil and Gas Imports (Import Non MIGAS) do not have a direct influence but other supporting sectors that affect Indonesia's foreign exchange reserves, such as exchange rates, gold, securities, foreign banknotes, and other supporting sectors.

The practical consequence of a decline in Oil and Gas Exports (Export MIGAS) is a decline in crude oil production that may not be sufficient for domestic needs. In the next few years or the near future, Indonesia is likely to rely on oil and gas imports from other countries to meet the needs of its people, causing an increase in oil and gas imports. Analysis of data from the Central Bureau of Statistics (BPS) shows a shift from Export MIGAS to oil and gas imports as a strong reason to fulfill oil and gas needs as the value of crude oil imports continues to increase.

In terms of Non-Oil and Gas Imports (Import Non MIGAS), the computer, electronics, and optical products business sector experienced the largest decline. In addition, as it has a multiplicative impact on how the industrial sector is utilized, the shortage of containers and carriers around the world requires further attention (Kementrian Perindustrian, 2020). In addition to causing a buildup of products in port warehouses, which increases logistics costs and increases the likelihood of commodity damage, the lack of available containers also results in a five-fold increase in shipping prices. Some exporters have had to cancel some of their shipments due to a lack of available shipping capacity, which if this happens often enough, can result in defaults and fines.

This study has limitations, but it is hoped that improvements can be made for the next period of research. The limitations in this study are the determination of research variables through the determination of data which when viewed from the macro conditions of Indonesia, especially in the export and import sectors of foreign exchange reserves, the value of the monthly data increases and affects the annual data which tends to experience instability during the analysis process

Recommendations for future research include conducting additional analysis of variables from sectors that support Indonesia's foreign exchange reserves. Similarly, adding additional variables to explain their influence should also be considered. As a second suggestion, it is important to explore the implications of the oil and gas sector on the prediction of oil and gas

imports on foreign exchange reserves. The third suggestion is to conduct an in-depth analysis of the oil and gas and non-oil and gas sectors, focusing on their short-term impact on Indonesia's foreign exchange reserves.

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