EFFECTS OF ECONOMIC GROWTH, INDUSTRIALIZATION, AND URBANIZATION ON CARBON DIOXIDE EMISSIONS: EVIDENCE FROM VIETNAM

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Abstract

The article aims to explore the causal relationship between economic growth, industrialization, and urbanization in Vietnam between 1987 and 2016 using the VECM. In the short run, it has been empirically found that CO_2 emissions have positive effect on GDP, while industry value added, and urban population have negative relationships with GDP. Results also indicated that CO_2 emissions and urban population negatively affect industry value added, but an increase of GDP may enhance the industry value added. Results showed that both GDP and industry value added have negative impacts on urban population. In the long term, results demonstrated that economic growth harms the environment, while surprisingly, industry value added, and urban population can improve the environmental quality. Results of the Johansen co-integration test indicate that there is a long run relationship between economic growth, industry value added, urban population, and CO_2 emissions in Vietnam. Lastly, policies are recommended to achieve both targets in economic growth and sustainable development for Vietnam.

Keywords: *carbon dioxide emissions, economic growth, industrialization, urbanization*

1. Introduction

The theme on the relationship between carbon dioxide (CO_2) emissions, economic growth, industrialization, and urbanization has been strongly debated by scholars all over the world. Dong *et al.* (2019) found that urbanization and income level have a significant influence on CO_2 emissions in 14 developed countries, and urbanization has a negative effect on CO_2 emissions in the mid-urbanization stage, while Hossain (2011) concluded that energy consumption in the newly industrialized countries generates CO_2 emissions, but economic growth, trade openness, and urbanization had positive effects on the environmental quality in the long run. A study by Nasir *et al.* (2021) argued that the industrialization process does not affect CO_2 emissions in Australia, while Mahmood *et al.* (2020) claimed that the effect of industrialization on the environment is inelastic, but the elastic effect has been found in the impact of urbanization on the emissions in Saudi Arabia.

Vietnam has experienced in economic reform and industrialization for more than two decades and it had great changes in economic structure (Tran and Doan, 2011). By 2019, the agriculture, forestry and fishing sector increased by 2.01 percent, while the industry and construction sector increased by 8.90 percent, and the services sector increased by 7.3 percent. The contribution to the overall growth of each sector accounted for 4.6 percent, 50.4 percent, and 45 percent, respectively (General Statistics Office, 2019). In Vietnam, due to the after-war housing pressures and land speculation, the process of urbanization occurs many years before the industrialization process, causing the urban model, and thinking to experience many crises. By 2020, the urbanization rate of Vietnam will be accounted for about 40 percent with the urban population of more than 45 million people (Chu and Nguyen, 2017). Industrialization and urbanization of Vietnam have progressed considerably. Urbanization of this country is lower than that of the global, however it is higher than the average in other developing countries and Southeast Asian countries (Ha *et al.*, 2019).

Table 1. GDP per capita, electricity consumption per capita, energy use per capita, urban population, and CO_2 emissions in Vietnam

Year	GDP per capita (constant 2010 US$)	Industry value added (% of GDP)	Urban population (%)	CO_2 emissions per capita (metric tonne)
1987	389.8	28.4	19.7	0.4
1996	628.1	29.7	22.6	0.5
2016	1,752.5	32.7	34.5	2.1

Source: World Bank, 2021

As seen in Table 1, gross domestic product (GDP) per capita of Vietnam increased by nearly 4.5 times from US$389.8 in 1987 to US$1,752.5 in 2016, while the value added of industry sector rose by 4.3 percent between 1987 and 2016. The rate of urban population of Vietnam increased by 14.8 percent from 19.7 percent in 1987 to 34.5 percent in 2016, while CO_2 emissions per capita increased by 5.2 times from 0.4 metric tonnes in 1987 to 2.1 metric tonnes in 2016.

In Vietnam, the relationship between economic growth and CO_2 emissions has been examined in work by Thanh and Khuong (2017); and Shahbaz *et al.* (2019), while Tang and Tan (2015) focuses on investigating the relationship between energy consumption, economic growth, foreign direct investment, and CO_2 emissions. Moreover, Morelli and Mele (2020) investigated the relationship between energy consumption, CO_2 emissions, and economic growth. However, none of these studies examine the effect of economic growth, industrialization, and urbanization on CO_2 emissions in Vietnam. Therefore, to narrow down this gap, the paper aims to investigate the impact of economic growth, industrialization, and urbanization on CO_2 emissions in Vietnam between 1987 and 2016 employing the Vector Error Correction Model (VECM). The fundamental contribution of this study is to recommend appropriate policies to foster economic growth and achieve sustainable development in Vietnam.

The remainder of this paper is structured as follows. Section 2 presents the literature review. Methods are discussed in section 3. In section 4, we present results. Finally, discussion and conclusion are summarized in section 5.

2. Literature Review

The relationship between economic growth, industrialization, urbanization, and CO_2 emissions has been highly debated by scholars all over the world. Dong *et al.* (2019) assessed the effect of industrialization and urbanization on CO_2 emissions in 14 developed economies and they found that the influence of industrialization on carbon emissions gradually increases in the low and intermediate income levels, but this effect begins to weaken in the high income level, while urbanization has no correlation to carbon emissions in the low-urbanization stage, however, it has a negative impact on carbon emissions in the mid-urbanization stage. Likewise, Hossain (2011) examined the relationship between CO_2 emissions, energy consumption, economic growth, trade openness, and urbanization in newly industrialized countries between 1971 and 2007. He concluded that energy consumption has been defined as a driver generating CO_2 emissions in these countries. Economic growth, trade openness, and urbanization have positive effects on the environmental quality in the long run. A study by Nasir *et al.* (2021) investigated the relationship between economic growth, trade openness, industrialization, and energy consumption on CO_2 emissions in Australia for the period 1980–2014. Results showed that financial development, energy consumption, and trade openness have positive impacts on CO_2 emissions, while the industrialization process is found to does not affect CO_2 emissions.

In Asia, Ding and Li (2017) examined the effect of industrialization and urbanization on CO2 emissions in 30 China's provinces between 2000 to 2013. It has been empirically found that economic development is the largest driver leading to CO_2 emissions, compared to structural change, energy intensity, and social transition. The urbanization process also has a positive effect on the regional CO_2 emissions. Similarly, Liu and Bae (2018) assessed the causal relationship between CO_2 emissions, energy intensity, economic growth, industrialization, urbanization, and renewable energy consumption in China between 1970 and 2015. They found that 1 percent augments of energy intensity, real GDP, industrialization, and urbanization increase CO_2 emissions by 1.1 percent, 0.6 percent, 0.3 percent, and 1.0 percent, respectively. A research by Ali e*t al.* (2019) evaluated the influence of urbanization on CO_2 emissions in Pakistan from 1972 to 2014 and results demonstrated that urbanization has been found to increase carbon emissions both in the short run and long run. Likewise, Mahmood *et al.* (2020) explored the impact of industrialization and urbanization on the CO_2 emissions per capita in Saudi Arabia between 1968 and 2014. They found that both industrialization and urbanization impede the environment with the inelastic effect of industrialization and elastic effect of urbanization on the emissions.

In Vietnam, Tang and Tan (2015) examined the relationship between energy consumption, economic growth, foreign direct investment, and CO_2 emissions, while Thanh and Khuong (2017) estimated factors affecting CO_2 emissions between 1990 and 2011. Shahbaz *et al.* (2019) investigated the relationship between economic growth and environmental degradation in Vietnam from 1974 to 2016 and they found that this country may expect a temporary reduction in CO_2 and therefore the government should concentrate on long-term economic and environmental strategies. Morelli and Mele (2020) investigated the relationship between energy consumption, CO_2 emissions, and economic growth in Vietnam between 1970 and 2014 and they concluded that there is unidirectional causality running from economic growth to energy consumption. Lastly, a study by Nguyen *et al.* (2021) assessed the effect of economic growth, financial development, transportation capacity on CO_2 emissions in Vietnam for the period 1986-2019 and results addressed that an increase in per capita GDP and financial development have negative influences on environmental quality, while transportation capacity and foreign investment can improve environmental quality.

3. Method

3.1. Data and Sources

A panel dataset for the relationship between economic growth, industrialization, urbanization, and CO_2 emissions in Vietnam for the period (1987–2016) is gathered from the World Development Indicators released by the World Bank. Thus, a total of 30 observations is entered for data analysis. The panel data is used for this research because of the following advantages: (1) it benefits in terms of obtaining a large sample, giving more degree of freedom, more information, and less multi-collinearity among variables; and (2) it may overcome constraints related to control individual or time heterogeneity faced by the cross-sectional data (Hsiao, 2014).

3.2. The Vector Error Correction Model (VECM)

The specification of a model is used to examine the relationship between CO_2 emissions, economic growth, industrialization, and urbanization can be defined as follows (Ding and Li, 2017; Dong *et al.*, 2019; and Mahmood *et al.*, 2020):

$$CO_{2t} = f(GDP_t, IND_t, URB_t) \qquad (1)$$

Where: CO_2 denotes CO_2 per capita (metric tonne); GDP_t means GDP per capita (constant 2010US$); IND_t denotes industry value added (% of GDP); and URB_t denotes the rate of urban population in the total population (%).

Table 2. Covariates of the VECM

Variable definition	Unit	Source
CO_2 emissions per capita	metric tonne	World Development Indicators
GDP per capita	constant 2010US$	World Development Indicators
Industry value added (% of GDP)	%	World Development Indicators
Rate of urban population (% of total)	%	World Development Indicators

After transforming the functional form of Equation 1, we obtain the following model:

$$LnCO_{2t} = \beta_0 + \beta_1 lnGDP_t + \beta_2 lnIND_t + \beta_3 lnURB_t + \varepsilon_t \qquad (2)$$

Where: $lnCO_{2t}$, $lnGDP_t$, $lnIND_t$, and $lnURB_t$ denote the natural logarithms of CO_2 per capita, GDP per capita, industry value added, and the rate of urban population in the total population; β_0 is the intercept; $(\beta_1,\ldots,\beta_3)$ are parameters to be estimated; and ε_t presents the error term.

The procedure of a VECM includes three steps. The first step is to check the stationarity of the series or their order of integration in all variables. In this research, the Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test were employed to examine the stationary state of the series. The second step is to check the presence of a long run relationship among all variables in the equation. In this stage, the co-integration tests will be carried out to investigate the existence of long run relationships between the variables. In the third step, the residuals from the equilibrium regression can be used to estimate the VECM (Azlina and Mustapha, 2012).

4. Results

4.1. CO_2 Emissions, Economic Growth, Industrialization, and Urbanization in Vietnam: An Overview

Table 3. Characteristics of CO_2 emissions, economic growth, industry value added, and urban population in Vietnam

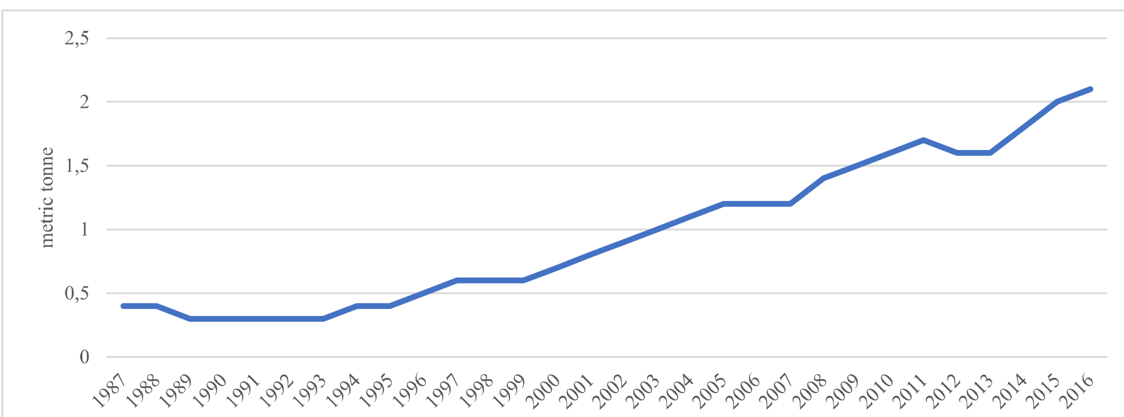
Variable	Mean	SD	Min	Max
CO_2 emissions per capita	0.96	0.57	0.3	2.1
GDP per capita	917.95	419.76	389.8	1752.5
Industry value added	32.58	5.17	22.7	40.2
The rate of urban population	25.89	4.66	19.7	34.5

Source: Author's calculation, 2021

Note: SD denotes standard deviation

The average CO_2 emissions and GDP per capita of Vietnam account for 0.96 metric tonnes and US$917.9, respectively. Industry value added and the rate of urban population of this country account for 32.5 percent and 25.8 percent, respectively, on average (Table 3).

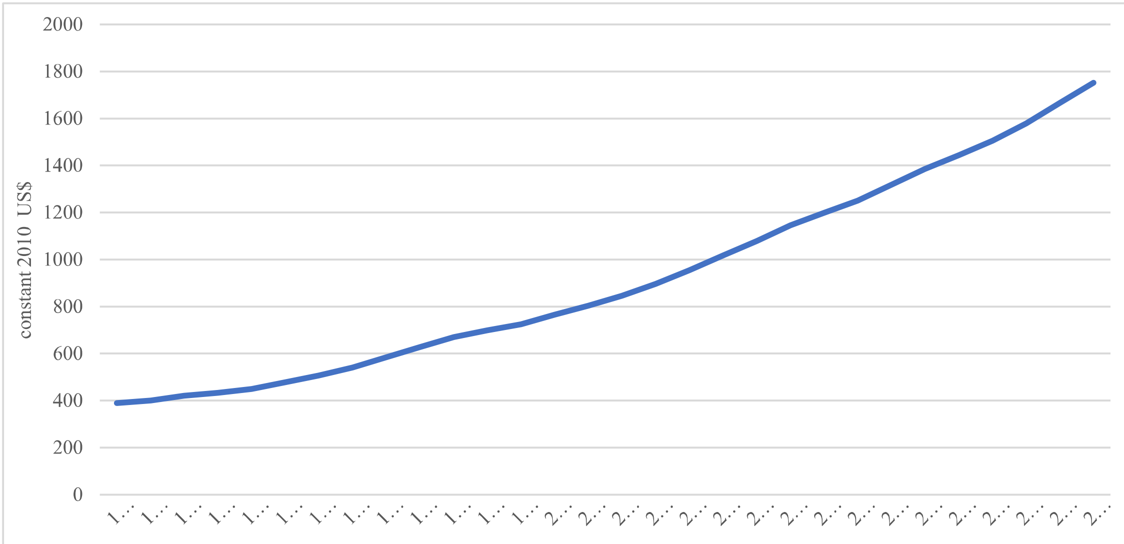
Figure 1. CO_2 emissions per capita in Vietnam



Source: World Bank, 2021

As seen in Figure 1, between 1987 and 2016, the average amount of CO_2 emissions per capita of Vietnam presented an upward trend. By 2016, CO_2 emissions per capita of this country accounted for 2.1 metric tonnes, increasing by 5.2 times compared to that in 1987. This result may be interpreted by the expansion of industrialization and modernization in the socio-economic development of this country (Figure 1).

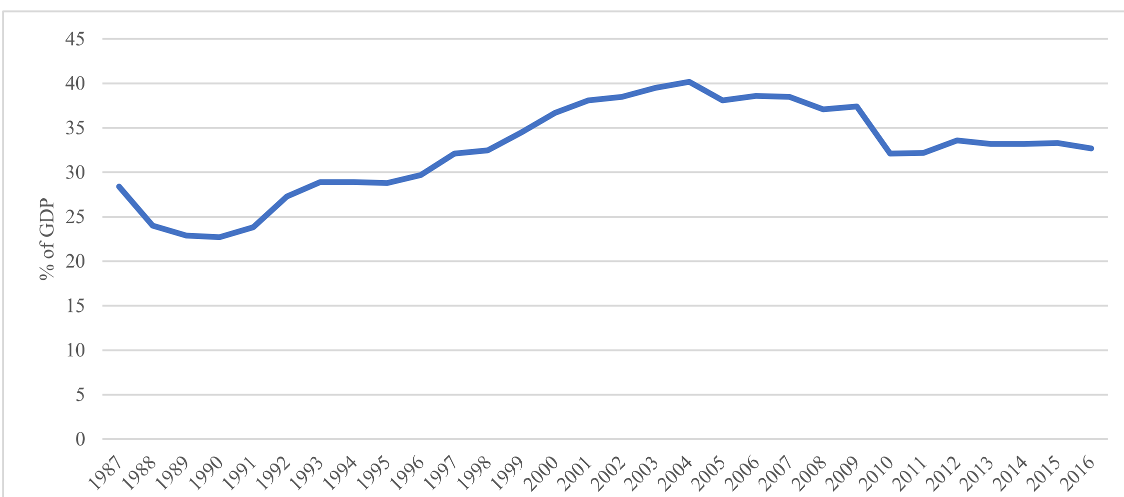
Figure 2. GDP per capita in Vietnam



Source: World Bank, 2021

As seen in Figure 2, GDP per capita of Vietnam tended to grow between 1987 and 2016. For example, by 2016, the average GDP per capita of this country accounted for about US$1,752.5, which was more than 4.5 times higher than that of 1987. This outcome expresses a remarkable achievement of Vietnam in the renovation of the economic management mechanism and integration of international economics (Figure 2).

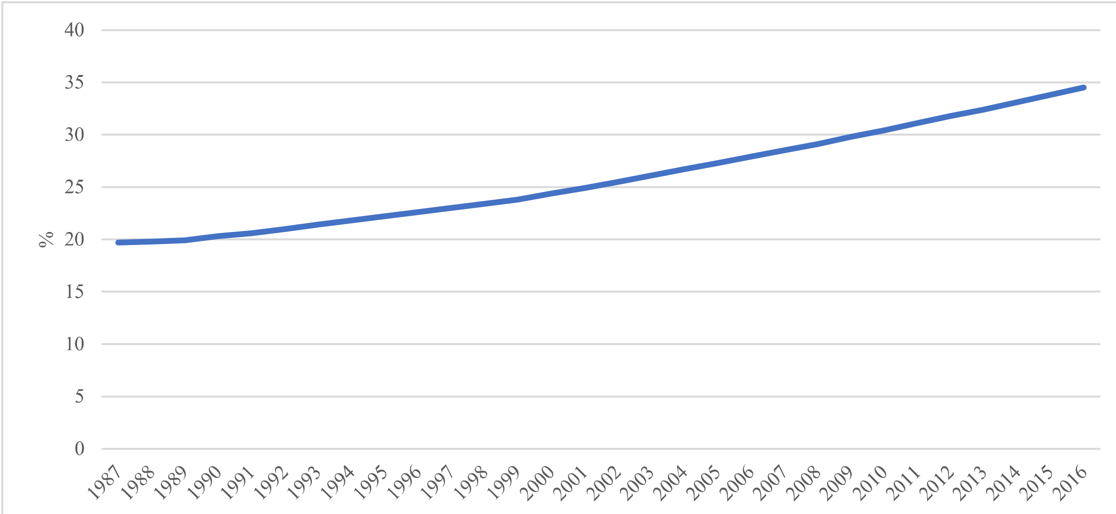
Figure 3. Value added of the industry sector in Vietnam



Source: World Bank, 2021

Value added of the industry sector of Vietnam tended to increase for the last three decades (1987–2016). For instance, by 2016, the average value added of the industry of this country accounted for about 32.7 percent, which was more than 4.3 percent higher than that of 1987. This result reflects the progress of industrialization process in this country (Figure 3).

Figure 4. Rate of urban population in Vietnam



Source: World Bank, 2021

In Vietnam, urbanization has been extended along with the process of industrialization and modernization. For instance, after 30 years (1987–2016), by 2016, the rate of urban population accounted for 34.5 percent, increasing by nearly 20 percent compare to that of 1987 (Figure 4).

4.2. Effects of Economic Growth, Industrialization, and Urbanization on CO_2 Emissions in Vietnam

4.2.1. Implementation of the Unit Root Test

The unit root test is carried out to check the stationarity of the time series variables (Adeola and Ikpesu, 2016). In this study, the Augmented Dickey-Fuller (ADF) test and the Phillips-Peron (PP) test are used to examine the stationarity of CO_2 emissions, economic growth, industry value added, and urban population in Vietnam with the hypothesis as follows:

Null hypothesis (H_0): The variables contain a unit root

Alternative hypothesis (H_a): The variables do not contain a unit root

If a variable contains a unit root, then this implies that the time series of this variable is not stationarity.

Table 4. Results of the unit root test

Variables		ADF Test		PP Test		Conclusion
		Level	1st difference	Level	1st difference	
$LnCO_2$ emissions per capita	Constant	0.02	-4.27***	0.14	-4.37***	I(1)
	Constant & trend	-3.57**	-3.97***	-3.03	-4.40***	I(1)
LnGDP per capita	Constant	-0.91	-2.34	0.04	-4.15***	I(1)
	Constant & trend	-1.85	-2.36	-2.39	-4.08***	I(1)
LnIndustry value added	Constant	-2.29	-3.47***	-1.24	-4.69***	I(1)
	Constant & trend	-1.29	-4.24***	-1.31	-5.55***	I(1)
LnUrban population	Constant	1.71	-5.17***	2.41	-4.36***	I(1)
	Constant & trend	-4.00***	-5.35***	-4.24***	-4.98***	I(1)

Source: Author's calculation, 2021

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

The results in Table 4 show that the time series of CO2 emissions per capita, GDP per capita, industry value added, and urban population are not stationary at the level [I(0)]. Therefore, the first difference is carried out to examine the stationary of these variables. Results indicate that the absolute values of test statistics are greater than critical values at the 1% and 5%, respectively and therefore we can conclude that the time series of these variables do not contain unit roots and this suggests that the time series are stationary at the first difference [I(1)].

4.2.2. Examination of the Long Run Relationship among Variables

Before examining the long run relationship among variables, the optimal lag length should be determined. The purpose of this step is to specify the optimal lag for the VECM.

Table 5. Selection of the lag length

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	128.44				8.2e-10	-9.57	-9.51	-9.37
1	279.34	301.79	16	0.000	2.6e-14	-19.94	-19.67	-18.98*
2	294.05	29.42	16	0.021	3.2e-14	-19.85	-19.34	-18.10
3	310.23	32.35	16	0.009	4.1e-14	-19.86	-19.13	-17.34
4	347.97	75.47*	16	0.000	1.5e-14*	-21.53*	-20.58*	-18.24

Endogenous: LnCO_2 LnGDP LnIndustry value added LnUrban population

Exogenous: Constant

Number of observations = 26

Source: Author's calculation, 2021

*Notes: *denotes lag order selected by the criterion; LL means log likelihood values; LR represents sequential modified LR test statistics; FPE denotes final prediction error; AIC means Akaike information criterion; HQIC represents Hannan-Quinn information criterion, and SBIC means Schwarz's Bayesian information criterion*

As seen in Table 5, results suggest that the optimal lag length, in this case, is four lags because this value is recommended by AIC and HQIC, while one lag (the number of lag is equal to 1) is only recommended by SBIC indicator. Therefore, four lags (the number of lag is equal to 4) is chosen to run the VECM in the third step.

The Johansen co-integration test is performed to examine the long-run relationship among variables. If variables are co-integrated, it suggests that there is a long-term relationship among variables (Musunuru, 2017).

The hypothesis to be tested can be identified as follows:

Null hypothesis (H_0): There is no co-integration among variables

The alternative hypothesis (H_a): There is co-integration among variables

In this study, the Johansen co-integration test is carried out by the trace statistic test. Trace test is a likelihood-ratio-type test, which operates under different assumptions in the deterministic part of the data generation process (Lutkepohl *et al.*, 2001).

Table 6. Results of Trace statistic in the Johansen co-integration test

Maximum rank	LL	Eigenvalue	Trace statistic	5% critical value	1% critical value
0	278.08		64.03	47.21	54.46
1	292.27	0.63	35.65	29.68	35.65
2	302.44	0.51	15.30*1*5	15.41	20.04
3	310.09	0.42	0.00	3.76	6.65
4	310.10	0.00			

Source: Author's calculation, 2021

*Note: *1 and *5 denote the number of co-integration (ranks) chosen to accept the null hypothesis at 1% and 5% critical values*

As seen in Table 6, we cannot reject the null hypothesis in the rank two (two co-integrations) because trace statistics are less than the 1% critical value (15.30 < 20.04) and the 5% critical value (15.30 < 15.41) and these reflect that there are two co-integrations at the 1% and 5% critical values among variables.

4.2.3. Estimation of the VECM

Table 7. Estimation of the VECM in the short run

Variables	Coefficient	Std. Error	z	P-value
DLnCO_2 per capita				
LnCO_2 per capita				
LD	-0.028	0.39	-0.07	0.941
L2D	0.035	0.33	0.11	0.914
L3D	0.092	0.27	0.33	0.742
LnGDP per capita				
LD	1.439	2.22	0.65	0.518
L2D	-0.581	2.06	-0.28	0.778
L3D	0.255	1.94	0.13	0.895
LnIndustry value added				
LD	-0.155	0.48	-0.32	0.746
L2D	0.486	0.50	0.96	0.339
L3D	0.115	0.47	0.24	0.807

LnUrban population				
LD	1.096	5.35	0.20	0.838
L2D	-3.864	4.03	-0.96	0.338
L3D	2.927	3.75	0.78	0.435
Constant	0.005	0.19	0.03	0.978
DLnGDP per capita				
LnCO_2 per capita				
LD	0.078**	0.03	2.32	0.020
L2D	0.048*	0.02	1.66	0.097
L3D	0.059**	0.02	2.45	0.014
LnGDP per capita				
LD	0.078	0.19	0.41	0.685
L2D	-0.032	0.17	-0.18	0.857
L3D	0.153	0.16	0.90	0.366
LnIndustry value added				
LD	-0.098**	0.04	-2.36	0.018
L2D	-0.091**	0.04	-2.06	0.040
L3D	-0.017	0.04	-0.43	0.670
LnUrban population				
LD	-0.909*	0.46	-1.95	0.051
L2D	-0.022	0.35	-0.06	0.949
L3D	-0.433	0.32	-1.33	0.185
Constant	0.063***	0.01	3.66	0.000
DLnIndustry value added				
LnCO_2 per capita				
LD	-0.422**	0.20	-2.02	0.043
L2D	-0.319	0.17	-1.80	0.072
L3D	0.044	0.14	0.30	0.765
LnGDP per capita				
LD	2.200*	1.18	1.85	0.064
L2D	0.189	1.10	0.17	0.863

L3D	-0.794	1.03	-0.76	0.445
LnIndustry value added				
LD	0.403	0.25	1.57	0.116
L2D	0.214	0.27	0.79	0.431
L3D	0.345	0.25	1.37	0.171
LnUrban population				
LD	1.485	2.86	0.52	0.604
L2D	1.630	2.15	0.76	0.449
L3D	-6.744***	2.00	-3.36	0.001
Constant	0.028	0.10	0.27	0.785
DLnUrban population				
LnCO_2 per capita				
LD	0.009	0.01	0.60	0.547
L2D	0.013	0.01	1.05	0.294
L3D	0.014	0.01	1.37	0.171
LnGDP per capita				
LD	-0.047	0.08	-0.55	0.581
L2D	-0.052	0.07	-0.66	0.508
L3D	-0.216***	0.07	-2.88	0.004
LnIndustry value added				
LD	-0.038**	0.01	-2.06	0.040
L2D	0.007	0.01	0.37	0.712
L3D	0.007	0.01	0.43	0.667
LnUrban population				
LD	-0.200	0.20	-0.97	0.332
L2D	-0.034	0.15	-0.22	0.824
L3D	0.253*	0.14	1.76	0.079
Constant	0.034***	0.00	4.58	0.000

Source: Author's calculation, 2021

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

As seen in Table 7, CO_2 emissions positively affect GDP, but industry value added, and urban population have negative relationships with GDP. It has been empirically found that GDP has a positive effect on industry value added, while CO_2 emissions and urban population have negative relationships with industry value added. In addition, GDP and industry value added have been found to have negative impacts on urban population in Vietnam.

Table 8. Estimation of the VECM in the long run

Variables	Coefficient	Std. Error	z	P-value
LnCO_2 per capita	1			
LnGDP per capita	5.881***	1.00	5.87	0.000
LnIndustry value added	-1.888***	0.26	-7.07	0.000
LnUrban population	-17.724***	2.52	-7.02	0.000
Constant	24.696			

Source: Author's calculation, 2021

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

In the long run, the growth of GDP per capita has been defined as a factor generating environmental degradation, but industry value added, and urban population are significant determinants which contribute to improve the environmental quality in Vietnam (Table 8).

5. Discussion and Conclusion

In the short run, the evidence has been found to show that CO_2 emissions have positive influence on GDP, while industry value added, and urban population negatively affect GDP. These reflect that economic growth in the short run of Vietnam depends on other sectors such as agriculture and services and the rural area rather than the industry and urbanization. CO_2 emissions and urban population have negative relationships with industry value added, but GDP contributes to the growth of the industry sector. Results indicate that both GDP and industry value added have negative effects on urban population. Thanh and Khuong (2017) concluded that GDP can reduce CO_2 emissions in the short run, but our results did not find a relationship between these variables. The difference can be interpreted by the model and duration employed for the study. The VECM is used in our research to examine the relationship between economic growth, industry value added, urban population, and CO2 emissions between 1987 and 2016, while Thanh and Khuong (2017) employed the Autoregressive Distributed Lag Model for the period 1990–2011.

In the long term, results addressed that economic growth harms the environment. This result is consistent to argument of Thanh and Khuong (2017); Ding and Li (2017);

Shahbaz *et al.* (2019); and Nguyen *et al.* (2021). Our results also found that industry value added, and urban population are significant factors since these can improve the environmental quality. However, Dong *et al.* (2019) addressed that industrialization may increase CO_2 emissions in developed countries, and Ding and Li (2017) claimed that urbanization contributes to CO_2 emissions in China's provinces. These imply that the progress of industrialization and urbanization of Vietnam is carefully considered along with environmental protection in the long term.

Results of the Johansen co-integration test indicate that there is a long run relationship between economic growth, industry value added, urban population, and CO_2 emissions in Vietnam. This result is consistent to conclusions of Tang and Tan (2015); Thanh and Khuong (2017); Shahbaz *et al.* (2019); and Nguyen *et al.* (2021).

The article aims to explore the causal relationship between CO_2 emissions, economic growth, industrialization, and urbanization in Vietnam between 1987 and 2016 using the VECM. In the short run, it has been empirically found that CO_2 emissions have positive effect on GDP, while industry value added, and urban population have negative relationships with GDP. Results also indicated that CO_2 emissions and urban population negatively affect industry value added, but an increase of GDP may enhance the industry value added. Results showed that both GDP and industry value added have negative impacts on urban population. In the long term, results demonstrated that economic growth harms the environment, while industry value added, and urban population are positive factors because these can improve the environmental quality.

Policies are recommended to enhance economic growth and achieve sustainable development in Vietnam. First, industrialization and urbanization should be carefully controlled because these can reduce economic growth in the short run. Therefore, the industry sector should be restructured, and urbanization should be carefully controlled in the short run to contribute to economic development. Moreover, the government should invest more on other industries such as agriculture and services and the rural area because these are motivators for economic growth in Vietnam for the short run. Second, CO_2 emissions and urbanization should be managed since these have negative effects on the growth of the industry sector and consequently, development of industrialization and urbanization should be considered along with environmental protection. Third, economic growth should be encouraged because it contributes to increase the industry value added. Fourth, in the long term, economic growth should be carefully considered because it decreases the environmental quality. Finally, industrialization and urbanization are positive factors contributing to reduce CO_2 emissions in the long run and therefore the government should concentrate on feasible policies such as "green economy", "green growth", "low carbon economy", and "circular economy" to achieve both targets in economic growth and sustainable development.

6. References

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