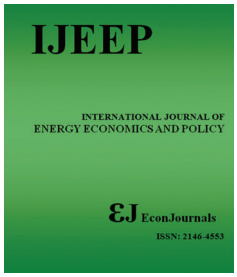
Tran Trong Nguyen; Nguyen Thu Thuy; Nguyen Van Chien et al.

Article

Energy consumption, economic growth and trade balance in East Asia : a panel data approach

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Tran Trong Nguyen/Nguyen Thu Thuy et. al. (2020). Energy consumption, economic growth and trade balance in East Asia : a panel data approach. In: International Journal of Energy Economics and Policy 10 (4), S. 443 - 449. https://www.econjournals.com/index.php/ijeep/article/download/9401/5184. doi:10.32479/ijeep.9401.



International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2020, 10(4), 443-449.

Energy Consumption, Economic Growth and Trade Balance in East Asia: A Panel Data Approach

Trong Nguyen Tran[1], Thu Thuy Nguyen[2], Van Chien Nguyen[3]*, Thi Thu Huong Vu[4]

[1]Academy of Policy and Development, Vietnam, [2]Academy of Finance, Vietnam, [3]Thu Dau Mot University, Vietnam, [4]Thuongmai University, Vietnam. *Email: chiennv@tdmu.edu.vn, huong.vtt@tmu.edu.vn

Received: 11 February 2020 **Accepted:** 05 May 2020 **DOI:** https://doi.org/10.32479/ijeep.9401

ABSTRACT

The purpose of this work is to study the effects energy consumption, economic growth and trade balance in the East Asian countries. Using a panel data analysis in the period over 1996-2015, the study analyzes based on the methods of fixed, random effects, and pooled ordinary least squares. The data were collected from World Development Indicators, Department of Statistics in relevant countries used in the study. Our results demonstrate that energy consumption has negatively affected trade balance while economic growth that can negatively affect the balance of trade but insignificant. Further, the prime factors that can significantly impact trade balance are exports, exchange rates and development level. Both exports and exchange rates have positive and significant impacted on trade balance. Finally, a country with a higher level of domestic income will certainly perform a higher level of trade balance.

Keywords: Economic Growth, Energy Consumption, Fixed Effect, Random Effect, Trade Balance
JEL Classifications: C58, F14, O47, Q43, Q48

1. INTRODUCTION

Energy has been considered as a very important factor of production and economic development in each country. It has played a great role in the economic growth, production and trade expansion of any country. As a result, the use of energy that reflects the quality of lives, it is consistent with the level of economic growth, trade expansion. In previous literature, there are mixed results about the effects of energy use and balance trade. Although it is believed that energy consumption can significantly affect environmental consequences, but also improve the trade balance because of decreasing import of other energies to the host countries (Imran, 2017). In contrast, energy consumption (i.e. oil and petroleum consumption) can negatively inspire trade balance; in this case, more trade deficit can be taken part (Shawa and Shen, 2013).

In the context of the global economic integration, the economic growth has significantly contributed the trade of the country with the rest of the world. A various studies have been done on trade balance in both developed and developing countries. The literature on the economic performance and trade balance has been focused on a large number of empirical studies. As presented in some recent studies (Panshak et al., 2019; Manual and San, 2019), economic performance appear to be positive and significant that generate the balance of trade. To be precise, more efficiency in economic performance that will enhance international trade and trade balance, especially trade deficit that is normally happened in most developing countries.

The prime finding in the literature is that real exchange rate shocks can affect the trade balance (Hassan and Zaman, 2012; Shawa and Shen, 2013; Elahi et al., 2016; Sasaki and Yoshida, 2018; Dogru et al., 2019; Manual and San, 2019). However, few studies in the literature suggested that trade balance is predominantly determined by export value (Gao and Tian, 2016). In the case of China, the country has been robustness of exporting firms through

maintaining a couple of financial, tax incentives, although it can generate the economic performance but piecemeal increased trade deficit in terms of ecological products (Gao and Tian, 2016).

To discuss more determinants of trade balance in the specific situation in Asia, this study has conducted on the relationship between energy consumption, economic growth and trade balance. To the best of our knowledge, a very few studies has focused on the impact of energy consumption on trade balance in developing countries, especially in the low-middle income countries. The study aims at fulfilling this gap by analyzing the relationship between energy consumption per capita with trade balance in a very dynamic region in Asia. The purpose of the study is to investigate the link between energy consumption, economic growth and trade balance in the case of some East Asian developing and developed countries over the time period of 1996 and 2015.

The remaining structure of the study is as follows. Section 2 discussed the literature review. Section 3 described the data, the research model, and methodology of this study. The empirical analysis is presented in section 4. Section 5 covers the conclusion.

2. LITERATURE REVIEW

Numerous previous studies examining the determinants of trade balance have been conducted in developing and developed countries in the world, especially in a particular countries such as emerging market economies in Asia. There exists contradictory results in the previous empirical works consistent with the link between energy consumption, economic growth and trade balance in various situations. The findings indicate that energy policy is known as one of the most important factors to support production activities, export enhancement and trade expansion.

Followed by Imran (2017) on the study in developing countries in Latin America, and Caribbean area in the period of time of 1990-2015, it is believed that energy consumption can significantly affect environmental consequences. Further, a higher level in energy consumption, especially for renewable energy can positively inspire energy demand in the country and also improve the trade balance because of decreasing import of other energies to the host countries.

Considering Tanzania in the time-series studies, Shawa and Shen (2013) indicated that Tanzania has faced for many years of trade deficit, using the method of Ordinary Least Square (OLS) with the sample dataset in the years of 1980-2002, the evident said that availability of natural resources (i.e. natural gas and minerals) is an important factor to enhance trade balance because it can greatly generate exports in the future. In addition, the policy of currency devaluation is inappropriate to enhance trade balance, by contrast, currency stabilization is more preferred. Tang et al. (2016) analyse the relationship between energy consumption and economic growth in Vietnam using the neoclassical Solow growth framework for the 1971-2011 period. The concept and methods of cointegration and Granger causality are used to establish the relationship between the variables of interest. The results confirm the existence of cointegration among the variables. In particular, energy consumption, FDI and capital stock were found positively influence economic growth in Vietnam. The Granger causality test revealed unidirectional causality running from energy consumption to economic growth.

By analyzing in a developing country in Africa as Nigeria, Panshak et al. (2019) conducted on the time-series dataset from 1982 to 2015; the result of empirical research indicates that Nigeria's economic growth process is constraint of balance of payment. Further, Nigeria can grow at a faster rate with the policy of the purpose of external balance expansion or import demand contract. Nasreen et al. (2017) investigate the relationship between financial stability, economic growth, energy consumption and carbon dioxide (CO_2) emissions in South Asian countries over the period 1980–2012 using a multivariate framework. Bounds test for cointegration and Granger causality approach are employed for the empirical analysis. Estimated results suggest that all variables are non-stationary and cointegrated. The results show that financial stability improves environmental quality; while the increase in economic growth, energy consumption and population density is detrimental for environment quality in the long-run. The results also support the environmental Kuznets curve (EKC) hypothesis which assumes an inverted U-shaped path between income and environmental quality.

Dogru et al. (2019) by analyzing in the United State of America and found that if using linear and nonlinear autoregressive distributed lag (ARDL) with cointegration analysis in order to evaluate currency depreciation policy and appreciation policy can impact on the U.S trade with its counterparts like Canada, Mexico, and the U.K. Empirical results described that the policy of dollar depreciation may improve at a later date trade balance in tourism between U.S. with all trading partners. In contrast, the policy of U.S. dollar appreciation could subsequently deteriorate trade balance in tourism between U.S. and Canada, and the U.K., but insignificantly enhance with Mexico in the long run. Empirical results also described contradicting issue of J-curve theory.

Rekiso (2020) found that the situation of chronic trade deficits in Ethiopia has been focused. Based on the history of economic development of the country, the study described that the problems of chronic trade deficits in Ethiopia are dependent on the nature of fundamental structure in the economy, therefore, this chronic cannot be solved if the economy cannot be transformed its internal structure in the country, which is transformed from low-skill, low technology and less-productive economy to high-skill, highly intensive technology, and more-productive economy. It is also evident that process of structural transformation cannot be conducted in the regime of international trade liberalization which can request a country to become more specialized in order to make a better comparative advantage in Ethiopia. Apergis and Ozturk (2015) test the EKC hypothesis for 14 Asian countries spanning the period 1990-2011. The GMM methodology using panel data is employed in a multivariate framework to test the EKC hypothesis. The multivariate framework includes: CO_2 emissions, GDP per capita, population density, land, industry shares in GDP, and four indicators that measure the quality of institutions. In terms of the presence of an inverted U-shape association between emissions

and income per capita, the estimates have the expected signs and are statistically significant, yielding empirical support to the presence of an EKC hypothesis.

Elahi et al. (2016) conduct on a study in a sample of 10 developed countries and 15 developing countries during the period of time 2003-2013, it is suggested that an increase in exchange rate in relation to devaluation policy of local currency, which can positively generate the level of competitiveness, export value and will increase on trade balance. The study also recommends that the government should maintain the stabilization policy of real exchange rate and trade improvement and trade balance expansion in order to increase the effectiveness of the country's competitiveness. In addition, Van (2020) conduct in a study in an emerging country, a significant and positive impact from energy consumption on pollution degradation could be also detected.

In the study that focused on the crisis of financial global and unexpected problems in Japan, Sasaki and Yoshida (2018) indicated that trade balance in the country has changed from surplus to deficit. In addition to devaluation policy of Japan's yen, it exits a contradiction because deficit has still lasted, showing that this policy is ineffective. Furthermore, empirical results indicate that exports in Japan are not consistent with exchange rate shocks meanwhile importing goods and services' price increased in connection with the devaluation of Japanese yen, thus, income elasticity of importing goods and services sharply increased. In conclusion, trade balance in Japan is more likely to decline.

In the case of Malaysia, a country that is much reliant on international trade. A number of studies in trade balance have been focused. Using ARDL model, Manual and San (2019) examines the effects of macroeconomic factors, i.e. real exchange rate shocks, economic growth performance, and money supply on trade balance. As the results, economic performance and real exchange rate shocks can significant and positive affect trade balance in the case of Malaysia.

3. DATA AND METHODOLOGY

3.1. Data

The data used in the study is sourced from the database of World Development Indicators (WDI), Department of Statistics (DOS) in relevant countries used. Data that we use in this study were collected for some countries in East Asia. Using a sample dataset during the period of time from 1996 to 2015 on a yearly basis, the data is analyzed using Stata 15 software (Table 1).

In this study, the data consist of some macroeconomic factors such as export value, gross domestic product growth rate, energy consumption, real exchange rate and trade balance. The study has a conduct on both developed countries, i.e. South Korea, Malaysia, and Singapore, and some developing countries, i.e. China, Indonesia, Philippines, Thailand, and Vietnam.

3.2. Research Model

Impact of energy consumption, economic growth and trade balance have been investigated in a large amount of empirical studies in the world. Based on theoretical consideration, it is evident that the study is used a panel model with pooled OLS, fixed effect method (FEM), and random effect method (REM). More specifically, here is the research model in Figure 1.

A large number of previous studies have been applied common regression models such as Pooled OLS, FEM, and REM. In this study, we will investigate based on the steps and we will analyze how to select the best model among three models. The process of the analysis can be explained in the following Figure 2.

In order to discover the analysis of this relationship, we hypothesize the following model:

$$TRADE\_BALANCE_{it} = f(ENERGY_{it}, GROW_{it}, EXPORT_{it}, EXR_{it})$$

The equation for the fixed effect model is:

$$Y_{it}=\beta_1 X_{it}+\alpha_i+u_{it} \quad (1.1)$$

$$TRADE\_BALANCE_{it} = \alpha + \beta_1 ENERGY_{it} + \beta_2 GROW_{it} + \beta_3 EXPORT_{it} + \beta_4 EXR_{it} + u_{it} \quad (1.2)$$

Table 1: Measurement of variables used in the study

Dependent variables	Abbreviation	Source
Trade balance, current 10^8 $USD	TRADE _BALANCE	WDI
Independent variables		
Energy consumption (kWh per capita)	ENERGY	WDI
GDP growth rate (annual %)	GROW	WDI
Exports of goods and services (current 10^6 US$)	EXPORT	WDI
Real effective exchange rate	EXR	WDI, DOS

Figure 1: Research model

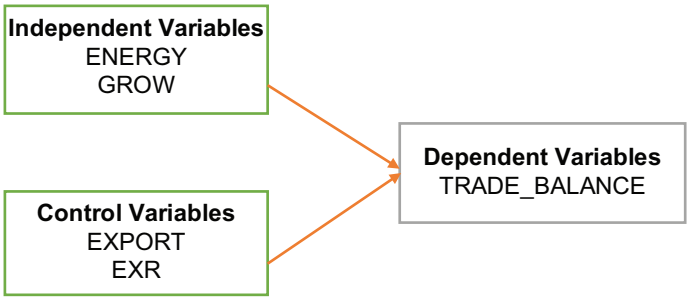
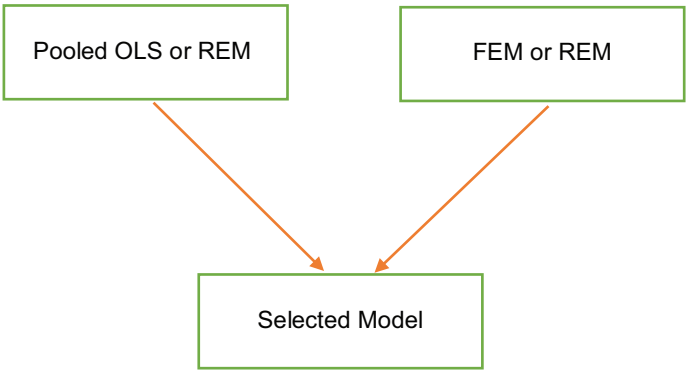


Figure 2: Model selection



Where:
- α_i (i=1….n) is the unknown intercept for each country (n country-specific intercepts),
- Y_{it} is the explanatory variable; i, and t denote for the country i and time t. This can be abbreviated by TRADE_BALANCE,
- X_{it} denotes an independent variable. It includes EXPORT, EXR, GROW, and ENERGY,
- β_1 is the coefficient for that independent variable,
- u_{it} is the error term.

Regarding REM, the rationale behind REM is that the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. An advantage of random effects is that you can include time invariant variables. In the FEM these variables are absorbed by the intercept. REM allows to generalize the inferences beyond the sample used in the model.

The REM is:

$$Y_{it}=\beta_1 X_{it}+\alpha_i+u_{it}+\varepsilon_{it} \quad (2.1)$$

$$TRADE\_BALANCE_{it} = \alpha + \beta_1 EXPORT_{it} + \beta_2 EXR_{it} + \beta_3 GROW_{it} + \beta_4 ENERGY_{it} + \varepsilon_{it} \quad (2.2)$$

Where:
- α_i (i=1….n) is the unknown intercept for each country (n country-specific intercepts),
- Y_{it} is the explanatory variable; i, t denote for the country i and time t. This can be abbreviation like TRADE_BALANCE,
- X_{it} denotes an independent variable. It includes EXPORT, EXR, GROW, and ENERGY,
- β_1 is the coefficient for that independent variable,
- u_{it} is the error term between entity error,
- εi_t is the error term within entity error.

4. RESULTS OF ECONOMIC MODELING

4.1. Descriptive Statistics

Table 2 presents data description including 200 observations of 8 East Asian countries over a 25-year period from 1990 to 2015.

Table 2: Descriptive statistics

Country	Items	Trade balance	Export	Growth	Energy	EXR
China	Mean	106.220	769.174	0.098	1685.419	7.623
	Minimum	−11.497	57.374	0.039	510.619	5.655
	Maximum	348.832	2462.902	0.142	3927.044	9.601
	Std. dev.	110.984	815.914	0.024	1104.709	1.033
	Observations	25	25	25	25	25
Indonesia	Mean	8.276	96.236	0.049	442.118	10025.6
	Minimum	−6.237	29.295	−0.131	162.523	7572.978
	Maximum	24.021	212.996	0.082	811.906	19703.75
	Std. dev.	8.998	60.414	0.040	191.272	2989.206
	Observations	25	25	25	25	25
Malaysia	Mean	20.338	138.123	0.059	2856.953	3.320
	Minimum	−3.482	32.664	−0.073	1157.36	2.639
	Maximum	51.312	254.006	0.1000	4651.959	3.936
	Std. dev.	17.119	74.119	0.039	1018.157	0.482
	Observations	25	25	25	25	25
Philippines	Mean	−8.087	36.448	0.041	515.7655	48.248
	Minimum	−16.675	11.43	−0.005	335.265	36.789
	Maximum	−1.361	75.321	0.076	696.346	64.084
	Std. dev.	3.745	17.682	0.023	112.204	8.990
	Observations	25	25	25	25	25
Singapore	Mean	31.57	273.952	0.063	7418.345	1.432
	Minimum	2.536	67.4893	−0.021	4983.046	1.142
	Maximum	76.981	604.391	0.145	8844.688	1.736
	Std. dev.	24.803	179.080	0.039	1322.832	0.180
	Observations	25	25	25	25	25
South Korea	Mean	17.747	313.234	0.054	6509.697	1108.553
	Minimum	−21.978	70.653	−0.054	2373.214	927.767
	Maximum	82.854	725.298	0.113	10496.51	1525.172
	Std. dev.	25.317	223.388	0.036	2721.647	172.792
	Observations	25	25	25	25	25
Thailand	Mean	5.152	127.485	0.045	1666.882	35.672
	Minimum	−12.065	29.229	−0.076	709.552	29.309
	Maximum	26.976	282.259	0.111	2538.796	47.870
	Std. dev.	11.005	84.461	0.041	549.527	6.095
	Observations	25	25	25	25	25
Vietnam	Mean	−2.008	42.304	0.067	526.050	16714.78
	Minimum	−13.733	2.087	0.047	95.250	11817.06
	Maximum	8.596	161.187	0.095	1423.688	26542.69
	Std. dev.	5.037	46.933	0.013	419.287	3490.746
	Observations	25	25	25	25	25

Source: Result from the analysis

In fact, for each country with each index, first row is mean. Respectively, rows are minimum, maximum, standard deviation and the number of observations used in the study. In general, trade balance in average of Philippines and Vietnam are under zero, indicating a deficit. While other countries' balance of trade is positive, meaning that these countries have an excess trade balance. Further, China, South Korea, Singapore, Malaysia, and Singapore have reached a higher level in development than their counterparts like Vietnam and Philippines, so trade balance is more positive in the case of China, South Korea, Singapore, Malaysia, and Singapore, and less positive in the case of Vietnam, Philippines with minus 20.6 bn $US, minus 98.5 bn $US on average, respectively.

In addition to export performance, China is the leading exporters in the group of 8 selected countries, which is 2.5 times the second leading country – South Korea. Vietnam and Philippines are two countries at the bottom of the exporting list. In terms of economic growth, the average economic growth rate of East Asian countries was at 5.42% while the highest average rate for China and Vietnam was 9% and 6.52%, respectively, compared with 4.76% for Philippines at the lowest rate. China is once again the country whose GDP growth is the most performance in the group meanwhile other countries have the fluctuation of GDP growth about 4-7%. Regarding energy consumption, Singapore, and South Korea are at the top of consuming energy. At the same time, Indonesia, Philippines and Vietnam seem to use rare energy.

4.2. Multi-collinear Test

In the theory of correlation analysis conduct on Gujarati (2004), it is evident that multi-collinearity existence between independent variables could be certainly found if correlation coefficient is 0.8 and more, severe multi-collinearity could be exactly present when absolute value of pairwise correlations between variables may be somewhat high. Table 3 highlights the correlation matrix among variables used in the study. In fact, there is less multi-collinearity problem in all cases in the analysis, correlation coefficients do not have an excess of 0.8 so that the multi-collinearity is not present.

Another test we used in the study is that the analysis needs to check the multi-collinearity based on Variance Inflation Factor (VIF) that are used. The result of VIF shown in Table 4 shows that the VIF of all independent variables is <10. Therefore, it is concluded that there is no multi-collinearity problem in the models.

4.3. Discussion of Estimation Models

Quantitative research method is used to find empirical evidence on the factors affecting the balance of trade. The regression methods on the panel data are used include pooled OLS, FEM and REM. In respect to FEM, individual specific effect is significantly correlated with the independent variables, assuming that there is a true effect size which underlines all studies in the study, and differences in observed effects are due to sampling error. In connection to REM, the true effect can exactly vary from study to study.

As suggested in Wooldridge (2010), pooled OLS is more exactly to estimate if the study can select a different sample for the period of time of the panel data. Because of existence of inadequate pooled OLS, either FEM or REM should be employed in relation to the situation of the same sample of entity used in the study. Thus, the results are examined by fixed or REMs that are suggested are more possibly exact than using by pooled OLS.

In general, the effect size may be either higher or lower in this study. Due to the difference in the mixes of participants, implementations of interventions, and other reasons, it is evident to recognize that there might be different effect sizes underlying different analyses.

Breusch and Pagan Lagrangian multiplier test for random effects can be used to choose either Pooled OLS or REM. In the theory, the results the variance for u is 0 and the P = 5% which means the study cannot reject the null hypothesis and hence select to do a pooled regression. Otherwise is REM. The result is represented in the Table 5 below.

First of all, Breusch and Pagan Lagrangian multiplier test is used for the choice of model between pooled OLS and REM. The p-value of the Breusch and Pagan Lagrangian multiplier test is 0.06. For the significance of 5%, the appropriate model is REM.

In order to choose between FEM and REM, Hausman specification tests have been focused. To be precise, the selection between the two models is based on the inter-variance and intra-variability. The select model is FEM if Pro. >Chi-square, otherwise is REM.

H_0: The null hypothesis is that the preferred model is random effects

H_a: The alternate hypothesis is that the model is fixed effects.

The Hausman test result is given in Table 6.

Table 6 indicates that P-value of the Hausman model is 0.4487, which is much larger than 0.05, RE model is suggested to be used rather than FEM. In conclusion, REM is the most suitable in this study, in which the independent variable is balance of trade.

4.4. Results of Econometric Modeling

In this section, the study will totally discuss results of the econometric modeling in the case of East Asian countries.

Table 3: Correlation coefficents between variables

	Trade balance	Export	Growth	Energy	EXR	Dev.
Tradebalance	1					
Export	0.8922 (0.0000)	1				
Growth	0.1891 (0.0073)	0.1540 (0.0294)	1			
Energy	0.2482 (0.0004)	0.3407 (0.0000)	−0.0718 (0.3127)	1		
EXR	−0.2083 (0.0031)	−0.2359 (0.0008)	−0.0462 (0.5163)	−0.3981 (0.0000)	1	
Dev.	0.4049 (0.0000)	0.3939 (0.0000)	0.2452 (0.0005)	0.6720 (0.0000)	−0.5214 (0.0000)	1

Source: Result from the analysis

REM is the most suitable in this study, we have tested the diagnostics of the model in connection REM (Table 7).

4.4.1. Autocorrelation test

Based on the Wooldridge test, we have:

- The null hypothesis H_0: No first order autocorrelation
- The alternative hypothesis H_a: Existence of an autocorrelation

At this stage, autocorrelation test used for null hypothesis: "no first order autocorrelation," the Wooldridge Test is used. According to the results in Table 8, the P-value of the REM is very close to zero. They are all <0.05 so that null hypothesis is rejected, which indicated that there is an autocorrelation between variables in the three models.

4.4.2. Heteroscedasticity test

To test for heteroscedasticity of the REM model, the White test is performed. In the theory, if the test result with P = 0.05, so there is heteroscedasticity in the model at the significant level at 5%. In a result, Table 9 indicates that the test result with P = 0.0000, which proved that the model has heteroscedasticity problem.

To sum up, the model has problems of autocorrelation and heteroscedasticity. In order to fix these errors, the study needs to correct them. After correction the errors, the results are shown in the following Table 10.

5. DISCUSSION THE RESULTS

According to Table 10, the estimation of the REM is finally selected as the best model to discuss. Regarding the estimation results, our analysis shows the relationship energy consumption, economic growth on trade balance – in the case of East Asian countries, we have:

Table 4: VIF coefficients of independent variables

Variable	VIF	1/VIF
Energy	2.09	0.478351
Growth	1.22	0.822473
Export	1.21	0.823291
EXR	1.39	0.718445
Dev.	2.58	0.388321
Mean VIF	1.70	

Source: Result from the analysis. VIF: Variance inflation factor

Table 5: Breusch and Pagan Lagrangian for homoscedasticity

Items	Value
Chi-square (01)	2.36
Prob. >Chi-square	0.0624

H_0: Constant variance. Source: Result from the analysis

Table 6: Hausman test results

Items	Value
Chi-square (2)	1.60
Prob >Chi-square	0.4487

Source: Result from the analysis

5.1. Energy Consumption

Regression coefficients of this variable = −0.002, which is negative and statistically significant. To be precise, the impact of energy consumption on trade balance is statistically significant and negative. A higher level in energy consumption, on average, will cause decrease trade balance by 0.002 bn US dollars.

This result is not consistent with many other empirical findings and also with our theoretical expectation because theoretically. In fact, when energy consumption which is denoted by energy consumption per capita in relation to an economic factor that will improve a country's trade balance. In the study in developing countries in Latin America, and Caribbean area, Imran (2017) also found a positive effect. In this study, we recommend that even though the energy consumption in East Asia has been expanded over time, but high-income countries such as Singapore, Malaysia, and South Korea are still at the top on its consumption, lower-middle income countries such as Indonesia, Philippines and Vietnam seem to use a lower level of energy consumption per capita. In addition to trade balance performance, high-income economies have prefer more trade surplus, by contrast, trade deficit for middle income countries in the case in East Asia.

Table 7: Results of econometric modeling

Variables	Pooled OLS	FEM	REM
Energy	−0.003 (0.000)**	−0.0009 (0.596)	−0.002 (0.066) *
Growth	−3.580 (0.942)	−7.168 (0.891)	−16.176 (0.744)
Export	0.124 (0.000)***	0.117 (0.000)***	0.121 (0.000)***
EXR	0.0003 (0.406)	0.001 (0.229)	0.0005 (0.372)
Dev.	19.591 (0.000)***	omitted	19.459 (0.028) ***
C	−7.725 (0.061)*	−5.332 (0.486)	−9.038 (0.191)

Source: Result from the analysis. *, **, and *** indicate significance level of 10%, 5% and 1%. FEM: Fixed effect method, REM: Random effect method

Table 8: Wooldridge test for autocorrelation in panel data

Items	REM
F(1,7)	111.32
Prob. >F	0.000

Source: Wooldridge test - STATA 15. REM: Random effect method

Table 9: Heteroscedasticity test

Items	REM
White test	W0=14.468 (Pr >F=0) W50=10.083 (Pr >F=0) W10=11.418 (Pr >F=0)

Source: Results from STATA 15. REM: Random effect method

Table 10: Results of econometric modeling (Correction)

Variables	REM*
Energy	−0.002 (0.073)*
Growth	−16.176 (0.807)
Export	0.121 (0.000) ***
EXR	0.0005 (0.015) **
Dev.	19.459 (0.000) ***
C	−9.038 (0.057)

Source: Result from the analysis. *, **, and *** indicate significance level of 10%, 5% and 1%

5.2. Regarding Economic Growth

It is evident that the effect of economic growth on trade balance is also negative but insignificant. More specifically, an increase in economic performance will not impact on trade balance in the case of East Asian countries. This finding is not in relation to theoretical expectations and in significantly correlated with others empirical studies. As shown in the descriptive statistics, developing countries have a higher economic growth rate than developed countries, by contrast, trade balance is worse. Developed countries may do business in developing countries in order to exploit cheap labor force and larger market scales. Panshak et al. (2019); Manual and San (2019) found the reversed result with this study.

Empirical results reveal that export can significantly generate the balance of the trade. Increase export value by a 1 bn US dollar will cause to increase trade balance by 0.121 bn US dollars. This finding is consistent with the studies result from Gao and Tian (2016) conduct in the case of China. However, China has supported exports through numerous incentives such as financial assistance, tax reduction where this mode of channel may be the main source to enhance trade balance.

5.3. Real Exchange Rate

Regression coefficient of EXR is 0.005 and statistically significant. This means that the real exchange rate has positive impact on East Asian countries' trade balance. Therefore, it can be concluded that with robustness of trade balance, the exchange rate is one of the most important macroeconomic factors that drive East Asian trade balance. This finding is also found in various studies in the past; for example, Elahi et al. (2016) in a sample of 10 developed countries and 15 developing countries in the world; Sasaki and Yoshida, 2018; Dogru et al. (2019) in the United State of America; Manual and San (2019) in the case of Malaysia.

5.4. Development Level between Countries

It is significantly evident that if a country with a higher level of domestic income will certainly perform a higher level of trade balance. In this case, China, South Korea, Singapore, Malaysia, and Singapore can capture much surplus in trade balance whilst much deficit in trade balance of their counterparts as Vietnam and Philippines.

6. CONCLUSION

A very few studies have focused on the effect of energy consumption on trade balance. This study is expected to contribute this empirical analysis in the case of a specific region in Asia. In this study, factors impacting the balance of trade are discussed. Using a sample data during the period of 1996 - 2015 in East Asian countries, prime factors that can significantly impact the balance of trade are energy consumption, exports, exchange rates and development level. Empirical results demonstrate that economic growth is insignificant to trade balance. Thus, East Asian countries should focus on export and the policy of devaluation of exchange rate in order to inspire trade balance. While, in the case of energy consumption, there is unidirectional linkage running from energy consumption to trade balance, but negative sign is found, which means that the use of energy consumption has negatively affected for trade balance. Further, a country with a higher level of domestic income will certainly perform a higher level of trade balance

AUTHOR CONTRIBUTIONS

The authors contribute equally to this work.

REFERENCES

Apergis, N., Ozturk, I. (2015), Testing environmental Kuznets curve hypothesis in Asian countries. Ecological Indicators, 52, 16-22.

Dogru, T., Isik, C., Sirakaya-Turk, E. (2019), The balance of trade and exchange rates: Theory and contemporary evidence from tourism. Tourism Management, 74, 12-23.

Elahi, N., Salimi, F., Masoomzadeh, E. (2016), Investigating asymmetric effects of monetary shocks on the exchange rate and trade balance, with an emphasis on inflation targeting. Procedia Economics and Finance, 36, 165-176.

Gao, J., Tian, M. (2016), Analysis of over-consumption of natural resources and the ecological trade deficit in China based on ecological footprints. Ecological Indicators, 61(2), 899-904.

Gujarati, D. (2004), Basic Econometrics. 4th ed. New York: McGraw-Hill Companies.

Hassan, S.A., Zaman, K. (2012), Effect of oil prices on trade balance: New insights into the cointegration relationship from Pakistan. Economic Modeling, 29(6), 2125-2143.

Imran, H. (2017), Economics-energy-environment nexus in Latin America and the Caribbean. Energy, 141(C), 170-178.

Manual, V., San, W. (2019), Dynamic relationship between trade balance and macroeconomic elements: Empirical evidence from emerging economies in Malaysia. International Journal of Recent Technology and Engineering, 7(5S), 2278-3075.

Nasreen, S., Anwar, S., Ozturk, I. (2017), Financial stability, energy consumption and environmental quality: Evidence from South Asian economies. Renewable and Sustainable Energy Reviews, 67, 1105-1122.

Panshak, Y., Civcir, I., Ozdeser, H. (2019), Towards determining Nigeria's economic growth path: A balance-of-payments approach. EconomiA, Doi:10.1016/j.econ.2019.11.004.

Rekiso, Z.S. (2020), Trade deficits as development deficits: Case of Ethiopia. Structural Change and Economic Dynamics, 52, 344-353.

Sasaki, Y., Yoshida, Y. (2018), Decomposition of Japan's trade balance. International Review of Economics and Finance, 56, 507-537.

Shawa, J., Shen, Y. (2013), Analysis of the determinants of trade balance: Case study of Tanzania. International Journal of Business and Economics Research, 2(6), 134-141.

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

Van, C.N. (2020), Energy consumption, income, trading openness, and environmental pollution: Testing environmental Kuznets curve hypothesis. Journal of Southwest Jiaotong University, 55(1), 1-10.

Wooldridge, J. (2010), Econometric Analysis of Cross Section and Panel Data. Massachusetts, United States: MIT Press.