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ENERGY, TOURISM, FINANCE, AND RESOURCE DEPLETION: PANEL DATA ANALYSIS

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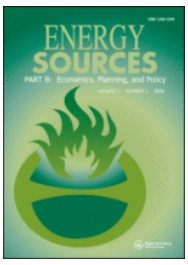

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Energy, tourism, finance, and resource depletion: panel data analysis (Article)

Bhuiyan, M.A.[a], Zaman, K.[b], Shoukry, A.M.[c,d], Gani, S.[e], Sharkawy, M.A.[f,g], Sasmoko[h], Khan, A.[i], Ahmad, A.[i], Hishan, S.S.[j,k]

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Abstract

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This study examines the dynamic linkages between alternative and nuclear energy consumption, tourism receipts, bank-specific factors, and environment and resource factors in a heterogeneous panel of countries for the period 1995–2016. The study also addresses the United Nations sustainable development agenda under a resource conservation framework across countries. A two-step differenced Generalized Method of Moments (GMM) estimator is employed for robust inferences. The results show that bank-specific factors substantially reduce resource depletion, whereas international tourism increases energy resource depletion and carbon emissions across countries. Nuclear energy consumption reduces resource depletion, whereas industrial value added increases resource depletion and carbon emissions; thus, it is imperative to devise strong policies for sustainable production across countries. The results of panel causality tests confirm different causality patterns among the studied variables. The study concludes that an environmental and resource conservation process needs sustainable policy instruments, including cleaner production techniques, renewable energy sources, and sustainable production and consumption to achieve green growth. © 2019, © 2019 Taylor & Francis Group, LLC.

Author keywords

dynamic panel GMM | financial factors | net tourism receipts | Nuclear energy consumption | panel causality | resource depletion

Indexed keywords

Engineering controlled terms: Carbon | Conservation | Energy policy | Energy utilization | Industrial emissions | Method of moments | Nuclear energy | Pollution control | Renewable energy resources

Engineering uncontrolled terms: Dynamic panels | Financial factors | net tourism receipts | Panel causality | Resource depletion

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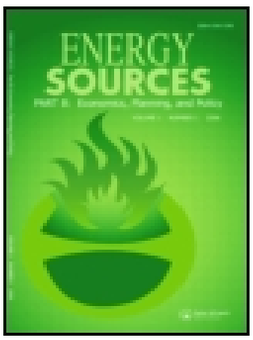

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Energy, tourism, finance, and resource depletion: panel data analysis

Miraj Ahmed Bhuiyan[a], Khalid Zaman[b], Alaa Mohamd Shoukry[c,d], Showkat Gani[e], Mohamed A. Sharkawy[f,g], Sasmoko[h], Aqeel Khan[i], Adnan Ahmad[i], and Sanil S. Hishan[j,k]

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ABSTRACT

This study examines the dynamic linkages between alternative and nuclear energy consumption, tourism receipts, bank-specific factors, and environment and resource factors in a heterogeneous panel of countries for the period 1995–2016. The study also addresses the United Nations sustainable development agenda under a resource conservation framework across countries. A two-step differenced Generalized Method of Moments (GMM) estimator is employed for robust inferences. The results show that bank-specific factors substantially reduce resource depletion, whereas international tourism increases energy resource depletion and carbon emissions across countries. Nuclear energy consumption reduces resource depletion, whereas industrial value added increases resource depletion and carbon emissions; thus, it is imperative to devise strong policies for sustainable production across countries. The results of panel causality tests confirm different causality patterns among the studied variables. The study concludes that an environmental and resource conservation process needs sustainable policy instruments, including cleaner production techniques, renewable energy sources, and sustainable production and consumption to achieve green growth.

KEYWORDS

Nuclear energy consumption; resource depletion; financial factors; net tourism receipts; dynamic panel GMM; panel causality

1. Introduction

The nexus between environment, tourism, and growth has attracted significant attention in recent time due to huge concerns over environmental sustainability, which is largely promoted by the United Nations sustainable goals to transform the world in a better way through sustained growth (UNSDGs 2015). The environmental impacts of tourism are quite high in terms of natural resource depletion, air pollution, physical damage to ecosystems, deforestation, loss of biodiversity, etc. These factors affect water resources, energy and food resources, and land degradation while international tourism activities further escalate air and noise pollution, waste disposal and sewage issues, etc.

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(UNEP 2001). The positive effects of tourism include promoting culture, foreign exchange earnings, employment generation, and infrastructure development (Asadzadeh and Mousavi 2017)

Tourism is considered a major industry sector of OECD countries and contributes, on average, 4.2% to GDP, 21.7% of service exports, and 6.9% of employment. Almost 55% of inbound tourists in OECD countries received during 2012 and 2016 and total travel receipts reached up to 60.4% during this period. Australia, Canada, Chile, and Korean economy is largely affected by climate change. Energy-related emissions are largely intensified in Mexico's economy while Turkey's economy is carbon-intensive due to heavy industrial processes. The UK economy relies on coal for power generation (OECD 2018).

The present study uses a panel of heterogeneous countries including nine from the OECD: Australia, Bulgaria, Canada, Chile, Japan, Korea, Mexico, Poland, Romania, Russian Federation, Turkey, Ukraine, and the United Kingdom. These countries were selected due to rapid banking reforms held at nationwide that balanced the natural resources, environment, and international tourism. The dynamic linkages between net tourism receipts, nuclear energy demand, bank-specific factors, and environment and resource depletion in this sample are examined for the period 1995–2016. The dynamic panel Generalized Method of Moments (GMM) technique is used to control countries' fixed effects by first-differenced transformation while correcting the possibility of endogeneity problems from the given set of models. Moreover, the study evaluates the causality patterns between the studied variables.

2. Literature review

The inclusion of international tourism indicators, financial market integrations, and renewable energy consumption in a sustainable policy agenda is desirable to conserve natural resources across the globe (Shahbaz et al. 2018). The negative environmental impacts of international tourism are quite visible in terms of ecosystem degradation. Strong financial market integration and renewable energy sources mediate the process of environmental sustainability in order to reduce negative externalities across countries (Shahbaz et al. 2017). The concept of "sustainable tourism" is widely discussed in the academic and research arena, where both the factors – environment and international tourism – are considered as interdependent rather than interrelated factors (Hassan 2000; Pigram 1980; Sims, Rogner, and Gregory 2003). In continuation of the eco-tourism debate, the role of renewable energy sources is imperative for mitigating high carbon emissions and GHG emissions across countries (Khan et al. 2016; Qureshi, Rasli, and Zaman 2016). A sound financial system provides healthy and wealthy economic growth that conserves global natural resources and ensures environmental protection (Alam et al., 2015). The "income–growth hypothesis" and the "natural resources-based view" of firms are found in the works of Lopez (1994) and Hart (1995), where the former's analysis is based on the environmental Kuznets curve while the latter's is based on management theory that is aligned with natural capital as a means to increase sustainable global economic gains. The recent spike in published studies confirms that eco-tourism policies (Marsiglio 2015), renewable energy sources (Zhang and Gao 2016), cleaner production technologies (Naradda Gamage, Hewa Kuruppuge, and Haq 2017), green financial agendas (Işik, Kasımatı, and Ongan 2017), and pollution abatement policies (Gupta and Dutta 2018) are helpful for achieving green development across countries.

This study has a wider contribution to energy and resource economics under sustainable tourism and bank-specific factors, which is a less-explored area in energy resource planning and policy development. This is believed to be the first study to interlink bank-specific factors, international tourism, and nuclear energy with environmental sustainability indicators, including carbon emissions, natural resource depletion, mineral depletion, and energy depletion, which is imperative for sound energy policies and planning across countries. Previous studies have been largely limited to the following topics: (i) energy demand and environmental degradation (Dincer and Rosen 1998; Zaman and Abd-El Moemen 2017); (ii) tourism and environment (Buckley 2011; Zaman, Moemen,

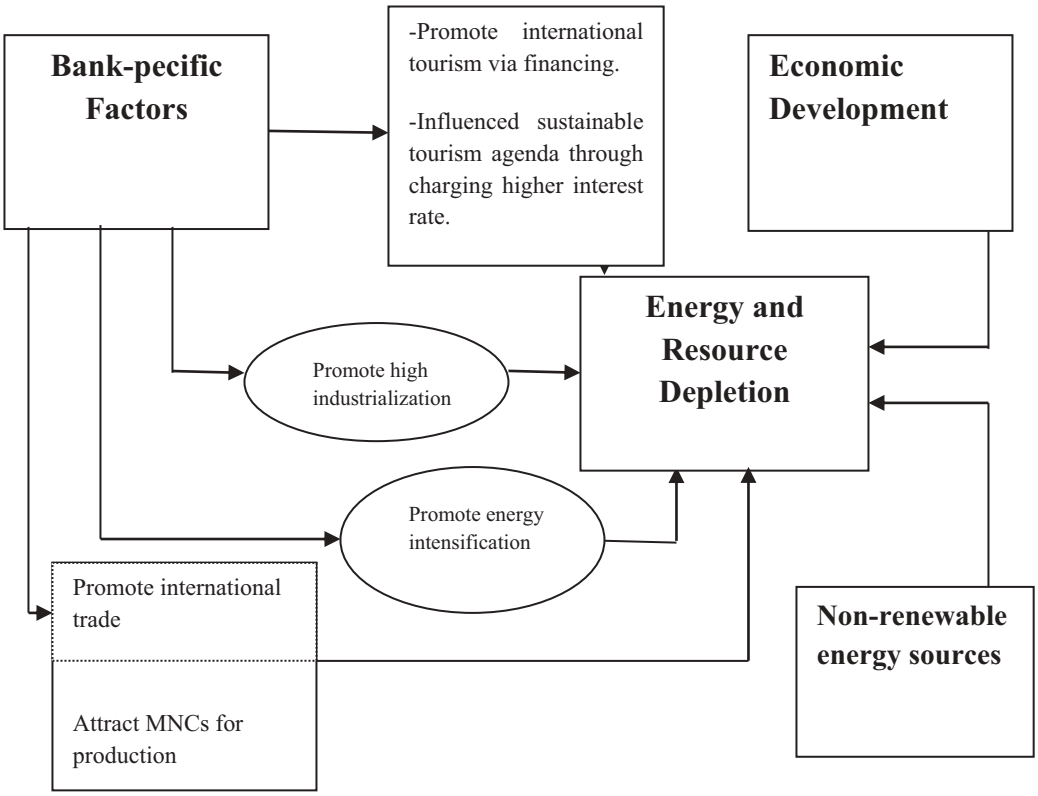

Figure 1. Causal mechanism between bank-specific factors and sustainable development.
Source: Adapted from Sabouri and Moosavi (2016), Oyegunle and Weber (2015), Li and Lin (2015), and Eneh (2017).

and Islam 2017); (iii) financial factors and environment (Farhani and Ozturk 2015; Khan, Saleem, and Fatima 2018); (iv) banking factors and resource conservation (Ali et al. 2017; Barrett, Lee, and McPeak 2005). These studies largely worked across different economic settings and used different empirical approaches; however, to the best of the author's knowledge, there is no single study available that conjoins bank-specific factors, nuclear energy demand, international tourism, and energy and resource factors across countries. Figure 1 shows the channel through which the banking factors affect environmental sustainability agendas through the mutual integration of tourism development and renewable energy sources across countries.

3. Data source and methodological framework

The study used a number of promising bank-specific factors, net tourism receipts, and nuclear energy demand to evaluate the impact of tourism on environment and resource depletion in a heterogeneous panel of countries for the period 1995–2016. These variables include bank capital-to-asset ratio (%), bank non-performing loans-to-total gross loans ratio (%), broad money-to-total reserves ratio (%), and deposit interest rate (%). International tourism shows net tourism receipts in current US$. Energy shows alternative and nuclear energy consumption (% of total energy use). Industrial value added (% of GDP) is used as a control variable. Environmental and resource factors include CO_2 emissions (metric tons per capita), energy depletion, mineral depletion, and natural resources depletion as % of GNI. Data were taken from the World Bank (2017), and missing value was filled by preceding and succeeding values of the respective variables, where required.

These variables were selected for several reasons. First, the banking sector is largely involved in funds disbursement and plays a vital role in generating financial activities; thus, this sector needs to exercise caution over environmental regulations to avoid unsustainable financial activities across countries. Second, environmental conservation policies require a renewable energy mix and sustainable tourism policies to lessen the impact on climate change and conserve biodiversity across the globe. The present study used bank-specific factors along with the international tourism and nuclear energy to evaluate their dynamic impacts on environmental and resource depletion in a panel of countries. Previous studies largely used financial indicators but not specific bank-regulated factors. Thus, this study used three bank-specific factors, including bank capital-to-asset ratio, non-performing bank loans, and deposit interest rate, and broad money supply served as a mediating factor to expedite the process of banking regulations in the financial market that supports key economic sectors of the countries, including the tourism industry and energy and resources markets. The other variables include nuclear energy demand, international tourism, and industry value added, which served as a control variable to analyze the renewable energy mix, eco-tourism policies, and sustainable industrial production and was helpful to reduce negative externalities in the form of energy and resource depletion. The study used a structured time period from 2005 to 2016, when banking regulations and capital markets were affected by a global financial crisis in 2008 and the environment is compromised by financial crunch, non-renewable energy sources, and unsustainable production and consumption.

3.1. *Linear dynamic panel data (DPD) and panel casualty tests*

The two most extensive estimators used in DPD models is where the one-way fixed effect is resolved by the "first-differenced" Arellano–Bond (AB) approach, and the System GMM estimator. The AB approach deals with the problem by incorporating a system of equations per time period by applicable instruments to each equation. However, it is latterly specified that the lagged instruments are considered poor instruments for differenced regressors, especially if the regressors follow a close random walk. Thus, a modification has been made to include lagged differenced with the lagged levels variables to expand the system GMM estimator. Both estimators are designed for datasets with many panels and few periods, which requires the absence of autocorrelation in the idiosyncratic errors. Hence, the Sargan test, or Arellano–Bond test for zero autocorrelation in the first-differenced errors, can be used to evaluate the model. Serial correlation in these errors at an order higher than unity implies that moment conditions used to estimate are not valid (Baum 2013; Hurlin 2018).The Dumitrescu–Hurlin (2012) panel causality test has no such restriction imposed in terms of either $T > N$ or $T < N$ to evaluate the cause–effect relationship between the variables. The DH causality considers the cross-sectional dependency, which produces efficient results. This test worked in the non-causality homogenous test, which accounts for both the causality and heterogeneity among the regression equations.

3.2. *Differenced GMM estimator and DH panel causality test*

The differenced GMM was used based on its merit as developed by Arellano and Bond (1991). The study conducted two-step GMM iterations with the period seemingly unrelated regression (SUR) instrument weighting matrix and period SUR (PCSE) standard errors and covariance. One of the prime advantages when using the panel GMM estimator is that it controls the country effects by first-differenced variables and further addresses possible endogeneity among the list of explanatory variables. The Sargan test is used for over-identifying restrictions, i.e., the usage of instruments' validity under the differenced GMM estimator. After obtaining the robust parameter estimates, the study proceeds to the Dumitrescu–Hurlin (DH) panel causality tests. The study further evaluates DH panel causality under the critical values of W-statistics and Z-bar statistics. Acceptance of the null

hypothesis confirms no causal relationship between the variables, whereas the rejection of the null hypothesis corresponds to a causal relationship among the variables. Linear and non-linear causality were further assessed to help make better policies across countries.

4. Results

Table 1 presents the descriptive statistics and shows that the bank capital-to-asset ratio has a mean value of 8.393% (max. 15.056%; min. 3.5%). The variable has a positive skewed distribution and high kurtosis value. The broad money supply and bank non-performing loans have mean values of 11.230% and 5.906%, respectively. Energy depletion, mineral depletion, and natural resource depletion have average values of 1.05E + 10 US$, 0.813% of GNI, and 1,980% of GNI, respectively. The high mass carbon emissions interest rate, net tourism receipts, nuclear energy consumption, and industry value added have mean values of 8.414 metric tons per capita, 9.609%, 8.08E + 09 US$, 10.937% of the total energy consumption, and 31.965% of GDP, respectively.

Table 2 shows the correlation matrix for ready reference. The results show that bank-specific factors and industrialization have a negative correlation with carbon emissions, whereas it is positively influenced by net tourism receipts and nuclear energy consumption across countries. Energy depletion is influenced by bank-specific factors, net tourism receipts, and industrialization, whereas nuclear energy substantially decreases energy resource depletion. There is a negative correlation between mineral depletion, bank-specific factors, net tourism receipts, and nuclear energy demand, whereas it is positively correlated with industrial value added. Finally, the bank capital-to-asset ratio and industrial value added are both positively correlated with the natural resource depletion, whereas the remaining bank-specific factors, net tourism receipts, and nuclear energy demand have a negative correlation with the natural resource depletion across countries.

Table 3 shows the panel unit root summary. The results show that bank capital, CO_2 emissions, energy depletion, natural resource depletion, and nuclear energy demand exhibit first-differenced stationary variables. The broad money supply, bank non-performing loans, interest rate, mineral depletion, net tourism receipts, and industry value added stationary at level. The order of integration is diverse in different panel unit root tests, which makes sense to estimate panel GMM estimator to absorb possible endogeneity issues from the given models.

Table 4 shows the results of the dynamic panel GMM estimation. The results show that initial values of energy depletion, mineral depletion, natural resource depletion, and carbon emissions have a positive sign, which confirms that natural resource and environmental factors have increased over the past few years in the panel of countries. The result of Sargan J-statistics in all four equations confirms that the lagged instruments for the panel GMM estimation are valid at conventional levels for all prescribed cases estimated.

The results show that the broad money supply has a negative relationship with energy resources with an estimated elasticity value of −0.247%. The results show that financial markets are less elastic than the energy commodity market; hence, it is vital to generate more financial capital to spend on the energy resource market for sustainable growth. The impact of tourism infrastructure is vital for

Table 1. Descriptive statistics.

Descriptive Statistics of the Variables											
Methods	BNKAST	BRDMON	BNKNPL	CO2	ENRGDEP	INTRT	MINDEP	NETRCPT	NRDEP	NUCLEAR	IND
Mean	8.393	11.230	5.906	8.414	1.05E + 10	9.609	0.813	8.08E + 09	1.980	10.937	31.965
Maximum	15.056	71.783	59.756	18.200	1.67E + 11	101.958	14.533	4.21E + 10	14.561	28.975	44.587
Minimum	3.500	1.162	0.400	2.919	134317.8	0.035	0	2000000	3.64E - 05	0.160	19.780
Std. Dev.	2.769	14.315	12.036	4.290	2.48E + 10	15.308	2.090	1.04E + 10	2.676	7.472	4.9116
Skewness	0.102	1.743	3.655	0.778	4.044	3.3810	4.090	1.5253	2.078	0.430	−0.320
Kurtosis	1.931	5.085	15.672	2.591	21.43	15.473	21.097	4.237	7.256	2.122	2.776

Table 2. Correlation matrix.

Correlation										
Probability	CO2	ENRGDEP	MINDEP	NRDEP	BNKAST	BNKNPL	BRDMON	INTRT	NETRCPT	NUCLEAR	IND
CO2	1.000000										
	– –										
ENRGDEP	0.209107	1.000000									
	0.0004	– –									
MINDEP	−0.153691	−0.071559	1.000000								
	0.0092	0.2277	– –								
NRDEP	0.012630	0.540320	0.693225	1.000000							
	0.8316	0.0000	0.0000	– –							
BNKAST	−0.560988	0.102795	−0.079736	0.101281	1.000000						
	0.0000	0.0827	0.1787	0.0873	– –						
BNKNPL	−0.170081	−0.062702	−0.103593	−0.066158	0.402460	1.000000					
	0.0039	0.2906	0.0803	0.2648	0.0000	– –					
BRDMON	0.525007	0.016100	−0.077496	−0.146567	−0.694977	−0.209277	1.000000				
	0.0000	0.7863	0.1913	0.0131	0.0000	0.0004	– –				
INTRT	−0.304763	−0.108091	−0.108569	−0.118965	0.423302	0.137572	−0.244798	1.000000			
	0.0000	0.0680	0.0667	0.0444	0.0000	0.0199	0.0000	– –			
NETRCPT	0.153346	0.267751	−0.221702	−0.147300	−0.283917	−0.191798	0.524835	−0.129762	1.000000		
	0.0094	0.0000	0.0002	0.0126	0.0000	0.0011	0.0000	0.0282	– –		
NUCLEAR	0.055500	−0.103638	−0.158071	−0.203988	0.003958	0.220694	0.170440	−0.217583	0.088201	1.000000	
	0.3497	0.0802	0.0074	0.0005	0.9469	0.0002	0.0038	0.0002	0.1368	– –	
IND	−0.232950	0.042580	0.250334	0.343234	0.223201	0.159082	−0.507948	0.176011	−0.385537	−0.125800	1.000000
	0.0001	0.4732	0.0000	0.0000	0.0001	0.0070	0.0000	0.0028	0.0000	0.0335	– –

Table 3. Panel unit root summary.

Panel Unit Root at different Methods											
Methods	BNKAST	BRDMON	BNKNPL	CO2	ENRGDEP	INTRT	MINDEP	NETRCPT	NRDEP	NUCLEAR	IND
LLC	2.608	−2.815*	−1.700**	−0.677	−1.204	−9.569*	−1.477***	−1.877**	−1.266	0.310	−3.309*
IPS	2.714	−1.863**	−1.055	−0.057	−0.272	−7.497*	−1.455***	−0.625	−1.030	1.435	−1.537***
Fisher-ADF	20.414	37.215***	29.585	30.258	20.182	175.545*	37.026***	27.008	28.934	22.664	33.228
Fisher-PP	36.319	60.990*	17.661	25.972	23.153	487.149*	28.623	22.332	23.045	23.398	36.528***
Methods	ΔBNKAST	ΔBRDMON	ΔBNKNPL	ΔCO2	ΔENRGDEP	ΔINTRT	ΔMINDEP	ΔNETRCPT	ΔNRDEP	ΔNUCLEAR	ΔIND
LLC	−3.287*	−7.167*	−7.154*	−8.494*	−9.148*	−15.468*	−7.032*	−3.604*	−7.433*	−5.645*	−6.902*
IPS	−7.458*	−9.049*	−7.071*	−8.089*	−8.147*	−13.350*	−7.139*	−5.452*	−7.328*	−6.394*	−7.025*
Fisher-ADF	108.433*	127.406*	100.483*	113.091*	113.223*	231.592*	100.253*	84.367*	102.613*	92.553*	98.596*
Fisher-PP	473.197*	327.438*	134.627*	183.605*	184.002*	514.530*	137.199*	366.259*	162.348*	183.775*	218.793*

Note: * shows 99% significance level, ** shows 95% significance level, and *** shows 90% significance level.

Table 4. Dynamic panel GMM estimates.

Panel GMM Estimates for Equations (1) to (4)				
Variables	ln$132#(ENRGDEP) $_{i,t}$	ln$132#(MINDEP) $^{a1}_{i,t}$	ln$132#(NRDEP) $_{i,t}$	ln(CO2) $_{i,t}$
ln$132#(ENRGDEP)$_{i,t-1}$	0.798[a]*	–	–	–
ln$132#(MINDEP) $^{a1}_{i,t-1}$	–	0.785[a]*	–	–
ln$132#(NRDEP)$_{i,t-1}$	–	–	0.758*	–
ln(CO2)$_{i,t-1}$	–	–	–	0.797*
ln$132#(BNKAST) $_{i,t}$	−0.261[a]	−0.029[a1]	−0.358[a]*	−0.014
ln$132#(BNKNPL) $_{i,t}$	−0.029[a]	−0.070[a1]*	−0.108[a]*	−0.012*
ln$132#(BRDMON) $_{i,t}$	−0.247[a]*	−0.007[a1]	−0.100[a]*	−0.025*
ln$132#(INTRT) $_{i,t}$	−0.015[a]	−0.085[a1]*	−0.034[a]**	−0.003***
ln$132#(NETRCPT)$_{i,t}$	0.099[a]*	0.002[a1]	−0.044[a]**	0.007**
ln$132#(NUCLEAR) $_{i,t}$	0.036[a]	−0.029[a1]**	−0.016[a]	−0.005
ln$132#(IND)$_{i,t}$	0.256[a]	0.537[a1]*	−0.049[a]	0.128*
Statistical Tests[b]				
Sargan J-$132#statistic	3.93E - 30	6.27E - 30	3.30E - 30	3.63E - 30
Instrument rank	8	8	8	8
AR(1)-prob.value	0.666	0.663	0.120	0.343
AR(2)-prob.value	0.954	0.478	0.412	0.745

Note: * and *** indicates 1% and 10% level of significance. 'a' shows cross-section specification is Fixed and GLS weight is cross-section SUR, 'b' shows cross-section specification is Difference and GMM weight is Difference (AB 1-step), and 'a1' shows mineral depletion is without natural log due to the log of non-positive number. Instrumental list: first lag of the regressors.

the energy resource market to gain sufficient revenue for the cost of resource depletion. The result shows that if there is a 1% increase in net tourism receipts, then energy resources are depleted by 0.099%. The government should improve tourism infrastructure and devise policies that promote eco-tourism across countries. Further, it requires more investment for financing clean energy (Kaminker and Stewart 2012). The results conclude that the banking sector should be more elastic in terms of loan disbursement for energy-saving projects that promote renewable energy efficiency programs to help mitigate environmental concerns across the globe (Al-Mulali, Tang, and Ozturk 2015).

The second regression apparatus shows that bank non-performing loans, interest rates, and nuclear energy demand substantially help reduce mineral resource depletion, which corresponds to the elasticity estimates of −0.070%, −0.085%, and −0.029%, respectively. The results confirm that financial factors and renewable energy demand in the form of nuclear energy largely decrease mineral resource depletion, which is imperative for green development. The industrial value added is the chief factor that damages natural resources in the form of mineral depletion with a magnitude value of 0.537%, which is far greater than the intensity of financial and energy factors to reduce mineral depletion. The results are in line with the previous work of Kaloo, Hood, and Obwogi (2015), Dittmer (2015), etc.

In the third regression apparatus, the results confirmed that bank-specific factors and international tourism have a negative and significant impact on natural resource depletion, with a magnitude value of −0.358% for bank capital ratio, −0.108% for bank non-performing loans, −0.100% for broad money supply, −0.034% for interest rate, and −0.044% for net tourism receipts. Nuclear energy demand and industrialization are both unable to demonstrate a significant impact on the natural resource markets across countries. Valdivia and Barbieri (2014) emphasized the need for agritourism to increase household income, minimize the risks associated with agricultural production, and conserve natural resources for long-term sustainable development. Deng, Ma, and Cao (2014) argued the "resource curse hypothesis" under the domain of instability for tourism-led growth is determined and concluded that the resource curse hypothesis is related with the health curse, ecological damaging, institutional instability, and fluctuations in the volume of trade. These resources are affected by tourism activities through different growth channels that ultimately influence economic growth in the region.

Table 5. Estimates of Dumitrescu Hurlin panel causality.

Variables	Dumitrescu Hurlin Panel Causality Pattern
CO2 ↔ BNKAST	Bidirectional
NETRCPT → BNKAST	Unidirectional
BNKAST → NUCLEAR	Unidirectional
ENRGDEP ↔ BNKNPL	Bidirectional
IND↔ BNKNPL	Bidirectional
BNKNPL →NETRCPT	Unidirectional
BRDMON → ENRGDEP	Unidirectional
BRDMON → NETRCPT	Unidirectional
NUCLEAR↔ CO2	Bidirectional
IND→NETRCPT	Unidirectional
NUCLEAR→IND	Unidirectional
INTRT→NRD	Unidirectional
NUCLEAR↔NETRCPT	Bidirectional
NUCLEAR→NRD	Unidirectional

Note: → shows unidirectional causality, while ↔ shows Bidirectional causality.

Finally, the study examined the impact of bank-specific factors, net tourism receipts, nuclear energy demand, and industrial value added on the quality of environment that is considered by CO_2 emissions in a panel of countries. The results show banking factors helpful for reducing high mass carbon emissions with values of −0.102% for bank non-performing loans, −0.025% for broad money supply, and −0.003% for deposit interest rate. However, international tourism and industrial value added are the chief factors that deteriorate environmental quality by high mass carbon emissions across countries. Balaguer and Cantavella-Jorda (2002), Gunduz* and Hatemi-J (2005), Katircioglu (2009), Tang (2011), Pérez-Rodríguez, Ledesma-Rodríguez, and Santana-Gallego (2015), Chiu and Yeh (2017), Isik, Dogru, and Turk (2018), and many more have empirically analyzed the tourism-led growth hypothesis (TLGH) and found different outcomes in terms of economic growth strategies. However, in this study, we confirm the negative trade-off between TLGH and the environmental sustainability agenda, which needs strong policies to develop an integrated model that supports countries' economic and environmental objectives. The impact of industrialization on carbon emissions has an effect of greater magnitude compared with international tourism; thus, industrial production should be based upon sustainable technological factors that produce less/zero carbon emissions. The impact of nuclear energy demand on CO_2 emissions has a correct negative sign; however, the estimate is unable to signify its positive impact on environmental quality during the study period. Al-Mulali (2014) confirmed the positive relationship between nuclear energy consumption and an environmental quality indicator as nuclear energy significantly increases per capita income in the panel of countries. Table 5 shows the results of the panel causality tests for ready reference.

The results confirm the bidirectional causality between (i) CO_2 emissions and banks' capital-to-asset ratio; (ii) energy depletion and bank non-performing loans; (iii) industrial value added and bank non-performing loans; (iv) nuclear energy demand and CO_2 emissions; and (v) nuclear energy to net tourism receipts. Unidirectional causality stems from (i) net tourism receipts-to-bank capital ratio; (ii) bank capital-to-nuclear energy demand ratio; (iii) broad money supply-to-energy depletion ratio and net tourism receipts; (iv) industry value added-to-net tourism receipts; (v) nuclear energy demand-to-industry value added and natural resource depletion; and (vi) interest rate to natural resource depletion. The causality results conclude that international tourism net receipts increase the cost of environmental degradation; therefore, policies should be developed to maintain eco-tourism across countries. Banking factors should be more flexible in order to provide investment for energy projects and for renewable energy to mitigate climatic concerns and the resource curse hypothesis in a panel of selected countries. The linear causality test is based upon Granger causality while non-linear causality is applied on VECM residual series is obtained for policy inferences (Table 6).

Table 6. Linear and non-linear causality test estimates.

	Linear Causality based upon Granger Causality Test (Wald F-statistics)							NLC
Variables	Dln(BNKAST)	Dln(BNKNPL)	Dln(BRDMON)	Dln(INTRT)	Dln(IND)	Dln(NUCLEAR)	Dln(NETRCPT)	ECT(−1)
Dln(CO2)	1.342	10.089*	0.553	0.049	16.230*	58.595*	0.290	0.311
Dln(ENRGDEP)	3.844***	3.850***	0.657	3.897**	1.330	2.159	4.658**	0.282
Dln(MINDEP)	0.029	6.657*	1.318	0.164	17.748*	0.306	0.608	1.166
Dln(NRDEP)	4.867**	7.505*	0.304	0.022	24.485*	0.050	1.663	0.284

Note: *, **, and *** indicates 1%, 5%, and 10% significance level. Wald F-test restrictions imposed on regressors. ECT shows error correction term. NLC shows non-linear causality based on VECM.

The results confirm unidirectional causality running from CO_2 emissions to bank capital asset, industry value added, and nuclear energy demand, whereas energy depletion has one-way linkages from bank capital asset, bank non-performing loans, interest rate, and net tourism receipts. There is a one-way causal relationship of non-performing bank loans and interest rate, whereas natural resource depletion has causal linkages with bank capital asset, bank non-performing loans, and interest rate. There is not found any non-linear causation among the variables, which is found by an insignificant error correction term. Thus, the causality existing among the study's variables gives sound policy inferences to integrate an environmental model for long-term sustained growth.

5. Conclusions

This study examined the long-run relationship between energy demand, international tourism, and financial development, and its resulting impact on energy and resource depletion in a panel of 13 countries for the period 1995–2016. The results provide a novel contribution in evaluating the United Nations sustainability agenda by introducing financial sector development, nuclear energy demand, and tourism indicators in the environmental model. The results confirm the positive impact of nuclear energy demand and bank-specific factors on energy and resource restoration. International tourism and industrialization both jeopardize the natural resource conservation process and robust policies are required to care for the natural environment via sustainable production and consumption. The results further show one-way and two-way linkages between the studied variables, which require consideration by policymakers when devising long-term policies for sustainable growth.

Banking indicators should be channeled in such a way to support the environment and this could be possible when domestic and foreign investors properly handle energy and resource waste. Further, international tourism policies should be made in such a way as to absorb the negative environmental externalities by tourism activities that confined and supported with the environmental resources in a panel of countries. Finally, policies related to the adoption of a new energy mix in a country's portfolio should be reconsidered and included in the sustainable environmental agenda. The policies of nuclear energy for carbon-free energy sources connected with resource depletion should be reconsidered as nuclear energy jeopardizes natural resources across countries. The causality patterns highlight the need for healthy environmental policies that facilitate the conservation of natural resources by formulating sound banking reforms in order to mitigate climatic concerns and fulfill the United Nations Kyoto protocol in the region.

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