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The relationship between crude oil prices, energy consumption, trade openness and economic growth: An empirical study on Vietnam

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Abstract. In the study, the VECM was employed to evaluate the nexus between crude oil prices, energy use, trade openness, and economic growth of Vietnam between 1991 and 2020. It has been empirically found that economic growth of Vietnam was significantly and negatively influenced by crude oil prices and energy consumption in the short run. Results state that the development of trade openness may accelerate economic growth of this country. Further, the increase of crude oil prices can reduce energy consumption and trade openness of Vietnam. Trade openness can be promoted by energy consumption in the short run. In the long run, results suggest that the increase of crude oil prices may harm economic growth, while the rise of energy consumption may facilitate economic growth of Vietnam. The Johansen test demonstrates that there is a long-term relationship between crude oil prices, energy consumption, trade openness, and economic growth in Vietnam. Lastly, policies are recommended to ensure energy security, accelerate economic growth and achieve sustainable development for Vietnam.

Keywords: oil prices, energy consumption, trade openness, economic growth, Vietnam.

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1. INTRODUCTION

Between 2016 and 2020, the annual gross domestic product (GDP) of Vietnam reached 5.99 percent, on average, which was the highest rate in Southeast Asia. The GDP of this country increased by nearly US$70 billion from US$205.3 billion in 2016 to US$271.2 billion in 2020. By 2020, GDP per capita amounted to US$2,779, 1.33 times higher than that in 2015. In Southeast Asia, trade openness of Vietnam was recorded in the second position behind Singapore, that climbed from 184.7 percent in 2016 to 208.3 percent in 2020 (General Statistics Office, 2021). Crude oil has an important contribution to economic development of emerging countries like Vietnam and there is a close relationship between the domestic oil

market and the international oil market (Bui, 2020). Although the energy sector plays an important role in the development of Vietnam, this country has to face issues related to the increasing demand for energy (EREA & DEA, 2019). For instance, the total consumption for electricity of Vietnam had a rapid increase from 3.3 billion kWh to 140.72 billion kWh between 1980 and 2015 (Ngoc, 2019). The total final energy demand of Vietnam was forecasted to rise about 3.6 percent annually, on average, between 1990 and 2035. Energy consumption of Vietnam was predicted to rise until 2035 because the demand for energy of sectors in the economy accelerates (APERC, 2013).

With the implementation of the renovation in 1986, Vietnam obtained remarkable achievements in economic growth and poverty reduction by transforming its economy into a market-oriented economy along with employing international economic integration, export enforcement, and encouragement of foreign direct investment (Poole et al., 2017). However, Vietnam is facing issues relating to macroeconomic and financial bottlenecks, the asset price acceleration and inflation have been seen as the consequence of monetary policy (World Bank, 2016), and inflexible macroeconomic policy in responding to possible shocks because of weak financial buffers (IMF, 2018). Although Vietnam is an oil-exporting country, it still needs to import a large volume of oil products because of small domestic production and limited reserves. Policies implemented by the government have much more important role than functions of the market in terms of determining oil prices in the domestic market. Thus, the Vietnamese economy depends upon variation of oil prices in the international market (Trang et al., 2017).

The association between energy consumption, trade openness, and economic growth in Vietnam has been investigated by Tang et al. (2016), Nguyen and Nguyen (2021), and Lee et al. (2021). Tang et al. (2016) argued that in Vietnam, energy conservation can harm economic development because it is an energy-dependent economy. Public investment had negative effects on the economy, but foreign direct investment (FDI) and trade openness accelerate economic growth of Vietnam (Nguyen and Nguyen, 2021), while according to Lee et al. (2021), FDI and trade openness had an asymmetric nexus. Apergis and Gangpopadhyay (2020), Pham and Le (2020), and Bui (2020) evaluated the influence of world oil prices on the Vietnamese economy. Apergis and Gangpopadhyay (2020) concluded that the long run relationship between carbon dioxide (CO_2) emissions, energy use, and prices of oil is non-linear and asymmetric, while Trang et al. (2017) and Pham and Le (2020) argued that world oil prices do not have effects on economic growth in Vietnam. Bui (2020) argued that reduction of oil prices in the world market can generate disequilibrium in the oil and commodity markets for the short term. Therefore, the strategic aim of the paper is to explore the causal relationship between crude oil prices, energy use, trade openness, and economic growth of Vietnam for the period 1989-2018. More importantly, policies are recommended to achieve targets in economic growth, energy security, and sustainable development for this country.

The reminder of this study is organized as follows. Section 2 illustrates the literature review. Section 3 presents methodologies. Results and discussion are analysed in section 4. Finally, section 5 refers to conclusion and policy implications.

2. LITERATURE REVIEW

The nexus among crude oil prices, energy use, trade openness, and economic growth has been examined by scholars. AlZoughool et al. (2019) evaluated the impact of instable finance, oil prices, and trade openness on the economy in Jordan, Malaysia, Philippines, Thailand, Indonesia, and Singapore. It has been empirically found that there are cointegration correlation between the variables in all six countries. In Jordan, Philippines, Indonesia, and Singapore, they found that there is a bidirectional causality between instable finance and GDP. Two ways relationships have been found between GDP and instable finance, GDP and trade openness in Malaysia, GDP and trade openness in Jordan, GDP and oil prices in the

Philippines, GDP and instable finance in Thailand, oil prices and GDP in Indonesia, and trade openness and GDP in Singapore. Likewise, the nexus among energy use, urbanization, and economic growth in New Emerging-Market Countries (Colombia, India, Indonesia, Kenya, Malaysia, and Mexico) from 1971 to 2014 was investigated by Bakirtas and Akpolat (2018). They argued that there is a causality running from the economy to energy use, and from urbanization to energy use and the economy. Further, they also found that there is the association between energy use, urbanization and the economy, the economy, urbanization and energy use, and energy use, the economy and urbanization. Nasreen and Anwar (2014) evaluated association among the economy, trade openness and energy use of 15 Asian countries between 1980 and 2011 and they concluded that the long-term relationship existed between variables.

Further, according to Udeagha and Ngepah (2020), the influence of trade openness on the economy in South Africa for the period 1960-2016 was asymmetric in both the short and long run. Similarly, the causal relationship between oil price, energy use and CO2 emissions in Venezuela was carried out by Agbanike et al. (2019). They claimed that there is a long-run relationship between the variables. The rise of crude oil price leads to the development of energy use, government consumption expenditure, and energy use has been found as a result of CO2 emissions, and CO2 emissions have negative impacts on the economy. Cetin et al. (2018) estimated the effect of economic growth, energy use, trade openness, and financial growth on pollution in Turkey between 1960 and 2013 and they found that GDP, energy use, trade openness, and financial growth have impacts on carbon emissions in the long run and there is a unidirectional causality running from economic growth, energy consumption, trade openness, and financial growth to carbon emissions.

Ngoc (2019) investigated the nexus between electricity use, petroleum consumption and the economy in Vietnam from 1980 to 2014 and results show that there is a directional relationship among variables. Results also addressed that electricity use has a positive influence on the economy of Vietnam both in the short-run and long-run. Likewise, Thanh et al. (2019) assessed the effect of FDI, trade openness and economic growth on the development of Vietnam between 2005 and 2015. They concluded that FDI with trade openness has a substitute impact on the economic growth and economic institutions present the combined influences on FDI and trade openness. Lastly, Tang et al. (2016) assessed the relationship between energy consumption and economic growth in Vietnam from 1971 to 2011. Findings showed that energy use, FDI and capital have positive effects on the economy in Vietnam and there is a unidirectional relationship between energy use and GDP.

3. METHODOLOGY

3.1. Sources of data

A dataset for trade openness and GDP of Vietnam between 1991 and 2020 was gathered from the World Bank database. Data on crude oil prices was collected from the website (https://www.macrotrends.net), and data on energy consumption was gathered from the World Energy Report released by BP Statistical Review. The panel data was used for this study because it allows a large sample, increases more degree of freedom, more information, and avoids multi-collinearity among variables, and it also overcomes problems of the cross-sectional data in control variables and time heterogeneity (Hsiao, 2014).

3.2. The vector error correction model (VECM)

The specification of the model was employed to examine the nexus between GDP, crude oil prices, energy use, and trade openness can be stimulated based on the work of Tang et al. (2016) as follows:

$$GDP_t = f(OP_t, EN_t, TR_t) \quad (1)$$

Where: GDP_t denotes the annual GDP growth rate (%); OP_t presents crude oil prices (US$/barrel); EN_t denotes energy consumption per capita (gigajoule); and TR_t presents trade openness (% of GDP).

Table 1

Covariates of the VECM

Variable definition	Unit	Source
Crude oil prices: average closing prices of crude oil in the world market	US$/barrel	https://macrotrend.net
Energy consumption per capita	gigajoule	BP Statistical Review of World Energy
Trade openness: percentage of GDP	%	World Development Indicators
Annual GDP growth rate	%	World Development Indicators

Equation 1 can be transformed as follows:

$$LnGDP_t = \beta_0 + \beta_1 lnOP_t + \beta_2 lnEN_t + \beta_3 lnTR_t + \varepsilon_t \quad (2)$$

Where: $lnGDP_t$, $lnOP_t$, $lnEN_t$, and $lnTR_t$ denote the natural logarithms of the annual GDP growth, crude oil prices, energy consumption per capita, and trade openness; β_0 is the intercept; (β_1,…,β_3) are parameters to be estimated; and ε_t presents the error term.

Crude oil prices, energy consumption, and trade openness were chosen for the study since these variables have relationships with economic growth of Vietnam (Tang et al., 2016; Trang et al., 2017; Apergis and Gangpopadhyay, 2020; Pham and Le, 2020; and Bui, 2020).

There are 3 steps to run a VECM. First, stability of the series of all covariates was examined by using the Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test. Second, existence of the long-term relationship among variables was diagnosed. Finally, estimation of the VECM both in the short run and long run.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. An overview on crude oil prices in the world market, energy consumption, trade openness, and economic growth in Vietnam

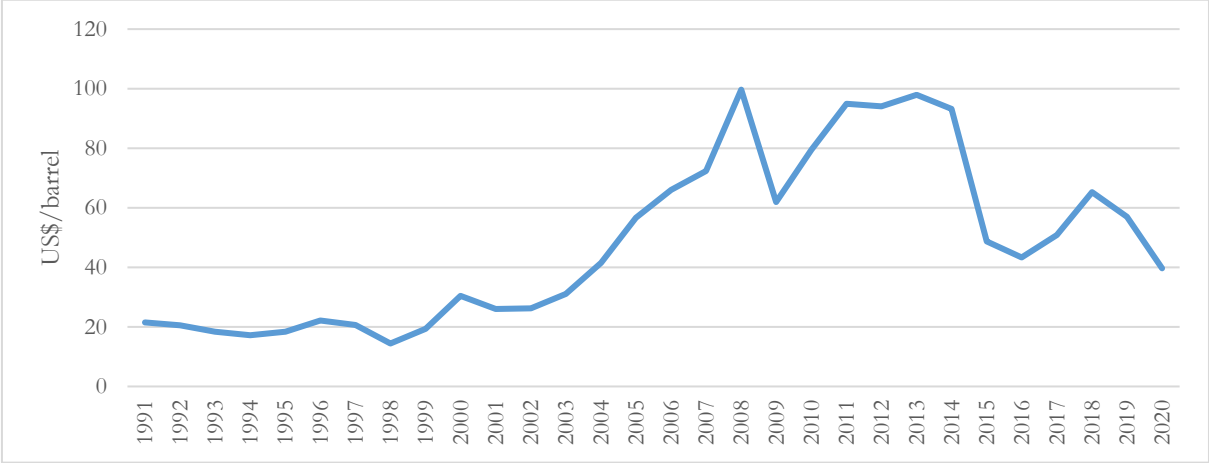

Figure 1. Crude Oil Prices in the World Market
Source: Macrotrends, 2022.

As seen in Figure 1, world crude oil prices strongly fluctuated during the last three decades (1991-2020). Starting at more than US$21 in 1991, world crude oil prices sharply increased and reached a peak at nearly US$100 in 2008 and then significantly decreased by about US$62 in the next year. By 2020, world crude oil prices accounted for nearly US$40, which was doubled higher than that in 1991.

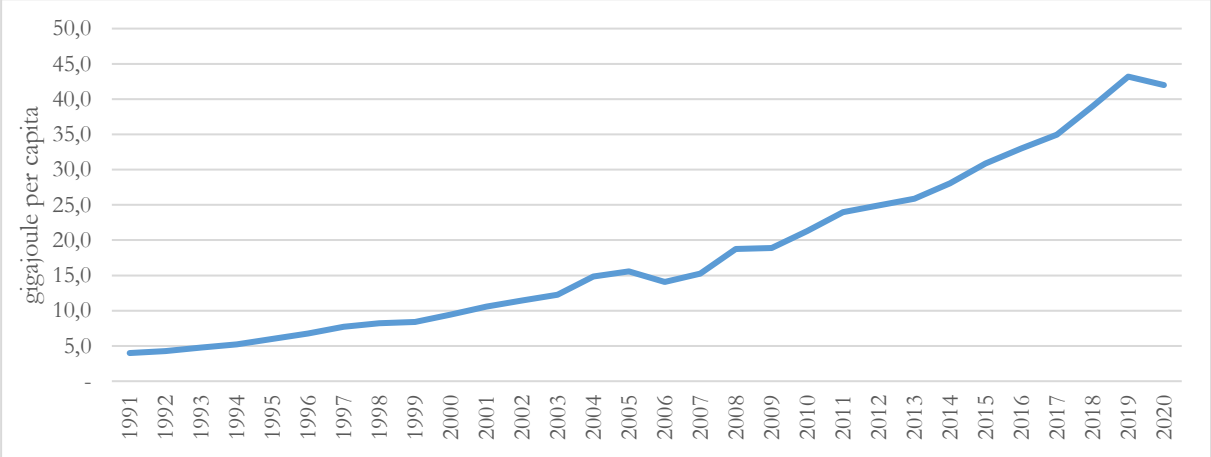

Figure 2. Energy Consumption of Vietnam
Source: BP Statistical Review, 2022.

Energy consumption per capita of Vietnam increased by 38 gigajoules from 4 gigajoules in 1991 to 42 gigajoules in 2020. A significant increase of energy consumption reflects the development of social economics of the country.

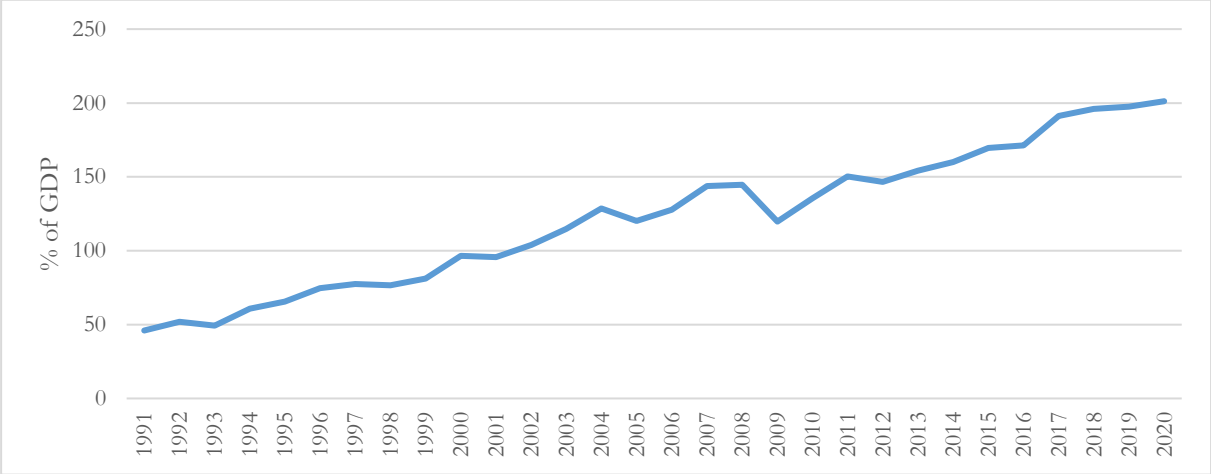

Figure 3. Trade Openness of Vietnam
Source: World Bank, 2022.

As can be seen in Figure 3, Vietnam has high trade openness. Starting at 46 percent in 1991, trade openness of this country presented a significant increase to reach more than 200 percent in 2020. This reflects the international economic integration of Vietnam in recent years.

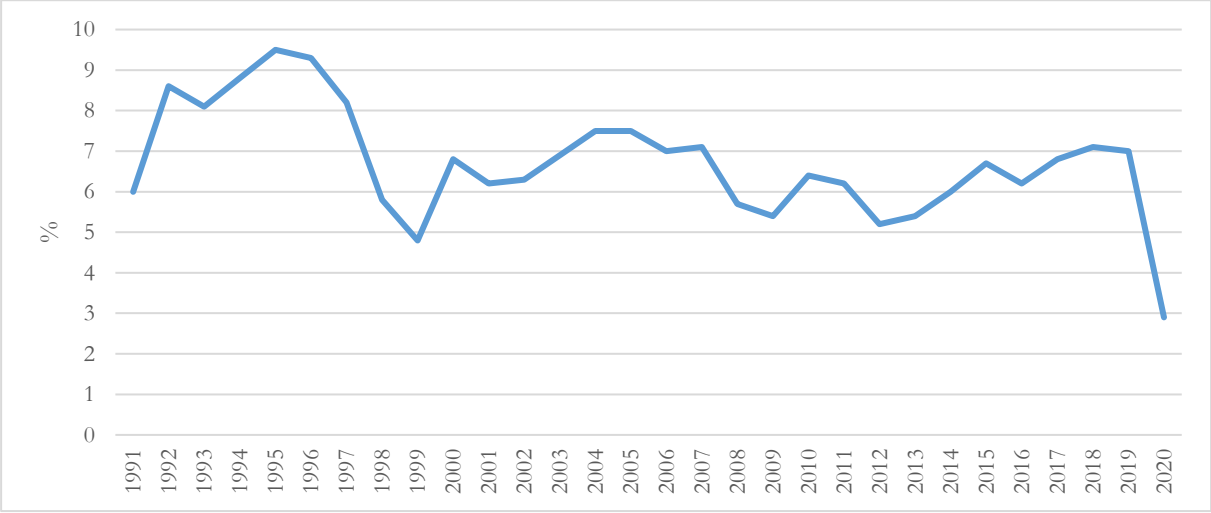

Figure 4. Annual GDP Growth Rate of Vietnam
Source: World Bank, 2022.

The annual GDP growth rate of Vietnam presented a huge variation between 1991 and 2020. By 2020, the annual GDP growth of this country accounted for 2.9 percent, doubled lower than that in 1991.

Table 2

Description of Covariates in the VECM

Variable	**Mean**	**SD**	**Min**	**Max**
Crude oil prices	48.28	28.34	14.42	99.67
Energy consumption	18.12	11.92	4	43.2
Trade openness	121.75	47.21	46	201.2
Annual GDP growth rate	6.71	1.39	2.9	9.5

Source: Author's calculation

Crude oil prices in the world market account for 48.2 US$/barrel. Energy consumption per capita, trade openness, and GDP growth rate of Vietnam account for 18.1 gigajoules, 121.7 percent, and 6.7 percent, on average, respectively.

4.2. The nexus among crude oil prices, energy consumption, trade openness and economic growth in Vietnam

Performance of the Unit Root Test

The unit root test of variables was examined by the ADF and PP test as follows:

Null hypothesis (H_0): The unit root exists in variables

Alternative hypothesis (H_a): The unit root does not exist in variables

We can conclude that the variable is not stable if it has a unit root.

Table 3

The Unit Root Examination

Variables	ADF Test		PP Test		Conclusion
	Level	1st difference	Level	1st difference	
Constant	-1.43	-4.35***	-1.27	-4.49***	I(1)
Constant & trend	-1.15	-4.49***	-1.01	-4.55***	I(1)
Constant	-1.53	-6.37***	-2.02	-5.42***	I(1)
Constant & trend	-2.97	-7.06***	-2.31	-6.01***	I(1)
Constant	-1.89	-5.18***	-2.79*	-6.95***	I(1)
Constant & trend	-1.83	-6.27***	-2.17	-8.03***	I(1)
Constant	-1.79	-2.85**	-1.89	-3.15**	I(1)
Constant & trend	-2.90	-2.76	-2.89	-3.26*	I(1)

Note: ***, ** and * denote statistical significance at 1%, 5%, and 10%, respectively

Source: Author's calculation, 2022.

As seen in Table 3, all variables are not stable at the level [I(0)] and therefore it is necessary to employ the first difference to investigate the stability of variables. We can conclude that the unit root test was not existed in the time series of variables since the absolute values of test statistics of crude oil prices, energy use, trade openness, and GDP are greater than critical values at the 1% and 5%.

Determination of the Lag Length

This step was conducted to clarify the optimal lag for the VECM.

Table 4

Selection of the Lag Length

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	3.39				0.000	0.046	0.102	0.240
1	89.96	173.15	16	0.00	5.5e-08	-5.382	-5.103	-4.414*
2	111.40	42.87	16	0.00	4.0e-08	-5.800	-5.298	-4.058
3	140.04	57.28	16	0.00	2.0e-08	-6.772	-6.048	-4.256
4	167.21	54.32*	16	0.00	1.6e-08*	-7.631*	-6.684*	-4.341

Endogenous: LnCrude oil prices LnEnergy consumption LnTrade openness LnGDP growth

Exogenous: Constant

Number of observations = 26

Notes: * denotes lag order selected by the criterion; LL—log-likelihood values; LR—sequential modified likelihood ratio test statistics; FPE—final prediction error; AIC—Akaike information criterion; HQIC—Hannan–Quinn information criterion; SBIC—Schwarz's Bayesian information criterion.
Source: Author's calculation, 2022.

As seen in Table 4, the optimal lag for the VECM is 4 since 4 lags were proposed by the AIC and HQIC indicators, while 1 lag was only chosen by the SBIC.

The long-term relationship among variables was checked by the Johansen co-integration test.

Table 5

The Johansen Co-integration Test

Maximum rank	LL	Eigenvalue	Trace statistic	5% critical value	1% critical value
0	125.45		83.52	47.21	54.46
1	142.92	0.73	48.57	29.68	35.65
2	158.87	0.70	16.67*1	15.41	20.04
3	164.64	0.35	5.12	3.76	6.65
4	167.21	0.17			

Note: *1 denotes the number of co-integration (ranks) chosen to accept the null hypothesis at 1% critical value
Source: Author's calculation, 2022.

The Johansen co-integration test suggests that there are 2 co-integrations among variables in the long run at the 1% critical value because the Trace statistic value is smaller than the 1% critical value (16.67 < 20.04).

The VECM

Table 6

Results of the VECM in the Short Run

Variables	Coefficient	Std. Error	z	P-value
DLnGDP				
LnGDP				
LD	1.24***	0.31	3.99	0.000
L2D	1.44***	0.40	3.61	0.000
L3D	0.89***	0.34	2.59	0.000
LnOil prices				
LD	0.05	0.13	0.40	0.688
L2D	-0.53***	0.14	-3.82	0.000
L3D	-0.94***	0.26	-3.55	0.000
LnEnergy consumption				
LD	0.05	0.86	0.07	0.948
L2D	-3.21***	1.14	-2.82	0.005
L3D	0.89	0.81	1.10	0.272
LnTrade openness				
LD	-3.81***	1.06	-3.58	0.000
L2D	-0.22	0.59	-0.37	0.710
L3D	1.23**	0.54	2.26	0.024
Constant	0.04	0.10	0.43	0.669
DLnOil prices				
LnGDP				
LD	0.33	0.68	0.48	0.629
L2D	0.42	0.88	0.48	0.630
L3D	0.78	0.76	1.03	0.301
LnOil prices				
LD	0.01	0.28	0.05	0.959

L2D	-0.24	0.31	-0.79	0.428
L3D	-0.40	0.58	-0.69	0.493
LnEnergy consumption				
LD	0.09	1.89	0.05	0.962
L2D	-1.03	2.51	-0.41	0.681
L3D	2.40	1.78	1.34	0.179
LnTrade openness				
LD	-1.53	2.35	-0.65	0.515
L2D	0.18	1.31	0.14	0.890
L3D	-0.36	1.20	-0.30	0.764
Constant	-0.12	0.23	-0.51	0.608
DLnEnergy consumption				
LnGDP				
LD	0.17	0.13	1.26	0.207
L2D	0.13	0.17	0.75	0.455
L3D	0.09	0.15	0.63	0.526
LnOil prices				
LD	-0.10*	0.05	-1.83	0.067
L2D	-0.01	0.06	-0.28	0.781
L3D	-0.16	0.11	-1.44	0.149
LnEnergy consumption				
LD	0.13	0.37	0.36	0.718
L2D	-0.93*	0.50	-1.86	0.062
L3D	0.42	0.35	1.21	0.228
LnTrade openness				
LD	-0.25	0.46	-0.54	0.588
L2D	0.06	0.26	0.23	0.815
L3D	0.12	0.24	0.52	0.604
Constant	0.08*	0.04	1.78	0.074
DLnTrade openness				
LnGDP				
LD	0.13	0.09	1.52	0.128
L2D	-0.01	0.11	-0.13	0.897
L3D	-0.13	0.10	-1.30	0.193
LnOil prices				
LD	-0.03	0.03	-1.04	0.298
L2D	-0.14***	0.04	-3.43	0.001
L3D	0.11	0.07	1.43	0.154
LnEnergy consumption				
LD	-0.92***	0.25	-3.67	0.000
L2D	0.74**	0.33	2.24	0.025
L3D	0.26	0.23	1.11	0.268
LnTrade openness				
LD	0.34	0.31	1.10	0.272
L2D	0.31*	0.17	1.79	0.074
L3D	-0.14	0.16	-0.89	0.373
Constant	0.01	0.03	0.51	0.609

Notes: LD, L2D, and L3D mean lag 1, lag 2, and lag 3, respectively; ***, ** and * denote statistical significance at 1%, 5%, and 10%, respectively

Source: Author's calculation, 2022.

As seen in Table 6, it has been empirically found that price of crude oil and energy use have significant and negative relationships with GDP, and these imply that the increase of crude oil prices and energy use may harm the economy. Vietnam is an energy-dependent economy and variation of the crude oil prices in

the international market has a strong impact on the domestic market of oil and petroleum. The increase of crude oil prices in the world market generates the increase of related goods prices and consequently, it leads to inflation and budget deficit in Vietnam (Trang et al., 2017; and Pham and Le, 2020). The majority energy exports of Vietnam include crude oil and coal since 1990. However, Vietnam is predicted to become a net energy importer due to the high demand energy growth and constraints in available energy resources. For instance, the total final energy demand of Vietnam is forecasted to rise about 3.6 percent annually, on average, between 1990 and 2035. Thus, the development of energy consumption may harm the Vietnamese economy in the short run.

Results also state that trade openness facilitates GDP of Vietnam after 3 years. It is evidence to show that crude oil prices negatively affect energy use and trade openness. Results address that the impact of energy consumption on trade openness is positive reflecting that energy consumption enhances trade openness of Vietnam. In Southeast Asia, trade openness of Vietnam was ranked in the second position behind Singapore, which climbed from 184.7 percent in 2016 to 208.3 percent in 2020. Trade has been seen as an essential driver contributing to economic growth. In addition, the significant and positive association between energy use and trade openness implying the dependence of the energy domestic market on export and import activities.

Table 7

Results of the VECM in the Long Run

Variables	**Coefficient**	**Std. Error**	**z**	**P-value**
LnGDP	1			
LnOil prices	-0.15**	0.06	-2.32	0.020
LnEnergy consumption	0.60**	0.24	2.44	0.015
LnTrade openness	-0.25	0.44	-0.57	0.570
Constant	-1.94			

Note: ** denotes statistical significance at 5%
Source: Author's calculation, 2022.

In the long run, it has been empirically found that the increase of crude oil prices reduces GDP in Vietnam, while energy consumption supports economic growth of this country. These imply that the Vietnamese economy can be negatively influenced by the shocks of price of crude oil in the world market for the long run. Although energy use promotes the economy of Vietnam in the long run, it is necessary to carefully control energy consumption to ensure energy export-import balance and energy security for Vietnam.

5. DISCUSSION

In the short run, results stated that crude oil prices and energy consumption have significant and negative effects on economic growth of Vietnam. These reflects that the increase of crude oil prices in the world and energy use generates the decrease of GDP in Vietnam. This result was consistent to conclusion of Bui (2020), while Trang et al. (2017) and Pham and Le (2020) found that there is no significant nexus between the world crude oil prices and GDP of Vietnam. Crude oil is one of important exported products of Vietnam and crude oil exporting plays a vital role for Vietnam's economy since it provides the foreign currency for import activities, international transactions, and pays to foreign debts (Trung et al., 2016). Prior 2009, Vietnam could not refine oil and therefore it exports crude oil and imports petroleum products. Revenues from crude oil present a significant contribution to the national economy. For instance, by 2014, crude oil revenues accounted for VND98.1 trillion, contributing 12 percent to the total state budget. Hence,

it is the fact that is a strong dependence of the domestic oil and petroleum market and economic growth of Vietnam on the world crude oil prices.

Further, the increase of energy use leads to the drop of the Vietnamese economy in the short run. Vietnam exports crude oil and coal and this country has become a net energy exporter since 1990. In contrast, since 2020, Vietnam became a net energy importer due to the high demand energy growth and limited supply of energy resources. The total final energy demand of Vietnam was forecasted to rise about 3.6 percent annually, on average, between 1990 and 2035. Therefore, the rise in energy consumption may reduce the Vietnamese economy in the short term.

Results also showed that the development of trade openness may facilitate GDP of Vietnam for 3 years lag. Between 2008 and 2018, Vietnam economy presented the impressive growth at 6.1 percent, on average, due to essential drivers such as trade and FDI (Nguyen and Truong, 2022). Its trade openness climbed from 184.7 percent in 2016 to 208.3 percent in 2020, and this was ranked in the second position only behind Singapore (General Statistics Office, 2021). Therefore, trade openness can be identified as a positive determinant contributing to the Vietnamese economy in the short run.

The significant and negative nexus between crude oil prices and energy use and trade openness of Vietnam in the short run reflecting that shock in the increase of crude oil prices in the world market reduces energy consumption and trade openness of Vietnam. Energy use and trade in the domestic market still depend on crude oil prices in the world market.

Energy consumption may promote trade openness of Vietnam in the short run. Energy consumption of Vietnam was predicted to rise until 2035 because of the increase demand for every sector in the economy, including residential and commercial sectors. The increase demand for energy imports may accelerate trade openness of Vietnam in the short run.

In the long run, results demonstrated that crude oil prices have a significant and negative influence on the economy, while energy consumption supports economic growth of Vietnam. These imply the progress of the Vietnamese energy sector in terms of reducing dependency on the world oil market. For example, since February 2009, a refinery with a capacity of about 150 000 barrels per day has been in operation in Quang Nam province, that provides 6.5 million tonnes of petroleum products annually for domestic consumption. Moreover, the primary energy supply of Vietnam was projected to increase by 4.2 percent from 68 Mtoe in 2010 to 188 Mtoe in 2035 (APERC, 2013). Lastly, results addressed that there is a positive relationship between energy consumption and economic growth of Vietnam in the long run and this result was consistent to argument of Tang et al. (2016). Although the rise of energy use may accelerate economic growth of Vietnam, policies in the renewable energy should be considered by the government to avoid issues in an energy-dependent economy.

6. CONCLUSION AND POLICY IMPLICATIONS

The purpose of the article is to explore the nexus among crude oil prices, energy use, trade openness, and GDP of Vietnam between 1991 and 2020. Results show that crude oil prices and energy use have significant and negative effects on the Vietnamese economy in the short run. It has been empirically found that the development of trade openness may accelerate GDP of this country. Further, we also found that the increase of crude oil prices can reduce energy use and trade openness of Vietnam. The rise of energy use promotes trade openness in the short run.

In the long run, results stated that the increase of crude oil prices may decrease economic growth, while the rise of energy consumption supports the Vietnamese economy. The Johansen test demonstrated that there are two cointegrations among variables at the 1% critical value and this implies that there is a long - term relationship between crude oil prices, energy use, trade openness, and economic growth in Vietnam.

Policies were recommended to ensure energy security, accelerate the economy and achieve sustainable development for Vietnam. First, to reduce dependence on the world crude oil market, domestic natural resources should be diversified and effectively exploited in addition to implement a reasonable import-export balance, reduce primary energy exports, and ensure energy security in the future. Second, development of energy along with natural resources and environmental protection to ensure sustainable development for the energy sector. Third, reduction of dependence on energy imports to avoid price shocks in the world energy market. Fourth, strengthening the share of renewable energy (hydro, biomass, solar, and geothermal) in the total commercial primary energy supply to 5 percent by 2025 and to 11 percent by 2050 to reduce exploiting fossil energy resources such as crude oil, coal, and gas (APERC, 2013). Fifth, trade openness should be continued to facilitate because it fosters economic growth. Finally, although the rise of energy use facilitates trade openness and economic growth, it should be carefully examined to ensure energy security and sustainable development for Vietnam.

REFERENCES

Agbanike, T. F., Nwani, C., Uwazie, U. I., Anochiwa, L. I., Onoja, T. G. C., & Ogbonnaya, I. O. (2019). Oil price, energy consumption and carbon dioxide (CO 2) emissions: insight into sustainability challenges in Venezuela. *Latin American Economic Review*, *28*(8), 1–26.

AlZoughool, S. A., Adnan, A. A., AlQatawneh, D. K. A., & AlQudah, T. H. A. (2019). Trade openness, oil prices, financial instability on economic growth in Asian countries: Evidence of second-generation techniques. *European Journal of Economic and Financial Research*, *3*(4), 106–132.

APERC (2013). APEC energy demand and supply outlook. 5th Edition. Asia Pacific Energy Research Centre. February 2013.

Apergis, N., & Gangopadhyay, P. (2020). The asymmetric relationships between pollution, energy use and oil prices in Vietnam: Some behavioural implications for energy policy-making. *Energy Policy*, *140*(111430), 1–12.

Bakirtas, T., & Akpolat, A. G. (2018). The relationship between energy consumption, urbanization, and economic growth in new emerging-market countries. *Energy*, *147*, 110–121.

BP Statistical Review (2021). Statistical Review of World Energy 2021. July 2021.

Bui, X. H. (2021). World oil crisis and its impacts on the petroleum market and the economy of Vietnam. *International Journal of Energy Economics and Policy*, *11*(2), 40–48.

Cetin, M., Ecevit, E., & Yucel, A. G. (2018). The impact of economic growth, energy consumption, trade openness, and financial development on carbon emissions: empirical evidence from Turkey. *Environmental Science and Pollution Research*, *25*(36), 36589–36603.

EREA & DEA (2019). Vietnam energy outlook report 2019. Hanoi, November 2019.

General Statistics Office (2021). *Situation and Motivation on Socio-Economics of Viet Nam for 5 Years (2016-2020)*. Statistical Publishing House, 2021.

Hsiao, C. (2014). *Analysis of panel data*. Third Edition. Cambridge University Press: New York, 2014.

IMF (2018). Viet Nam 2018 article IV consultation – press release and staff report. IMF Country Report No. 18/215. July 2018.

Lee, J. Y., Hsiao, Y. C., Bui, N., & Nguyen, T. T. (2021). Inward foreign direct investment and trade openness in Vietnam: A nonlinear autoregressive distributed lag approach. *Economies*, *9*(120), 1–18.

Macrotrends (2022). Crude oil prices – 70 year historical chart. Retrieved April 2, 2022, from https://www.macrotrends.net/1369/crude-oil-price-history-chart

Nasreen, S., & Anwar, S. (2014). Causal relationship between trade openness, economic growth and energy consumption: A panel data analysis of Asian countries. *Energy Policy*, *69*, 82–91.

Ngoc, B. H. (2019). Energy consumption and economic growth nexus in Vietnam: An ARDL approach. *In International Econometric Conference of Vietnam* (pp. 311-322).

Nguyen, K. T., & Nguyen, H. T. (2021). The impact of investments on economic growth: Evidence from Vietnam. *The Journal of Asian Finance, Economics and Business*, *8*(8), 345–353.

Nguyen, H. H., & Truong, Q. H. (2022). The nexus between inward foreign direct investment and global value chains in developing countries: A case study of Viet Nam. ERIA Discussion Paper Series No. 418. ERIA-DP-2021-51.

Pham, T. T. T., & Le, N. P. A. (2020). A mixed data sampling approach to the asymmetric impacts of world oil price on macroeconomic variables in Vietnam. *Journal of Economics and Development*, *22*(2), 311–324.

Poole, J. P., Santos-Paulino, A. U., Sokolova, M. V., & DiCaprio, A. (2017). The impact of trade and technology on skills in Viet Nam (No. 770). ADBI Working Paper.

Tang, C. F., Tan, B. W., & Ozturk, I. (2016). Energy consumption and economic growth in Vietnam. *Renewable and Sustainable Energy Reviews*, *54*, 1506–1514.

Thanh, S. D., Canh, N. P., & Schinckus, C. (2019). Impact of foreign direct investment, trade openness and economic institutions on growth in emerging countries: The case of Vietnam. *Journal of International Studies*, *12*(3), 243–264. https://doi.org/10.14254/2071-8330.2019/12-3/20

Trang, N. T. N., Tho, T. N., & Hong, D. T. T. (2017). The impact of oil price on the growth, inflation, unemployment and budget deficit of Vietnam. *International Journal of Energy Economics and Policy*, *7*(3), 42–49.

Trung, L. V., Viet, T. Q., & Chat, P. V. (2016). An overview of Vietnam's oil and gas industry. *Petrovietnam Journal*, *10*, 64–71.

Udeagha, M. C., & Ngepah, N. (2020). The asymmetric effect of trade openness on economic growth in South Africa: a nonlinear ARDL approach. *Economic Change and Restructuring*, 1-50.

World Bank (2016). Taking stock: An update on Vietnam's recent economic developments. Special Focus: Transforming Vietnamese Agriculture - Gaining More from Less. World Bank, December 2016.

World Bank (2022). World development indicators. Annual GDP growth of Viet Nam. Retrieved April 2, 2022, from https://databank.worldbank.org/reports.aspx?source=2&series=TG.VAL.TOTL.GD.ZS&country=#

World Bank (2022). World development indicators. Trade openness of Viet Nam. Retrieved April 2, 2022, from https://databank.worldbank.org/reports.aspx?source=2&series=TG.VAL.TOTL.GD.ZS&country=#.