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Causal Relationships Among Tourism, International Trade, Pollution, and Economic Growth: Evidence from Central Asian Countries

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Abstract: This study investigates the cointegration and causality among environmental quality (CO_2 emissions), international trade, economic growth, and tourism of five Central Asian Republic States (CARS-5), namely Azerbaijan, Tajikistan, Kazakhstan, the Kyrgyz Republic, and Uzbekistan, for 1992–2018. To this end, we employed the Johansen cointegration approach, modified Wald tests, and the Toda & Yamamoto (1995) approach. The empirical results showed that the variables were cointegrated in the long run, and the Granger causality test results revealed the existence of causality in the series. Furthermore, the empirical results validated both the export-led and the tourism-led growth hypotheses for Tajikistan and Kazakhstan. These findings suggest that the CARS-5 should develop appropriate and prudent public policies to stimulate sustainable economic development.

Keywords: Central Asian Republics, economic growth, environmental quality, tourism, trade.

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INTRODUCTION

Sustainable economic development is always on prime position amongst the researchers and policymakers (Gyamfi et al., 2020). Since beginning from supply orientated strategy, concomitant with classical, neoclassical school and endogenous growth model, more consideration is given to supply of inputs to escalate growth process. In retort to supply orientated approach, Keynesian and Post-Keynesian economist have given more concentration to demand orientated approaches, dominated by Export-led growth model and cumulative causation model. The Post-Keynesian economists assert that growth is delimited to demand where external demand is decisive for economic growth. Balassa (1978); Feder (1983) posited that export growth leads to output growth. The linkage in economic growth, environmental quality and tourism development is a hot topic for research. The relative association between economic growth and carbon emissions (environmental quality) is fundamentally studied through Environmental Kuznets Curve (EKC) hypothesis, an inverse U-Shaped path. According to EKC hypothesis, with the low level of per capita income, environmental debasement swells up, out stretches to the highest level and afterward initiates to diminish. Numerous studies such as Bouznit &

Pablo-Romero (2016); Ozturk et al. (2016) endorse the polynomial quadratic appearance of EKC. In contrast, we find several other studies who failed to detect the polynomial quadratic state of EKC (Azomahou et al., 2006; Linh & Lin, 2014). Several other studies such as Azam (2016); Ahmad et al. (2018) affirmed an up-hilling association between economic growth and environmental pollution.

The international trade theory grasped hundreds of years to evolve. The Mercantilist school of thought emphasized on the adoption of protectionism strategies for obstructing imports and fortifying exports for the development of an economy. The classical and neoclassical schools of thoughts gave more weightage to trade liberalization and posited that free trade among the nations can be lucrative for the nations. The effects of exogenous variables on the economic growth were first addressed by Krugman (1981), by formulating a model for such exogenous impacts. According to new trade theory, more emphasis should be given to the openness of the economy. Furthermore, it is prerequisite that natural obstacles such as transportation cost (Krugman, 1980), and spurious hindrances such as tariffs rate and other duty foisted on international trade (Trefler, 1995) should be eliminated. The issue of international trade and economic growth got substantial importance in recent decades. Economy with more exports is tentatively expected to confront with more external demand for their products and thus can develop hastily (Szkorupová, 2014). Similarly, an economy with low exports may face relative adversity in stretching their output level.

During 1950's and 1960's most of the developing countries followed Import Substitution (IS) policy to safeguard their domestic economy and stimulate their economic growth. Ershova & Ershov (2016) expounded that import substitution arrangement is contrivance for revamping the competitiveness of an economy. However, there exists diminutive empirical work on the issue of import substitution policy. In mid of 1970's and early 1980's, a considerable shift had been observed from import substitution (IS) policy toward Export Promotion (EP) policy. The EP approach expedites better allocation of resources, increase in economies of scale, accumulating capital formation, and threshold for technological advancement. The Export-led growth model became an efficacious tool not only in academia but also stands imperative in the development of many developing countries by rectifying their trade imbalances (Guan & Hong, 2012; Gokmenoglu et al., 2015).

Undeniably, tourism has become one of the dominant sources of public revenue in developed and developing countries. Countries with low intensity of economic aptitude had emerged to increase their economic value and living standing through tourism. The prominence of tourism cannot be slighted in term of increasing employment opportunities, creating local demand for the local products and elevating the growth process of an economy. Tourism emerges as one of the indispensable determinants to stimulate the world economy. However, tourism-growth nexus is not theoretically well dissected and the issue is still enthralling for researchers and public policymakers. Theoretically, tourism is assimilated to economic growth through Tourism-Led Growth Model (TLGM), which is emanated as the analogy from Export-led growth model. Balaguer & Cantavella-Jordá (2002) were the pioneering contributors to proffer theoretical and empirical foundation to tourism-growth nexus. The theoretical rationalization made by Balaguer & Cantavella-Jordá (2002) alleges that tourism hauls foreign exchange to the economy which endows a source of financing to the domestic economy, which can be utilized in import of capital goods or basic inputs that contribute to the domestic economy. Several studies have scrutinized the up-slanting association between economic growth and tourism (Lean & Tang, 2010; Gugushvili et al., 2017). Besides the TLGM, several studies like Payne & Mervar (2010); Schubert, et al. (2011) hypothesized on Economic-Driven Tourism Growth (EDTG) Hypothesis and antithetical to TLGM hypothesis. EDTG posited that economic growth prompts tourism growth. However, there exists little empirical literature available on issue of EDTG model.

Regarding, the environmental quality, the CARS countries contain large reservoirs of carbon products. These carbon products are one of the apex contributing factors to GDP. Carbon emission is often practiced as a criterion of environmental quality; however there exists very little empirical work on the issue of economic growth and environmental quality in case of CARS. In term of geography, all CARS under this study are landlocked and marginalize trade among the rest of the world happing. Carbon products not only contribute to GDP but also to the balance of trade. In case of growth-trade nexus, this region has not investigated empirically. For small economies, international financing is very imperative for perpetuating development projects, whereas international trade, international tourism and foreign aid and assistance can be consequential. Due to landlocked characteristics, CARS trade with the rest of the world is subsistence. On the other hand, CARS possessed a great potential for tourism and thus can be threshold for international financing.

The main focus of this study is on five (5) Central Asian Republic States namely Kazakhstan, Kyrgyz Republic, Tajikistan, Azerbaijan, Uzbekistan. This study aims to investigate the nexus between economic growth, environmental pollution, international trade and tourism in case of CARS-5. To examine the long-run cointegration among the variables, this study will exert the model formulated by Johansen (1988); Johansen & Juselius (1990) that required the estimation of Vector-Auto Regressive model (VAR). For causality analysis, this study will exert the Granger Causality test based on Toda & Yamamoto (1995) methodology.

METHODS

This section contains the summary of data and its sources, theoretical foundation of the model, and estimation techniques adopted for the empirical analysis. Balanced secondary data are used on all variables taken from the World Development Indicators 2019, the World Bank database and World Travel and Tourism Council 2019. Annual GDP growth rate represents economic growth, environmental quality is measured by CO_2 emissions metric ton per capita, where international trade is proxied by total volume of trade taken as Billion USD. In case of CO_2 emissions metric ton per capita data is available till 2015 for the rest of period data is either at mass or calculated from secondary sources. World Travel and Tourism Council (WTTC) database is exerted for tourism data. Tourism total contribution to GDP is practiced as a proxy for tourism.

Balaguer & Cantavella-Jordá (2002) were the pioneers who dispensed the theoretical foundation to the tourism-growth nexuses. Tourism-Led Economic Growth (TLEG) hypothesis became the prime contrivance for researchers in academia and public policymakers. Besides TLEG, several other studies such as Payne & Mervar (2010); Schubert et al. (2011) tried to develop an antithetical of TLEG hypothesis; that as Economic-Driven Tourism Growth (EDTG) Hypothesis. EDTG hypothesis posits that economic growth brings growth in tourism. The debate on Growth and Environment is always on the hot spot between the economist and environmentalist since the emergence of industrialization. However, contradiction still persists in their debate. Environmentalists do argue that there should be zero level of pollution in long-run or the rate of emission should be zero. In retort to this argument, many economists consider it as a residual fabricates during production which can only be brought to zero or to abiding rate when there is no production. Simon Kuznets was the pioneer who gives the theoretical justification for addressing the dispute between economic growth and environment. In line with studies done by Balaguer & Cantavella-Jordá (2002); Chou (2013); Antonakakis et al. (2015); Ahmad et al. (2018); Azam (2020); Balsalobre-Lorente & Leitão (2020), this study uses the following multivariate regression model within the framework of growth theories:

$$GRT_{i,t} = \Upsilon_{0,i} + \Upsilon_{1,i}POL_{i,t} + \Upsilon_{2,i}TRD_{i,t} + \Upsilon_{3,i}TRM_{i.t} + \varepsilon_{i,t} \ldots (1)$$

Where GRT_t= Annual GDP growth rate at time t; POL_t= Carbon dioxide emission excreted to environment at time t, measured in metric tons per capita; TRD_t= Import plus exports of a country at time t, measured in US$ millions; and TRM_t= total contribution of tourism to GDP, taken as percentage of GDP; ε is the error term, while term i is for countries consolidation.

Before applying any sort of estimation technique, it stands mandatory to resolve the issue of stationarity. For this purpose the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests of stationarity are incorporated in this study. This study also exercises the Johansen (1988); Johansen & Juselius (1990) tests of cointegration for finding the long run relationship among the targeted variables. For interrogating the pattern of causality, this study is capitalizing the Granger causality test developed by Toda & Yamamoto (1995).

The cointegration test requires to implement the estimation of the unrestricted Vector Autoregressive (VAR) model. The standard form of this model is given below:

$$Y_t = \delta_0 + \sum_{i=1}^{k} \delta_i Y_{t-i} + \mu_t \dots (2)$$

Where $Y_t = (GRT, POL, TRD, TRM)$ is a 4 x 1 vector of non-stationary *I*(1) variables. $\delta_0$is 4 x 1 vector of constant, k is the number of lags, δ_i is the 4 x 4 matrix estimable parameters, and $\mu_t$is 4 x 1 vector of the error term. If $Y_t = (GRT, POL, TRD, TRM)$ is cointegrated, Eq. can be generated using Vector Error Correction Model (VECM) methodology given as below:

$$\Delta Y_t = \delta_0 + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \Pi Y_{t-1} + \mu_t \dots (3)$$

Where $\Gamma_i = \sum_{j=i+1}^{k} \delta_i$and $\Pi = \sum_{i=1}^{k} \delta_i - I$. $\Delta$is the difference operator, Y_i and θ are coefficient matrices and$I$ is n x n identity matrix. The Johansen's approach required the computation of the VAR Eq. (2) and to obtain the residuals which will then capitalized to reckoning two likelihood ratio (LR) test. The LR test statistic is then utilized in acquiring the unique cointegrating vector ofY_t.

The coefficient matrix Πaccommodates information respecting the cointegration association among variables. If Π is zero; there is no linear combination relationship among the variables $Y_t = (GRT, POL, TRD, TRM)$. If Π is one, then there is a linear and autonomous combination endure among the variables $Y_t = (GRT, POL, TRD, TRM)$. Finally, if Π is greater than one, then there is vector cointegration among the variables $Y_t = (GRT, POL, TRD, TRM)$.The rank of cointegration is then tested by two segregated test statistic: The Trace Test and Max Eigenvalue Test. The Trace Test is stated as follows:

$$Trace = -T \sum_{i-q+1}^{n} \ln(1 - \bar{\lambda}) \dots (4)$$

Where $\bar{\lambda}_{r+1}, \dots \dots \dots \bar{\lambda}_n$ are $n - q$ of the smallest squared conical between $Y_t$and ΔY_t.

The Maximum Eigenvalue test is illustrated below:

$$L - max = -T ln(1 - \bar{\lambda}_{q+1}) \dots (5)$$

The Max Eigenvalue test statistic emulates the q cointegrating vectors; $r \leq q$ and the alternative are$r \leq q + 1$.

To examine the direction of causality among the variables, the use of Granger causality analysis is very common in empirical work. However, this approach has few shortcomings; first, the standard Granger (1969) causality test may lead to spurious regression due to optimal lags selection issue. *Second*, the F-test will not genuine until and unless the variables in level are cointegrated with each other. Thus, contemplating these drawbacks, this study has adopted the Toda & Yamamoto (1995) methodology for testing the causality among the variables. The Toda & Yamamoto (1995) methodology addresses the above shortcomings that are associated with traditional Granger causality, and presumes that regardless of integration at level, first difference, or second difference, the Toda & Yamamoto (1995) causality test is credible. Furthermore, Toda & Yamamoto (1995) causality test does not require testing for cointegration. This methodology is still genuine when there is non-cointegrated series. Thus, Toda & Yamamoto (1995) methodology requires the estimation of an 'Augmented' VAR system. The Toda & Yamamoto (1995) procedure use Modified WALD (MWALD) methodology to test the restriction of VAR (k) model's parameters. Moreover, this test requires the estimation of VAR[k+d(max)], where d(max) is the maximal order of integration in the series.

RESULTS AND DISCUSSION

Table 1 shows the results of unit root test for each series and each country consolidated under this study. Table 1 depicts results of unit root test. In cases of Azerbaijan, Tajikistan, Kazakhstan and Uzbekistan, the null hypothesis can't be spurned at the level as the series is non-stationary at level. At first difference, all series became stationary. The unit root can't be spurned for all series at the level and without trend and with trend, except tourism in case Kyrgyz Republic. In case of tourism where unit root can't be spurned at none. At 1st difference, the null hypothesis is spurned for all series. Recapitulating up, it is contemplated that all the data series for each country are non-stationary at the level and stationary or integrated at the first difference.

All variables are integrated of order $I(1)$, thus this study proceeds with finding the cointegration among the variables. For this purpose, the Engle-Granger (EG) test is capitalized. The non-stationary time series do not retain the long-run average values due to error term, thus it is important to transmute them into stationary processes. In doing so Eq. (1) is estimated at level through the least squares and then the residuals procure from the regression is check for unit root of order $I(0)$. The results procured from the regression are exhibited in Table 2.

The outcomes of EG test spurn the null hypothesis of no cointegration at 1 and 5 percent respectively. Thus, the appraised residuals exhibit that economic growth, environmental pollution, trade and tourism have the long-run confederation for the period of 1992-2018. EG test methodology has numerous defects that as EG test is only applicable when there are only two single variables in the model. Thus, before making any judgment this study is likely to exercise more standard and powerful test; Standard Maximum Likelihood methodology by Johansen (1988); Johansen & Juselius (1990).

Before running cointegration test it is paramount to determined optimal lag length for VAR system. After finding the optimal lag, this study will then proceed to capitalized λ-Max and use the Trace tests to identify the number of cointegration vectors. As noted by Reinsel & Ahn (1992) the model with a limited number of observations, the likelihood ratio (LR) can be biased. Thus, it is advocated that the LR statistic should be multiply by factor $(T - nk)/T$, where T is the number of observations, n is the number of variables in the model and k is the order of VAR system to procure the adjusted estimates. Optimal lag length is determined by the AIC criteria, which is 3 for each country. The optimal lag length and cointegration results for each country are exhibited in Table 3.

Table 1 Unit Root Test Analysis

	ADF methodology t-Statement				PP methodology t-Statement			
Country	Azerbaijan							
	Level *I*(0)		First Difference *I*(1)		Level *I*(0)		First Difference *I*(1)	
Variables	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend
$Ln\ GRT$	-2.901	-2.466	-3.23**	-3.59	-2.157	-1.614	-3.22**	-3.4143
$Ln\ POL$[1]	-5.835*	-4.821*	-4.501*	-4.752*	-6.766*	-5.424*	-6.400*	-6.545*
$Ln\ TRM$	-0.238	-0.736	-3.52**	-3.61	-0.771	-1.301	-3.50**	-3.5135
$Ln\ TRD$	-1.057	-1.308	-4.032*	-3.944*	-1.057	-1.600	-3.993*	-3.907*
Country	Tajikistan							
	Level *I*(0)		First Difference *I*(1)		Level *I*(0)		First Difference *I*(1)	
$Ln\ GRT$	-3.42**	-2.585	-2.235[2]	-2.894	-3.42**	-2.585	-6.932*	-8.288*
$Ln\ POL$	-5.905*	-3.122	-3786*	-3.67**	-5.267*	-5.725*	-5.455*	-6.138*
$Ln\ TRM$	-1.654	-1.728	-5.016*	-5.022*	-1.6532	-1.728	-5.016*	-5.022*
$Ln\ TRD$	-1.087	-1.437	-4.821*	-4.769*	-1.0863	-1.437	-4.821*	-4.769*
Country	Kazakhstan							
	Level *I*(0)		First Difference *I*(1)		Level *I*(0)		First Difference *I*(1)	
$Ln\ GRT$	-2.977	-1.8135	-5.856*	-7.456*	-1.675	-1.387	-3.798*	-5.120*
$Ln\ POL$	-3.953*	-2.5998	-2.132[3]	-1.452	-1.757	-3.001	-4.177*	-4.08**
$Ln\ TRM$	-2.193	-2.1492	-5.612*	-4.961*	-2.087	-2.141	-5.865*	-6.425*
$Ln\ TRD$	-1.104	-2.9660	-3.49**	-3403	-1.184	-1.622	-3.25**	-3.105
Country	Kyrgyz Republic							
	Level *I*(0)		First Difference *I*(1)		Level *I*(0)		First Difference *I*(1)	
$Ln\ GRT$	-3.30**	-3.0694	-3.921*	-4.30**	-3.64**	-2.4018	-5.655*	-7.318*
$Ln\ POL$	-1.873	-2.3502	-5.460*	-5.347*	-3.994*	-4.18**	-3.941*	-3.63**
$Ln\ TRM$	-3.972*	-3.80**[4]	-7.999*	-4.718*	-3.912*	-3.85**[5]	-9.213*	-11.12*
$Ln\ TRD$	-1.004	-2.4168	-5.189*	-5.071*	-0.8007	-2.470	-2.455*	-5.309*
Country	Uzbekistan							
	Level *I*(0)		First Difference *I*(1)		Level *I*(0)		First Difference *I*(1)	
$Ln\ GRT$	-4.609*	-3.64**[6]	-8.176*	-9.763*	-5.219*	-3.70**[7]	-7.586*	-9.381*
$Ln\ POL$	-0.211	-1.729	-5.044*	-4.696*	-0.086	-1.642	-5.094*	-5.194*
$Ln\ TRM$	-0.904	-1.165	-4.541*	-5.245*	-1.009	-1.165	-4.622*	-5.245*
$Ln\ TRD$	-0.576	-1.836	-3.962*	-3.86**	-0.596	-1.836	-3.828*	-3.69**

Note: "*" and "**" show 1% and 5% level of significance respectively.

Table 2 Engle-Granger (EG) Long-Run Cointegration Test

Country	Azerbaijan	Tajikistan	Kazakhstan	Kyrgyz Republic	Uzbekistan
ADF (0)	-3.0541**	-4.3350*	-3.3412 **	-3.0152 **	-5.6311*

Note: "*" and "**" denotes significance level at the 1% and 5% level respectively.

[1] The series become non-stationary at None and at level through ADF Method (T-statistic= -1.7209, *p* value= 0.0806)
[2] The series become stationary at None and at first difference through ADF Method (T-statistic=-2.176**)
[3] The series become stationary at None and at first difference through ADF Method (T-statistic= -2.175**)
[4] The series become none-stationary at None and at level through ADF Method (T-statistic= -0.4728, Probability= 0.5000)
[5] The series become non-stationary at None and at level through PP Method (T-statistic= -0.5759, Probability= 0.4576)
[6] The series become none-stationary at None and at level through ADF Method (T-statistic= -1.5293, Probability= 0.1161)
[7] The series become non-stationary at None and at level through PP Method (T-statistic= -1.5457, Probability= 0.1126)

Table 3 Cointegration Test Analysis

Country	Azerbaijan			Optimal Lag Selection	3
Hypothesized No. of CE(s)	Eigenvalues	λ-Max Statistics	Critical Value 95%	Trace Statistics	Critical Value 95%
None	0.96092	71.33*	27.59	126.05*	47.86
At most 1	0.78699	34.03*	21.14	54.73*	29.80
At most 2	0.57642	18.90*	14.27	20.71*	15.50
At most 3	0.07886	1.81	3.85	1.81	3.85
Country	Tajikistan			Optimal Lag Selection	3
Hypothesized No. of CE(s)	Eigenvalues	λ-Max Statistics	Critical Value 95%	Trace Statistics	Critical Value 95%
None	0.9828	89.30*	27.59	178.96*	47.85
At most 1	0.8986	50.35*	21.14	89.66*	29.80
At most 2	0.7267	28.54*	14.27	39.32*	15.50
At most 3	0.3875	10.79*	3.85	10.78*	3.85
Country	Kazakhstan			Optimal Lag Selection	3
Hypothesized No. of CE(s)	Eigenvalues	λ-Max Statistics	Critical Value 95%	Trace Statistics	Critical Value 95%
None	0.9820	88.37*	27.59	182.22*	47.86
At most 1	0.8993	50.49*	21.14	93.86*	29.80
At most 2	0.7333	29.07*	14.27	43.37*	15.50
At most 3	0.4780	14.30*	3.85	14.30*	3.85
Country	Kyrgyz Republic			Optimal Lag Selection	3
Hypothesized No. of CE(s)	Eigenvalues	λ-Max Statistics	Critical Value 95%	Trace Statistics	Critical Value 95%
None	0.9893	99.80*	27.59	144.52*	47.86
At most 1	0.6696	24.35*	21.14	44.73*	29.80
At most 2	0.5324	16.73*	14.26	20.37*	15.50
At most 3	0.1526	3.65	3.85	3.64	3.85
Country	Uzbekistan			Optimal Lag Selection	3
Hypothesized No. of CE(s)	Eigenvalues	λ-Max Statistics	Critical Value 95%	Trace Statistics	Critical Value 95%
None	0.9413	62.37*	27.59	129.33*	47.86
At most 1	0.8842	47.43*	21.14	66.97*	29.80
At most 2	0.5835	19.27*	14.27	19.54*	15.50
At most 3	0.0124	0.28	3.85	0.28	3.85

Note: * denotes spurn of the Null hypothesis (No Cointegration) at the 0.05 level of significance.

Table 3 radiates that the null hypothesis of no cointegration is spurned by either statistic; λ-Max and Trace tests, for all countries under consideration. Thus, the empirical outcomes support the cointegration association among the variables. Findings also provide justification for Export-Led growth model (ELGM) and Tourism-Led growth model (TLGM). Since the empirical results buttress the existence of cointegration among the variables, we proceed to interrogate the causality and direction of causality among the series. Since there exists long run cointegration among the variables, therefore the standard Granger Causality test does not remain genuine any more, rather, we have to deploy the Multivariate Granger Causality methodology (Toda & Yamamoto, 1995) for finding the direction of causality among the targeted variables.

Table 4 Granger Causality Test Analysis (TY Augmented Lags Methods)

Country	Azerbaijan			k +d (max)=3+1=4
Source of Causality	Dependent Variable			
	Ln GRT	Ln POL	Ln TRD	Ln TRM
Ln GRT	-	4.053	2.528	1.004
Ln POL	2.849	-	4.194	1.886
Ln TRD	7.458**	9.497**	-	3.052
Ln TRM	20.981*	9.591**	2.276	-
Country	Tajikistan			k +d (max)=3+1=4
Source of Causality	Dependent Variable			
	Ln GRT	Ln POL	Ln TRD	Ln TRM
Ln GRT	-	10.191**	5.246	1.482
Ln POL	7.732***	-	8.102**	3.986
Ln TRD	9.576**	1.636	-	0.005
Ln TRM	4.846	5.302	8.492**	-
Country	Kazakhstan			k +d (max)=3+1=4
Source of Causality	Dependent Variable			
	Ln GRT	Ln POL	Ln TRD	Ln TRM
Ln GRT	-	2.234	2.339	2.300
Ln POL	0.914	-	7.099***	7.853**
Ln TRD	2.494	4.296	-	9.303**
Ln TRM	6.488***	3.817	1.555	-
Country	Kyrgyz Republic			k +d (max)=3+1=4
Source of Causality	Dependent Variable			
	Ln GRT	Ln POL	Ln TRD	Ln TRM
Ln GRT	-	6.134	2.344	1.301
Ln POL	97.941*	-	0.395	0.763
Ln TRD	51.846*	1.273	-	1.603
Ln TRM	23.657*	1.819	7.035***	-
Country	Uzbekistan			k +d (max)=3+1=4
Source of Causality	Dependent Variable			
	Ln GRT	Ln POL	Ln TRD	Ln TRM
Ln GRT	-	2.106	11.445*	0.564
Ln POL	2.890	-	6.458***	3.592
Ln TRD	1.468	5.297	-	1.037
Ln TRM	4.931	7.766***	9.129**	-

Note: *, ** and *** indicate significance at the 1%, 5% and 10% levels respectively.

Two steps are required while implementing this procedure for finding the direction of causality. *First*, to determine the optimal lag length (k) and find the order of integration (d). Once the lag length (k) and order of integration d(max) is determined, then we have to estimate the VAR($k+d$) model at level. Table 1 clearly discloses that none of the variables is stationary at level, rather they are stationary at first difference. It means that d(max)=1. Furthermore, table 3 exhibited that the optimal lag length for all countries is 3, thus, k=3. Hence, the optimal lag for estimating VAR at level is [$k+d$(max)=3+1]=4. *Second*, to analyze the standard WALD test on the first k VAR matrix and conclude the inference on Granger causality. The computed MWALD test statistics are exhibit in Table 4.

The results computed through MWALD test exhibit the direction of causality among the targeted variables for the sample countries. Table 4 shows that there is unidirectional causality which is running from international trade to economic growth, tourism to economic growth, international trade to environmental quality and tourism to environmental quality in Azerbaijan. Similarly, bidirectional Granger causality is affirmed between economic growth and environmental pollution for Tajikistan. For Kazakhstan, international trade was found to Granger causes economic growth, environmental pollution and tourism were found to granger cause the international trade. Results also revealed that there is unidirectional causality which is running from tourism to economic growth, from environmental pollution to international trade, and from international trade and environmental pollution to tourism in Kazakhstan.

Likewise, results show that the environmental pollution, international trade and tourism are granger causing the economic growth in Kyrgyz Republic. Unidirectional causality was found between environmental pollution, international trade and tourism, while running from these variables towards economic growth. Similarly, unidirectional causality was also found between tourism and internal trade. Unidirectional causality exists between tourism and environmental pollution, running from tourism to environmental pollution. Furthermore, unidirectional causality exists and running from economic growth, environmental pollution, and tourism to international trade.

Similarly, the empirical outcomes of the λ-Max and Trace tests exhibited that there exist cointegration among the economic growth, environmental pollution, international trade and tourism. Results of the λ-Max and Trace tests of this study are consistent with the findings by Shahbaz et al. (2013); Szkorupová (2014); Seghir et al. (2015); Ali et al. (2017); Zafeiriou & Azam (2017); Haseeb et al. (2018); Azam (2019); Awan et al. (2020); Haseeb & Azam (2021). Moreover, the Granger causality results of this study consistent with the findings by Dritsaki (2013); Gokmenoglu et al. (2015); Seghir et al. (2015); Charfeddine et al. (2018); Azam et al. (2018).

CONCLUSION

The broad objective of this study was to investigate the linkages among the tourism, environmental quality measured by CO_2 emission, international trade, and economic growth for the Five Central Asian countries over the period 1992 to 2018. Appropriate estimation techniques were employed for this purpose. The empirical results strongly supported the long-run association among the underlying variables. The findings also supported the existences of export-led growth hypothesis, tourism-led growth hypothesis and economic-driven tourism growth hypothesis. The empirical results affirmed the export-led growth hypothesis for Azerbaijan, Tajikistan and Kyrgyz Republic. However, no evidence of export-led growth hypothesis was found for Kazakhstan and Uzbekistan. Likewise, tourism-led growth hypothesis was validated for Azerbaijan, Kazakhstan and Kyrgyz Republic, whereas, no evidence of tourism-led growth hypothesis was found for Tajikistan and Uzbekistan. Similarly, economic-driven tourism growth hypothesis was found unrealistic in CARS–5. Based upon the empirical findings, this study suggests that there is a need of appropriate policies to control environmental pollution, encourage sustainable tourism, and expand the trade volume. It is also required that the policy making department in these countries should formulate effective public policy for achieving the desired level of sustainable economic growth and economic development.

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