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The Impact of Leading Economic Indicators on the Export of ASEAN Countries*

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Abstract

The article applies the ECM – ARDL model to examine the relationship between economic indicators and the existence of the disease in the long run of 10 ASEAN countries from 2000 to 2019. There are two models: The first model investigates the impact of GDP per capita, net inflow FDI, unemployment rate, and inflation rate on the proportion of export to GDP of ASEAN countries, the second model is similar to the first one but adds one more variable to the independent variable list – 'the variable for disease'. The results prove the long-run effect of GDP per capita, FDI, unemployment and inflation rate on export of the selected countries, though individual country shows differences in the sign and magnitude of these impacts. Surprisingly, the number of people suffering from disease does not affect the export of all selected countries as expected. The results of the two models also indicate that the disequilibrium in the short run converges to the equilibrium in the long run with a high proportion, especially in the case of Cambodia and the Philippines, with the rate of 95.65% and 151.94%, respectively. The findings can be useful for policymakers in promulgating efficient policies to enhance the trading activities of the selected countries.

Keywords: ASEAN, Export, Panel Data, Autoregressive Distributed Lag, Error Correction Model

JEL Classification Codes: C12, C22, C23, F16

1. Introduction

In today's open economy, trading activities play a vital role in any nation's economic growth. Governments around the world have developed policies and strategies to increase their trade volumes. To promulgate reasonable policies, it is necessary to have an understanding of the criteria, which affect international trade. The research concerning these impacts is hence crucial.

Different studies have applied the ARDL model to tackle the causal relationship among the economic indicators, for example, export, foreign direct investment, economic growth, exchange rate, tourism, etc for a single country or group of countries. Specifically, the Granger causality among economic growth, FDI, and export of East and Southern Asia was investigated by Hsiao and Hsiao (2006) and Nikolaos and Pavlos (2018). (Duasa, 2007) identified the factors affecting Malaysia's trade balance. Hye (2012) found the relationship between export and import, real GDP and export, and real GDP and import of China. In the long run, trade openness stimulates the economic growth of Pakistan is the result of the analysis of Shahbaz (2012). It was proven in a recent study by Kong et al. (2021) that trade openness has a positive impact on China's economic growth.

The impact of the unemployment rate on economic growth appeared in many studies (Chang, 2005; Ekanem, 2005; Kreishan, 2011; Louail & Riache, 2019; Tzougas, 2013). Besides, how trade enhancement affects the unemployment rate was identified by Hasan et al. (2012) and Jin et al. (2019). Nikolaos and Pavlos (2018) found a two-way relationship between unemployment and the export of the old European Union member countries. Meanwhile, Bayar (2014) proved the negative impact of unemployment on the export of Turkey.

Similar to unemployment, the relationship between inflation and GDP was investigated by many scholars, for

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instance, Behera and Mishra (2016), Lee and Yu (2021), and Ngoc (2020). They all used the ARDL model in their research to determine the impact of inflation on national income Nevertheless, the impact of inflation on export volume was not investigated widely. Several studies that dealt with this relationship are those of Monineath (2018), Mwakanemela (2014), Purusa and Istiqomah (2018), and Sumantri and Latifah (2019). Among these authors, only Monineath (2018) applied the ARDL model in the research to reveal the relationship between inflation and export performance.

Besides, there is no previous research that considered all the indicators of GDP, foreign direct investment, unemployment, inflation, and disease to show their impacts on the export activities of ASEAN countries. Besides, many scholars examined the influence of export, FDI, GDP growth on unemployment and inflation, but few studies investigated the opposite relationship. Thus, this paper aims at constructing a model to investigate the relationship between the above mentioned economic indicators and trading activities in the long run and the short run. Using the data from 10 countries in ASEAN in the time 2000–2019, the research employed the Error Correction Model – Autoregressive Distributed Lag (ECM – ARDL) model to determine the impact of economic growth, foreign direct investment, unemployment rate, inflation rate, and especially the appearance of disease on the export of individual country in ASEAN. The expansion of adding different variables in this paper can enrich the related literature.

The results reveal the differences in the effect of each variable on the export of individual countries. Interestingly, the number of people infected with the disease (SARS) does not put any pressure on export activity. The error correction term indicates the high rate of convergence of disequilibrium in the short run to the equilibrium state in the long run. The estimation results are checked with the diagnostic test and stability test, which confirm the stability and homoscedasticity of the model.

The structure of the article is as follows. Section 2 discusses the Literature Review before moving to the Data and Methodology in Section 3. Section 4 provides the Empirical Analysis and Discussion. Finally, it is the Conclusion.

2. Literature Review

ARDL is a useful model for forecasting and checking the long-run and short-run relationship between variables. Since the Error Correction (EC) was introduced and applied in economics, it became noteworthy and was considered as a useful model tackling the stationary series. Hylleberg and Mizon (1989) stated in their research: *"the error correction formulation provides an excellent framework within which it is possible to apply both the data information and the information available from economic theory"*.

Many scholars employ ARDL and ECM models with both time series data and/or panel data in their research to reveal the relationship between the variables, for example, international trade, economic growth, FDI inflow, exchange rate, unemployment, etc. Specifically, considering the exchange rate and international trade, Duasa (2007) proved that the real exchange rate does not affect trade volume in the case of Malaysia. In the research analyzing the impact of exchange rate volatility on Vietnam's export, Thuy and Thuy (2019) employed the ARDL bound test and found that exports change negatively in the short run and positively in the long run, once the domestic currency depreciates. With the same topic, Nguyen et al. (2021) applied nonlinear ARDL (NARDL) in the analysis and proved the trivial impact of exchange rate on export and import.

Considering the relationship between economic growth, FDI, and trading activities, Narayan and Smyth (2005) examined the relationship between trade flows and the economic growth of Fiji by exploiting the ARDL model and found that the impact of export on economic growth is trivial. However, they proved the significantly positive effect of signing the IMF agreement on Fiji's GDP growth. Using the data of Ghana and applying the ARDL model Frimpong Magnus and Oteng-Abayie (2006) pointed that trading activities enhance but FDI discourages economic growth. Using panel data of OECD countries, Kónya (2006) revealed that export stimulates GDP in some countries, GDP encourages export in others and there is a two-way relationship between these indicators in Canada, Finland, and the Netherlands. The result of Granger causality indicated a positive impact of international trade on the economic growth in the three transition economies (Awokuse, 2007). With time series, applying the ARDL model for the data of Malaysia, Duasa (2007) found that there is an impact of income and money supply on the trade balance.

The research of Katircioglu (2009) indicated the long-run relationship between tourism, international trade, and economic growth by applying the bound test and Granger causality test. That FDI inflow stimulates export activity was found by Prasanna (2010). The same results were shown by Cañal-Fernández and Fernández (2018), who examined the long-run impact of FDI, export, import, and GDP in Spain using the ARDL model and found the positive impact of FDI, import, and GDP on export as a result of short-run Granger causality. Halicioglu (2011) exploited the ARDL model with data from Turkey to check the long-run relationship between income, energy consumption, and exports. The result suggested that there exists a long-run and short-run relationship between export and aggregate output. Using the data of Vietnam from 2009 to 2018 and applying the ECM model, Nguyen and Do (2020) pointed the rate of convergence to the long-run equilibrium of Vietnam's export performance under the effect of economic growth, import,

and inward FDI. In one of the novel articles using the ARDL model to investigate the relationship between trade openness and the economic growth of China, the authors proved this relationship occurs both in the long run and in the short run (Kong et al., 2021). This result is consistent with Shahbaz (2012), who conducted a similar approach for Pakistan data.

The link between the unemployment rate and economic growth was first introduced by Okun's law in 1962 (Okun, 1962). The relationship between unemployment and inflation was first represented by Phillips (1958). However, the impact of unemployment on trading activities is being investigated. According to Bayar (2014), unemployment discourages the export volume of Turkey by applying the bound test approach with quarterly data from 2000:Q1 to 2013:Q3. Whereas, Nikolaos and Pavlos (2018) showed that unemployment Granger causes export when estimating the data of fifteen European countries in the period 1970–2015 with the fixed effect model.

In terms of the impact of inflation on export activity, Mwakanemela (2014) found that an increase in the inflation rate reduces the manufacturing export volume. Mwakanemela (2014) used Vector Error Correction (VEC) model to figure out the major determinants of Tanzanian export. Purusa and Istiqomah (2018) exploited the fixed effect model and used the data of five ASEAN countries (Indonesia, Malaysia, the Philippines, Thailand, and Vietnam) from 2000 to 2015 to show that inflation discourages export performance. With the Multiple Linear Regression method, Sumantri and Latifah (2019) pointed that Indonesia's CPI does not have any impact on the export and import activities of this country. A study tackling the determinants of export in Cambodia by using the ARDL model showed that the inflation rate has a negative impact on the export activity of this country (Monineath, 2018).

The analyses concerning the relationship between GDP, FDI, and export are varied. However, there is no previous research conducting the relationship among international trade and economic indicators, included GDP per capita, FDI, unemployment rate, inflation rate, and diseases. This article applies the ARDL model with panel data to investigate the impact of GDP per capita, net flow FDI, unemployment rate, and inflation rate on the export of ten countries in ASEAN. Interestingly, the analysis yearns to figure whether the disease hampers trading activities or not by adding a variable, which stands for the number of people suffering a disease during the period considered.

3. Data and Methodology

3.1. Data

The two-dimensional panel data (country and time) collected from the World Bank from 10 ASEAN countries over a period of 20 years between 2000 and 2019 is used in this paper. There are 200 observations in total.

The proportion of export to GDP, inflation rate, and the unemployment rate is as a percentage. GDP per capita and net inflows of Foreign Direct Investment (FDI) of each country are calculated as current US$.

The information about the disease in this article considers severe acute respiratory syndrome (SARS), which spread quickly and widely in 2002 and 2003. According to the summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003 from the World Health Organization, the number of cases infected of the selected countries are as follow: Indonesia –2, Malaysia –5, Philippines –14, Singapore –238, Thailand –9, and Vietnam –63 (WHO, 2015).

Since the inflation rate of several countries is negative in some years, the inflation variable cannot take the log form. It is also invalid to take a log for the disease variable, where the value of the number of people infected is 0. All the other variables in the analysis are in the log form.

3.2. Methodology

The research focuses on investigating the impact of GDP per capita, FDI, unemployment, inflation, trade openness, and disease on ASEAN countries' export. There are two models as in Equation (2) and Equation (3). The difference between these two models is the appearance of the variable for the occurrence of disease in the time considered, respectively.

$$\ln\text{EX\_GDP}_{it} = \alpha_0 + \alpha_1 \ln \text{GDPPC}_{it} + \alpha_2 \ln\text{FDI}_{it} + \alpha_3 \ln\text{UN}_{it} + \alpha_4 \text{INF}_{it} + \varepsilon_{it} \quad (1)$$

$$\ln\text{EX\_GDP}_{it} = \beta_0 + \beta_1 \ln \text{GDPPC}_{it} + \beta_2 \ln\text{FDI}_{it} + \beta_3 \ln\text{UN}_{it} + \beta_4 \text{INF}_{it} + \beta_5 \text{Disesase}_{it} + \varepsilon_{2t} \quad (2)$$

Where $\ln\text{EX\_GDP}_{it}$, $\ln\text{GDPPC}_{it}$, $\ln\text{FDI}_{it}$, $\ln\text{UN}_{it}$, INF_{it}, denotes the proportion of export to GDP of country i at year t; GDP per capita of country i at year t; net inflows FDI of country i at year t, the unemployment rate of country i at year t, and the inflation rate of country i at year t, respectively; Disease_{it} indicates the number of people of country i, who were infected by SARS in year t; and ε_t is the error term.

The result of estimation can get into the problem of multicollinearity if there is a correlation between variables. Hence, first, it is necessary to check the correlation among variables. According to Gujarati (2009) and Kennedy (2003), the enormous correlation coefficient between two variables – excess of 0.8 – can cause problematic issues. Some of the solutions used to tackle this problem are obtaining more data, formalizing relationships among regressors, dropping a variable,and specifying a relationship among some parameters (Kennedy, 2003). After checking for the correlation among the variables in the models, the results suggest there is no correlation between variables.

Autoregressive Distributed Lag (ARDL) approach is applied in the analysis with the aim of finding the relationship in the short run and the long run between variables. Besides, it is also an efficient tool to conduct forecasting tasks. Conducting ARDL approach, Equation (4) and Equation (5) can be expressed as follow:

$$\begin{aligned}\Delta \ln EX\_GDP_{it} = {} & \gamma_0 + \sum_{k=1}^{p_1} \gamma_1 \Delta \ln EX\_GDP_{i,t-k} \\ & + \sum_{k=0}^{p_2} \gamma_2 \Delta \ln GDPPC_{i,t-k} + \sum_{k=0}^{p_3} \gamma_3 \Delta \ln FDI_{i,t-k} \\ & + \sum_{k=0}^{p_4} \gamma_4 \Delta \ln UN_{i,t-k} + \sum_{k=0}^{p_5} \gamma_5 \Delta INF_{i,t-k} \\ & + \gamma_6 \ln EX\_GDP_{i,t-1} + \gamma_7 \ln GDPPC_{i,t-1} \\ & + \gamma_8 \ln FDI_{i,t-1} + \gamma_9 \ln UN_{i,t-1} + \gamma_{10} INF_{i,t-1} + \mu_{1t}\end{aligned} \tag{3}$$

$$\begin{aligned}\Delta \ln EX\_GDP_{it} = {} & \delta_0 + \sum_{k=1}^{p_1} \delta_1 \Delta \ln EX\_GDP_{i,t-k} \\ & + \sum_{k=0}^{p_2} \delta_2 \Delta \ln GDPPC_{i,t-k} + \sum_{k=0}^{p_3} \delta_3 \Delta \ln FDI_{i,t-k} \\ & + \sum_{k=0}^{p_4} \delta_4 \Delta \ln UN_{i,t-k} + \sum_{k=0}^{p_5} \delta_5 \Delta INF_{i,t-k} \\ & + \delta_6 \ln EX\_GDP_{i,t-1} + \delta_7 \ln GDPPC_{i,t-1} \\ & + \delta_8 \ln FDI_{i,t-1} + \delta_9 \ln UN_{i,t-1} + \delta_{10} INF_{i,t-1} \\ & + \delta_{11} Disease_{it} + \mu_{2t}\end{aligned} \tag{4}$$

The Error Correction Model of ARDL (ECM – ARDL) is as below:

$$\begin{aligned}\Delta \ln EX\_GDP_{it} = {} & \gamma_0 + \sum_{k=1}^{p_1} \gamma_1 \Delta \ln EX\_GDP_{i,t-k} \\ & + \sum_{k=0}^{p_2} \gamma_2 \Delta \ln GDPPC_{i,t-k} + \sum_{k=0}^{p_3} \gamma_3 \Delta \ln FDI_{i,t-k} \\ & + \sum_{k=0}^{p_4} \gamma_4 \Delta \ln UN_{i,t-k} + \sum_{k=0}^{p_5} \gamma_5 \Delta INF_{i,t-k} \\ & + \lambda EC_{jt-1} + v_{1t}\end{aligned} \tag{5}$$

Where p_1, p_2, p_3, p_4, p_5 is the lag of $\ln EX\_GDP_{it}$, $\ln GDPPC_{it}$, $\ln FDI_{it}$, $\ln UN_{it}$, and INF_{it} respectively. EC_{jt-1} denotes the error correction term, which is enacted from the long-run relationship. It indicates the degree of the reaction of the dependent variable to the deviation from equilibrium state and the time of adjustment, wherein the disequilibrium is corrected.

To apply ARDL, the following steps need to be investigated. First, the unit root test is performed to check for the stationary of the data. The ARDL can be applied in case the data is stationary at the level $I(0)$ or first difference $I(1)$. The scholars performing the unit root tests for panel data the first time are Levin et al. (2002). The other unit root such as Dickey-Fuller (DF), augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) are now accepted. The article conducts these tests to show the stationary of the panel data.

Once the first step ensures the stationary of data in the analysis, choosing optimal lag for the model is the next step. The lag order of each variable of the individual country is selected based on the criteria: Akaike Information Criterion (AIC), Hannan – Quinn Information Criterion (HQIC), and Schwartz – Bayes Information Criterion (SBIC). The selected lag is the one, which has the lowest figure in AIC, HQIC, and SBIC. The optimal lag of the model is set as the maximum lag of the variable in the model. When entering the model, each variable can be assigned a different lag length.

Before estimating the model, it is crucial to check for cointegration. The null hypothesis of no level relationships is investigated with the Bound testing method of Pesaran et al. (2001). There is a relationship between long-run and short-run variables if the null hypothesis is rejected. In this research, both F-statistic and t-statistic are used to decide on null hypothesis rejection. The null hypothesis is rejected once the F-statistic is larger than the critical value for $I(1)$ regressors and the t-statistic is less than the critical value for $I(1)$ regressors.

The estimation is conducted for each country and each model when the cointegration is proved from the previous step. Finally, diagnostic tests are performed, including the White test for homoscedasticity and the stability test. The non-rejection of the null hypothesis of homoscedasticity in the White test proves the plausible results of the estimations. Besides, the stationary test, namely the cumulative sum of recursive residuals (CUSUM) and the square of the cumulative sum of recursive residuals (CUSUMSQ) introduced by Brown et al. (1975) are applied. The ARDL is stable on the condition that the CUSUM and/or CUSUMSQ are in the range of 5% significance level.

4. Empirical Results and Discussion

Table 1 shows the results of panel unit root tests at the level and first difference. As can be seen from the results, two variables (inflation and disease) are stationary at level; whereas, the others are stationary at first difference. The ARDL is hence a feasible approach to apply for the models.

Table 2, panel A shows the results of cointegration of Model 1 for nine countries. The results for Indonesia are omitted due to the lack of data for the inflation variable. The critical value for $I(1)$ concerning F-statistic is 4.68, 3.79, and 3.35 at 1%, 5%, and 10% significance levels, respectively.

Table 1: Results of Panel Unit root tests

	lnex_gdp	lngdppc	lnfdi	lnun	INF	Disease
Panel A: Level						
Levin, Lin & Chu	–	–4.7597 (0.0000)	–	–2.0151 (0.0219)	–	–2.7812 (0.0027)
Im, Pesaran & Shin W-stat	0.7600 (0.7764)	–1.1718 (0.1206)	–0.0799 (0.4682)	–0.6617 (0.2541)	–3.0838 (0.0010)	–
ADF Fisher Chi-square	14.4264 (0.8082)	23.3268 (0.2730)	20.6991 (0.4150)	45.0751 (0.0011)	42.7325 (0.0009)	46.6893 (0.0000)
PP Fisher Chi-square	15.2844 (0.7599)	7.0465 (0.9965)	48.9799 (0.0003)	20.8745 (0.4046)	93.8935 (0.0000)	111.4684 (0.0000)
Panel B: First Difference						
Levin, Lin & Chu	–	–2.6425 (0.0041)	–	–3.5782 (0.0002)		
Im, Pesaran & Shin W-stat	–5.6843 (0.0000)	–3.4788 (0.0003)	–7.9367 (0.0000)	–5.7835 (0.0000)		
ADF Fisher Chi-square	92.6722 (0.0000)	48.4444 (0.0004)	155.0935 (0.0000)	105.3116 (0.0000)		
PP Fisher Chi-square	139.5396 (0.0000)	93.2579 (0.0000)	322.6635 (0.0000)	152.2017 (0.0000)		

Note: *p*-values in parenthesis.

The figure for *t*-statistic is –4.79, –4.19, and –3.86 at 1%, 5%, and 10% significance levels, respectively. According to the results, there are seven countries in Model 1, in which there are relationships between the variables in the long run and the short run. For the other two countries – Laos and Thailand, the null hypothesis of no level relationship is not rejected considering the results of *F*-statistics and/or *t*-statistic. The final column in the table shows the error correction term. From the results, the rate of convergence to the equilibrium of Brunei, Cambodia, Malaysia, the Philippines, Singapore, and Vietnam is 43.43%, 95.65%, 22.20%, 151.94%, 60.03%, and 39.75%, respectively.

The results of estimating Model 1 is in Table 3. As can be seen, the sign, magnitude, and significance levels of the six selected countries are different. Brunei, the Philippines, and Vietnam have all the significant coefficients. A 1% increase in GDP per capita stimulates the proportion of export to the GDP of Brunei and Vietnam by 1.24% and 1.49%. This is in line with the former studies. However, GDP per capita harms the export of Malaysia and the Philippines and there is no causality between GDP and export in Cambodia and Singapore. Considering net flow FDI, the impact of FDI on export in Brunei, Cambodia, and Vietnam is negative but this influence is positive for Malaysia and the Philippines. From the evidence from previous research, the causality relationship between FDI and export is ambiguous (Cañal-Fernández & Fernández, 2018; Hsiao & Hsiao, 2006; Mehrara et al., 2014; Shawa & Shen, 2013).

The unemployment rate significantly and negatively affects the export in Brunei and the Philippines, which is consistent with the result from the paper of Chang (2005), and Nikolaos and Pavlos (2018). Meanwhile, the relation between unemployment and export in Vietnam is positive. Interestingly, the unemployment rate does not have any impact on the export of Cambodia, Malaysia, and Singapore.

Regarding inflation, an increase of 1% in inflation reduces the export of Brunei by 0.25%, whereas, the inflation rate has a positive impact on the export of the Philippines, Singapore, and Vietnam, though the magnitude of the effect is trivial. Furthermore, inflation does not affect the export of Cambodia and Malaysia. As in former analyses, the relationship between inflation and international trade is changing, for example, inflation does not affect the export of Indonesia (Sumantri & Latifah, 2019).

When adding the variable for the number of cases infected by SARS, the results of Model 2 are as Panel B – Table 2 and Table 4. Specifically, Panel B – Table 2 indicates the cointegration results of each country by providing *F*-statistic, *t*-statistic, and EC of 5 countries (Malaysia, the Philippines, Singapore, Thailand, and Vietnam) having citizens who were suffering from SARS in 2003. The result of Indonesia is omitted due to the lack of inflation data.

Table 2: ARDL Approach to Cointegration

Country	ARDL	*F*-statistic	*t*-statistic	EC_{t-1}
Panel A: Model 1				
Brunei	ARDL(2, 2, 2, 1, 2)	8986.638***	–21.319***	–0.4343**
Cambodia	ARDL(2, 2, 2, 2, 2)	9.910***	–4.253**	–0.9565*
Laos	ARDL(2, 2, 2, 2, 1)	2.340	–2.069	–7.9798
Malaysia	ARDL(1, 0, 1, 1, 0)	8.017***	–3.676*	–0.2220***
Myanmar	ARDL(1, 2, 0, 0, 2)	3.417	–2.755	–0.6197**
Philippines	ARDL(2, 2, 1, 2, 0)	6.430***	–4.881***	–1.5194***
Singapore	ARDL(2, 2, 2, 1, 2)	6.882***	–4.644***	–0.6003***
Thailand	ARDL(1, 2, 0, 2, 1)	5.809***	0.515	0.1462
Vietnam	ARDL(2, 2, 1, 2, 0)	37.287***	–3.960*	–0.3975***
Panel B: Model 2				
Malaysia	ARDL(1, 0, 1, 1, 0, 0)	6.623***	–3.661	–0.2243***
Philippines	ARDL(2, 2, 1, 2, 0, 0)	4.880***	–3.857	–1.7045**
Singapore	ARDL(2, 2, 2, 1, 2, 0)	4.482**	–2.766	–0.5544*
Thailand	ARDL(1, 2, 0, 2, 1, 0)	6.924***	0.666	0.1649
Vietnam	ARDL(2, 2, 1, 2, 0, 0)	29.355***	–3.817	–0.3950**

*, **, *** denotes the significant level at 10%, 5%, and 1%, respectively.

Table 3: ARDL Long-Run Results of Model 1

Country	Variables			
	lngdppc	lnfdi	lnun	inf
Brunei	1.2414** (0.0603)	–0.4287** (0.0231)	–4.6597** (0.2094)	–0.2489** (0.0154)
Cambodia	0.5229 (0.2007)	–0.2269** (0.0519)	–0.0941 (0.1806)	–0.0016 (0.0064)
Malaysia	–0.7090*** (0.1149)	0.1077* (0.0617)	1.274 (0.7896)	0.0298 (0.0218)
Philippines	–0.4929*** (0.0253)	0.0384* (0.0176)	–0.2748** (0.0817)	0.0131** (0.0052)
Singapore	–0.4985 (0.2857)	0.3122 (0.1820)	0.6508 (0.3064)	0.0621* (0.0236)
Vietnam	1.4943*** (0.3339)	–0.7380** (0.2182)	0.3536*** (0.0753)	0.0223** (0.0086)

Standard errors are in the parentheses and *, **, *** denotes the significant level at 10%, 5%, and 1%, respectively.

Table 4: ARDL Long-Run Results of Model 2

Country	Variables				
	lngdppc	lnfdi	lnun	inf	Disease
Malaysia	–0.7374*** (0.1238)	0.1178* (0.0650)	1.3346 (0.8066)	0.0245 (0.0230)	–0.0199 (0.0241)
Philippines	–0.5050*** (0.0297)	0.0356* (0.0168)	–0.2893 (0.0787)	0.0105 (0.0062)	–0.0026 (0.0037)
Singapore	–0.5289 (0.3644)	0.3520 (0.2603)	0.7447 (0.4948)	0.0686 (0.0361)	0.0002 (0.0007)
Vietnam	1.5382*** (0.3613)	–0.7621** (0.2342)	0.3666*** (0.0820)	0.0241* (0.0096)	0.0006 (0.0008)

Standard errors are in the parentheses and *, **, *** denotes the significant level at 10%, 5%, and 1%, respectively.

Among these 5 countries, 4 are selected to estimate the model in the next step, including Malaysia, the Philippines, Singapore, and Vietnam. There is a minor change in the rate of convergence to the equilibrium for the selected countries. Concerning the estimation of Model 2, the results change both in the significance level and the magnitude when adding the variable 'disease'. The impact of GDP per capita on export is positive for Vietnam, but negative for Malaysia and the Philippines. The relationship between FDI and export is negative for Vietnam but positive for Malaysia and the Philippines. The unemployment rate in Model 2 is only significant for the case of Vietnam and it shows a positive effect on export. The inflation rate positively affects export in Vietnam at a 10% level and the magnitude is minor. Interestingly, the number of people suffering from disease indicates a negligible positive or negative effect on export but all the coefficients for all selected countries are insignificant. This is understandable as the disease considered in the article is SARS, which occurred 3 years from 2002 to 2003. There are only 5 countries in the article suffering from SARS. Moreover, the number of people infected with this disease is trivial in comparison to other countries, for example, China, Hongkong, and Taiwan.

For the sake of brevity, the results of short-run estimation or ECM approach for Model 1 and Model 2 are not listed here. The results in the short run indicate the opposite direction between indicators and export in comparison to those in the long run. This happens for three countries: Brunei, the Philippines, and Vietnam. For example, the influences of GDP per capita, FDI, and unemployment on the export activity of Vietnam change to negative, positive, and negative compared to the impacts in the long run (Table 3 and Table 4). There are several coefficients, which are not significant in the long-run estimation, but turn out to be significant in the short-run results and vice versa. Specifically, the inflation rate does not affect Cambodia's export in the long run; however, it does in the short run. The rise of net inflow FDI hurts Cambodia's export in the long run but in the short run, this effect vanishes.

The diagnostic test and stability test are checked after the outcomes of the ARDL model emerge. Table 5 provides the results of the diagnostic test for Model 1 and Model 2. For both models, all the selected countries confirm the existence of homoscedasticity since the null hypothesis of homoscedasticity is not rejected. This means that the outcomes of the ECM – ARDL approach applied for the two models in this article are plausible. The result of the stability test, namely CUSUM and CUSUMSQ are shown in Figure 1. There is no result for Brunei since the data of this country contains a gap – the data for FDI in 2016 is missing. Concerning CUSUM, all the countries have CUSUM within the critical bounds at a 5% significant level, except for Malaysia and Singapore. Malaysia had the CUSUM out of the bound since 2012, while the CUSUM of Singapore steps out in 2017. However, the CUSUMSQ of all the selected countries stays within the critical bounds for the whole period. This means that the outcomes of the ARDL – ECM method used in both models are stable.

5. Conclusion

The research applies ECM – ARDL model to estimate the relationship between variables in the long run and the short run of ASEAN countries. With the data of proportion of export to GDP, GDP per capita, net inflow FDI, unemployment rate, inflation rate, and the appearance of disease from ten ASEAN countries in period 2000–2019, the ECM–ARDL model succeeds in showing the long-run and short-run impact of each variable on the trading activity of each country.

After following the process, the selected countries for Model 1 and Model 2 (adding one independent variable – the number of people suffering from the disease - compared to Model 1) are six (Brunei, Cambodia,

Table 5: Results of Diagnostic Test

Panel A: Model 1		Panel B: Model 2	
Country	**Residual Heteroscedasticity Test**	**Country**	**Residual Heteroscedasticity Test**
Brunei	χ^2 (14) = 15 (Prob = 0.3782)		
Cambodia	χ^2 (16) = 17 (Prob = 0.3856)		
Malaysia	χ^2 (18) = 19 (Prob = 0.3918)	Malaysia	χ^2 (18) = 19 (Prob = 0.3918)
Philippines	χ^2 (17) = 18 (Prob = 0.3888)	Philippines	χ^2 (17) = 18 (Prob = 0.3888)
Singapore	χ^2 (17) = 18 (Prob = 0.3888)	Singapore	χ^2 (17) = 18 (Prob = 0.3888)
Vietnam	χ^2 (17) = 18 (Prob = 0.3888)	Vietnam	χ^2 (17) = 18 (Prob = 0.3888)

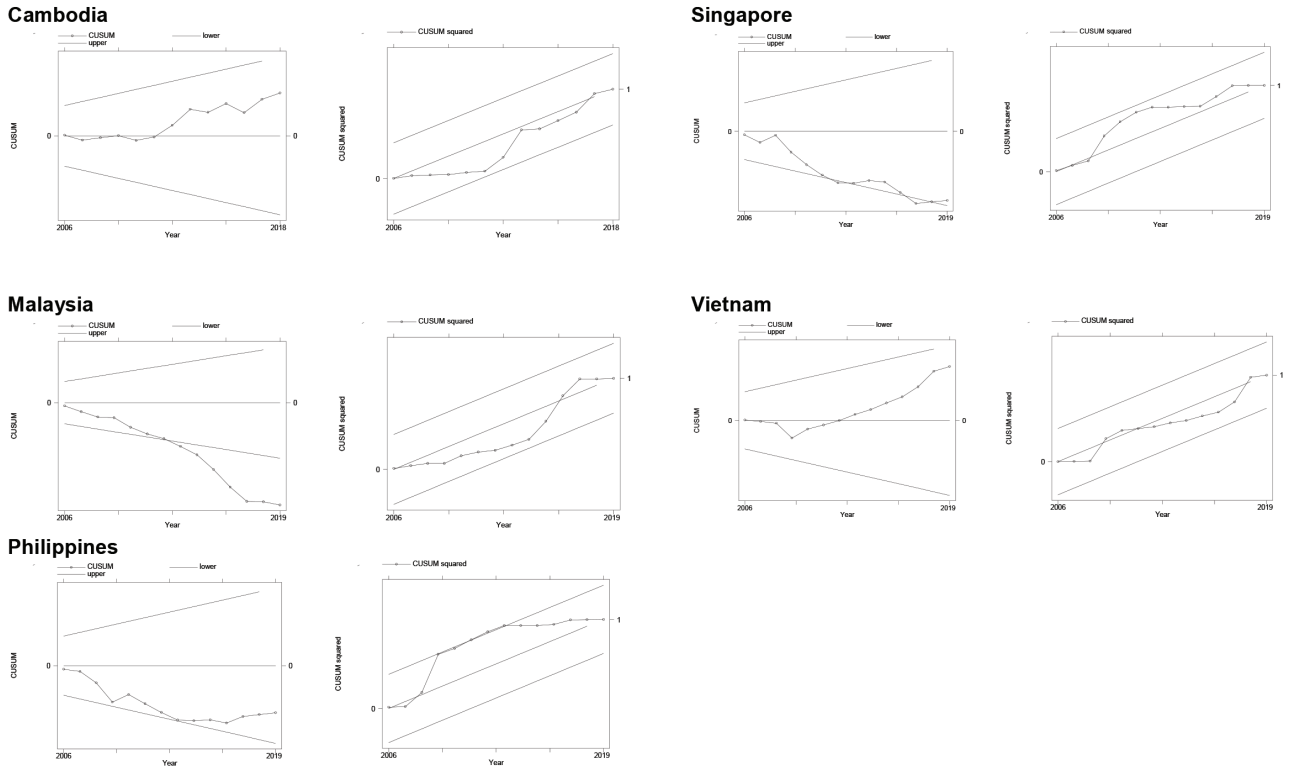

Figure 1: Results of Stability Test

Malaysia, Myanmar, the Philippines, Singapore, and Vietnam) and four (Malaysia, the Philippines, Singapore, and Vietnam), respectively. These countries prove the long-run relationship between variables and possess a high rate of convergence from the disequilibrium in the short run to the equilibrium in the long run, especially in the case of Cambodia and the Philippines with the rate of 95.65% and 151.94%, respectively.

The estimation ECM–ARDL method for six countries in Model 1 and five countries in Model 2 indicates the differences in sign and magnitude of the impact of economic indicators on the export of each country. In several countries, the results are conformance to the former analyses. GDP per capita encourages the export of Brunei and Vietnam but discourages the export of Malaysia and the Philippines. Net inflow FDI has a negative impact on the export of Brunei, Cambodia, and Vietnam, while this effect is positive for Malaysia and the Philippines. The increase of unemployment rate and inflation rate reduces the export of Brunei but stimulates the export of Vietnam. Surprisingly, the occurrence of disease does not have any impact on the export activity of all the selected countries. The results of the two models are confirmed to be plausible and stable after checking the diagnostic test and stability test.

The findings of this study can be used as a guide for policymakers in determining the factors that influence export and promulgating effective policies to boost the country's trading activities.

The article attempts to scrutinize the effect of economic indicators and the pandemic on the export volume. However, the result of the disease variable turns out to be insignificant. It is pivotal to conduct further research on this aspect. By applying different models and extending the data, the impact of the epidemic on trade flow might be conceivable.

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