The Influence Of Fuel Consumption And Co2 Emissions On Economic Growth

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Abstract

This study was conducted to determine the impact and relationship between emissions on economic growth in Indonesia. This study uses data from a period of 40 years, namely from 1974 to 2014 using vector modeling to be able to understand the causal relationship between variables. The data from this study were obtained from the world bank. The variables that we use in this study are the GDP development variable, the fossil fuel consumption variable, and the CO2 emission variable from the Manufacturing and Construction Industry in Indonesia. We found that all variables had no causal relationship. In the short term, we find that all variables influence each other, such as GDP developments which positively affect the consumption of fossil fuels, GDP developments which also positively affect manufacturing and construction CO2 emissions, in addition to manufacturing and construction CO2 emissions that have a direct positive impact on fossil fuel consumption.

Keywords: GDP, Fossil Fuels, CO2 Emissions
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Introduction

The rising usage of renewable energy and technical breakthroughs reduce CO2 emissions. As a result, regulations promoting the utilization of renewable energy and technical developments will contribute to environmental protection sustainability is achieved By lowering emissions of CO2. Economic growth, on the other side, has a positive influence on CO2 emissions, which indicates that growing economic growth will increase CO2 emissions (Raihan, Muhtasim, Khan, Pavel, & Faruk, 2022). There is an inverse relationship between economic growth and CO2 emissions. This can be read as increased Economic expansion has a strong and favorable impact on both the short and long term increasing CO2 emissions (Arista & Amar, 2019).

Several Chinese provinces indicate a negative association The achievement of optimal economic conditions indicates a balance the relationship between economic expansion and CO2 emissions by reducing the amount of CO2 emissions. In addition, other provinces show that the increase in economic growth is in line with the increase in emissions caused by the use of energy consumption (Liu, Zhong, & Yang, 2022). The increase in GDP has a large and favorable impact on rising CO2 levels emissions, although a minor one. Furthermore, rising energy use certainly has a favorable impact on rising emissions (Puntoon, Tarkhamtham, & Tansuchat, 2022).

Tourism and CO2 emissions are both negative and significant in both long-term and short-term economic growth. Meanwhile, fossil energy has a negligible association, both long and short

term, to CO2 emissions. Therefore, environmental mitigation and recovery programs, both government, community and stakeholders, are urgently needed to support more environmentally friendly and sustainable economic growth (Oliveira & Moutinho, 2022). Five ASEAN member states from 2002-2018 showed that CO2 emissions negatively affect national output and coal consumption but on the other hand electricity consumption has a positive effect on national output while deforestation has no effect on national output (Kristiana et al, 2021).
Economic expansion in the agricultural sector has a considerable a negative impact on per capita carbon emissions, whereas industrial growth has a strong beneficial impact on per capita emissions (Farhan, 2016). Economic growth in the industrial sector has a significant negative impact on CO2 emissions in Indonesia, whereas economic growth in the transportation sector has no significant effect (Novara, 2015).
Previous study indicates that economic expansion, globalization, and trade openness all have a favorable impact on CO2 emissions. However, there are different results the relationship between renewable energy and CO2 emissions that negatively impact both (Abban et al, 2022). However, it is different from the research conducted by Candra which states that economic development and industrialisation have an adverse effect on CO2 emissions. This is because countries have begun to use more advanced technology and use renewable energy or low-emission technology. So that it does not have too much impact on environmental pollution due to CO2 emissions (Candra, 2018). The study will look at the growth of GDP, consumption of fossil fuels and emissions of CO2 from the industrial and construction industries (in percent).

Literature Review

Fuel exports, capital creation, and workforce size all have a long-term favorable Saudi economic development will be impacted. Increases in CO2 emissions, on the other hand, has a long-term deleterious influence. on the connection between fuel exports and economic growth (Murshed, 2022). Increased emissions, on the other hand, have a positive influence However, the utilization of Renewable energy is detrimental to economic growth. Monetary policy has a minor impact on GDP, but it also has ramifications for welfare and resource allocation across many economic sectors (Sequeira, 2021).
Economic growth is higher in nations with strong PSM characteristics than in countries with weak PSM characteristics (Sandow et all, 2022). Capital flight and foreign debt have a detrimental impact on economic growth (Agyeman et all, 2022). Long-term economic development has a good impact on international trade (Caporale, Sova, & Sova, 2022). Economic growth is harmed by government spending and corruption control. (Nguyen & Bui, 2022).
When both markets and consumers predict significant future inflation, import prices respond to changes in a country's exchange rate (Anderl et al, 2022). Inflation is detrimental to economic growth both in the short and long run. Meanwhile, uncertainty about inflation has a negative impact in the near term but has no long-term influence (Mandeya & Ho, 2021). An increase in a country's inflation has an impact on labor friction and the function of money as a medium of exchange. This can be demonstrated by the increased volatility of unemployment due to inflation shocks (Lahcen et al, 2022).
Inflation that occurs in superpower countries such as China can affect the economies of Asian countries (Sun, Hong & Wang, 2019). The effect of global inflation due to the financial crisis is stronger than the effect of domestic inflation which is more volatile (Burdekin et al, 2022). The

combination of the global component through the economic influence of the G7 countries and the domestic component has a predictive ability that can later predict a country's inflation rate. For short-term and long-term forecasting of inflation and economic growth, asset values provide valuable predictive content (Yue & Leung, 2011). Inflation has a significant effect on the construction industry, where this inflation can lead to project cost overruns caused by rising material prices, increases in labor wages, changes in machine rental rates, so that the initial project budget deviates from the final project budget (Musarat, Alaloul & Liew, 2021). An increase in the money supply or quantitative easing has a significant effect in reducing a country's inflation rate. Through banking policies that provide credit easing to the private sector it is proven to be able to reduce the rate of inflation (Ergmen, 2022).

Corporate credit risk, operational risk in banks, and other dangers continue to stymie financial services for global trade supply networks. Traditional financial services risk early warning systems have limitations in terms of risk avoidance and early warning capabilities. As a result, the introduction of AI algorithm-based risk identification in financial services will have an impact on financial services potential, allowing financial services to play a larger role in assisting to help small and medium-sized energy firms thrive and grow. the magnitude of imports and exports (Liu, Yang, Hao, & Song, 2022).

International trade drives up demand for renewable energy. International trade, as well as income per capita, CO2 emissions per capita, as well as old energy prices, all contribute to rising demand for renewable energy (Karatzas & Hansen, 2022). International trade also benefits poor countries more than affluent countries (Lu, Gozgor, Mahalik, Padhan, & Yan, 2022). The rising The use of renewable energy by non-OECD countries reduces exports, while growing renewable energy use in OECD countries helps boost exports (Ilechukwu & Lahiri, 2022).

The controversy over the quality of the European Geographical Indication (GI) scheme, whether GI has a positive or negative impact on international trade has finally been answered with positive results (Filippis, Giua, Salvatici, & Piñeiro, 2022). The high pricing of international trade in natural resources shows the dark game, lack of transparency, and weak governance of international trade in natural resources (Mehrotra & Carbonnier, 2021). National level trade resilience depends on the synergy and development of the following factors; Social and economic globalization, logistical performance, health-care readiness, responsiveness of national governments, and income levels are all factors to consider (Rahmayani, 2021).

The COVID-19 pandemic has damaged the global oil trade network (Wang et al, 2022), making oil exporting possible countries arbitrary in determining the amount of exports and prices so that it will be fatal if regional oil supplies experience a critical point (Richard, Burdekin & Tao, 2022). The following is the hypothesis that we compiled :

H1: The positive impact of GDP, Fossil Fuels, CO2 Emissions on economic growth

H2: The negative impact of GDP, Fossil Fuels, CO2 Emissions on economic growth

Research Method

This study examines the percent of GDP growth, Fossil fuel use, manufacturing and construction industries contribute to CO2 emissions, and GDP growth as a measure of economic growth (in percent). This study uses a qualitative method with an autoregressive vector model with the following equation:

$GDPt = \beta 0 + \beta 1\ Fct1 + \beta 2Eit2 + e\ t$

$Fct = \beta 0 + \beta 1GDPt1 + \beta 2Eit2 + e\ t$

$Eit = \beta 0 + \beta 1Fct1 + \beta 2GDPt2 + e\ t$

Information:

GDP = GDP Growth

Fc = Fossil Fuel Consumption

Ei = Emissions from Manufacturing and Construction Industry

β = Constant

e = error term

t = Time Period

This study uses a research period from 1971 to 2014. The descriptive variables are taken from the variables used as indicators which are shown in Table 1.

Table 1. Variabel Description

Variable	Description	Source	Unit of Analysis
GDP	GDP the annual percentage rate is increase at current market rates in stable national currency. The aggregates are composed of determined of using constant US dollar prices in 2015. GDP is the total of the total value contributed of all residents, plus goods taxes and and less non-product value subsidies. It is calculated without taking asset depreciation or natural resource depletion and degradation into account.	World Bank	Percent
Fc	Fossil fuels consist of products of coal, oil, petroleum, and natural gas.	World Bank	Percent
Ei	CO2 emissions from the manufacturing and construction industries include industrial fuel combustion emissions. Source/Sink A2 (Category 1) These emissions are addressed by the IPCC. However, the IPCC category includes emissions from industrial automobile manufacturers that generate power and/or heat in the 1996 IPCC Guidelines. Because IEA data is not compiled in a fashion that allows energy consumption to be divided based on a specific end use, automakers are displayed separately (Unloaded Auto Producers). Emissions from coke inputs into blast furnaces are also included in the manufacturing and	World Bank	Percent

	construction sectors, and can be recorded in either the transformation sector, the industrial sector, or a separate IPCC Category 2 sector. Industrial Processes, Source/Sink.		

Result and Discussion

Before carrying out further testing, the first step that must be done is to test the stationarity of the data. This is done to find out whether the data is stationary or not. The test results are shown in the table below.

Table 2. Root Test Results

Variable	Unit Root	Statistics for the ADF	Probability	Information
GDP	Level	-4.565106	0.0006	Stationary
	First diff	-7.151584	0.0000	Stationary
Fc	Level	-3.981409	0.0035	Stationary
	First diff	-6.025347	0.0000	Stationary
Ei	Level	-1.905560	0.3268	Not Stationary
	First diff	-6.288841	0.0000	Stationary

Table 2 shows that GDP, Fc, Ei are stationary at different levels. The results above can be seen that GDP and Fc are stationary at the level with a probability value of less than 0.05. Different results are found in Ei which is stationary at the first difference level with a probability value of 0.0000 which is less than 0.05.

The data is already stationary in the unit root test, then the best lag test will be performed. The optimal lag test is necessary to establish the optimal lag duration to be employed. Optimum lag test produces the following results:

Table 3. Optimum Lag Test

lag	LR	FPE	AIC	SC	HQ
0	NA	16456.35	18.22207	18.34745	18.26773
1	202.5006*	107.3763*	13.18810*	13.68964*	13.37073*
2	10.68785	122.6432	13.31278	14.19046	13.63238
3	7.348539	153.1202	13.51475	14.76859	13.97133

Table 3 displays the results of the Optimal Lag test. The AIC is shown in the table above. values at lag 0 to 3 can be concluded that the variable lengths GDP, Fc, and Ei are at LR, FPE, AIC, SC, and HQ at lag 1.

The cointegration test was carried out to find out whether there is an equation of movement and stability of the relationship between variables. In addition, this test was conducted to determine

the selection of the method used for this study whether using VAR or VECM analysis. The cointegration test can use the the Cointegration Test of Johansen. Cointegration analysis produces the following results:

Table 4. Cointegration Test

Hypothesized No. ofCE(s)	Eigenvalue	Trace Statistics	0.005 Critical Value	Probability
None*	0.408219	37.14482	29.79707	0.0059
At most1	0.267058	15.11082	15.49471	0.0571
At most2	0.047908	2.061911	3.841466	0.1510

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4 summarizes the cointegration test results. It is clear from the results above that there is an indication of 1 cointegration which can be seen in the trace test information. In addition, it can be strengthened with a probability value of less than 0.05 so that through this test the next analysis step is to use the VECM analysis model.

Table 5. VECM Analysis

Error Correction:	D(GDP)	D(FC)	D(EI)
CointEq1	-0.362244	0.180898	0.062701
	(0.16094)	(0.05890)	(0.09719)
	[-2.25078]	[3.07143]	[0.64513]
D(GDP(-1))	-0.134122	-0.135412	-0.281178
	(0.16116)	(0.05898)	(0.09733)
	[-0.83221]	[-2.29595]	[-2.88902]
D(FC(-1))	0.058852	-0.184559	0.244492
	(0.45261)	(0.16563)	(0.27333)
	[0.13003]	[-1.11427]	[0.89450]
D(EI(-1))	0.289976	0.230531	0.055903
	(0.26174)	(0.09578)	(0.15806)
	[1.10789]	[2.40679]	[0.35368]
C	-0.096318	1.117931	-0.257493
	(0.71580)	(0.26195)	(0.43226)

	[-0.13456]	[4.26776]	[-0.59568]

Based on table 5. We can see that in the short term changes in GDP during the past quarter significantly affected FC in the current quarter, with a statistical t value [-2.29595] greater than a t table value of 2.019541. Furthermore, changes in GDP during the last quarter significantly affected EI in the current quarter, with a statistical t value [-2.88902] greater than a t table value of 2.019541. And finally the change in EI when 1 quarter ago significantly affected FC in the current quarter, with a statistical t value [2.40679] greater than the t table value of 2.01954.

Table 6. Granger

Null Hypothesis:	Obs	F-Statistic	Prob.
FC does not Granger Cause GDP		1.13468	0.3325
GDP does not Granger Cause FC	42	0.13067	0.8779
EI does not Granger Cause GDP		0.74801	0.4803
GDP does not Granger Cause EI	42	3.24636	0.0502
EI does not Granger Cause FC		2.47057	0.0984
FC does not Granger Cause EI	42	0.20729	0.8137

Based on the results of the Grenger causality test in table 6, it can be seen that all variables, both GDP, FC, and EI, do not have a causal relationship because the probability values of all variables are respectively greater than 0.05.

Conclusion

From the results of the discussion above, it is found that all variables, both economic growth (GDP), consumption of fossil fuels (FC), and manufacturing industry emissions (EI), All do not have a causal relationship, but in the short term, changes in GDP do significantly positively affect FC, meaning If GDP increases, FC will also increase. Furthermore, changes in GDP also change in EI has a strong favorable influence on FC in the short run.

References

Abban, O. J., Hongxing, Y., Nuta, A. C., Dankyi, A. B., Ofori, C., & Cobbinah, J. (2022). Renewable energy, economic growth, and CO2 emissions contained Co-movement in African oil-producing countries: A wavelet based analysis. Energy Strategy Reviews, 44, 1-15.

Agyeman G., Sakyi D., Fosu E. (2022). External Debt And Economic Growth In Selected Sub-Saharan Africanx Countries: The Role Of Capital Flight. Research in Globalization, 5, 1-9.

Anderl, C., Caporale, G. M., (2022). Nonlinearities in the exchange rate pass-through: The role of inflation expectations. Journal Pre-proof, 1, 1-30.

Arista, T. R., & Amar, S. (2019). Analisis Kausalitas Emisi CO2, Konsumsi Energi, Pertumbuhan Ekonomi, dan Modal Manusia di ASEAN. Jurnal Kajian Ekonomi dan Pembangunan, 1(2), 519-532.

Candra, K. A. (2018). Analisis Pengaruh Pertumbuhan Ekonomi dan Penanaman Modal Asing Terhadap Emisi Karbondioksida di Delapan Negara ASEAN Periode 2004-2013. CALYPTRA, 7(1), 2646-2661.

Caporale, G. M., Sova. A. D., Sova, R. (2022). The direct and indirect effects of financial development on international trade: Evidence from the CEEC-6. Journal of International Financial Markets, Institutions and Money, 78, 1-16.

Ergmen, Y. E. (2022). Forecasting inflation rates with multi-level international dependence. Economics Letters, 214, 1-7.

Farhan, A. (2021). PENGARUH AGRIKULTURA DAN INDUSTRI PADA EMISI KARBON STUDI NEGARA-NEGARA ASIA TAHUN 2010-2016. Media Mahardhika, 19(2), 230-237.

Filippis, F. D., Giua, M., Salvatici, L., Piñeiro, C. V. (2022). The international trade impacts of Geographical Indications: Hype or hope?. Food Policy, 112, 1-11.

Ilechukwu, N., Lahiri, S. (2022). Renewable-energy consumption and international trade. Energy Reports, 8, 10624-10629.

Karatzas, C. M. A., Hansen, C. (2022). International trade resilience and the Covid-19 pandemic. Journal of Business Research, 138, 77-91.

Kristiana, N., Laut, L. T., & Prakoso, J. A. (2021). Pengaruh Konsumsi Energi dan Deforestasi Terhadap Output Nasional Lima Negara Anggota ASEAN. Jurnal Ekonomi Pembangunan, 10(2), 105-112.

Lahcen, M. A., Baughman, G., Rabinovich, S., Buggenum, H. V. (2022). Nonlinear unemployment effects of the inflation tax. European Economic Review, 148, 1-35.

Liu, C., Yang, S., Hao, T., Song, R. (2022). Service risk of energy industry international trade supply chain based on artificial intelligence algorithm. Energy Reports, 8, 13211-13219.

Liu, X., Zhong, S., & Yang, M. (2022). Study on the decoupling relationship of energy-related CO2 emissions and economic growth in China: Using the new two-dimensional decoupling model. Ecological Indicators, 143, 1-10.

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, 122, 1-7.

Mandeya S.M.T., Ho S. (2021). Inflation, Inflation Uncertainty And The Economic Growth Nexus: An Impact Study Of South Africa. MethodsX, 8, 1-17.

Mehrotra, R., Carbonnier, G. (2021). Abnormal pricing in international commodity trade: Empirical evidence from Switzerland. Resources Policy, 74, 1-13.

Murshed M. (2022). The Impacts of Fuel Exports on Sustainable Economic Growth: The Importance of Controlling Enviromental Pollution in Saudi Arabia. Energy Reports, 8, 13708-13722.

Musarat, M. A., Alaloul, W. S., Liew, M. S. (2021). Impact of inflation rate on construction projects budget: A review. Ain Shams Engineering Journal, 12(1), 407-414.

Nguyen M.T. & Bui N.T. (2022). Government Expenditure And Economic Growth: Does The Role Of Corruption Control Matter?. Heliyon, 8(10), 1-8.

Novara, N. (2015). Pengaruh Pertumbuhan PDB Sektoral Terhadap Emisi CO2 di Indonesia. Skripsi. Universitas Syiah Kuala.

Oliveira, H. V. E., Moutinho, V. (2022). Do renewable, non-renewable energy, carbon emission and KOF globalization influencing economic growth? Evidence from BRICS' countries. Energy Reports, 8, 48-53.

Puntoon, W., Tarkhamtham, P., & Tansuchat, R. (2022). The impacts of economic growth, industrial production, and energy consumption on CO2 emissions: A case study of leading CO2 emitting countries. Energy Reports, 8(16), 414-419.

Rahmayani, D. (2021). Analisis Kausalitas Pariwisata, Konsumsi Energi Fosil, Pertumbuhan Ekonomi dan Emisi CO2 di Indonesia. Jurnal Dinamika Ekonomi Pembangunan, 4(2), 124-139.

Raihan, A., Muhtasim, D. A., Khan, M. N. A., Pavel, M. I., & Faruk, O. (2022). Nexus between carbon emissions, economic growth, renewable energy use, and technological innovation towards achieving environmental sustainability in Bangladesh. Cleaner Energy Systems, 3, 1-14.

Richard, C. K., Burdekin, Tao, R. (2022). Chinese influences on inflation determination in Australia and the ASEAN group: A Markov-switching analysis. Asia and the Global Economy, 2(2), 1-17.

Sandow J.N., Fosu E., Duodu E. (2022). External Debt And Economic Growth In Sub-Saharan Africa: Does Heterogeneity In The Quality Of Public Sector Management Make A Difference?. Heliyon, 8(9), 1-9.

Sequeira T.N. (2021). Inflation, Economic Growth And Education Expenditure. Economic Modelling, 99, 1-12.

Sun Y., Hong Y., Wang S. (2019). Out-Of-Sample Forecasts Of China's Economic Growth And Inflation Using Rolling Weighted Least Squares. Journal Of Management Science And Engineering, 4(1), 1-11.

Wang, Z. C. H., Liu, X., Wang, Z., Wen, S., (2022). Risk diffusion of international oil trade cuts: A network-based dynamics model. Energy Reports, 8, 11320-11333.

Yue, H. Y., Leung, K. T. (2011). The Effects of Quantitative Easing on Inflation Rate: A Possible Explanation on the Phenomenon. European Journal of Economics, Finance and Administrative Sciences, 35-40.