
The relationship between tourism, foreign direct investment, energy consumption, agriculture and economic growth: evidence from Vietnam

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Abstract: This research is one of the most effective studies in Vietnam using observed variables including tourism, agriculture, foreign direct investment, energy consumption and economic development in the period 1990-2019. This work affirms the role of attracting foreign investment in Vietnam in the past 20 years, from which we predict the same results in the future. The research method used ARDL (Autoregressive Distributed Lag) model, Bound Test, ECM model and Granger causality to explore the short-run, long-run and causal relationships between them. The results show that Foreign Direct Investment (FDI) positively affects economic development while energy consumption is in the opposite direction, energy consumption exists a positive relationship to agricultural development whereas tourism development exists a negative impact in terms of drought. In addition, one-way causal relations are found that FDI promotes energy consumption, economic development leads to increased energy consumption and the promotion of tourism by energy consumption. Thereby, we have given a number of solutions to increase attracting foreign investment. In addition, we have proposed to open directions for improving renewable capacity such as finding modern renewable energy sources for agriculture and tourism development. Besides, we also show that the impact of the Covid-19 pandemic globally, which has been start in progress since 2019 until now.

Keywords: FDI, ARDL model, Vietnam, economic/tourism/agricultural development, energy consumption, Covid-19.

INTRODUCTION

The development of Vietnam over the past 30 years is remarkable. Political and economic reforms since 1986 have promoted economic development, rapidly turning Vietnam from one of the poorest countries in the world into a low-middle-income country. From 2002 to 2019, gross domestic product (GDP) per capita increased by 2.7 times, reaching over \$ 2,700 in 2019, with more than 45 million people out of poverty. The poverty rate fell sharply from over 70% to below 6%. In 2019, Vietnam's real GDP increased by around 7% and in 2020, but in the context of the Covid-19 pandemic happened complicatedly which it has an average rate of 3.4%. This is a great success for Vietnam with the growth rate in 2020 among the highest growth rates in the world.

There have been some studies on economic development in Vietnam such as assessment of potential and development strategy in the short and long term, as well as factors that promote economic development (Forde, 2016; Thanh, 2014). The strengths of the Vietnamese economy over the past 20 years include: agriculture, tourism, ability to attract foreign investment cash flows, energy consumption and the ability to renew energy for all fields of economic activity.

Vietnam has favorable conditions to develop agricultural products with the identity of lowland, mountainous, highland and coastal ecological sub-regions. Since then, for more than 30 years of innovation, Vietnam's agriculture industry has always maintained an average growth rate of about 3.5% per year, reaching a high level in Asia in general and Southeast Asian particular. With this strength, Vietnam is a country with more than 80% of the population working in agriculture, providing an advantage in national food storage and export for other countries. In the long-term vision towards a country with a higher per capita income, from there, policy priorities for long-term sustainable growth greater than 7% / year in 2020 to 2030.

In the tourism industry, in 1990 there were 250,000 international visitors to Vietnam and after 5 years it increased more than 4 times with more than 1.3 million, followed by 2010 and 2019 reaching 5 million and over 18 million, respectively. From that, it clearly shows that increased 72 times higher than in 1990. According to the World Tourism Organization ranked the highest annual growth rate in the world with 22.7% in the period 2015-2019.

Currently, the energy sector is one of the most important industries with stable energy sources and low cost factors for economic growth. However, in recent years, investment in the energy sector has decreased which has created gaps, putting great pressure on our energy security. But Vietnam is a developing country with a high and continuous growth economy, and energy security is still a priority factor in Vietnam's economic development policy. According to statistics, the domestic energy demand is currently

about 2 times faster than the growth rate of income per capita. Therefore, it aims to use renewable energy sources to meet the high demands in life.

Foreign direct investment (FDI) plays an important role in Vietnam's economic development. According to statistics, FDI contributes about 23.5% of the total national investment capital (nearly 20% of GDP), accounting for over 70% of export turnover (Hoang, 2019). Since then, Vietnam has become an attractive country to many foreign investors with a stable investment environment.

From the results of the above economic sectors, it shows that Vietnam has an abundant source of energy and resources for the economic development of the country. However, whether these sectors have a clear role or proportion of contributions to Vietnam's economic development in the past 10 or 20 years or in the future, or their relationships is our the main research problem in this article. From there, research questions were raised:

1. What is the role of tourism, agriculture, FDI and energy consumption in Vietnam's economic development in the period 1990-2019?
2. What is the short-run and long-run relationship between economic development, tourism, FDI, agriculture and energy consumption?
3. Causal relationship between pairs of observed variables: Economy - tourism, Economy - agriculture, Economy - energy, Economy - FDI, Tourism - energy, Tourism - FDI, Energy - FDI?
4. What are solutions to promote sustainable development of Vietnam's economy for the next 10 years through forecasts?

We study the factors that affect the economic development is an important task in each time period for leaders to correctly identify the influencing factors to adjust, change, orient properly and ensure the to ensure the economy is always on the right track and sustainable. However, time-based studies in Vietnam are not yet available and this will reinforce and increase background data for better empirical studies. In this study, we choose observations on tourism, agriculture, FDI and energy consumption to measure economic development in the period 1990 to 2019 in Vietnam. Because, Vietnam is oriented tourism and agriculture are two spearhead areas to accelerate the country's development. In addition, foreign direct investment is an important resource that brings the increase and balance of foreign currencies to the national economy. In addition, the economies of other countries are also an opportunity to exchange and learn to expand their competitiveness at home and abroad.

The research results will show an overview of Vietnam's economy over the past 20 years, the importance and contribution of all economic sectors to the development of the country, although, by a major impact of the Covid-19 pandemic from 2019 to the present. However, our research has contributed results and solutions for economic consultants who have a long-term and sustainable orientation to Vietnam's economic development.

LITERATURE REVIEW

This study focuses on the role of tourism, agriculture, energy and FDI in Vietnam's economic development in the period 1990-2019. The research is formed from a lot of previous studies, aimed at improving research on economic models in Vietnam. The economic development of a country is assessed in terms of national income, but is actually an interaction with the fields of tourism, agriculture, energy, and investment.

1. Economic growth and FDI

Turkcan (2010) performed tests to find the relationship between FDI and economic growth using tabular data set from 1975-2004 for 23 OECD countries. The author considers economic growth and FDI as endogenous variables and estimates a system of equations concurrently with two equations with generalized timing methods for the OECD case. They found that FDI and economic growth were important mutual determinants; In addition, the growth rate of exports is the decisive factor for FDI and economic growth statistically. The results show that there exists a relationship between FDI and economic growth.

Duarte et al. (2017) examined the relationship between FDI, economic growth and financial development in Cabo Verde country in the period 1987-2014. By using bound test method to integrate and analyze the ECM-Granger causality. The results indicate that there is a long term relationship when GDP and FDI change. Moreover, the results also show that FDI has a positive impact on the economic growth of this country.

In the study for the European Union (EU-28), the main purpose is to investigate the relationship between economic growth and the flow of foreign direct investment in the past economic crisis. The most important conclusion is the reciprocal relationship between economic growth and FDI since the beginning of the crisis by Simionescu (2016).

Dinh et al. (2019) explored the relationship between foreign investment attraction and the role of short- and long-term economic development in developing countries in the period 2000-2014. Their results show that FDI does not have a positive impact on the economy in the short term, but it is a major driver of economic development in the long term.

Eshliki & Kaboudi (2012) investigated the effect of FDI on economic growth in South Asia between 1977-2009. After evaluating and estimating, they concluded that FDI has a positive effect on economic growth and, besides, variables such as human capital, economic infrastructure and capital formation have a positive effect positively affects gross national product.

Dkhili & Dhiab (2018) explained the role of economic freedom in attracting foreign investment, thereby promoting economic growth and many other areas of the country.

2. Economic growth and tourist development

Tourism as a driver of economic growth and development in 27 European countries (EU-27) and the ASEAN region is an interesting study to demonstrate the economic

importance of tourism. , tourism development planning and challenges in the EU-27 and ASEAN. With these results describing the tourism industry's performance in terms of international tourist arrivals and revenue, tourism's contribution to GDP, employment, exports and imports, investments, development assistance plans tourism and other goals that each country's economic consultants understand and adhere to in order to develop tourism more sustainably by Athanasopoulou (2013).

The researchers stated that international tourism can lead to economic growth and if tourism development is an additional determinant of income or the influence of tourism development on economic growth through standard income determinants. Their findings describe the contribution of the tourism industry to the long-term growth of an economy by Du et al. (2014).

By Ekanayake& Long (2012), their research was conducted in developed countries with time data for the period 1995-2009. They examined the causal relationship between tourism development and economic growth using the Granger causality test in a multivariate regression model. Their research results show that there exist a cause and effect relationship between economy and tourism. From there, we suggest that the government of Vietnam promote tourism as a matter of promoting economic development.

The scientists Samimi et al (2011) use a P-VAR approach with data from 1995-2009 to examine the cause and effect relationship and the long term relationship between economic growth and tourism development in other countries developing country. The results show that there is a bilateral cause and effect relationship and a positive long-term relationship between economic growth and tourism development.

Khan et al (2020) explored the role of tourism in economic development in Pakistan. The study aims to confirm the important role tourism plays in the development of emerging economies. The research results of the author show that 1% increase in tourism significantly increases gross domestic product (GPD) 0.051%, foreign direct investment increases 2.647%, energy development 0.134%, agricultural development 0.26% and 0.51% poverty reduction in the long run.

Suhel& Bashir (2018) analyzed the relationship between tourist numbers, annual growth, tourism investment, government travel spending, and economic growth in South Sumatra. By apply both Granger causality model and equation model simultaneously to estimate the experimental model. The results show that the number of tourists, the added value of the tourism industry and the travel spending of the tourism industry influence economic growth. The author has made a number of recommendations and in which investment in tourism will promote economic development is the most prominent point.

One study in Pakistan investigated the causal relationship between tourism, economic growth (GDP, capital investment), energy consumption and environmental pollutants. From the empirical results, the authors declare that economic growth plays an important role in tourism development by Khan et al. (2020).

3. Economic growth and energy consumption

Abid&Sebri(2012) showed a causal relationship between energy consumption and economic performance for the total economy as well as for the industrial, transport and residential sectors in Tunisia in the period 1980-2007.

Hirsh &Koomey (2015) found that the rate of increase in electricity consumption has important implications for business operations and public policy. Research results also broaden the changing trends in the relationship between growth in economic activity and electricity use, beside an increase in energy consumption represents economic growth.

One of the most important resources for economic growth is energy. To investigate the extent to which energy is contributed to the Indian economy, a study whose primary objective is to examine the relationships between energy consumption per capita and GDP in India from the period 1970–1971 to the period 2014–2015. The results of the study demonstrate that there is a one-way causal relationship running from GDP to energy consumption per capita and there is no long-term equilibrium relationship between energy consumption per capita and GDP in Indiaby Singh &Vashishtha (2020).

One study investigates the role of non-renewable energy in economic growth and the Co2 emission of the leading oil-producing economies in Africa, specifically Nigeria in the period 1980– 2015, research results show that policy makers in oil-producing economies are forced to explore ways to invest in and promote, technologies that minimize carbon in production processes aim to increase economic growth if they must continue to increase the consumption of their abundant resources - oil and natural gas (Awodumi & Adewuyi, 2020).

Besides, the another studyin Nigeria examined the relationship between electricity consumption and economic growth using Johansen and JuseliusCointegrationtest based on the Cobb-Douglas growth model for the period 1980-2008. This study has confirmed that electricity consumption has a positive impact on economic growth, besides there is a two-way causal relationship between electricity consumption and economic growth (Ogundipe&Apata, 2013).

In addition, in Pakistan, by running ARDL regression to investigate the link between energy consumption, economic growth and CO2 emissions with time series data from 1965 to 2015, results showed that energy consumption and economic growth increase CO2 emissions (Khan et al., 2020).

Robledo&Guzmán(2011) and Campo& Sarmiento (2013)investigated the long-term relationship between energy consumption and GDP for 10 countries in Latin America from 1971 to 2007. The results showed that there is a causal relationship between these two observed variables. The author has proposed many solutions to promote economic development for these countries based on data and resources of each country.

The study used a regression model with surveys for 17 Mediterranean countries from 1995-2014 to explore the relationships between tourism, energy consumption, CO2 emissions and economic growth. The results show that energy consumption supports low

or moderate economic growth, in addition there is a two-way causal relationship between GDP and all other variables by Aslan et al. (2021).

In the researcher article's literature review, in order to outline the current studies on energy and energy needs in the world, Kassim&Isik's work has been carried out in transition economies change. Final results after reviewing the system show that the research confirms the growth hypothesis(14%), the feedback hypothesis(54%), the neutral hypothesis (9%) and of the exist (23%) (Kassim & Isik, 2020).

4. Economic growth and agricultural development

Agriculture is a special production industry and is extremely important to a country's economic and social development, because it is the initial production of the physical production of society. Currently, the industrial revolution 4.0 together with the development of science and technology has supported agriculture to become more modern. According to World Bank data, agriculture is now a livelihood for 86% of the rural population and job creation for 1.3 billion both smallholder and landless farmers. According to the 5.5 billion people worldwide, there are 3 billion people living in rural areas, accounting for nearly half of humanity. The total rural population is estimated to be 2.5 billion people working in agriculture and 1.5 billion people living on small farms (Mellor, 2017).

Agriculture performs many important functions in economic development: transferring labor, supplying basic necessities, exporting, accumulating savings, and creating domestic markets for domestically produced goods. Since then, the successful development of many countries, especially those that focus their resources on agriculture, has been explained by the agricultural sector's ability to perform these functions. Agricultural development is the result of favorable natural conditions, sound policies, and the development of important institutions Diao et al. (2007).

A study in developed and developing countries such as Indonesia, China, the Netherlands and the United States supports the hypothesis: the position of agriculture in the economy appears to be more important than in developing countries and is less important in developed countries. This study focuses on the increase in the share of agriculture in the contribution to GDP and total agricultural employment in the studied countries. The results confirm that the hypothesis is correct (Arendonk, 2015).

There was a lot of agricultural research in Nigeria with the aim of finding solutions to economic growth and poverty reduction. Especially, Oyakhilomen&Zibah (2014) found out the relationship between agricultural production and economic growth. Time series data were used in this study and data analyzes was performed using unit root tests and limit test method (ARDL) for linkage integration. The results of data analysis show that agricultural production has a positive effect on economic growth in Nigeria, so more policies are needed to increase investment attraction in this sector. In the study of Odetola&Etumnu (2013)also confirmed that the agricultural sector has positively and

consistently contributed to the economic growth in Nigeria, reaffirming the importance of the industry in the economy.

From the above studies, with the diversity of observed variables, research locations and various of economic regression models based on the current economic development of Vietnam, we has selected the variables tourism, agriculture, energy, foreign investment and economic development to explore the relationships in long term, short term and cause and effect between them in the period 1990-2019 with the ARDL regression model.

DATA SOURCE AND METHODOLOGY

This datais used from Vietnam Data of *World Bank database system* and the *Ourworldindata.org* websites. After we review previous studies in the literature section andwe give some results to target our research, such as: the relationship between tourism, foreign investment and economic development in Saudi Arabia (Dkhili & Dhiab, 2018), attracting foreign investment in the energy sector in economic development in Pakistan(Latief & Lefen, 2019); the links between energy consumption, economic development, price indexes, foreign investment and financial development in Malaysia(Tang & Tan, 2014), the relationship between tourism and economy in developed countries, investment from abroad and economic development in the short and long term in Vietnam(Dinh et al., 2019), the relationship between economic development, tourism(Dkhili & Dhiab, 2018) and energy consumption and CO2 emissions in the Mediterranean Sea countries(Aslan et al., 2021).From there,we determine the relationship between the variables such as tourism revenue (TR), energy consumption (EC) , foreign direct investment (FDI) , agriculture (AGRI) and economic development (GDP) in Vietnam for the period 1995-2019, the scholar specify a simple double-log linear Cobb-Douglass production function and the equation is:

$$GDP=f(TR, FDI, AGRI, EC)$$

The result includes testing the long-run and short-run relationship between these observed variables, the linear logarithm form is posed:

$$\ln GDP_{it} = \alpha_i + \beta_i \ln GDP_{it} + \gamma_i \ln TR_{it} + \delta_i \ln FDI_{it} + \omega_i \ln AGRI_{it} + \mu_i \ln EC_{it} + u_{it}$$

According to Dritsakis(2011), the ARDL method has many advantages over other cointegration methods:

- First, in the case of a small sample size, the ARDL model is a more statistically significant approach to cointegration testing, while Johansen cointegration technique requires a larger number of samples to gain reliability.
- Second, Contrary to conventional methods for finding long-term relationships, the ARDL method does not estimate the system of equations, but instead estimates only a single equation.
- Third, other cointegration techniques require combining the same latency regression variables and the regression variables can tolerate different optimal delaysin the ARDL approach.

- Final, if the author does not guarantee the unit root attribute or the static attribute of the data system, static at I(1) or I(0), then the application of the ARDL procedure is most suitable for the experimental research.

In this work, we give the proposed methodologies such as: Unit root test, ARDL test and Causal test as follows:

Unit root test

Annual time series data on energy consumption, economic growth (real GDP), tourism revenue, foreign investment attraction, and the extent of agricultural development on expanded agricultural land are collected data in public data systems. Besides, all observed variables are taken according to natural logarithms.

Unit root test (URT) is applied to determine if variables are stationary individually before performing causality testing. This work is important in testing the stability of a time series because a non-static regression can invalidate standard experimental results. The presence of random trends is determined by examining the presence of unit roots in the time series data. In this study, URT is tested using Augmented Dickey-Fuller (ADF) and Schwarz-Bayesian criterion (SBC) to determine the optimal lag for the economic function by selecting values for the lag (n) and obtaining the value of n where SBC reaches minimum.

ARDL test

The standard log-linear function of the long-run relationship between economic development with tourism, agriculture, energy and foreign investment in Vietnam is expressed by the following functions:

$$\begin{aligned}
 & \Delta \ln GDP_{it} \\
 & = \alpha_0 + \sum_{i=1}^n \omega_1 \Delta \ln GDP_{it-i} + \sum_{i=0}^n \omega_2 \Delta \ln TR_{it-i} + \sum_{i=0}^n \omega_3 \Delta \ln FDI_{it-i} \\
 & + \sum_{i=0}^n \omega_4 \Delta \ln AGRI_{it-i} + \sum_{i=0}^n \omega_5 \Delta \ln EC_{it-i} + \phi \ln GDP_{it-1} + \phi_1 \ln TR_{it-i} \\
 & + \phi_2 \ln FDI_{it-i} + \phi_3 \ln AGRI_{it-i} + \phi_4 \ln EC_{it-i} \\
 & + \partial_{it}
 \end{aligned} \tag{1}$$

Where Δ is the first difference operator; α_0 stand for constant; t is time element; $\omega_{1,2,3,4,5}$ represent the short-run parameters of the model; $\phi_{1,2,3,4}$ are long-run coefficients; while ∂_{it} is white noise error term and lastly, it represents country at particular time period.

The ARDL test based the joint significance of F-statistic and the X^2 statistic of Wald test. The null hypothesis of no cointegration among the variables under study is examined by testing the joint significance of the F-statistic of $\omega_{1,2,3,4,5}$.

After finding out the cointegrations, an error correction mechanism (ECM) can be proceeds as equation (2) to assess the short-run influence of these variables.

$$\begin{aligned}
\Delta \ln GDP_{it} &= \gamma_1 + \sum_{i=1}^n \beta_1 \Delta \ln GDP_{it-i} + \sum_{i=0}^n \beta_2 \Delta \ln TR_{it-i} + \sum_{i=0}^n \beta_3 \Delta \ln FDI_{it-i} \\
&+ \sum_{i=0}^n \beta_4 \Delta \ln AGRI_{it-i} + \sum_{i=0}^n \beta_5 \Delta \ln EC_{it-i} + \phi_1 ECT_{it-1} \\
&+ \mu_{it1} \tag{2} \\
\Delta \ln TR_{it} &= \gamma_2 + \sum_{i=1}^n \beta_6 \Delta \ln TR_{it-i} + \sum_{i=0}^n \beta_7 \Delta \ln GDP_{it-i} + \sum_{i=0}^n \beta_8 \Delta \ln FDI_{it-i} \\
&+ \sum_{i=0}^n \beta_9 \Delta \ln AGRI_{it-i} + \sum_{i=0}^n \beta_{10} \Delta \ln EC_{it-i} + \phi_2 ECT_{it-1} + \mu_{it2} \\
\Delta \ln FDI_{it} &= \gamma_3 + \sum_{i=1}^n \beta_{11} \Delta \ln FDI_{it-i} + \sum_{i=0}^n \beta_{12} \Delta \ln GDP_{it-i} + \sum_{i=0}^n \beta_{13} \Delta \ln TR_{it-i} \\
&+ \sum_{i=0}^n \beta_{14} \Delta \ln AGRI_{it-i} + \sum_{i=0}^n \beta_{15} \Delta \ln EC_{it-i} + \phi_3 ECT_{it-1} + \mu_{it3} \\
\Delta \ln AGRI_{it} &= \gamma_4 + \sum_{i=1}^n \beta_{16} \Delta \ln AGRI_{it-i} + \sum_{i=0}^n \beta_{17} \Delta \ln GDP_{it-i} \\
&+ \sum_{i=0}^n \beta_{18} \Delta \ln TR_{it-i} + \sum_{i=0}^n \beta_{19} \Delta \ln FDI_{it-i} + \sum_{i=0}^n \beta_{20} \Delta \ln EC_{it-i} \\
&+ \phi_4 ECT_{it-1} + \mu_{it4} \\
\Delta \ln EC_{it} &= \gamma_5 + \sum_{i=1}^n \beta_{21} \Delta \ln EC_{it-i} + \sum_{i=0}^n \beta_{22} \Delta \ln GDP_{it-i} + \sum_{i=0}^n \beta_{23} \Delta \ln TR_{it-i} \\
&+ \sum_{i=0}^n \beta_{24} \Delta \ln FDI_{it-i} + \sum_{i=0}^n \beta_{25} \Delta \ln AGRI_{it-i} + \phi_5 ECT_{it-1} + \mu_{it5}
\end{aligned}$$

Where ECT is the error correction term, γ ($i = 0, \dots, 5$) is the constants of the model; β ($i = 1, \dots, 25$); μ ($it = 1, \dots, 5$) are the error term and ϕ is its coefficient which shows how fast the variables attain long-run equilibrium if there is any deviation in the short-run. The error correction term further confirms the existence of a stable long-run relationship among these variables.

Causal test

The ARDL approach does reveal the degree of cointegration over the long-run, but it does not indicate causal relationships among the variables. Hence, Granger test was performed by examining the causal relationship between tourism, foreign investment, energy consumption, agricultural development and economic growth. The Granger

causality test uses in this research based on the model of Odhiambo(2009), Narayan (2008) and Belloumi (2014). As their result reported show that the existence of a long-run relationship between these variables shows that there must be Granger – causality in at least one direct. Estimate the following error correction models:

$$\begin{aligned} &\Delta \ln GDP_{it} \\ &= \alpha_0 + \sum \beta_1 \Delta \ln GDP_{it-i} + \sum \beta_2 \Delta \ln TR_{it-i} + \sum \beta_3 \Delta \ln FDI_{it-i} \\ &+ \sum \beta_4 \ln AGRI_{it-i} + \sum \beta_5 \Delta EC_{it-i} \\ &+ \varepsilon_{it1} \end{aligned} \quad (3)$$

$$\begin{aligned} &\Delta \ln TR_{it} \\ &= \alpha_1 + \sum \beta_6 \Delta \ln TR_{it-i} + \sum \beta_7 \Delta \ln GDP_{it-i} + \sum \beta_8 \Delta \ln FDI_{it-i} \\ &+ \sum \beta_9 \ln AGRI_{it-i} + \sum \beta_{10} \Delta EC_{it-i} \\ &+ \varepsilon_{it2} \end{aligned} \quad (4)$$

$$\begin{aligned} &\Delta \ln FDI_{it} \\ &= \alpha_2 + \sum \beta_{11} \Delta \ln FDI_{it-i} + \sum \beta_{12} \Delta \ln GDP_{it-i} + \sum \beta_{13} \Delta \ln TR_{it-i} \\ &+ \sum \beta_{14} \ln AGRI_{it-i} + \sum \beta_{15} \Delta EC_{it-i} \\ &+ \varepsilon_{it3} \end{aligned} \quad (5)$$

$$\begin{aligned} &\Delta \ln AGRI_{it} \\ &= \alpha_3 + \sum \beta_{16} \Delta \ln AGRI_{it-i} + \sum \beta_{17} \Delta \ln GDP_{it-i} + \sum \beta_{18} \Delta \ln TR_{it-i} \\ &+ \sum \beta_{19} \ln FDI_{it-i} + \sum \beta_{20} \Delta EC_{it-i} \\ &+ \varepsilon_{it4} \end{aligned} \quad (6)$$

$$\begin{aligned} &\Delta \ln EC_{it} \\ &= \alpha_4 + \sum \beta_{21} \Delta \ln EC_{it-i} + \sum \beta_{22} \Delta \ln GDP_{it-i} + \sum \beta_{23} \Delta \ln TR_{it-i} \\ &+ \sum \beta_{24} \ln FDI_{it-i} + \sum \beta_{25} \Delta \ln AGRI_{it-i} \\ &+ \varepsilon_{it5} \end{aligned} \quad (7)$$

Where α ($i = 0, \dots, 5$) are the constants of the model, β ($i = 1, \dots, 25$) and ε ($it = 1, \dots, 5$) are the error term.

EXPERIENCE RESULT

Stationary result

In Table 1, all the variables have stationary at I (I) by Unit root test.

Table 1: Unit root test

Variables	At level	At first difirence	Decision
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lnGDP	0.5513	0.0001	I(I)
lnTR	0.4782	0.0000	I(I)
lnFDI	0.5021	0.0071	I(I)
lnAGRI	0.6905	0.0001	I(I)
lnEC	0.9034	0.0002	I(I)

Optimal lags

Follow SBC, the optimal lags of the observation variables in Table 2

Table 2: Optimal lags

Lag	LogL	LR	FPE	AIC	SC	HQ
1	40.17175	20.98562*	0.005133*	-2.440839*	-2.155367*	-2.353568*

ARDL test for cointegration

The tests show the bound test for cointegration and the result for series model. When GDP model, the result indicates that $fGDP(TR, FDI, AGRI \text{ and } EC) = 5.47$; for TR model, $fTR(GDP, FDI, AGRI \text{ and } EC) = 15.4$; for FDI model, $fFDI(GDP, TR, AGRI \text{ and } EC) = 1.49$; for AGRI model, $fGARI(GDP, TR, FDI \text{ and } EC) = 6.38$ and for EC model, $fEC(GDP, TR, FDI \text{ and } AGRI) = 15.13$. The result indicates that there is a long run relationship among the variables when GDP, AGRI and AC are dependent variables while for others variables we do not reject the null hypothesis of no cointegration. For GDP, AGRI and EC as the dependent variables, the F-statistics of 5.47; 6.38; 15.13 are higher than the upper bound critical value 10% significance level. These results show that the variable share a long-run relationship, therefore, we can proceed with the estimation of a long-run and short-run for the variables GDP, AGRI and EC as dependent variables.

Table 3: Co-integration test result

Equation model	F-statistics	SC lag-length criteria	Bound critical values		Decision
			I(0)	I(1)	
$fGDP(TR, FDI, AGRI, EC)$	5.47	(1,1,0,1,0)	2.95	4.09	Co-integrated
$fTR(GDP, FDI, AGRI, EC)$	15.23	(1,0,1,0,0)	2.95	4.09	No Co-integrated
$fFDI(GDP, TR, AGRI, EC)$	1.48	(1,1,1,0,0)	2.95	4.09	No Co-integrated
$fAGRI = (GDP, TR, FDI, EC)$	6.38	(1,1,0,1,0)	2.95	4.09	Co-integrated
$fEC(GDP, TR, FDI, AGRI)$	15.13	(1,0,0,1,0)	2.95	4.09	Co-integrated (but not satisfied CUSUM sq)

Long-run and short-run analysis

In Table 4, it shows the long-run coefficients for the models estimates. In GDP model, GDP is a dependent variable, the results show that FDI and EC are correlated with

economic growth at 5%, AGRI and TR are not statistically significant. The long-run empirical results indicate that increasing FDI has resulted in economic in Vietnam and conversely, EC has a negative relationship with economic growth.

In the AGRI model, AGRI is a dependent variable, the resultsshow that TR and EC are correlated with agricultural development at 5%, GDP and FDI are not statistically significant. The long-run empirical results indicate that the growing EC has led to agricultural development in Vietnam and conversely, TR has a negative relationship with agricultural development.

Table 4: Long-run coefficients

Eq. model	Constant	GDP	TR	FDI	AGRI	EC	R ²	DW
GDP	-15.17	-	0.04	0.13**	0.97	-0.23**	57.4	2.25
AGRI	8.74	0.12	-0.06**	-0.05	-	0.16**	53	2.12

***Denotes statistical significance at 1% level. ** Denotes statistical significance at 5% level. * Denotes statistical significance at 10% level.

In Table 5 provides the short-run coefficients among parameters. The results show that there is no short-run relationship between observation variables.

Table 5: Short-run result

Eq. model	GDP	AGRI
GDP		-0.056
TR	0.22	
FDI		-0.009
AGRI	0.16	
EC		
Diagnostic test	T-statistic	T-statistic
Ramsey Reset	0.8675	0.8183
Heteroscedasticity	0.2561	0.5215
Serial Correlation LM test	0.1735	0.5986
Histogram normality test	P-value=0.9570	P-value=0.5256

In Figure 1, 2 and 3 provide the plot of cumulative sum of recursive residual (CUSUM) and the plot cumulative sum of squares of recursive residual (CUSUM sq) for the series model GDP, AGRI, EC. The results confirm the stability of the parameters is given that all the coefficients values lie inside the critical bound values.

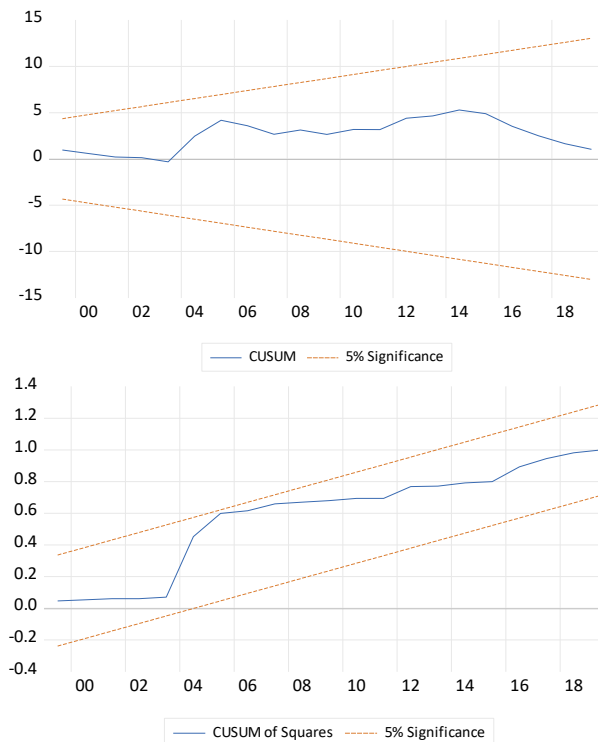


Figure 1: Plot of CUSUM and CUSUM of square test for GDP model

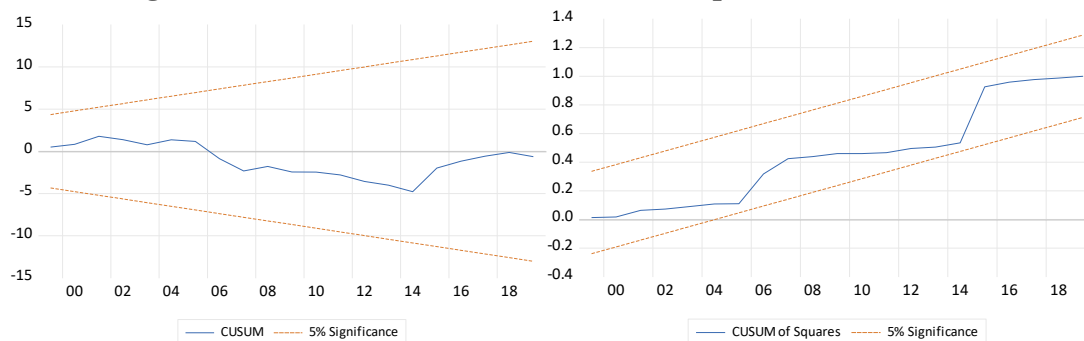


Figure 2: Plot of CUSUM and CUSUM of square test for AGRI model

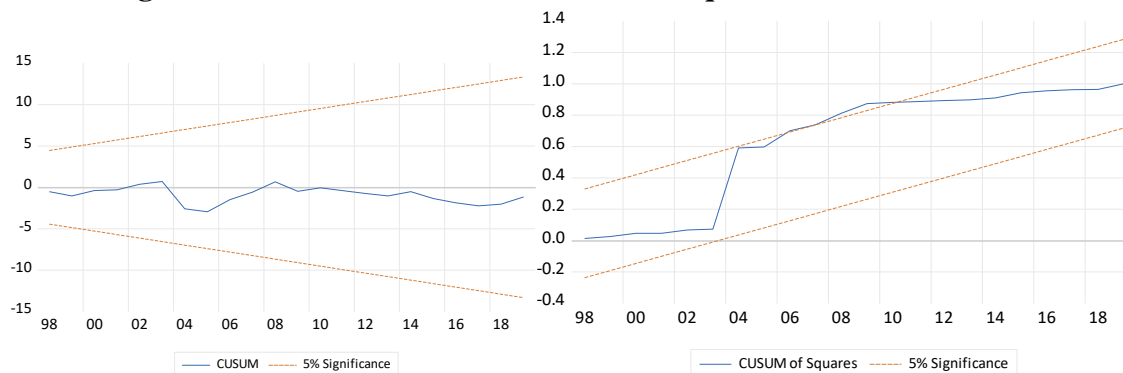


Figure 3: Plot of CUSUM and CUSUM of square test for EC model

Granger causality results

Causality analysis is performed after examining the long-term and short-term relationships between observed variables. There are some one-way causal relationships

found such as: GDP affects energy consumption and energy consumption is the cause of tourism development, attracting foreign investment is the cause of energy consumption increases.

Table 6: Granger causality results

Null Hypothesis:	Obs	F-Statistic	Prob.	Result
LFDI does not Granger Cause LEC	29	5.32365	0.0293	Causal
LGDP does not Granger Cause LEC	29	13.3156	0.0012	Causal
LEC does not Granger Cause LTR	29	5.04964	0.0333	Causal

CONCLUSION

Our study is conducted with the aim of exploring long-term, short-term causal relationships between observed variables such as tourism, foreign investment, energy consumption, agriculture and economic growth in Vietnam.

That study was done through sequential and scientific steps such as static test by unit root test and ensured no static variable at second order deviation, selected optimal lag with the model according to SBC criteria, fully perform the tests of correlation models, elasticity and correct functions with enough observed variables, normalize residuals, perform constraint tests to find relationships. In the long term, when there is cointegration, we test the relationship in a short time and finally test the causal relationship between the observed variables. The results have found that there is a long-term relationship between FDI and EC with GDP, and more specifically, FDI has a long-term relationship with economic growth, in which energy consumption tends to be opposite to economic development practice. This is quite consistent with Vietnam's economic reality in recent years, attracting investment from abroad plays an important role in promoting comprehensive development of many fields in the Vietnamese economy.

Annual summary reports always record and focus on solutions to increase investment attraction in areas such as high-tech agriculture, minerals, and tourism, and these are the areas that have a lot of contribution to investment general GDP and also a high-return market for investors. However, energy consumption has a negative impact on Vietnam's economic development in the long run. Meanwhile, Vietnam is a country with a lot of water resources, hydropower systems that have been formed for a long time, however, the maintenance and maintenance work requires a lot of money. On the other hand, the investment cost for a new hydropower plant is quite large and not as high as theoretical capacity.

Currently, Vietnam still has to import a large amount of energy at a relatively high cost each year to serve its operations, promote the industrial sectors and the domestic renewable energy capacity is only about 30- 40%. This is one of the new difficulties and challenges for economists about the trend towards renewable energy or the need to use energy more efficiently. In the agricultural sector, EC and TR have a long relationship with agricultural development. Specifically, energy consumption has a long-term positive

impact on Vietnam's agricultural development, showing that agriculture is being focused on investing in modernization to improve quality, it not only serves domestic demand but it also meet stringent standards when exporting to demanding markets like Europe and Australia. Besides, Tourism development is a long-term problem that has a negative impact on the development of the agricultural sector. Therefore, tourism service is considered a smoke-free industry with high revenue and profit to switch from agricultural services to tourism services. Therefore, it shows that most of the agricultural land has been converted to serve tourism activities such as visiting and experiencing agricultural products. This is an issue that needs attention and balance in the country's long-term development policy because fields such as agriculture are still strong points in the Vietnamese economy in the long run.

In the analysis of cause and effect, a one-way causal relationship is found between FDI-EC, GDP-EC and EC-TR. As a result, foreign investment drives energy consumption, economic growth drives energy consumption, and energy consumption drives tourism. Although energy consumption has a negative impact on economic growth in the long run, economic development boosts energy consumption, showing that energy plays a very important role in the Vietnamese economy.

From the above issues, we recognize that the Government of Vietnam needs to focus on a system of solutions to improve the ability to regenerate domestic energy sources, enhance solutions to exploit and use energy more efficiently and effectively research to find new renewable energy sources, reduce energy imports to reduce the burden of national spending. However, energy consumption will stimulate tourism growth and tourism is being seen as a priority industry in a long-term strategy. In summary, the study results also show the relationship between FDI, EC and TR, the long-term correlation of FDI with GDP of EC and AGRI. Therefore, the government may consider enhancing the best mix solutions between these sectors to increase economic benefits, especially:

- Some proposed solutions to increase investment attraction and improve investment quality such as the need to develop good and stable investment policies. Strengthen the regular and prestigious inspection and examination of foreign-invested projects.
- Attract foreign investment projects in the renewable energy sector, thereby not only creating more energy for the country, but also increasing energy consumption for agriculture and tourism and investing in mining projects green - clean energy source.
- There should be strategies to balance tourism development without affecting agricultural land as well as agricultural output, without imbalance the national resources. Expand types of rural tourism and green tourism, thereby, showing that responsible tourism towards the goal of synchronous development of both agriculture and tourism.

In the future, we study the Vietnamese economy scientifically and get better results, so we will add observational variables such as urbanization, financial management, medicines and technology information. In particular, currently during the Covid-19 pandemic is using modern infrastructure, application and design of a modern information technology models through an effective online way (Le DinhPhuCuong, 2020). In addition, the study will use a mix of real and public data in different periods in accordance with economic conditions to make observed variables with changes and suitability in order to have better results. Also, other issues such as health, public health, modern infrastructure development and especially, the application of Artificial Intelligence or IoT - Internet of Things (Le DinhPhuCuong&Cuong, 2021) to predict economic recovery.

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