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The Causality Analysis of Air Transport and Socio-economics Factors: The Case of OECD Countries

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Abstract

Air transport is one of the most important industries in the world with its rapid growth, and direct and indirect contribution to world economy. In other words, GDP, tourism and employment are the key factors causing that growth in air transport and an increase in those factors boost the demand for air transport. However, uncertainty in economy, rising unemployment and increased terrorist attacks towards tourism would be a big threat to the growth of air transport in the future. To understand the importance of the mentioned factors, we first aim to apply an econometric approach which is panel Granger causality analysis. To achieve that, data from World Bank data set for OECD countries between the year of 2000 and 2013 is used in this study. We apply Pesaran CDLM test and Friedman's test which are preferred when the number of units (N) is higher than the time (T) to test cross-sectional dependence and we then perform Granger causality analysis in order to see whether there is a causal relationship (unidirectional or bidirectional) or not among air transport, tourism, economic growth and employment.

Econometric results indicate that there is a unidirectional short run causal relationship between economic growth, tourism, employment and air transport and that those factors play an important role in the growth of air transport. In this paper, we also aim to discuss the future challenges for air transport within the frame of econometric results and statistical analysis.

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1. Introduction

Air transport plays an important role in facilitating economic growth of a country and has direct and indirect contribution to the world economy by providing employment, trade and tourism. Air transport industry supported nearly 63 million jobs around the world and $2.7 trillion (3.5%) of the world's gross domestic product (GDP) in 2014. It also contributes to the growth of other industries such as tourism by supporting their operations. The growth of tourism industry directly affects to the demand for air transportation. Globally 54% of international tourists travelled by air in 2014 (ATAG, 2016). Most of the studies had analysed the effects of air transport on employment, GDP and tourism. The results showed that air transport has a great effect on socio-economic factors such as GDP, tourism, and employment.

However, the aim of the study is to find out the effects of the tourism, GDP and employment on air transport and to talk about future limitations of air transport under these variables for OECD countries and world. Level of increase in GDP is one of the criterions of economic welfare in a country and a change in GDP can cause a direct effect on air transport. Employment is another strong socio-economic factor which is generally associated with development level of countries. Rise on employment also contributes to GDP and hence to air transport with this way. In the socio-economic point of tourism, development of tourism induces positive impacts in a country, for instance, reduction of unemployment or rising employment in tourism sector, development of welfare and contribution to GDP (Mammadov, 2013). Those positive impacts play a main role on air transport growth thanks to tourism.

To see the causal relationship between air transport and socio-economics factors, a panel data analysis, Granger causality analysis, is performed as an econometric approach. Panel data analysis is one of the most popular approach applied in different areas by researchers such as health, politics, finance, sustainability due to the having more advantages comparing to time series or cross sectional data.

The distinguishing characteristic of the study is that some studies on air transport have been done so far employing panel Granger causality analysis but none of them has analysed the link between air transport and socio-economic factors together.

This paper begins with introduction section and a brief review of literature is given in Section 2. Data and description of variables are given in Section 3. Methodology and econometric results are represented in Section 4 and conclusion is presented in Section 5.

2. Literature Review

In the literature, panel data or panel Granger causality analysis is applied in various subjects to examine the relationship between two or more variables and generally, the variable representing economic growth or development is chosen as one of the variables in social sciences because of the fact that economic growth is effected by different factors (Maksimovic et al., 2017). For example, Dogan and Aslan (2017) use different panel models along with causality analysis to exploring the relationship among CO_2 emissions, real GDP, energy consumption and tourism in the EU and candidate countries. Charfeddine and Mrabet (2017) apply Granger causality analysis to determine the impact of economic development and social-political factors on ecological footprint. Destek and Aslan (2017) employ the bootstrap Granger causality analysis to expose the relationship between energy consumption and economic growth. Fang and Chang (2016) examine the causal relationship between energy, human capital and economic growth. Saidi and Mbarek (2016) explore the relationship between nuclear energy, renewable energy, CO_2 emissions and economic growth for nine developed countries. Chang et al. (2014) investigate the causal link between nuclear energy consumption and economic growth in G6 countries. Tekin (2012) analyses economic growth, exports and foreign direct investment in the least developed countries.

When we evaluate the literature, a few studies are found relating to air transport performed causality analysis and some of the studies are also preferred to use economic growth as a variable alongside air

transport. For instance, Hakim and Merkert (2016) investigate the causal relationship between air transport and economic growth. Long run unidirectional causal relationship is found running from GDP to air transport in their study. Hu et al. (2015) use domestic air passenger traffic and economic growth as a variable for determining the causal link between two variables. Long-run equilibrium relationship is seen in their work between domestic air passenger traffic and economic growth. Button and Yuan (2013) examine the causal relationship between air freight transport and economic development. Their findings indicate that airfreight transport is a positive driver for local economic development. Fernandes and Pacheco (2010) examine the causal relationship between GDP and air passenger traffic. Unidirectional Granger causal relationship is accepted from economic growth to domestic air transport demand.

There is also found some studies in the literature in which employment and tourism are chosen as a variable to see the link between them and air transport applying different methods and using different statistical knowledge. For instance; Vijver et al. (2015) analyse the relationship between air transport and regional development with causes and effects in Europe. They use employment as a relatively robust and measurable indicator of regional development. The methodology bases on whether the air transport causally effect the employment and also, whether the employment leads to higher air transport or not. There is found that both directions are available for European urban regions. Duval (2013) focuses on air transport as it is related to tourism along with reviewing wider aeropolitical environment and the issue of carbon pricing on aviation. Regmi (2009) analyses the relationship between air transport and tourism with a case study of Nepal. Results suggest that different factors are effective for air transport for tourism such as terrorism as a political factor; global financial recessions, travel costs, etc. as economic factors; environmental factors and non-economic factors. Bieger and Wittmer (2006) discuss the relationship between air transport and tourism using a system model. In their study, they say that air transport and tourism are interlinked and tourism is a main factor and a simulator of change in air transport.

3. Data and Description of Variables

In this section, data and variables employed for the study are introduced with descriptive statistics and correlation matrix. The data used in this study come from The World Bank data set for chosen 28 OECD countries between the year of 2000 and 2013. All countries are chosen considering available data and Human Development Index (HDI). The index gives information about development level of countries and, specially, when socio-economic factors are taken part in a study, using the index in order to narrowing the data is quite important. For this study, all countries, Australia, Austria, Belgium, Canada, Chile, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea Rep., Latvia, Luxembourg, Netherlands, New Zealand, Poland, Portugal, Slovenia, Spain, United Kingdom, United States display very high human development (Human Development Index, 2016).

Variables were chosen based on the literature and importance level of them on economy and so on air transport. GDP, employment and tourism variables reflect the socio-economic factors in this study and operated as independent variables. The importance of the independent variables can be summarized as follows: GDP is the major indicator to measure economic growth in a country and it provides information to policy makers about whether the economy is expanding or not. GDP controls almost all indicators in a country with a direct and an indirect way such as employment and unemployment rates, wages, and so expanding rate of the GDP signals the healthy economy. Having healthy economy means having good living conditions or having high living standards. In the growing economy considering to GDP, air transport can be assumed that as one of the indicators which effected by GDP in the short run or long run or vice versa. Thus, GDP is the major indicator taken part in any of the studies which analysis the causal relationship.

For an inclusive and sustainable growth, employment rates are quite important and it comes almost first in future growth strategies of countries. Employment is important because it is a way to better understand the economy, labour market and to develop policies. In view of the macroeconomic side, employment level is based on the economic activity measured GDP and using employment as an indicator as important as GDP in a model estimation.

Tourism is also significant factor along with GDP and employment since developing tourism sector leads to increase in employment, economic welfare. Economic stability occurs in a positive way with its effects. However, the importance of the variable of GDP, employment and tourism on economy are the main reason to use them as socio-economic factors for the analysis in this study. However, models are created for each independent variable separately to see their direct effect on air transport.

The data is organized relating to availability of data set and years. For the air transport variable, there is seen that some studies in the literature utilize number of air passengers and the others, employ number of departures. The reason of it is that it changes with objectives of the study or accessing to all data. Generally, working with different countries is a challenge to collect more accurate data.

In Table 1, the variable of air transport, GDP, employment, and tourism are presented. To create the variable of air transport, registered carrier departures are divided into the total country population for each country to make the data more reliable. GDP as a measure of economic growth, employment to population ratio, the number of arrivals as a tourist in a country are given by World Bank with open access and are reorganized regarding to literature and selected countries to use them as independent variables. Estimates are made by Stata 13 and Eviews program.

Table 1. Description of Variables

Variables	Short Name	Description
Air Transport	AIRTRS	Registered carrier departures worldwide is weighted by country population[1]
GDP per capita (current U.S. dollars)	GDP	Gross domestic product divided by midyear population
Employment	EMPLOYMENT	Employment to population ratio, 15+, total (%)
Tourism	TOURISM	International tourism, number of arrivals

In Table 2 correlation matrix for variables are described. According to results, positive correlation is found between the variable of AIRTRS and GDP, EMPLOYMENT, TOURISM. When we consider the correlation between air transport and other defined variables, the highest correlation is seen between tourism and air transport whilst the lowest correlation is obtained from employment.

Table 2. Correlation Matrix

	AIRTRS	GDP	EMPLOYMENT	TOURISM
AIRTRS	1			
GDP	0.1928	1		
EMPLOYMENT	0.1789	0.3181	1	
TOURISM	0.4794	0.1250	-0.2375	1

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[1] Authors' calculation.

Descriptive statistics, given in Table 3 for each variable, contain observation, mean, standard deviation, minimum and maximum values.

Table 3. Descriptive Statistics

Variables	Observation	Mean	Standard Deviation	Min	Max
AIRTRS	392	0.02098	0.0240	0.00136	0.14145
GDP	392	31270.83	18580.64	3352.731	114927.7
EMPLOYMENT	392	55.1686	6.3526	37.898	75.396
TOURISM	392	15100000	19300000	285000	83600000

4. Methodology and Econometric Results

4.1. Methodology

Panel data analysis is one of the most popular econometric approaches in the literature to analyse the impacts of the indicators such as GDP, employment, etc. Using panel data models has some advantages, for instance (Baltagi, 2005: 4-9); It allows researchers to set up more complicated models and it is better for identifying and measuring effects than time series and cross-section data as a result of combining both cross-section and time series data. However, obtaining or organizing data sets is sometimes difficult and it can be assumed as a disadvantage of the panel data models.

Panel data model can be created as follows in general form:

$$X_{it} = \alpha_{it} + \theta_{it} Y_{it} + \varepsilon_{it} \tag{1}$$

$$i = 1,2,\dots,N$$
$$t = 1,2,\dots,T$$

In the Equation 1, X refers to dependent variable and Y presents the independent variable. Number of unit and time are defined as "i" and "t", respectively. Standard error is given as ε_{it}.

When we enhance the number of parameter as k=1,2,3,….,K, the model can be created as follows:

$$X_{it} = \alpha_{it} + \sum_{k=1}^{K} \theta_{kit} Y_{kit} + \varepsilon_{it} \tag{2}$$

Panel Granger causality analysis, developed by Granger (1969) for the first time to examine the causal relationship between two variables (Granderson & Linvill, 2002), is utilized in this study to investigate the causal relationship between air transport and GDP, employment, tourism. The causal relationship can be unidirectional and bidirectional or can be no causal relationship between air transport and those defined variables.

General form of the Panel causality analysis can be shown as follows:

$$X_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j X_{it-j} + \sum_{j=1}^{k} \beta_j Y_{it-j} + \varepsilon_{it} \tag{3}$$

$$Y_{it} = \gamma_0 + \sum_{j=1}^{k} \delta_j Y_{it-j} + \sum_{j=1}^{k} \theta_j X_{it-j} + \varepsilon_{it} \tag{4}$$

In the Equation 3, β parameter is tested to see whether it is equal to zero or not. If the null hypothesis is valid which means that there is not causal relationship from Y to X. If it is not valid, the link running from Y to X is found in the model. Same process is valid for θ parameter in the Equation 4 as well.

Panel Granger causality model can be formed by variables used in this study as follows[2]:

$$AIRTRS_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j AIRTRS_{it-j} + \sum_{j=1}^{k} \beta_j GDP_{it-j} + \varepsilon_{it}$$

$$GDP_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j GDP_{it-j} + \sum_{j=1}^{k} \theta_j AIRTRS_{it-j} + \varepsilon_{it} \tag{5}$$

$$AIRTRS_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j AIRTRS_{it-j} + \sum_{j=1}^{k} \beta_j EMPLOYMENT_{it-j} + \varepsilon_{it}$$

$$EMPLOYMENT_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j EMPLOYMENT_{it-j} + \sum_{j=1}^{k} \theta_j AIRTRS_{it-j} + \varepsilon_{it} \tag{6}$$

$$AIRTRS_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j AIRTRS_{it-j} + \sum_{j=1}^{k} \beta_j TOURISM_{it-j} + \varepsilon_{it}$$

$$TOURISM_{it} = \gamma_0 + \sum_{j=1}^{k} \alpha_j TOURISM_{it-j} + \sum_{j=1}^{k} \theta_j AIRTRS_{it-j} + \varepsilon_{it} \tag{7}$$

As an assumption of the Panel Granger causality analysis, first cross sectional dependence[3] is tested before estimating the causal relationship considering number of observation and time. The cross-sectional dependence is the main assumption in the panel Granger causality analysis (Mutascu, 2016) and testing the cross sectional dependence is necessary for a strong model estimation (Hoyos & Sarafidis, 2006), also effective and consistent estimates. Several tests have been developed by now considering the number of observation (N) and time (T) of the dataset such as Breusch-Pagan (1980), LM, Friedman, Pesaran (2004) tests (Fang & Chang, 2016). Rejection of the cross sectional independence refers to use of second generation unit root tests. First generation unit root tests could not take account the cross sectional dependence in the data unlike second unit root tests (Baltagi & Pesaran, 2007).

In this study, cross-sectional dependence regarding the situation of N>T is tested using Pesaran CDLM (2004) test and Friedman's test which allow us to test the null of the cross-sectional dependence does not exist in the model against the alternative hypothesis of cross-sectional dependence exist in the model. For the unit

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[2] In the model estimation, natural logarithmic transformation has been performed for all variables since variables are not stable in variance. Lags of the variables in the equations are counted according to information criteria in the Vector Autoregressive Model (VAR).
[3] Cross-sectional dependence can be assumed as a situation in which a shock, like economic crisis, occurs in a country and the shock effects the other countries as well.

root test, Pesaran CADF test is applied into the data.

Pesaran CDLM (2004) and Friedman's test for cross sectional independence are performed when the N, cross section dimension, is large and T, time dimension of panel, is small. Pesaran CDLM test is seen in the Equation 8 and Friedman's statistics is given in the Equation 8 created based on the average of Spearman's correlation (Hoyos and Sarafidis, 2006).

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \tag{8}$$

$$R = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{r}_{ij} \tag{9}$$

Pesaran CADF test is developed by Pesaran (2007) and the test statistic is calculated as follows (Westerlund et al., 2016):

$$CADF_i = \frac{y'_{i,-1} M_x \Delta y_i}{\hat{\sigma}_{\varepsilon,i} \sqrt{y'_{i,-1} M_x y_{i,-1}}} \tag{10}$$

$$M_x = I_{T-1} - x(x'x)^{-1} x'$$
$$x = (\Delta \bar{y}, \bar{y}_{-1})$$
$$\Delta y_i = (\Delta y_{i,2}, \ldots, \Delta y_{i,T})'$$
$$y_{i,-1} = (y_{i,1}, \ldots, y_{i,T-1})'$$
$$\Delta \bar{y} = N^{-1} \sum_{i=1}^{N} \Delta y_i$$

$$\hat{\sigma}^2_{\varepsilon,i} = T^{-1} (\Delta y_i)' M_x \Delta y_i$$

4.2. Econometric Results

In this part, econometric results are presented. Pesaran CDLM (2004) test and Friedman's test results are seen in Table 4. Pesaran CADF test results are given in Table 5 and Panel Granger causality analysis results are represented in Table 6.

Table 4. Pesaran CDLM (2004) and Friedman's Test Results

Variables	Peseran CDLM Test Results		Friedman Test Results	
	Test statistics	Prob	Test statistics	Prob
LAIRTRS	9.757	0.000	68.690	0.000
LGDP	65.287	0.000	305.531	0.000
LEMPLOYMENT	14.070	0.000	82.317	0.000
LTOURISM	46.344	0.000	240.702	0.000

According to Pesaran CDLM and Friedman's test results, in Table 4, null hypothesis is rejected at the 1% statistical level for all variables. It means than cross-sectional dependency exists in the model and it should be taken into account in the choosing process of unit root tests.

Pesaran CADF test is one of the second generation unit root tests regarded cross-sectional dependence and N>T. Table 5 shows that the variable of LAIRTRS and LEMPLOYMENT are not stationary at the level I(0) and so first differences of the variables are taken for Granger causality. According to first differences of the variables, LAIRTRS is found stationary at the first difference but however, second difference is needed for the variable of LEMPLOYMENT. Second differences of the variable of LEMPLOYMENT is carried out because of the fact that the first difference of the LEMPLOYMENT is not stationary at the level I(1). In Table 5, there is seen that LAIRTRS at the first difference and LEMPLOYMENT at the second difference are stationary characterized as FLAIRTRS and FFLEMPLOYMENT. Test results for the variable of LGDP and LTOURISM demonstrate that for both variables, the null hypothesis is rejected and hence we do not need to take differences of the variables.

Table 5. Pesaran CADF Test Results

Variables	Test Statistics				
	%1	%5	%10	t-bar	Probability
AIRTRS					
LAIRTRS	-2.340	-2.170	-2.070	-1.641	0.648
FLAIRTRS	-2.340	-2.170	-2.070	-2.222	0.008
GDP					
LGDP	-2.340	-2.170	-2.070	-2.013	0.079
EMPLOYMENT					
LEMPLOYMENT	-2.340	-2.170	-2.070	-1.606	0.708
FLEMPLOYMENT	-2.340	-2.170	-2.070	-1.784	0.379
FFLEMPLOYMENT	-2.340	-2.170	-2.070	-2.296	0.003
TOURISM					
LTOURISM	-2.340	-2.170	-2.070	-2.258	0.005

Table 6 summarizes the direction of the causal relationship of created variables. For the employment variable, null hypothesis, which presents that employment does not Granger cause air transport, is rejected and causal relationship is found running from employment to air transport. For GDP, the null hypothesis is also rejected and found a causal link running from GDP to air transport. For the variable of tourism, null hypothesis is rejected and so the causal relationship is from tourism to air transport. Results point out that unidirectional causal relationship is found from employment, GDP, and tourism to air transport at 5% and 10% significant level.

Table 6: Panel Granger Causality Analysis

Lag: 3 2000-2013 Observation: 392	Test Statistics (F-Statistic)	Probability
H_0 hypothesis		
FFLEMPLOYMENT does not Granger Cause LAIRTRS	4.5278	0.0041
FFLAIRTRS does not Granger Cause FFEMPLOYMENT	0.8853	0.4493
LGDP does not Granger Cause FFLAIRTRS	2.8095	0.0399
FFLAIRTRS does not Granger Cause LGDP	0.5772	0.6301
LTOURISM does not Granger Cause FFLAIRTRS	4.122	0.0070
FFLAIRTRS does not Granger Cause LTOURISM	0.0419	0.9885

5. Conclusion

This study analyses the relationship between air transport and socio-economics factors through panel causality analysis for 28 OECD countries over the period of 2000 and 2013. Pesaran CDLM (2004) and Friedman's tests are applied to decide whether cross-sectional dependence exists or not for the variables before running the unit root test. After findings give the cross-sectional dependence results, Pesaran CADF test is run for the stationary process of the variables. After all these tests are performed, panel Granger causality analysis is employed for short run relationship. Results indicate that unidirectional causal relationship is found in the short run running from GDP, employment, tourism to air transport and related literature supports these results.

As a result of this study, econometric findings support that socio-economics factors are effective on air transport in the short run. As mentioned in the introduction section, a change in the socio-economics factors can have positive impacts on air transport along with negative effects. It is possible to say that now considering to results, any threat on GDP, employment and tourism will also be threat to air transport growth and lead to a sort of limitations or any improvement of the factors will lead to the development of air transport. Furthermore, future growth of air transportation depends on not just economic prosperity but also on tourism and employment as socio-economic factors all over the world so governments should work on boosting economic activity, creating new jobs to enhance employment rates and preventing the threats like terrorist attacks on tourism activities.

This study suggests that governments, policy makers or decision makers in a country should play a crucial role taken the socio-economic factors into account to develop air transport and to control the things caused a challenge for air transport.

References

ATAG: Aviation Benefits Beyond Borders, ATAG Reports, July 2016.

Baltagi, B. H., 2005. Econometric Analysis of Panel Data, H. Steve and G. Rachel Editor. John Wiley & Sons Inc., Chichester.

Baltagi, B.H., Pesaran, M.H., 2007. Heterogeneity and Cross Section Dependence in Panel Data Models: Theory and Applications. Journal of Applied Econometrics 22, 229-232.

Bieger, T. and Wittmer, Andreas. (2006). Air transport and tourism - Perspectives and challenges for destinations, airlines and governments. Journal of Air Transport Management, 12.1, 40-46.

Button, K., Yuan, J., 2013. Airfreight Transport and Economic Development: An Examination of Causality. Urban Studies 50, 329-340.

Chang T. Gatwabuyege, F., Gupta, R., Inglesi-Lotz R., Manjezi, N.C., B.D. Simo-Kengne, B.D., 2014.Causal relationship between nuclear energy consumption and economic growth in G6 countries: Evidence from panel Granger causality tests. Progress in Nuclear Energy 77, 187-193.

Charfeddine, L., Mrabet, Z., 2017. The impact of economic development and social-political factors on ecological footprint: A panel data analysis for 15 MENA countries. Renewable and Sustainable Energy Reviews 76, 138-154.

Destek, M.A., Aslan, A., 2017. Renewable and non-renewable energy consumption and economic growth in emerging economies: Evidence from bootstrap panel causality. Renewable Energy 111, 757-763.

Dogan, A., Aslan, A., 2017. Exploring the relationship among CO2 emissions, real GDP, energy consumption and tourism in the EU and candidate countries: Evidence from panel models robust to heterogeneity and cross-sectional dependence. Renewable and Sustainable Energy Reviews 77, 239-245.

Duval D. T. 2013. Critical Issues in Air Transport and Tourism. Tourism Geographies 15.3, 494-510.

Fang Z., Chang Y., 2016. Energy, human capital and economic growth in Asia Pacific countries — Evidence from a panel cointegration and causality analysis. Energy Economics 56, 177-184.

Fernandes, E., Pacheco, R., 2010. The causal relationship between GDP and domestic air passenger traffic in Brazil. Transportation Planning and Technology 33, 569-581.

Granderson, G., Linvill, C., 2002. Regulation, efficiency, and Granger causality. International Journal of Industrial Organization 20, 1225-1245.

Granger, C.W.J., 1969. Investigating causal relations by econometric models and cross-spectral methods. Econometrica 37, 424–438.

Hakim, M., Merkert, R., 2016. The causal relationship between air transport and economic growth: Empirical evidence from South Asia. Journal of Transport Geography 56, 120-127.

Hoyos, R. and Sarafidis, V. 2006. Testing for cross-sectional dependence in panel-data models, The Stat Journal 6, 482-496.

Hu, Y., Xiao J., Deng Y., Xiao Y., Wang S., 2015. Domestic air passenger traffic and economic growth in China: Evidence from heterogeneous panel models, Journal of Air Transport Management 42, 95-100.

Human Development Report, (2016. http://hdr.undp.org/en/2016-report

Mammadov R., 2013. Tourism as the main factor of socio-economic development of regions in Azerbaijan, International Conference on Energy, Regional Integration and Socio-economic Development from EcoMod. Baku, Azerbaijan.

Maksimović, G., Milosavljević, V., Ćirković, B., Milošević, B., Jović, S., & Alizamir, M., 2017 Analyzing of economic growth based on electricity consumption from different sources, Physica A: Statistical Mechanics and Its Applications 484, 3740.

Mutascu, M., 2016. A bootstrap panel Granger causality analysis of energy consumption and economic growth in the G7 countries. Renewable And Sustainable Energy Reviews 63, 166-171.

Pesaran, M.H., 2004. General diagnostic tests for cross section dependence in panels. Cambridge Working Papers in Economics 0435, 42.

Pesaran, H. M. 2007. A simple panel unit root test in the presence of cross section dependence. Journal of Applied Econometrics 22, 265–312.

Regmi, U.K. 2009. Relationship between air transport and tourism: A Case study of Nepal, Molde University College Master Thesis, LOG 950 Logistics.

Saidi. K., M.B. Mbarek, 2016. Nuclear energy, renewable energy, CO2 emissions, and economic growth for nine developed countries: Evidence from panel Granger causality tests. Progress in Nuclear Energy 88, 364-374.

Tekin, R.B., 2012. Economic growth, exports and foreign direct investment in least developed countries: A panel Granger causality analysis. Economic Modelling 29, 868-878.

Vijver, E., Derudder, B. and Witlox, F. 2015. Air Passenger Transport and Regional Development: Cause and Effect in Europe. Promet – Traffic&Transportation, 28.2, 143-154.

Westerlund, J., Hosseinkouchack, M., and Solberger, M. 2016. The Local Power of the CADF and CIPS Panel Unit Root Tests. Econometric Reviews 35.5, 845-870.