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Impact Of International Trade On Indonesia's Consume Of Renewable Energy

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Abstract

This research intends to look into the exports percent of GDP, imports percent of GDP, and percentage of renewable energy in the GDP's total energy usage. This study uses data from 1999 to 2019 It was constructed using secondary data from the World Bank. The method used is quantitative by modeling the Model for Vector Error Correction (VECM) using exports, imports, and consumption of renewable energy in Indonesia as variables. We found that Causality or causal relationship occurs in renewable energy consumption variables that affect imports, import variables affect exports and vice versa export variables affect imports. This shows that using renewable energy is encourages imports and exports in Indonesia. So that international trade has a significant role in encouraging the renewable energy usage.

Keywords : Export, Import, Consumption of Renewable Energy
Jel Classification Code : F13, F15, F23

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Introduction

The development of a country will be in line with activities that support a country towards the goals to be achieved. The state will try to do everything possible to meet its needs, one of which is through international trade to reach outside the country. International trade is a form of need between countries where countries need international trade in order to meet their needs for both resources and services (Viphindrartin & Bawono, 2021).

The need for energy is currently still dominated by non-renewable energy originating from within the earth such as oil (Rahman, Dargusch, & Wadley, 2021). The non-renewable energy's finite

supply requires humans to make updates and innovations, one of which is through renewable energy (Sharvini, Noor, Chong, Stringer, & Yusuf, 2018). Energy is a necessity that is needed by society. The increasing number of people in Indonesia makes the increase in energy use, in this case the role of non-renewable energy is increasingly threatened (Shang, Han, Gozgor, Mahalik, & Sahoo, 2022) Renewable energy is an energy source that can be used continuously and is available in nature (Xiaoman, Majeed, Vasbieva, Yameogo, & Hussain, 2021).

Renewable energy can be used freely, can be renewed continuously, and its availability in nature is abundant (Gürsan & de Gooyert, 2021). There are many reasons why renewable energy should be developed and widely utilized. The reason is that it is abundantly available, does not produce pollution and carbon emissions, and makes people independent in seeking their own energy (Chen, Miao, & Zhu, 2021). Energy utilization is a crucial component of every production process. From the initial use of energy from human power to the use of sophisticated machines that use electricity or machines that use energy sourced from fossil fuels (Esmaeilion, 2020). Developments in the efficiency of energy use have been going on for a long time and increased greatly during the industrial revolution (Stock, Obenaus, Kunz, & Kohl, 2018). The first industrial revolution took place in Great Britain or what we call England. New discoveries in the field of technology, especially in the field of industrial technology, have increasingly increased the production of goods in the UK (Rymarczyk, 2020). One indicator of the success of economic development in a country is by measuring the country's economic growth (Sulisnaningrum, Widarni, & Bawono, 2022). Economic growth looks at how economic activity affects people's income. increases in a nation's capacity to generate products and services is what is meant by economic growth in the long run (Prabowo, Sulisnaningrum, & Harnani, 2021). Therefore, the existence of energy is very important for a nation because it is part of the main resources in production, distribution and consumption activities so that it can be called an economic driver (Yanto, 2022). Consumption of renewable energy is favorably correlated with global trade (Lu, Gozgor, Mahalik, Padhan, & Yan, 2022). However, the use of renewable energy can make international trade less competitive (Ilechukwu & Lahiri, 2022). This study intends to look into the exports percent of GDP, imports percent of GDP, and percentage of renewable energy in the GDP's total energy usage.

Literature Review

Countries need to be more independent and start investing in local economies and focus on trade with each other in order to respond more flexibly (An, Mikhaylov, & Richter, 2020). International trade is influenced by the diversity of a country's production potential, production cost savings through specialization of goods, and differences in tastes (Wilantari & Bawono, 2021). During the Covid-19 pandemic, boosting global trade we must continue to unite factors, including globalization of society and economic, performance of logistics, health service readiness, income levels, and the response of the national government (Mena, Karatzas, & Hansen, 2022).

International trade is carried out through exports and imports with efforts to market transactions between countries (Sasongko, Bawono, & Prabowo, 2021). Exports have a positive impact whereas imports have a negative impact on economic growth. So it is necessary to develop products that have more competitive value to support export activities (Nguyen, 2020).

Additionally, both imports and exports have a big impact on economic growth (Tiba & Frikha, 2018).

Consumption of renewable energy is favorably correlated with the possibility of global trade. (Ahmed, Ahmad, Rjoub, Kalugina, & Hussain, 2022). Economic growth, population growth, energy subsidies, and consumption of fossil energy positively and significantly affect Indonesia's use of sustainable energy (Sharif, Mishra, Sinha, Jiao, Shahbaz, & Afshan, 2020).

For the purpose of lowering carbon emissions, using renewable energy is essential (Novianto, & Prabowo, 2021). In the meanwhile, lowering carbon emissions is significantly impacted by global trade (Sasana & Aminata, 2019). The correlation between imports and carbon emissions are favorable, the connection between exports and carbon emissions is negative, and the correlation between foreign investment and carbon emissions is positive, but it is not statistically significant., so it is necessary environmental protection is regulated by international agreements. and domestic law and the promotion of international trade to maintain ecological balance (Jijian, Twum, Agyemang, Edziah, & Ayamba, 2021). CO2 emissions are under pressure from renewable energy and energy pricing, while the amount of trade is under very significant pressure to reduce CO2 emissions. (Ike, Usman, Alola, & Sarkodie, 2020).

H1: The use of renewable energy is favorably correlated with global trade.

H2: Utilizing renewable energy sources may reduce the competitiveness of global trade.

Research Method

This research investigates export percent of GDP, import percent of GDP, and percentage of renewable energy in the GDP's total energy usage (in percent). This study uses a quantitative method with *autoregressive vector* with the following equation:

$RE_t = _0 + _1EM_{t1} + _2IM_{t2} + e_t$

$EM_t = _0 + _1RE_{t1} + _2IM_{t2} + e_t$

$IM_t = _0 + _1EM_{t1} + _2RE_{t2} + e_t$

Description :

RE = Renewable Energy (in percent)

EM = Export percent of GDP

IM = Import percent of GDP

β = Constant

e = Error term

t = Time Period

This study uses data from 1999 to 2019 It was constructed using secondary data from the World Bank. The method used is quantitative by modeling the VECM Analysis using exports, imports,

and consumption of renewable energy in Indonesia as variables. The following are descriptive variables of the variables that will be presented in table 1.

Table 1. Variable Description

Variable	Description	Source	Unit of Analysis
EM	Exports of goods serve as an estimate for the total value of all goods and other market services allotted to the world at large. They consist of transportation, license fees, travel, the cost of goods, royalties, freight, insurance, and other services like financial, communication, government, construction, informational and other related fields. They do not include investment income (formerly known as factor services), or employee remuneration, and transfer payments.	World Bank	Percent
IM	The value of all items and other market services is described by imports of goods and services that are brought into the country. They consist travel, freight, the price of goods, insurance, license fees, royalties, and the offer of additional services by businesses in the public and commercial sectors, as well as in the informational, financial, construction, and other related industries. These exclude transfer payments, investment earnings (formerly known as factor services), and employee salaries.	World Bank	Percent
RE	Consumption of renewable energy is the share of renewable energy in all final energy consumption.	World Bank	Percent

Results And Discussion

Stationary test of data or also called unit root can be done first before testing the causality assumption or VAR analysis. The stationary test it's critical to assess whether the data being used is stationary using the ADF test. The conclusions of the unit root test it was as follows:

Table 2. ADF's Unit Root Test

Variables	Unit Root	Statistics for the ADF Test	Probability	Description
Renewable Energy (RE)	Level	0.928304	0.9937	
	First Diff	-3.353197	0.0274	Stationary

Export (EM)	Level	-1.338556	0.5880	
	First Diff	-6.590040	0.0000	Stationary
Import (IM)	Level	-1.744510	0.3952	
	First Diff	-6.125177	0.0001	Stationary

Table 2 illustrates that RE, EM, and IM are not constant at the level Consequently, the next test is run at the first difference level. These results indicate that RE, EM, and IM at the first difference level, remain stationary with ADF statistical values greater than and probability values less than 0.05. Data that is stationary in the unit root test, then the optimum lag test will be carried out. To choose the best lag length to utilize, it is crucial to do an optimal lag test. The optimum lag test produces the following results:

Table 3. Optimum Lag Test

Lag	LogL.	LR	FPE	AIC	SC	HQ
0	-154.8777	NA	1442.872	15.78777	15.93713	15.81693
1	-114.6155	64.41962*	64.34823*	12.66155*	13.25898*	12.77817*

Table 3 display the results of the Optimum Lag Test. Based on the table above, the latency 0 to 1 AIC value can be concluded that the lengths of the RE, EM, and IM variables are at LR to HQ at lag 1. Using a cointegration test, it is possible to ascertain whether there an equation of movement and stability of the relationship between variables. Cointegration test can use *Johansen's Cointegration Test method*. Cointegration test produces the results as continues to follow:

Table 4. Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
None *	0.732579	34.41390	29.79707	0.0137
At most 1	0.373074	9.354182	15.49471	0.3336
At most 2	0.025078	0.482565	3.841466	0.4873

Trace test indicates 1 cointegrating eqn(s) at the

rejectionof the hypothesis at the 0.05 level

***MacKinnon-Haug-Michelis (1999) p-values*

Table 4 describes the cointegration test's findings. Based on the table, it is obvious that there is an indication of 1 cointegration which can be seen in the description *trace test*. In addition, it can be strengthened by a probability value of <0.05 so that through this test, the next step of analysis is to use the VECM model.

Table 5. VECM Analysis

	D(RE)	D(EM)	D(IM)
D(RE(-1))	0.182625	-0.112824	-0.276198
	(0.22278)	(0.25984)	(0.41916)
	[0.81975]	[-0.43421]	[-0.65893]
D(EM(-1))	0.145632	0.259532	0.613080
	(0.36244)	(0.42273)	(0.68194)
	[0.40181]	[0.61394]	[0.89903]
D(IM(-1))	-0.675493	-0.126029	-0.528749
	(0.37830)	(0.44122)	(0.71177)
	[-1.78561]	[-0.28564]	[-0.74287]
C	-1.653102	-1.679482	-1.051419
	(0.66327)	(0.77360)	(1.24794)
	[-2.49234]	[-2.17100]	[-0.84252]

**t-table value with df 19 and significance level of 0.05 is 1.729*

Table 5 above displays the findings from the VECM analysis.. If the t-statistic value and t-table are compared as part of the significance test, then a significant relationship occurs in the IM variable that affects RE with the t-statistic value of [-1.78561] it's number exceeds that of the t-table of the value from the critical value of 1.729. A significant relationship also occurs in IM and RE with a t-statistic value of [-2.20465] it's number exceeds that of the t-table of 1.729 in the two

previous periods. Thus, it can be concluded that imports that occurred in the previous one and two periods significantly affected the present-day application of renewable energy sources.

The significance relationship can also by contrasting the coefficient value and the t-statistic value, one can determine. The criteria seen are if the t-statistic value it's number exceeds that of the coefficient value, it is significantly related. According to table 5 above, it is evident that RE and EM negatively related to value of an coefficient of -0.112824 and t-statistic value [-0.43421]. Similarly, RE and IM have a substantial negative effect with either a coefficient value of -0.276198 and t-statistic [-0.65893]. Thus, it can be concluded that the higher the consumption of renewable energy, the lower exports and imports.

EM and RE have an impact that is substansial positive that of an coefficient of 0.145632 and t-statistic [0.40181]. This also occurs in EM and IM which have an impact that is substansial positive and has value of an coefficient 0.613080 and t-statistic [0.89903]. Accordingly, rising exports will result in rising imports and utilizing renewable energy. IM and RE have a negative influence to value of an coefficient of -0.675493 and t-statistic [-1.78561]. IM and EM also have a significant negative effect to value of an coefficient of -0.126029 and t-statistic [-0.28564]. So, it can be interpreted that if there is an increase in imports, there will be a decrease in renewable energy consumption and exports.

Table 6. The Granger Causality Analysis

Null Hypothesis:	Obs	F-Statistic	Prob.
EM does not Granger Cause RE	20	2.55002	0.1287
RE does not Granger Cause EM		2.67304	0.1204
Im does not Granger Cause RE	20	1.99840	0.1755
RE does not Granger Cause Im		5.86127	0.0270
Im does not Granger Cause Em	20	7.05541	0.0166
Em does not Granger Cause Im		10.4597	0.0049

Based on Table 6, The Granger Causality Test results reveal that only a causal relation emerges in the RE variable that influences IM with a probability value of 0.0270. Similarly, the IM variable affects EM with a probability value of 0.0166. On the other hand, there is also a causal relationship in the EM variable that affects the IM variable with a probability value of 0.0049. While other variables' causal connections have no discernible impact.

Conclusion

Causality or causal relationship occurs in renewable energy consumption variables that affect imports, import variables affect exports and vice versa export variables affect imports. This shows that using renewable energy is encourages imports and exports in Indonesia. So that international trade has an important effect in motivating the use of renewable energy.

References

Ahmed, Z., Ahmad, M., Rjoub, H., Kalugina, O. A., & Hussain, N. (2022). Economic growth, renewable energy consumption, and ecological footprint: Exploring the role of environmental regulations and democracy in sustainable development. Sustainable Development, 30(4), 595-605.https://doi.org/10.1002/sd.2251

Chen, Y., Miao, J., & Zhu, Z. (2021). Measuring green total factor productivity of China's agricultural sector: a three-stage SBM-DEA model with non-point source pollution and CO2 emissions. Journal of Cleaner Production, 318(1), 1-12.https://doi.org/10.1016/j.jclepro.2021.128543

Esmaeilion, F. (2020). Hybrid renewable energy systems for desalination. Applied Water Science, 10(3), 1-47.https://doi.org/10.1007/s13201-020-1168-5

Gürsan, C., & de Gooyert, V. (2021). The systemic impact of a transition fuel: Does natural gas help or hinder the energy transition?. Renewable and Sustainable Energy Reviews, 138(1), 1-21.https://doi.org/10.1016/j.rser.2020.110552

Ike, G. N., Usman, O., Alola, A. A., & Sarkodie, S. A. (2020). Environmental quality effects of income, energy prices and trade: the role of renewable energy consumption in G-7 countries. Science of The Total Environment, 721(1), 1-13.https://doi.org/10.1016/j.scitotenv.2020.137813

Ilechukwu, N., & Lahiri, S. (2022). Renewable-energy consumption and international trade. Energy Reports, 8(1), 10624-10629.https://doi.org/10.1016/j.egyr.2022.08.209

An, J., Mikhaylov, A., & Richter, U. H. (2020). Trade war effects: Evidence from sectors of energy and resources in Africa. Heliyon, 6(12), 1-8.https://doi.org/10.1016/j.heliyon.2020.e05693

Jijian, Z., Twum, A. K., Agyemang, A. O., Edziah, B. K., & Ayamba, E. C. (2021). Empirical study on the impact of international trade and foreign direct investment on carbon emission for belt and road countries. Energy Reports, 7(1), 7591-7600.https://doi.org/10.1016/j.egyr.2021.09.122

Lu, Z., Gozgor, G., Mahalik, M. K., Padhan, H., & Yan, C. (2022). Welfare gains from international trade and renewable energy demand: Evidence from the OECD countries. Energy Economics, 112(1), 1-7.https://doi.org/10.1016/j.eneco.2022.106153

Mena, C., Karatzas, A., & Hansen, C. (2022). International trade resilience and the Covid-19 pandemic. Journal of Business Research, 138(1), 77-91.https://doi.org/10.1016/j.jbusres.2021.08.064

Nguyen, H. H. (2020). Impact of foreign direct investment and international trade on economic growth: Empirical study in Vietnam. The Journal of Asian Finance, Economics and Business, 7(3), 323-331.https://doi.org/10.13106/jafeb.2020.vol7.no3.323

Novianto, I., & Prabowo, B. H. (2021). Green Human Resource Management, Employment and Social Corporate Responsibility in Asia. Splash Magz, 1(2),17-20.http://doi.org/10.54204/splashmagzvol1no2pp17to20

Prabowo,B.H, Sulisnaningrum, E., & Harnani , S. (2021). FINANCIAL CRISIS AND USURY IN DIGITAL ECONOMIC : WHY MAJOR RELIGION PROHIBIT USURY? MONETARY STUDIES IN ASIA 5. JBFEM, 4(1), 27-46. https://doi.org/10.32770/jbfem.vol427-46

Rahman, A., Dargusch, P., & Wadley, D. (2021). The political economy of oil supply in Indonesia and the implications for renewable energy development. Renewable and Sustainable Energy Reviews, 144(1), 1-11.https://doi.org/10.1016/j.rser.2021.111027

Rymarczyk, J. (2020). Technologies, opportunities and challenges of the industrial revolution 4.0: theoretical considerations. Entrepreneurial business and economics review, 8(1), 185-198.https://doi.org/10.15678/EBER.2020.080110

Sasana, H., & Aminata, J. (2019). Energy subsidy, energy consumption, economic growth, and carbon dioxide emission: Indonesian case studies. International Journal of Energy Economics and Policy, 9(2), 117-122.

Sasongko, B., Bawono, S., & Prabowo, B. H. (2021). The Economic Performance of China in Trade War: The Case Study of Three Global Economic Crises in 1997–2020. In Environmental, Social, and Governance Perspectives on Economic Development in Asia. Emerald Publishing Limited.

Shang, Y., Han, D., Gozgor, G., Mahalik, M. K., & Sahoo, B. K. (2022). The impact of climate policy uncertainty on renewable and non-renewable energy demand in the United States. Renewable Energy, 197(1), 654-667.https://doi.org/10.1016/j.renene.2022.07.159

Sharif, A., Mishra, S., Sinha, A., Jiao, Z., Shahbaz, M., & Afshan, S. (2020). The renewable energy consumption-environmental degradation nexus in Top-10 polluted countries: Fresh insights from quantile-on-quantile regression approach. Renewable Energy, 150(1), 670-690.https://doi.org/10.1016/j.renene.2019.12.149

Sharvini, S. R., Noor, Z. Z., Chong, C. S., Stringer, L. C., & Yusuf, R. O. (2018). Energy consumption trends and their linkages with renewable energy policies in East and Southeast Asian countries: Challenges and opportunities. Sustainable Environment Research, 28(6), 257-266.https://doi.org/10.1016/j.serj.2018.08.006

Stock, T., Obenaus, M., Kunz, S., & Kohl, H. (2018). Industry 4.0 as enabler for a sustainable development: A qualitative assessment of its ecological and social potential. Process Safety and Environmental Protection, 118(1), 254-267.

Sulisnaningrum, E., Widarni, E. L., & Bawono, S. (2022). Causality Relationship Between Human Capital, Technological Development and Economic Growth. Organization, 6(2), 1-12.http://doi.org/10.31039/jomeino.2022.6.2.1

Tiba, S., & Frikha, M. (2018). Income, trade openness and energy interactions: Evidence from simultaneous equation modeling. Energy, 147(1), 799-811.https://doi.org/10.1016/j.energy.2018.01.013

Viphindrartin, S., & Bawono, S. (2021). International Economics. Munich : BookRix.

Wilantari, R. N., & Bawono, S. (2021). Tantangan Dominasi Amerika Serikat oleh Tiongkok dalam Perang Dagang. Jurnal Manajemen Jayanegara, 13(1), 32-36.

Xiaoman, W., Majeed, A., Vasbieva, D. G., Yameogo, C. E. W., & Hussain, N. (2021). Natural resources abundance, economic globalization, and carbon emissions: Advancing sustainable development agenda. Sustainable development, 29(5), 1037-1048.https://doi.org/10.1002/sd.2192

Yanto,D.D.G.F.(2022). Green Economy and Sustainable Development in Indonesia: ARDL Approach,Tamansiswa Accounting Journal International,4(1),9-15.https://doi.org/10.54204/TAJI/Vol412022002