Jurnal Ekonomi dan Studi Pembangunan, 12 (1), 2020
ISSN 2086-1575 E-ISSN 2502-7115

Is the Economic Growth of ASEAN-10 related to Air Transportation? A Panel ARDL Approach

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Received: August, 2019; Accepted: February, 2020; Published: March, 2020
Permalink/DOI: http://dx.doi.org/10.17977/um002v12i12020p010

Abstract

Investment in transport infrastructure is one of the important actions to accelerate regional development because it will open access among regions. Thus, it can lead to accelerate economic growth. This study aims to analyze the short-run and long-run relationship between economic growth and air transportation in ASEAN-10 countries. The data used in this study are the number of air transport passengers, air transport carrier, air freights, interactions between passengers and air transport carrier, and gross domestic product growth sourced from World Bank in a year period of 2002-2017. Panel ARDL is used in this analysis. Based on the specification, estimation, and examination of the model, the Panel ARDL is the best choice model. The Panel ARDL model shows that in the short term there is no significant relationship between air transportation and economic growth, but in the long term explains, except air freight, that air transport passengers, air transport airline, and the interaction between passengers have a significant effect on ASEAN-10 economic growth. This study emphasizes that to increase economic growth, increase in air transportation services is an important factor.

Keywords: GDP Growth, Air Transport, Panel ARDL, ASEAN-10
JEL Classification: O4, R4, E1

INTRODUCTION

Economic growth is usually the key factor to develop the underdeveloped countries (Jamal, 2017). Economic growth is very important in the country. A country's economic growth is achieved for the welfare of society in a country. Schumpeter (1934) states that economic growth is closely related to innovation, with this innovation will affect economic progress.

Measuring a country's economic growth, Gross domestic product (GDP) is an important indicator in the long run. In this study, GDP (Gross Domestic Product) is used as the dependent variable. GDP functions is as an appraiser whether a country's economy is running well or not. GDP is the market value of all final goods and services produced in a country in a given period (Mankiw, 2013).

One of the huge impact on the local, national and international economies is the air transportation network. GDP of ASEAN countries had the most reasonable influence on air transportation (Laplace and Latgé-Roucolle, 2016). Likewise,

economic growth greatly influenced the development of civil aviation (Fernandes and Pacheco, 2010).

It is thus natural that airports and national airlines are often associated with figures of desired by a country or region (Guimera, Mossa, Turtschi, and Amaral, 2004). ASEAN transport deregulation policies include the ASEAN Multilateral Agreement on Full Liberalization of Air Transport Services. With this agreement, each airline referred by the ASEAN Member State is approved to operate scheduled cargo and passenger services between its home country and one point to the international airport in the other member state, and to the international airport of the third member state, without limitation on capacity and schedule (Asean.org, 2015).

According to ICAO (International Civil Aviation Organization), airports are certain areas on land or waters (including buildings, installations, and equipment) that are intended either in whole or in part for the arrival, departure, and movement of aircraft. The construction of airport infrastructure causes population growth employment (Eivind Tveter, 2017). Furthermore, in the short and long-term, regional airports have economic and cointegration towards economics (Douglas Baker, Rico Merkert, and Md. Kamruzzaman, 2015). Based on information related to socio-economic data taken through different public sources, it can be estimated that the relationship between air traffic and GDP shows a statistically significant estimation result (Isabelle Laplace, Chantal Latgé-Roucolle, 2016). Airports can also increase the average total factor of production (Alexandra Fragoudaki, Dimitrios Giokas, Kyriaki, 2016), but the effects of airport output differ significantly between airports (Robert, 2014)

In nation-development, infrastructure is an important support for running economic activities. Investment in transport infrastructure is one of the important actions to accelerate regional development because it will open access among regions. Even, the research conducted by Kim (1998) shows that transportation investment has a positive effect on Korea's economic growth, and the most effective is the airport.

The advancement of adequate infrastructure and transportation can facilitate the running of countries' economic activities. These economic activities include production, distribution, and consumption activities. One of the supporters of economic activity is through the use of reliable transportation equipment.

Nowadays, the modes of transportation that are in great demand by producers and consumers in travelling a long distance are air transportation. The trend of world transportation use shows that air transportation is the most widely used transportation by the world community. Land transportation takes second place after air transportation, and sea transportation occupies the last position (trends.google.com).

To illustrate the magnitude of the impact of air transportation on economic growth, Oxford Economics and ATAG (Air Transport Group) in Baker, Merkert, and Kamruzzaman (2015) suggest that air transportation contributes around the US $ 2.4 trillion to the global economy. In ASEAN, air transportation contributed 584,110 direct jobs in 2014, while the contribution of GDP from the region was around the US $ 22 billion. This accounts for 5 per cent of total direct employment in the Asia Pacific region (InterVISTAS, 2015).

In this study, we distinguish the section of the study in 6 sections. Section 1 describes the background of the study, while section 2 describes the theoretical framework in the field of analysis. The methodology of this research is explained in section 3, hereafter in section 4 presented the analysis in this study, further the results are presented in section 5, ultimately in section 6 interpret the conclusion of this study.

METHOD

This study will examine the development of air transportation in ASEAN countries, including Indonesia, Malaysia, Singapore, Philippines, Vietnam, Thailand, Lao PDR, Myanmar, Cambodia, and Brunei Darussalam. The secondary data is used in this analysis, that sourced from the annual data (time series data) for a period of 16 years, from 2002 to 2017 obtained from the World Bank. Therein, the econometric analysis technique in this study is panel data analysis. This data analysis method is used to analyze the effect of air transportation on the economic growth of ASEAN countries.

Data Stationary Testing

Test of stationery is needed to determine the order of integration. The stationary analysis is a must be done to avoid the spurious regression. The root test of the ADF Fisher Chi-square unit and Levin, Lin & Chu (LLC) were used in this analysis.

Cointegration Testing

Some panel co-integration test statistics suggested by Pedroni (1999) which were proposed by Zaidi and Saidi (2018) is an approach based on residual checks. The residual must be stationary for integrating variables. Contrary to the Pedroni, Kao assumed that cointegration vectors will be considered homogeneous according to individuals.

The Kao test develops the null hypothesis of no cointegration. According to Baltagi & Moscone suggested by Zaidi and Saidi (2018), if all variables are integrated into the form of first-difference (I (1)), the cointegration estimation model uses the Vector Error Correction Model (VECM).

Determination of Optimal Lags

Determination of optimal lag in this study using AIC, SC and HQ measured from the value of AIC, SC, and the smallest HQ to be selected to minimize the number of the residual sum of squares (RSS) and increase the value of R2 (Gujarati, 2009: 536-537).

Panel ARDL Estimates

In this study, the authors used the PMG (Pooled Mean Group) method. The dynamic panel model class of PMG estimator which was developed by Pesaran where the estimator is built under the assumptions of the heterogeneity of short-run coefficients (Saidi, 2018). The initial condition is considered to be fixed or random, while coefficients in the long-run are a nonlinear combination. The basis of PMG is ARDL model estimation. The econometric model used in the ARDL model is as follows:

$$GDP_{it} = \sum_{j=1}^{p} \alpha_{ij} GDP_{i,t-j} + \sum_{j=0}^{p} \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (1)$$

Where: X is the explanatory variables vector. ARDL model using panel data as follows:

$$\Delta GDP_{it} = \phi_i (GDP_{it-1} - \beta_i' X_{it}) + \sum_{j=1}^{p} \alpha_{ij}^{*} \Delta GDP_{i,t-j} + \sum_{j=0}^{p} \delta_{ij}^{*'} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

GDP is economic growth, X is air transportation measured by the number of passengers, carriers, the amount of freight, and interactions between passenger and air transport carrier. ϕ_i is the error corrector mechanism impact. α_i is short-term coefficient, β_i is long-term coefficient, t is years, 2002-2017, j is region namely 10 countries that are members of ASEAN and i are ordered lags, and μ_i are an error term.

RESULTS AND DISCUSSION

Unit Root Test

We can test stationarity using the root unit test. This is because in principle the test is intended to test whether certain coefficients in the autoregressive model are estimated to have a value of one or not. Therefore many econometrists have been and are developing a procedure for testing unit-roots. Below is presented the results of the Augmented Dickey-Fuller unit root test, and Levin Lin Chu.

From the unit root test results, it is known that all variables in this study are stationary at the 1st difference except GDP and freight. Furthermore, the root test at the 1st difference for GDP and freight results shown stationary as well. Table 1 shows the unit-root test.

Table 1. Unit Root Test

Series	Level			
	ADF Test		LLC test	
	Stat	Prob	Stat	Prob
GDP	39.7953	0.0053	-3.48847	0.0002
Passanger	6.66465	0.9976	0.04322	0.5172
Carrier	9.16260	0.9809	-0.08349	0.4667
Freigth	19.8462	0.4676	-1.90566	0.0283
Passager Carrier	8.45847	0.9884	0.37836	0.6474
	1st Difference			
Series	ADF Test		LLC test	
	Stat	Prob	Stat	Prob
GDP	85.3239	0.0000	-8.49128	0.0000
Passanger	61.5331	0.0000	-6.56385	0.0000
Carrier	53.2266	0.0001	-5.13018	0.0000
Freigth	48.0490	0.0004	-3.17582	0.0007
Passager Carrier	57.0596	0.0000	-4.40187	0.0000

Source: Result of research, 2018

Co-integration Test

Pedroni (1999) proposes a number of panel co-integration statistics test, which is based on residual checks. The residual must be stationary for integrating variable. The absence of co-integration is proposed by the null hypothesis, where the residual ε_{it} will be I(1). The Kao Test (1999) follows the Pedroni test. However, Kao assumed that co-integration vectors will be considered homogeneous according to individuals.

Table 2. Cointegration Test

			Weighted	
	Statistic	**Prob**	**Statistic**	**Prob**
Panel v-Statistic	0.240898	0.4048	-1.48683	0.9315
Panel rho-Statistic	0.585065	0.7207	0.811522	0.7915
Panel PP-Statistic	-6.26866	0.0000	-5.74493	0.0000
Panel ADF-Statistic	-1.7578	0.0394	-2.21975	0.0132
Between Dimension				
	Statistic	**Prob**		
Group rho-Statistic	2.108605	0.9825		
Group PP-Statistic	-9.6238	0.0000		
Group ADF-Statistic	-1.68429	0.0461		

Source: Result of research, 2018.

The results of Pedroni co-integration test show that the results are significant, except for the panel v-statistic, the panel rho-statistic and group rho-statistic, so the null hypothesis has no co-integration is rejected. This means that passenger variables, carrier, freight, interactions between passengers and air transport carrier, cointegrated with a percentage of GDP. Both the panel PP-statistic and the group PP-statistic have better characteristics. Both of these are more credible. The null hypothesis of no co-integration is not accepted at the level of 1% by the PP-Statistic panel and PP-statistical group. After the presence of co-integration is found out, then estimating the long-run relationship among variables is the next goal. So, it is feasible to accept the alternative hypothesis of the existence of co-integration.

Granger-Causality Test

Granger Causality Test aims to determine the causal relationship between the independent variables on the dependent variable. The causality test focuses more on the causal factors of ASEAN economic development in terms of the development of air transportation. Significant test level used in this test is 5% (0.05) with lag length 1 in accordance with the testing of the length of lag that has been done. The results show that the carrier and freight have a unidirectional, while the interaction between passengers and carriers with freight has a bidirectional causality.

Optimal Lag

Gujarati (2004: 536-537) explained that the determination of the optimal lag using AIC, SC and HQ seen from the value of AIC, SC and the smallest HQ to be

selected to minimize the number of residual sum of squares (RSS) or increase the value of R2 so that the model error rate the smallest. In the lag test, lag 1 as the optimal lag in this study.

The Results of Estimation

Before testing with the Panel ARDL (Autoregressive Distributed Lag), Lag testing is done first. The selected lag is in lag 1. The PMG method assumes a co-integration presence. This requires separate use of co-integration test and unit root test in panel data (Bergheim, 2008). The PMG method obtained coherent and asymptotic properties from estimators for two stationary variables I(0) and non-stationary I(1) (Asteriou & Hall, 2007. Roudet, Saxegaard, & Tsangarides, 2007). The PMG approach does not only allow for estimating the long-run relationship among cointegration variables but also provides an error correction coefficient that ensures the availability of a long-run relationship. The lagged error correction coefficient measures the rate of dependent variables adapt to the changes in the independent variables in order to converge to its equilibrium (Apostolidou et al., 2015).

Table 3. Panel ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
PSG	7.738925	2.416224	3.202901	0.0018
CARRIER	22.53264	4.996686	4.509516	0.0000
FREIGHT	0.129819	0.502033	0.258587	0.7965
PASCARR	-2.212060	0.570878	-3.874839	0.0002
Short Run Equation				
COINTEQ01	-0.626038	0.137100	-4.566285	0.0000
D(PSG)	197.0616	114.6421	1.718928	0.0889
D(CARRIER)	302.9661	176.5993	1.715557	0.0895
D(FREIGHT)	6.954198	4.060896	1.712479	0.0900
D(PASCARR)	-44.64436	28.04002	-1.592166	0.1146
C	-52.38077	11.55244	-4.534173	0.0000

Source: Results of the research, 2018

The result shows that in the short term there is no relationship between air transport variables on economic growth in ASEAN countries. However, in the long term, the variables of air transportation, namely passenger, carrier, interactions between passengers and air transport carrier have a relationship with the percentage of GDP growth in ASEAN countries with probabilities of 0.0018, 0.0000, and 0.0002 although the freight does not indicate a relationship to economic growth ASEAN countries.

Fernandes and Pacheco (2010) investigated the relationship between transportation of national airline passengers and the growth of the economy in Brazil using the Granger causality test. Economic growth greatly influenced the development of civil aviation according to the results of the study. Economic growth in one country is the cause of the increase in the number of aircraft

passengers in the country. Furthermore, Laplace and Latgé-Roucolle (2016) in their research showed that the GDP of ASEAN countries had the most reasonable influence on air transportation.

CONCLUSION

The latest data from ASEAN Statistic reveals that the ASEAN economy remains resilient in 2014 amid uncertainty in the global economic environment. Real Gross Domestic Product (GDP) grew 4.6 per cent to reach the US $ 2.57 trillion. Sustainable GDP growth causes an increase in GDP per capita from the US $ 3,908 in 2013 to the US $ 4,130 in 2014 (asean.org, 2015). The service sector continues to be the biggest contributor to growth in 50.1 per cent of total GDP in the region in 2014 (asean.org).

From the results of the research that has been done, the results of the cointegration test show that passenger, carrier, freight, and interactions between passengers and air transport carrier cointegrated with the percentage of GDP growth (economic growth). In the short term, there is no relationship between air transportation variables on economic growth in ASEAN countries.

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