MANU Bil. 35 (2), XXX-XXX, 2024 (Disember)
E-ISSN 2590-4086

IMPACT OF DEGLOBALIZATION ON THE PATH TO RENEWABLE ENERGY USAGE IN ASEAN COUNTRIES

[1]ILMI SUGIRAHMA PUTRA
[2]RADEN AYU ADINDA SHAFIRA NAJMAH
[3]SHELA ARDHANA

[1,2,3]Universitas Padjajaran, Cibeusi, Jatinangor.

[1]Ilmi21001@mail.unpad.ac.id
[2]raden21003@mail.unpad.ac.id
[3]shela21001@mail.unpad.ac.id

[a] Corresponding author: Ilmi21001@mail.unpad.ac.id

Dihantar/Received: 22 May 2024| Penambahbaikan/Revised: 23 August 2024
Diterima/Accepted: 30 November 2024| Terbit/ Published: 31 December 2024
DOI: https://doi.org/10.51200/manu.v35i2.5765

Abstrak Dalam beberapa tahun kebelakangan ini, fenomena globalisasi sedang beralih ke arah satu proses yang dikenali sebagai deglobalisasi, iaitu proses mengurangkan kebergantungan dan integrasi antara unit-unit tertentu di seluruh dunia. Ini dapat dilihat daripada beberapa wilayah yang mempunyai rantaian bekalan tertumpu serantau, salah satunya ialah Asia Tenggara. Nampaknya, sebagai rantau yang mempunyai rantaian bekalan tertumpu serantau, Asia Tenggara juga telah mengalami trend peningkatan dalam tahap peratusan penggunaan tenaga boleh diperbaharui. Selepas melihat perkara ini, kami memutuskan untuk meneruskan penyiasatan bagaimana penyahlobalisasian mempengaruhi penggunaan tenaga boleh diperbaharui di negara ASEAN. Kajian kami mengkaji kesan tiga dimensi penyahlobalisasi, iaitu penyahlobalisasian ekonomi, sosial dan politik, terhadap penggunaan tenaga boleh diperbaharui. Kami juga memasukkan pembolehubah lain seperti populasi, pertumbuhan KDNK dan pelaburan langsung asing sebagai pembolehubah terkawal. Kajian menggunakan data panel dari negara ASEAN sepanjang 2006-2020. Dalam analisis statik menggunakan Pooled OLS (POLS) dan Model Kesan Tetap (FEM), kami mendapati bahawa penggunaan tenaga boleh diperbaharui dipengaruhi dengan ketara oleh penyahlobalisasian. Tambahan pula, penyahglobalisasian politik sentiasa memberi kesan positif terhadap penggunaan tenaga boleh diperbaharui sama ada dengan atau tanpa kesan individu dan masa. Manakala analisis dinamik yang menggunakan pendekatan Kumpulan Min Terkumpul bagi Autoregressive Distributed Lag (PMG-ARDL) menunjukkan bahawa penyahlobalisasian ekonomi dan sosial mempunyai kesan negatif ke atas penggunaan tenaga boleh diperbaharui dengan mengambil kira kesan masa. Kami juga membina beberapa implikasi dasar untuk negara ASEAN untuk mengekalkan peralihan kepada pembangunan mampan menggunakan tenaga boleh diperbaharui.

Kata kunci: Deglobalisasi, globalisasi, tenaga boleh diperbaharui, ASEAN, PMG-ARDL.

Abstract *In recent years, the phenomenon of globalization is shifting towards a process known as deglobalization, which is the process of decreasing interdependence and integration between certain units around the world. This can be seen from several regions are having a regionally focused supply chain, one of them is Southeast Asia. Apparently, as a region with a regionally focused supply chain, Southeast Asia has also experienced an increasing trend in the percentage level of renewable energy consumption. After seeing this, we decided to continue investigating how deglobalization influences the renewable energy usage in ASEAN countries. Our study examines the impact of three dimensions of deglobalization, which are economic, social, and political deglobalization, on renewable energy usage. We also include other variables such as population, GDP growth, and foreign direct investment as the controlled variables. The study used panel data from ASEAN countries throughout 2006-2020. In static analysis using Pooled OLS (POLS) and Fixed Effect Model (FEM), we discovered that the consumption of renewable energy is significantly impacted by deglobalization. Furthermore, political deglobalization constantly have a positive impact on the consumption of renewable energy either with or without individual and time effect. Whereas dynamic analysis employing the Pooled Mean Group of the Autoregressive Distributed Lag (PMG-ARDL) approach shows that economic and social deglobalization have a negative impact on the consumption of renewable energy by considering the time effect. We also construct several policy implications for ASEAN countries in order to maintain the transition to sustainable development using renewable energy.*

Keywords: *Deglobalization, globalization, renewable energy, ASEAN, PMG-ARDL.*

INTRODUCTION

Globalization is the process of development and integration among the countries. It is associated with the increased movement of goods, services, and capital worldwide, which has been hailed for promoting freedom, encouraging market competitiveness, and reducing barriers to goods and trade (Le Quéré et al., 2016; Shahbaz et al., 2017)). On the other hand, the benefits and disadvantages of globalization are the subject of ongoing debate.

Due to greater output levels, especially in developing regions with very high emission intensities, a scenario with freer trade would increase global carbon dioxide emissions and air pollution (Lin et al., 2019). Therefore, The OECD Services Trade Restrictiveness Index (STRI): Policy trends up to 2021, indicate that new obstacles to service trade are accelerating across all major sectors, leading several countries to reduce their trade. These situations contrast globalization, which has reduced interdependencies and integration among countries or regions, a concept known as deglobalization (Kim et al., 2023).

Deglobalization, which signifies a reversal of globalization, is an observable trend in our contemporary world. One compelling example of this trend is found in the ASEAN region, which has shifted its focus toward the regional market and reduced engagement in global trade. According to the OECD Trade Policy Paper 2023, the ratio of regional to

extra-regional foreign production is used to describe the regionalization of a supply chain from a region. A higher ratio indicates a more regionally concentrated supply chain. In this situation, Southeast Asia has an increasing ratio, indicating that their global supply chains have become more regionally focused.

However, the path of global interconnectedness is not only a change of economic dimensions but also a changed natural path of energy consumption. In carrying out the production of goods and services, many countries still use primary energy. This results a freer trade that could increase carbon emissions and air pollution. This forces countries to tackle this problem, and one of them is replacing primary consumption energy with renewable energy, which is abundant, diverse, and not subject to import and export restrictions that let any nation become self-sufficient in energy (Sadiq et al., 2023; Zhou et al., 2023).

As a region with a regionally focused supply chain, Southeast Asia has been an adaptive region for shifting towards a more environmentally and sustainable economy. According to the report of Renewable Energy Outlook for ASEAN: Towards a regional energy transition, there are key transition metrics and critical actions to encourage the decarbonization of the energy sector and facilitate sustainable energy transition. One of them is maximizing the biogas and residue recovery, and hastening low-carbon technology use such as renewable energy.

Figure 1.1

Path of Renewable Energy Consumption in ASEAN Region 2006-2020

Source: World Bank Data, edited by author

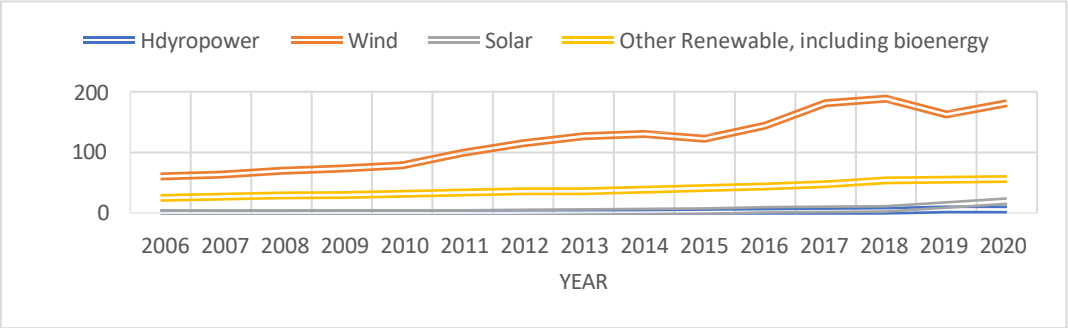


Figure 1.1 shows the proportion of renewable energy use in ASEAN countries. ASEAN has experienced an increasing trend in renewable energy consumption from 2006 until 2020. We also can see that the most widely used consumption of renewable energy is wind. Suppose we conclude what has been depicted earlier, as a region with more regionally focused supply chain, Southeast Asia has also experienced an increasing trend in renewable energy consumption.

On the other hand, the deglobalization case on geopolitical tension between the United Nations and China also has disadvantages, which disrupts the global supply chain, inculuding renewable energy technologies. According to (Awosusi et al., 2023), renewable energy is negatively correlated with political risk in short run and long run. In this situation, China is thought to be a prominent investor on renewable energy, which could lead to schisms among nations (Scholten & Bosman, 2018). At the same time, the

U.S. has restrictions on China's trade, whereas solar cells are a substantial technology for low-carbon energy. If trade tension continues, it will lead to challenges in tackling non-renewable energy consumption that countries depend on in the global chain.

However, literature studies about the impact of deglobalization on renewable energy usage are rarely found. Most of the research on this subject has concentrated on particular varieties of globalization. As an illustration, (Rehman et al., 2023) have discovered that financial openness, a proxy of globalization, has negatively impacted renewable energy generation. On the other hand, (Bayar et al., 2021) have found that the relationship between financial globalization and renewable energy could be more causative. Another research by (Ghazouani, 2022) has also found that globalization negatively impacted renewable energy deployment from 2002 until 2011 and then turned positive and statistically significant for the post-2014 period.

After recognizing this research gap, we decided to continue investigating how deglobalization influences the renewable energy usage in ASEAN countries. We also want to investigate the long-run relationship between the variables using the Pooled Mean Group of the Autoregressive Distributed Lag (ARDL) approach.

LITERATURE REVIEW

Deglobalization

In recent years, the phenomenon of globalization is shifting towards a process known as deglobalization. According to (Kim et al., 2020), Deglobalization refers to the gradual reduction of interconnection and cooperation among specific entities on a global scale.

Based on the literature review by Choi and Pyun (2019), financial closedness is measured by the 1-kaopen index. So, we adopted this measurement for all dimensions of deglobalization, concluding social and political with the KOF Globalization Index. We have chosen to base our literature review on each dimension of deglobalization and the KOF index.

a. Economic Deglobalization and Renewable Energy

The framework for trade deglobalization can be outlined through specific policies, and ample evidence supports this. For instance, the G20 group has introduced trade-restrictive measures to bolster the recovery of vulnerable economies. These policies manifest as quotas, tariffs, and newly implemented border regulations. Another pivotal reference point is the United States, which has adopted protectionist on China. The reactions of China and other nations to these U.S. protectionist policies could escalate protectionism throughout the global economy (Guo & Hawkes, 2019).

Indonesia, Malaysia, and Thailand, affirmed that economic growth, foreign direct investment (FDI) inflows, trade openness, and the human capital index all exert a significant favorable influence on energy consumption (Azam et al., 2015). Similarly, the study (Paramati et al., 2016) found that FDI inflows and stock market capitalization are vital in advancing clean energy usage across 20 emerging market economies.

Another study, a case in 35 OECD countries, has contrasting results. The finding is that trade openness has a strong nonlinear relationship with the use of renewable energy (Zhang et al., 2021). Kang et al. (2021) are supports the findings, in South Asian found that one percent increase in FDI resulting in a 3.36% reduction in renewable energy consumption.

b. Political Deglobalization

Collaboration across borders in the realm of renewable energy offers a myriad of advantages to the nations involved. These benefits encompass enhanced efficiency and cost-effectiveness in electricity generation, excellent market stability, expanded access to novel resources and prospects, and simplified international initiatives.

Research conducted in Turkey for the long-term economic and political dimensions of globalization have a substantial and positive impact on Turkey's consumption of renewable energy (Ozcan et al., 2022). Besides that, Langnel & Amegavi (2020) have analysed political aspect increases the sustainability of the environment.

On the other hand, (Cao et al., 2022) has different result. They found that political promotion reduces renewable energy technology innovation by 3.1%, 6.2%, and 2.7% per unit.

c. Social, Cultural, Interpersonal, and Informational Deglobalization and Renewable Energy

According to Waters (in Bottery, 2003), globalization can erode or fade geographical boundaries in social and cultural life. (Dreher, 2006) defines the social dimension of globalization, which involves the dissemination and interchange of individuals, concepts, and knowledge. This encompasses cultural, interpersonal, and informational aspects of globalization, as highlighted by (Gygli et al., 2019).

Social globalization, some studies imply, does not significantly impact Turkey's consumption of renewable energy in the short and long term (Ozcan et al., 2022). Another study found reversely evidence that social globalization increases environmental degradation (Suci et al., 2023).

METHODOLOGY

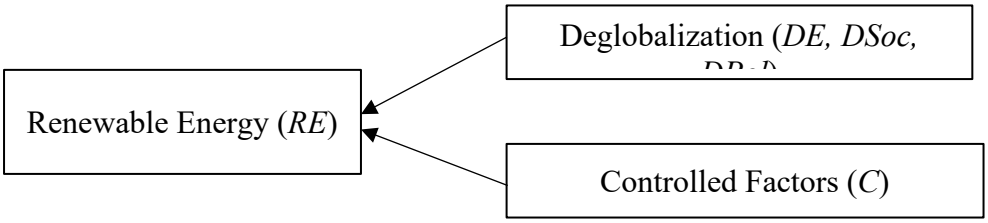
Research Design

This study will explain about the nexus between renewable energy usage and deglobalization in economic on ASEAN countries. Analysis of the study contained panel data for 15 years from 2006 to 2020 and 11 countries on ASEAN. We adapted the recent study by Sevinc et al (2023) that examined the effect of deglobalization to economic growth. The inverted KOF globalization index (100-KOF Index) is chosen as proxy for the deglobalization phenomenon and becomes the explanatory variable based on Bergin et al (2023) that used "1-KAOPEN index" to measured financial closedness (Sevinç et al, 2023; Wang et al, 2022). Also, we synthesized the model of Alola and Joshua (2020) who studied how renewable energy consumption, fossil fuel energy usage, and globalization affected CO_2 emissions using the Pooled Mean Group of the Autoregressive Distributed Lag (ARDL) approach. The argument can be summarized as if the deglobalization on economic, social, and political dimensions will be affected the

renewable energy usage. We consider the time effect assumption and without time effect assumption, so this study will utilize static and dynamic estimations. The research framework is defined based on recent study as follows:

$$RE_{it} = F\left(DE_{it},\ DSoc_{it}, DPol_{it}, \sum_k C_{it,k}\right) \quad (1)$$

Where *RE* refers to renewable energy usage, *DE* for deglobalization on economic dimension, *DSoc* for deglobalization on social dimension, and *DPol* for deglobalization on political dimension. Variables of *i* and *t* stands for countries and periods. *C* are set of controlled factors composed by *k* variables. That framework also we seen as:



The factors that we controlled in this model are economic growth, foreign direct investment, and population growth, respectively, which are common variables used in this study (Sevinç et al, 2023; Bayar et al, 2020; Isiksal & Assi, 2022).

Analysis Methods

This study using the PMG-ARDL (Pooled Mean Group-Autoregressive Distributed Lag) technique proposed by Pesaran et al (1999) to measure the dynamic effect of each variable and see the existence of a long-run relationship between the variables. The negative and significant coefficient of the adjustment error term confirms the existence of a long-run relationship in the model (Wang et al, 2022). Error Correction Model (ECM) can be derived from PMG-ARDL transformation, which integrates the short-run adjustment with the long-run equilibrium, because the number of panel observations is less than the time period (N < T) (Pesaran et al, 1999). The Hausman Test used to determine whether using a fixed or random model, which checks for the possibility of endogeneity (Sheytanova, 2015). The basic models on eq. (2) constructed and also tested.

$$RE_{it} = \beta_0 + \beta_1 DE_{it} + \beta_2 DESoc_{it} + \beta_3 DPol_{it} + \sum_k C_{it,k} + a_i + v_{it} \quad (2)$$

RE is the dependent variable which is the renewable energy data to represent the renewable energy usage. The *DE, DSoc, DPol* variables are the independent variable as a proxy for the deglobalization of the economy, social, and political, which contains the inverted KOF Economy Index. Where β_0 is the intercept parameter or constant, β_1 is slope of parameter in the relationship between dependent and independent variables, *ceteris paribus. i* illustrate each ASEAN country at time *t*. In addition, a_i indicates the individual effect of the model (also called time invariant) and v_{it} indicates the

idiosyncratic error (Wooldridge, 2015). We bring a set of control variables unified in variable *C* that affect the energy transition shown on eq. (3)

$$C_{it} = \theta_1 GDPgr_{it} + \theta_2 FDI_{it} + \theta_3 POP_{it} \quad (3)$$

where *GDPgr, FDI,* and *POP* are economic growth, foreign direct investment, and population growth, respectively. Furthermore, we can construct a PMG-ARDL model according to Pesaran et al. (1999) by referring to that econometric model then building an Error Correction Model (ECM). The panel ARDL model form is ARDL (p, q, q, …, q) as which:

$$RE_{it} = \beta_0 + \sum_j^p \lambda_{ij} RE_{i,t-j} + \sum_j^q \delta'_{ij,g} X_{g,i,t-j} + \zeta ECT_{t-1} + a_i + v_{it} \quad (4)$$

where

$$ECT_{it} = RE_{i,t-j} - \gamma_g X_{g,it} \quad (5)$$

In that equation, X_g contained deglobalization on economic, social, and political dimensions, population and GDP growth, and also foreign direct investment. j defines time lag numbers. λ_{ij} refer scalar coefficients of lagged dependent variable and δ'_{ij} is short-run dynamic coefficient of explanatory and control variables' adjustment on long-run equilibrium. γ_g implies the long-term coefficient for the X_g variables. ECT stands for the error correction term that extracted residuals from the regression of the long-run equation. To achieve this goal, the study employs two panel unit root tests: the Levin, Lin, and Chu (LLC) and Im, Pesaran, and Shin (IPS) by Levin et al. (2002) and Im et al. (2003), respectively.

Data Sources

This paper uses data of ASEAN member countries, which included the deglobalization data from KOF Swiss Economic Institute, the renewable energy usage, population growth, GDP growth, and foreign direct investment data collected from World Bank Open Data and ADB Key Indicator Database.

Table 1

Variable Description

Role	Variable	Definition	Source
Dependent Var. (Y)	RE	Ratio of renewable energy used from the total final energy consumption (Percent)	World Bank Open Data
Independent Var. (X1)	DE	Deglobalization index in economic dimensions (Scale of 1-100)	KOF Swiss Economic Institute,

			processed by the author
Independent Var. (X2)	DSoc	Deglobalization index in social dimensions (Scale of 1-100)	KOF Swiss Economic Institute, processed by the author
Independent Var. (X3)	DPol	Deglobalization index in political dimensions (Scale of 1-100)	KOF Swiss Economic Institute, processed by the author
Control Var. (C1)	POP	Growth of total population on each ASEAN countries (Percent)	World Bank Open Data
Control Var. (C2)	GDPgr	Growth of gross domestic product per capita of each ASEAN countries (Percent)	World Bank Open Data
Control Var (C3)	FDI	Foreign direct in the reporting economy of each ASEAN countries (BoP, Current US Dollars).	World Bank Open Data

Source: Processed by author

RESULTS AND DISCUSSION

We first looked at descriptive statistics and correlations among the variables that will be used and summarized them in Table 2, also the correlation matrix in Table 3.

Table 2

Descriptive Statistics Variables

Variables	N	Mean	Std. Dev	Min	Max
RE	165	31.20	25.12	0	85.77
DE	165	38.64	14.503	5.078339	65.73429
DSoc	165	56.72	17.07	21	88
Dpol	165	61.46	19.60	19	88
GDPgr	165	3.769	4.455	-10.98	29.93
POP	165	1.353	0.654	-0.312	5.322
FDI	165	1.04e+10	1.87e+10	-4.95e+09	1.05e+11

Source: Processed by author

Table 3

Correlation between Variable

	RE	DE	DSoc	DPol	POP	GDPgr	FDI
RE	1						
DE	0.7276	1					
DSoc	0.2987	0.4988	1				
DPol	0.4461	0.6163	0.5207	1			
POP	-0.1815	-0.2772	-0.2082	-0.3051	1		
GDPgr	0.3933	0.2783	0.1432	0.1005	-0.0577	1	
FDI	-0.4104	-0.635	-0.1004	-0.3364	-0.0467	-0.0641	1

Source: Processed by author

In both tables shown the condition expectation of the relationship between these variables is an initial description of the expected conditions of the research. Furthermore, the variables above tend to show correlation values below 0.5, implying that the correlation between variables is low and the efficiency of the estimator obtained can be trusted.

Table 4

Unit Root Test

Variables	IPS		LLC	
	I(0)	I(1)	I(0)	I(1)
RE	3.3247	-4.7368***	-0.7230	-2.7157***
	(0.9996)	(0.0000)	(0.2348)	(0.0033)
DE	-2.7796***	-	-3.3696***	-
	(0.0027)		(0.0004)	
DSoc	-2.6659***	-	-5.6283***	-
	(0.0038)		(0.0000)	
DPol	-0.4338	-5.3918***	-11.1220***	-10.1809***
	(0.3322)	(0.0000)	(0.0000)	(0.0000)
FDI	-1.1651	-8.9963***	-2.2770**	-11.5915***
	(0.1220)	(0.0000)	(0.0114)	(0.0039)
POP	3.9681	-2.5656***	-1.3291*	-7.9413***
	(1.0000)	(0.0051)	(0.0919)	(0.0000)
GDPgr	-0.4454	-6.0087***	1.5423	-7.2560***
	(0.3280)	(0.0001)	(0.9385)	(0.0000)

Notes:
P-values are in parentheses : *** p<0.01, ** p<0.05, * p<0.1
Source : Processed by author

Before estimating the model, unit root tests were conducted on all variables to determine the order of integration using the LLC and IPS approaches. DE and DSoc are integrated at order I [0], while all other variables are integrated at order I [1].

Table 5

Regression Estimation Results

Variables	(1) POLS	(2) FEM	(3) PMG
DE	1.348***	0.138	0.547***
DE (t-1)	-	-	-0.759***
DSoc	-0.194**	-1.042***	1.424***
DSoc (t-1)	-	-	-1.623***
DPol	0.0821	0.349**	0.259***
DPol (t-1)	-	-	1.05e-10**
FDI	1.44e-10	-1.18e-10	-2.471***
POP	1.644	-2.437*	-3.231**
GDPgr	1.119***	0.0243	-0.947***
GDPgr (t-1)	-	-	0.768***
ECT	-	-	-0.139
Δ DE	-	-	-0.198
Δ DSoc	-	-	-0.180
Δ DPol	-	-	0.107
Δ POP	-	-	-7.450
Δ GDPgr	-	-	-0.128
Δ FDI	-	-	4.57e-09
Intercept	-22.87***	67.93***	4.649
Observations	165	165	154
R-squared	0.582	0.381	-
Countries	-	11	11
Time Effect	NO	NO	YES
Panel	NO	YES	YES

Notes:

*** p<0.01, ** p<0.05, * p<0.1

Source : Processed by author

Table 5 shows the estimation with Pooled OLS (POLS), Fixed Effect Model (FEM), and PMG-ARDL model. Without considering the individual effect with POLS model, economic deglobalization has significant result at 5% level. If we consider the individual effect on FEM and PMG estimation that the result showed similar relationship. The effect of economic globalization has positive coefficient that implies if a country's relations with other countries are more closed in economy, there will be an increase in the usage of renewable energy. In an effort to reduce greenhouse gas emissions and address climate change, some countries may choose to reduce long-distance trade and high-carbon-based production. This finds in line with Sevinc et al. (2023), Kutan et al. (2018), and Kacprzyk et al. (2016). But when we look at the lagged variable (t-1), economic deglobalization changes its influence and becomes having a negative and significant relationship to the renewable energy usage. Closedness economy' country at previous

period will decrease renewable energy usage. This result is equivalent to the findings from Bergin et al (2023).

On the social deglobalization, it showed a negative relationship with renewable energy usage when we don't consider the time effect. It's similar to the long-run estimation which considers the effect of the previous period (t-1). The results are same with Gygli's et al., (2019). Social deglobalization may reduce the possibility of international cooperation in addressing renewable energy challenges, especially in terms of financing large-scale renewable energy projects because some renewable energy technologies, often rely on global markets for growth and scalability. However, in the long-run estimation with ordinary time variables (t), the results show that social deglobalization has a positive influence on the use of renewable energy. This study in line with Ahmad et al. (2021) findings.

Furthermore, there is deglobalization in the political field, which consistently has a positive and significant relationship with the use of renewable energy with or without individual and time effect. These findings are consistent with the work of Hasan (2019), Nguyen and Le (2021), and Tekbas (2021). They all concur that political deglobalization signifies a reduction in a nation's involvement in international political collaboration and entities, including regional and global organizations. Political deglobalization can promote energy sovereignty, which allows a country or region to control their own energy resources and policies. By reducing dependence on global policies, countries or regions can more easily adapt their energy policies to their local characteristics and needs. This can create an environment more conducive to the use of renewable energy that suits local conditions.

CONCLUSION

Our study mainly examines the impact of economic deglobalization on renewable energy usage, including some other variables. The study used panel data from ASEAN countries throughout 2006-2020. In static analysis using POLS and FEM, we discovered that deglobalization has a significant impact on renewable energy consumption. Furthermore, political deglobalization constantly have a positive impact on renewable energy consumption either with or without individual and time effect. Whereas dynamic analysis employing the PMG-ARDL approach shows that economic and social deglobalization have a negative impact on renewable energy consumption by considering the time effect.

We found that deglobalization may hinder the path of renewable energy usage in the long run if its occurred for continously. It's caused by ASEAN countries lacking the resources needed to shift from primary energy to renewable energy, so they are still dependent on primary energy consumption. Therefore, we need to look at the short-term and long-term impacts to see how deglobalization affects the renewable energy usage. This study also investigates several policy implications for ASEAN countries in order to maintain the transition to sustainable development using renewable energy. Our recommendation for the short term is that the domestic production of each country in ASEAN has to shift to be more environmentally friendly, especially the product usage for export-import to be more focused on the goal of green transition. For the long term, ASEAN countries need more integration among regional or globally, including political,

social and economic aspects, and the policy on restriction among ASEAN and global integration has to be minimized, especially along the generated green transition.

Apart from that, due to the complex and evolving phenomenon of deglobalization, this study has some limitations. During this study, the literature about this topic is rarely found. As a result, these findings may not include the entire process of deglobalization. Future studies should be focused on improving data collection and literature review to cover up the gaps.

REFERENCES

Alam, M. M., & Murad, M. W. (2020). The impacts of economic growth, trade openness and technological progress on renewable energy use in organization for economic co- operation and development countries. *Renewable Energy*, *145*, 382-390.

Alola, A. A., Joshua, U. (2020). Carbon emission effect of energy transition and globalization: inference from the low-, lower middle-, upper middle-, and high income economies. Environmental Science and Pollution Research.

Awosusi, A. A., Rjoub, H., Dördüncü, H., & Kirikkaleli, D. (2023). Does the potency of economic globalization and political instability reshape renewable energy usage in the face of environmental degradation?. *Environmental Science and Pollution Research*, *30*(9), 22686-22701.

Bayar, Y., Sasmaz, M. U., & Ozkaya, M. H. (2021). Impact of trade and financial globalization on renewable energy in eu transition economies: A bootstrap panel granger causality test. *Energies*, *14*(1).

Belaid, F., & Elsayed, A. H. (2019). What drives renewable energy production in MENA Region? Investigating the roles of political stability, governance and financial sector. *Working Papers*.

Bergin, P., Choi, W. J., Pyun, J. H. (2023). Catching Up By 'Deglobalizing': Capital Account Policy and Economic Growth. NBER Working Paper, 30944.

Bottery, M. (2003). Globalization and the educational policy context. In Davies, B & Burnham, J.W. (Eds.), Handbook of Educational Leadership and Management (pp.155-164). London: Pearson, Longman.

Can, M., Dogan, B., & Saboori, B. (2020). Does trade matter for environmental degradation in developing countries? New evidence in the context of export product diversification. *Environmental Science and Pollution Research*, *27*(15), 14702–14710.

Cao, D., Peng, C., Yang, G., & Zhang, W. (2022). How does the pressure of political promotion affect renewable energy technological innovation? Evidence from 30 Chinese provinces. *Energy*, *254*.

Čaušević, F. (2023). Globalization and deglobalization – introduction and literature review. In *Deglobalization, Financial Inequality, and the Green Economy* (pp. 1 11). Routledge.

Choi, W.J. and Pyun, J.H. (2019). Catching up by deglobalization: Capital account policy and economic growth (SSRN Working Paper No. 3516385).

Copeland, B. R., & Taylor, M. S. (2004). Trade, growth, and the environment. J. Econ. Liter., *42*(1), 7–71. https://doi.org/10.1257/.42.1.7.

Dasgupta, S., De Cian, E., 2016. Institutions and the environment: existing evidence and future directions in Climate Change: Economic impacts and adaptation series editor: Francesco Bosello. Nota Di Lavoro 41, Fondazione Eni Enrico Mattei.

Dogan, B., Saboori, B., & Can, M. (2019). Does economic complexity matter for environmental degradation? An empirical analysis for different stages of development. *Environmental Science and Pollution Control Series*, *26*(31), 31900–31912.

Dreher, A. (2006). Does Globalization Affect Growth? Evidence from a New Index of Globalization. Applied Economics, *38*(10), 1091–1110.

Eren, B. M., Taspinar, N., & Gokmenoglu, K. K. (2019). The impact of financial development and economic growth on renewable energy consumption: Empirical analysis of India. *Science of the Total Environment*, *663*, 189–197.

Ghazouani, T. (2022). Dynamic impact of globalization on renewable energy consumption: Non-parametric modelling evidence. *Technological Forecasting and Social Change*, *185*.

Guo Y., Hawkes A. The impact of demand uncertainties and China-US natural gas tariff on global gas trade Energy, 175 (2019), pp. 205-217

Gygli, S., F. Haelg, N. Potrafke, J.-E. Sturm (2019), The KOF Globalisation Index - Revisited. Review of International Organizations, forthcoming.10.2139/ssrn.3338784

Gyimah, J., Yao, X., Tachega, M. A., Sam Hayford, I., & Opoku-Mensah, E. (2022). Renewable energy consumption and economic growth: New evidence from Ghana. *Energy*, *248*.

Hair, J. F., Black, W. C., Tatham, R. L., & Anderson, R. E. (1995). Multivariate data analysis 6th Edition.

Hasan, M.A. (2019). Does globalization accelerate economic growth? South Asian experience using panel data. Journal of Economic Structures, *8*(1), 26.

Haseeb, M., Hussain, H. I., ´Slusarczyk, B., & Jermsittiparsert, K. (2019). Industry 4.0: a solution towards technology challenges of sustainable business performance. *Social Science*, *8*(5), 154.

Im, K.S., Pesaran, M.H., Shin, Y., (2003). Testing for unit roots in heterogeneous panels. J. Econ. 115, 53–74.

Isiksal, A.Z., Assi, A.F. (2022). Determinants of sustainable energy demand in the European economic area: Evidence from the PMG-ARDL model, Technological Forecasting and Social Change, *183*, 121901.

Jaax, A., Miroudot, S., & van Lieshout, E. (2023). OECD Trade Policy Papers: Deglobalisation? The reorganisation of global value chains in a changing world.

Kacprzyk, A., (2016). Economic freedom–growth nexus in European Union countries. Appl. Econ. Lett. *23*, 494–497.

Kang, X., Khan, F. U., Ullah, R., Arif, M., Rehman, S. U., & Ullah, F. (2021). Does foreign direct investment influence renewable energy consumption? Empirical evidence from south Asian countries. *Energies*, *14*(12), 3470.

Kilic, C. (2015). Effects of Globalization on Economic Growth: Panel Data Analysis for Developing Countries. *Petroleum-Gas University of Ploiesti Bulletin, Technical Series*, *67*(1).

Kim, H. M., Li, P., & Lee, Y. R. (2020). Observations of deglobalization against globalization and impacts on global business. *International Trade, Politics and Development*, *4*(2), 83-103.

Kutan, A. M., Paramati, S. R., Ummalla, M., & Zakari, A. (2018). Financing renewable energy projects in major emerging market economies: Evidence in the perspective of sustainable economic development. *Emerging Markets Finance and Trade*, *54*(8), 1761-1777.

Langnel, Z., and Amegavi, G.B. (2020). Globalization, electricity consumption and ecological footprint: An autoregressive distributive lag (ARDL) approach. Sustainable Cities and Society. *63*, 102482.

Levin, A., Lin, C.F., Chu, C.S.J., 2002. Unit root tests in panel data: asymptotic and finite sample properties. J. Econ. 108, 1–24. https://doi.org/10.1016/S0304 4076(01)00098- 7.

Le Quéré, C., Andrew, R. M., Canadell, J. G., Sitch, S., Korsbakken, J. I., Peters, G. P., & Zaehle, S. (2016). Global carbon budget 2016. *Earth System Science Data*, *8*(2), 605-649.

Lee, K. H., & Min, B. (2014). Globalization and carbon constrained global economy: a fad or a trend? *Journal of Asia Pacific Business*, *15*(2), 105–121.

Lin, J., Du, M., Chen, L., Feng, K., Liu, Y., V. Martin, R., ... & Hubacek, K. (2019). Carbon and health implications of trade restrictions. *Nature Communications*, *10*(1), 4947.

Murshed, M., Elheddad, M., Ahmed, R., Bassim, M., & Than, E. T. (2021). Foreign direct investments, renewable electricity output, and ecological footprints: do financial globalization facilitate renewable energy transition and environmental welfare in Bangladesh?. *Asia-Pacific Financial Markets*, 1-46.

Nguyen, V.C.T. and Le, H.Q. (2021). Globalization and economic growth: An empirical evidence from Vietnam. Journal of Organizational Behavior Research, *6*(1), 173-188.

Ozcan, B., Yucel, A. G., & Temiz, M. (2022). The effect of globalization on energy consumption: evidence from selected OECD countries. In Energy-Growth Nexus in an Era of Globalization (pp. 173-202). Elsevier.

OECD (2021). OECD Services Trade Restrictiveness Index: Policy trends up to 2021.

Ozturk, I., & Acaravci, A. (2013). The long-run and causal analysis of energy, growth, openness and financial development on carbon emissions in Turkey. *Energy Economics*, *36*, 262–267.

Padhan, H.; Padhang, P.C.; Tiwari, A.K.; Ahmed, R.; Hammoudeh, S. (2020) Renewable energy consumption and robust globalization(s) in OECD countries: Do oil, carbon emissions and economic activity matter? *Energy Strategy Reviews*, *32*, 100535.

Paramati, S. R., Ummalla, M., & Apergis, N. (2016). The effect of foreign direct investment and stock market growth on clean energy use across a panel of emerging market economies. *Energy Economics*, *56*, 29-41.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*, *94*(446), 621– 634.

Rahman, M. M., & Sultana, N. (2022). Impacts of institutional quality, economic growth, and exports on renewable energy: Emerging countries perspective. *Renewable Energy*, *189*, 938–951.

Rehman, F. U., Islam, M. M., Ullah, M. Z., Khan, S., & Rehman, M. Z. (2023). Information digitalization and renewable electricity generation: Evidence from South Asian countries. *Energy Reports*, *9*, 4721–4733.

Rose, A. K., & Wieladek, T. (2014). Financial protectionism? First evidence. *The Journal of Finance*, *69*(5), 2127-2149.

Sadiq M, Shinwari R, Wen F, Usman M, Hassan S T, Taghizadeh-Hesary F (2023) Do globalization and nuclear energy intensify the environmental costs in top nuclear energy-consuming countries? Progress in Nuclear Energy 156:104533.

Sbia, R., Shahbaz, M., & Hamdi, H. (2014). A contribution of foreign direct investment, clean energy, trade openness, carbon emissions and economic growth to energy demand in UAE. *Economic modelling*, *36*, 191-197.

Schaz, P. (2019). The real effects of financial protectionism (SSRN Working Paper No. 3333981). https://doi.org/10.2139/ssrn.3333981

Scholten, D., & Bosman, R. (2018). The strategic realities of the emerging energy game conclusion and reflection. *The geopolitics of renewables*, 307-328.

Sevinç. D., Polat. A., Sevil. T., Sevil. G. (2023). How Does Deglobalization Affect Economic Growth?. Journal of Research in Economics, Politics & Finance, *8*(1):1-19.

Shahbaz, M., Bhattacharya, M., & Ahmed, K. (2017). CO2 emissions in Australia: economic and non-economic drivers in the long-run. *Applied Economics*, *49*(13), 1273–1286.

Shahbaz, M., Khan, S., Ali, A., & Bhattacharya, M. (2017). The impact of globalization on CO2 emissions in China. *Singapore Economic Review*, *62*(4), 929–957.

Shahbaz, M., Nasreen, S., Ahmed, K., & Hammoudeh, S. (2017). Trade openness–carbon emissions nexus: the importance of turning points of trade openness for country panels. *Energy Economics*, *61*, 221–232.

Shahbaz, M., Shahzad, S. J. H., Mahalik, M. K., & Hammoudeh, S. (2018). Does globalisation worsen the environment's quality in developed economies? *Environmental Modelling & Assessment*, *23*(2), 141–156.

Shahbaz, M., Shahzad, S. J. H., Mahalik, M. K., & Sadorsky, P. (2018). How strong is the causal relationship between globalization and energy consumption in developed economies? A country-specific time-series and panel analysis. *Applied Economics*, *50*(13), 1479–1494.

Sheytanova, T. (2015). The accuracy of the Hausman Test in panel data: A Monte Carlo Study. Probability Theory and Statistics, p. 47. urn:nbn:se:oru:diva-44288

Suci, S. C., Zahara, V. M., Ginanjar, R. A. F., & Anwar, C. J. (2022, December 31). Does Globalization Worsen Environmental Quality in ASEAN Countries? Jurnal Ekonomi Pembangunan.

Tekbas, M. (2021). The impact of economic, social and political globalization on economic growth: Evidence from BRICS-T countries. Gaziantep University. *Journal of Social Sciences, 20*(1), 57–71. https://doi.org/10.21547/JSS.796472.

Topor, D. I., Marin-Pantelescu, A., Socol, A., Ivan, O. R., (2022). Decarbonization of the Romanian Economy: An ARDL and KRLS Approach of Ecological Footprint. Amfiteatru Economic, *24(*61), pp. 664-682.

Vakulchuk, R., Overland, I. & Scholten, D. (2020). Renewable energy and geopolitics: A review. Renew. Sustain. Energy Rev., Vol 122:109547, DOI: 10.1016/j.rser.2019.109547

Van Bergeijk, P. A. G. (2018). Finance and renewable energy: A review of the literature. Renewable and Sustainable Energy Reviews, *82*, 2944-2959. doi: 10.1016/j.rser.2017.10.079

Van Rijckeghem, C., & Weder, B. (2013). Financial deglobalization: is the world getting smaller?. In *Working Papers 2013/14, Bogazici University, Department of Economics*.

Wang, E., Gozgor, G., Mahalik, M. K., Patel, G., Hu. G. (2022). Effects of institutional quality and political risk on the renewable energy consumption in the OECD countries. Resources Policy, *79*, 103041, 0301-4207.

Werner, T., Motyka, V., Strnad, M., and Schmu¨ lling, T. (2001). Regulation of plant growth by cytokinin. Proc. Natl. Acad. Sci. USA 98: 10487–10492.

Wooldridge, J.M. (2015). Introductory Econometrics: A Modern Approach. Cengage Learning, 9781305446380.

Yameogo, C. E., & Dauda, R. O. (2020). The effect of income inequality and economic growth on environmental quality: a comparative analysis between Burkina Faso and Nigeria. *Journal of Public Affairs*, *e2566.

Yameogo, C. E., Omojolaibi, J. A., & Dauda, R. O. (2021). Economic globalization, institutions, and the environment's quality in sub-Saharan Africa. *Research in Globalization*, *3*, 100035.

Zechariah Langnel b, George Babington Amegavi (2020). Globalization, electricity consumption and ecological footprint: An autoregressive distributive lag (ARDL) approach. Sustainable Cities and Society 63 (2020) 102482.

Zhang, M., Zhang, S., Lee, C. C., & Zhou, D. (2021). Effects of trade openness on renewable energy consumption in OECD countries: New insights from panel smooth transition regression modelling. *Energy economics*, *104*, 105649.

Zhou, W., Jiang, H., & Chen, Z. (2023). Trade vs. Security: Recent Developments of Global Trade Rules and China's Policy and Regulatory Responses from Defensive to Proactive. *World Trade Review*, 1-19.

APPENDIX

1. Huasman Test

Appendix 1. Hausment Test

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
DE	.1379219	.393717	-.2557951	.056157
DSoc	-1.041933	-.8882844	-.153649	.0354792
DPol	.349244	.2952824	.0539616	.0391486
POP	-2.436702	-2.357231	-.0794708	.
GDPgr	.0243421	.0767579	-.0524158	.
FDI	-1.18e-10	-1.43e-10	2.53e-11	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 18.78
Prob>chi2 = 0.0021
(V_b-V_B is not positive definite)

Using the variables from Table 1, variable description, we run the Hausman Test and the result indicates that the Prob > Chi2 = 0.0021. As a result, we reject the H0 and it is preferable to use Fixed Effect than Random Effect.

2. Multicollinearity

Appendix 2. Variance Inflation Factor

Variable	VIF	1/VIF
DE	3.38	0.295430
FDI	2.11	0.474100
DPol	1.86	0.538894
DSoc	1.64	0.609058
POP	1.23	0.812937
GDPgr	1.13	0.887560
Mean VIF	1.89	

From appendix 2, we can see that the average of Variance Inflation Factor (VIF) is 1.89, which is bellow 10. According to Hair et al. (1995), if the VIF is above 10, it shows signs of correlation. But in our model, it has a low VIF so it can be concluded that there is no multicollinearity in this model.

3. Heteroskedasticity

Appendix 3. Breusch-Pagan/Cook-Weisberg Test for Heteroskedasticity

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of RE

         chi2(1)      =     0.61
         Prob > chi2  =   0.4341
```

We use the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. From Appendix 3, we can see that Prob > Chi = 0.4341, which is above 0.05. As a result, we accept the H0 and it can be concluded that there is no heteroskedasticity in this model.