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Use of Non Fossil Fuel Resources, Electricity, Economic Growth and Carbon Dioxide Emission in Pakistan

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Abstract

The ARDL (autoregressive distributed lag model) approach is used to study the effects of non fossil fuel resources, economic growth per capita, and use of electricity on carbon dioxide emanations in Pakistan from 1971 to 2014. The outcomes of OLS regression propose that use of non fossil fuel resources play an essential function in curbing carbon dioxide emanations because sign of coefficients is negative and significant, on the contrary the economic growth and electricity consumption increase carbon dioxide emanations in the environment. The findings of ARDL propose that all variables have no effect on the carbon dioxide emanations in the long-run. Nevertheless, the Granger Causality test suggests there is bidirectional causality between carbon dioxide emanations and economic growth per capita. Similarly, there is unidirectional causality between electricity utilization and carbon dioxide emissions. According to OLS regression findings, this study concluding that uses of non fossil fuel resources mitigate carbon dioxide emissions in Pakistan very effectively and therefore government gives preference to use of non fossil fuel resources.

Keywords: Non Fossil fuel resources, carbon dioxide emanations, electricity, economic growth per capita, Pakistan

Introduction

In this universe societies face environmental issues like weather change, climate change and global warming. Greenhouse fuel emanations particularly carbon dioxide emanations present the main reason of climate change and global warming. The eighty five % of world carbon dioxide emanations obtained from fossil fuels combustion, which is used for transportation and production of electricity. As a consequence, it is very imperative to trace substitute means of power to alleviate carbon dioxide emanations. China has surpassed the USA as the most imperative user of power and the biggest donor of carbon dioxide emanations, with 20% of worldwide power utilization and 29% on the whole carbon dioxide emanation. The USA utilizes non fossil resources like coal from which burning discharges huge quantities of carbon dioxide into the environment. The use of power utilization creates greenhouse gasoline (GHGS) emanation, and environmental contaminant (Daskalakis, 2009).

To alleviate carbon dioxide emanations for maintaining social and economic development, Pakistan has started to increase renewable and nuclear power resources to swap conventional fossil fuels. The authorities have generated power regulations to use of renewable and nuclear power. Therefore, non fossil -fuel resources utilization has accelerated to some extent. Despite the fact, the Government has formulated fossil fuel power resources and received wonderful effects on emanations of carbon dioxide. There is a huge discussion on whether fossil fuel power diminishes carbon dioxide emanations and concluded use of non fossil fuel resources can lead to decrease in carbon dioxide emanations (Jaforullah, 2015). For paradigm, greenhouse gas emanations for the life rotation of solar panels account for more or less 32-79 g CO_2 eq/kwh, at the same time for solar collectors it is 11-68 g CO_2 eq/kwh (Irandoust, 2016). Consequently, the present dissertation wants to study whether a raise of non fossil fuel resources could reduce carbon dioxide emissions.

The pervious investigators inspected the effect of share of fossil fuel power consumption on carbon dioxide emanations. Most of the researchers employed dissimilar econometric techniques to gauge the outcomes of renewable and nuclear power consumption for lessening of carbon dioxide emanations. Nevertheless, the outcomes are conflicting and questionable. In recent study, Al-mulali et al. (2016) and Silva et al. (2016) tested the causal association between renewable power and carbon dioxide emanations from 1960 to 2004 in the United States, Portugal, Denmark, as well as Spain, concluding that a raise in the share of renewable power utilization decrease carbon dioxide emanations in almost all international nations expect the United States. Irandoust (2016) provided proof that use of renewable resources alleviates carbon dioxide emanations in Nordics states. Dogan and Seker, (2016) authenticated that increasing the usage of renewable power decrease carbon dioxide emanations in various nations. Tiwari (2011) and Bento et al. (2016) arrived on the same conclusions for Italy and India.

Nevertheless, the employ of renewable power does not have an effect on reduction of carbon dioxide emission in the short-term as stated by Apergis et al. (2010). On the contrary, the causal association among renewable power utilization and carbon dioxide emanations in the US between 1960 and 2007 was investigated by Menyah and Rufael, (2010), they emphasize renewable power does not play an important role to the decrease of carbon dioxide emanations. Chang and Chiu, (2009) stated the use of renewable power diminish carbon dioxide emanations. However, Iwata et al. (2010) suggested nuclear power performs the smallest function in curtailing carbon dioxide emanations in most OECD countries.

To cover up these gaps, this dissertation studies the dynamic effect of fossil-fuel resources utilization, electricity and economic growth per capita on carbon dioxide emanations within the cointegration framework in Pakistan. Particularly, this dissertation inspects the short and long-term influences of non fossil-fuel resources, electricity consumption and economic growth per capita on CO_2 emanations in Pakistan by using autoregressive distributed lag (ARDL) technique, OLS, Granger causality test, and Error Correction Models (ECM).

Materials and Methods

Equation for Model

To find the effect of non fossil fuel resources, electricity utilization and economic growth per capita on carbon dioxide emanations using time-series data, the following equation (1) may be used (Baek, 2016).

$$\ln(co_2) = Э_0 + Э_1 \ln y_t + Э_2 \ln nf_t + Э_3 \ln ec_t + Э \qquad (1)$$

However, $(co_2)_t$ stand for carbon dioxide emanations at time t; yt economic growth per capita; nf is a non fossil fuel resources as alternative nuclear power consumption; ec presents electricity consumption at time t, and ut depicts the error term. The use of non fossil fuel resources has negative effect on carbon dioxide emanations; the coefficient of this variable might be non-positive. According to study of pervious literature, economic boom affect positively carbon dioxide emissions; as economic growth increases carbon dioxide emanations also increases, the sign of $Э_2$ might be positive. Further, a higher degree of electricity consumption ought to cause a raise in carbon dioxide emanations also, so the sign of $Э_3$ may be positive.

Cointegration analysis

So that, the long-run connection among use of fossil fuel power, economic growth per capita, electric power utilization, and carbon dioxide emanations will be determined in this study. For this purpose an ARDL technique is used to find cointegration between variables (Pesran and Shin 2001). This technique has a few benefits as compared to others cointegration techniques, as suggested by (Narayan 2005). The unrestricted errors correction model is depicted as under in equation (2):

$$\Delta \ln(co_2)\,t = \lambda + Э0 \sum_{k=0}^{m} Э1k\Delta \ln(CO2)\,t-k + \sum_{k=1}^{m} Э2k\Delta \ln yt - k + \sum_{k=0}^{m} Э3k\Delta \ln(nf)\,t-k + \sum_{k=0}^{m} Э4\,k\Delta \ln(ec)\,t-k + \lambda \ln y\,t-1 + \lambda \ln nf_{t-1} + \lambda \ln ec_{t-1} + \mu_i \qquad (2)$$

The Δ depicts first difference of the variable, and m stand for the lag lengths of variables and λ is the intercept term. The AIC (Akaike information criterion) or FPE (final prediction errors) are used to find the suitable lag length. The lag order selection is determined by using F-test Pesaran et al., (2001). The null hypothesis of shows there is no long -term relationship, which is represented as under:

(H_0:) $Ж_0 = Ж_1 = Ж_2 = Ж_3 = Ж_4 = 0$), while alternative hypothesis is represented by (H_1: $Ж_0 \neq Ж_1 \neq Ж_2 \neq Ж_3 \neq Ж_4 \neq 0$). The computed F-statistics values compare to the critical bounds values which are reported in the statistical table of Pesaran et al. 2001. The excess of computed values of F-statistics from the given critical values give information for rejection or acceptation of the null hypothesis. However, if the computed F-statistic values remains between the upper and lower critical bounds test values, it gives message of inconclusiveness. Moreover, if the values of F-test are below the lower bounds value, it depicts there is no cointegration.

For analyzing the long-run relationship between variables, the mechanism of ARDL is used as below (3).

$$\ln(co_2)\,t = Э0 \sum_{k=0}^{m} Э1k \ln(co2)\,t-k \sum_{k=1}^{m} Э2k \ln yt - k + \sum_{k=0}^{m} Э3k \ln(nf)\,t-k + \sum_{k=0}^{m} Э4\,k \ln(ec)\,t-k + u_{1t} \qquad (3)$$

Whilst this process of ARDL is completed, the error-correction model is reported in (4) which examine the short-term attitudes of the variables and speed of adjustment equilibrium towards long term.

$$\Delta \ln(co_2)\,t = Э0 \sum_{k=0}^{m} Э1k\Delta \ln(CO2)\,t-k + \sum_{k=1}^{m} Э2k\Delta \ln yt - k + \sum_{k=0}^{m} Э3k\Delta \ln(nf)\,t-k + \sum_{k=0}^{m} Э4\,k\Delta \ln(ne)\,t-k + ECT\text{-}1 \qquad (4)$$

Finally, the parameters created instability in the model, thus to check stability, a stability test is employed to find stability of model. The cumulative CUSUM and CUSUMSQ techniques (Pesran, 1997) are utilized to find stability of the coefficients. If the graphs of the CUSUMSQ and CUSUM statistics remains inside the boundary lines at 5% significance level, the null hypotheses are rejected, which demonstrate stability of all coefficients in the model.

Granger Causality Test

$$1\text{-L})\begin{bmatrix} co2 \\ yt \\ nft \\ ec \end{bmatrix} = \begin{bmatrix} c1 \\ c2 \\ c3 \\ c4 \end{bmatrix} + \sum_{i=1}^{q} (1-L) \begin{bmatrix} a11i\ a12i\ a13i\ a14i \\ a21i\ a22i\ a23i\ a24i \\ a31\ a32i\ a33i\ a34i \\ a41i\ a42i\ a43i\ a44i \end{bmatrix} + \begin{bmatrix} co2-1 \\ yt-1 \\ nft-1 \\ ec-1 \end{bmatrix} + \begin{bmatrix} \lambda 1 \\ \lambda 2 \\ \lambda 3 \\ \lambda 4 \end{bmatrix} (ECT\text{-}1) + \begin{bmatrix} \partial 1t \\ \partial 2t \\ \partial 3t \\ \partial 4t \end{bmatrix} \qquad (5)$$

The presence of causal liaison between variables shows cointegration; though the track of causality is hazy. In this way, the Granger causality test (1969) is used to find causal relationship among variables. On other hand, Equation (5) builds up a Vector Error Correction model to check causality between variables.

Used data

Yearly data were gathered between 1971– 2014 from world indicator. Carbon dioxide outflows were estimated in millions of metric tons. Non-fossil fuel including renewable energy of solar, biomass, wind, hydroelectric and geothermal, is estimated in millions of tons of oil equivalent. Real GDP per capita is estimated in constant 2005 as USD and it is taken as proxy for economic growth. The utilization of electricity is estimated in as kilowatt hour (kwh).

Results and Discussion

Table 1: The Findings of Unit Root Test

Variables	**SIC Lag**	Level	**SIC Lag**	Ist difference	**Decision**
Ln(carbon dioxide)t	1	**-1 154**	**1**	**-11.228***	**I(1)**
Ln nft $_t$	**0**	**-2.609***	**0**	**-8.031*****	**I(0)**
Ln yt	**1**	**-0.115**	**1**	**-7.445*****	**I(1)**
Ln ect	**1**	**-2 .327**	**1**	**-5.393*****	**I(1)**

Note: *, **. *** shows 10%, 5%, 1% statistically significant respectively..

In spite of the fact that the ARDL strategy has numerous advantages than other econometrics techniques, it is just employed if the variables are I (0) or I (1). If the sequence of integration of variables exceeds over I(1), the ARDL technique is not suitable to find cointegration among variables. In this manner, it is important to apply a unit root test before employing the ARDL strategy. The ADF (augmented Dicky-Fuller test) is valid for analysis for a little sample size. The outcomes of this test demonstrated that the logarithmic type of all variables with the exception of ln(carbon dioxide)t was non-stationary at I(0). The series of all variables were stationary at the first difference I (1) level and are reported in Table 1. These results suggest ARDL may be applied to find cointegration between variables.

ARDL Technique

In view of the fact that the decision of lag length can influence the F-test, it is important to choose the best possible optimal lag order of the variables before use of ARDL bound test.

The best lag order is decided by using Akaike data model (AIC), Final Prediction Error (FPE) standard, Hannan-Quinn (HQ) rule and Schwarz data foundation (SIC) and probability proportion (LR). The optimal selected Lag order is represented by * in the following Table 2.

Table 2: The Lag order Selection criteria's findings

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-31.48	NA	6.93	1.774	1.943	1.835
1	124.21	272.47	6.45	-5.21	-4.366	-4.905
2	11.90	3.259*	0.004*	0.006*	0.597*	0.219*
3	153.28	21.17	8.19	-5.06	-2.86	-4.27
4	166.77	15.52	1.06	-4.93	-2.06	-3.900

After deciding the optimal lag order, the F-test is used to check the cointegration relationship among variables.

Table 3: The Findings of bound test for cointegration

Panel1: Bound test of cointegration	Diagnostics tests	
Assessed equation $Log(co_{2t}) = f(log(nf_t) + log(yt) + log(ec)$	$R^2 = 0.957$	Adjusted-R^2 = 0.954
Optimal lag level = 1	F-stat = 303.61*	Prob = 0.00
F- Statistics 0.208 (Wald Statistics)	D.W = 1.38	
Critical values critical values(T=41)	Breusch-Godfrey LM test: 0.104 (1.77)	
	Hetroskdasticity, Breusch-Godfrey ARCH test 0.435 (0.96) Hetroskdasticity ARCH 0.352(0.841)	
	Lower Bound I(0)	Lower bound I(1)
Significance level		
1%	4.31	5.54
5%	3.1	4.08
10%	2.59	3.45

The outcomes show the value of the F-statistics does not exceed the critical values of upper and lower bound and are reported in Table 3. As per the proposed by (Pesaran et al. 2001), there is no long run relationship among variables. The parameter of lnnft is non-positive and recommending that non fossil fuel power utilization diminishes carbon dioxide outflows and it is significant. For instance, a 1% expansion in use of non fossil fuel resources leads a 0.099% reduction in carbon dioxide outflows. The parameter of lnyt is positive and it statistically significant, suggesting carbon dioxide emanations increase with an expansion in per capita of GDP.The parameter of ln(ec)t is statically significant and positive, suggesting that electricity utilization per capita increase carbon dioxide emanations. It ought to be noticed that a1% increase in use of electricity consumption carbon dioxide discharges by 0.23%. This is in concurrence with past outcomes from (Friedl and Getzner, 2003) for Austria, (Shahbaz, 2012) for Pakistan.

Hypothesis: There is no serial correlation in the residual. However, the serial correlation in the residuals is determined by findings. The serial correlation removed by taking one period lag bar of dependent variable.

Table 4: Estimation of long-term coefficients.

Var	Coeff	Stand Error	t-Stat	Pro
C	-1.377	0.062	-22.143	0.000
Log(y)t	0.100	0.023	3.417	0.000
Log(nf)t	-0.099	0.050	-2.023	0.050
Log(ec)t	0.236	0.027	7.908*	0.000

*shows significant level 1%

The findings of Error Correction Model are assessed on the bases of SIC and they are presented in Table 5. The elasticity of carbon dioxide emission for non fossil fuel power utilization is negative in the short- run and long-run but this is statistically insignificant. However, these findings give little confirmation on the beneficial part of non fossil fuel power utilization on carbon dioxide outflows. Nonetheless, non fossil fuel power utilization reduces carbon dioxide emission in short term and long term, non fossil resources affects the climate of earth negatively in the short-term and long-term but statistically, these are insignificant, nevertheless, use of non fossil resources have positive trend to combat carbon dioxide emission in OLS regression analysis.

Economic growth has a nonnegative and statically insignificant impact on carbon dioxide discharges even at the 10% level in the short run and long term. The short-run elasticity of electricity consumption for carbon dioxide outflows is 0.23 which is statically significant and, show that a 1% expansion in use of electricity is connected with a 0.23% expansion in carbon dioxide discharges. The outcome recommends that a positive connection between electricity consumption and carbon dioxide discharges exists in the short-run but not in the long-run. The ECM (error-correction term) exposes speed of adjustment of the carbon dioxide to back its long -run equilibrium level after a shock. The error correction adjustment term is statically significant and non-positive. The evaluated parameter of ECM (t−1) is−0.43, which recommended the deviation from the long-term of carbon dioxide emanations in a single year, is adjusted by 43% over the next year.

Findings of VECM

Table 5 : Error Correction Representation

Dependent variable ΔCARBON DIOXIDE			
Var	Coeff	Std Error	T-ratio (Prob)
Δlog(CARBON DIOXIDE (-2))	0.06	0.09	-0.83(0.53)
Δlog (nf(-1))	-.05	0.041	-1.31 (0.19)
Δlog (y(-1))	-0.007	0.035	0.21 (0.83)
Δlog (ec(-2))	0.23	0.08	2.75(0.00)
ECT(-1)	-0.43	0.161	-2.59(0.01)

Table 5 shows the consequences of the Granger causality examination. These findings conclude that a unidirectional relationship from carbon dioxide emanations to GDP per capita to exists, as well, demonstrating that GDP per capita causes carbon dioxide outflows. These outcomes are in concurrence with results of (Shafieiand Salim 2014) for OECD nations but not match with results of (Salim and Rafiq, 2012) for India, which shows unidirectional causality from carbon dioxide emanations to GDP per capita. It additionally verified from (Xue et al. 2014) for nine European nations and (Peng et al. 2016) for China.

Table 6: The findings of Granger Causality

Null Hyp	F-Statistics	Prob
Δlog(GDP) does not Granger cause Δlog (CARBON DIOXIDE)	1.26	0.29
Δlog (CARBON DIOXIDE) does not Granger cause Δlog(GDP)	3.12	0.05
Δlogne does not Granger cause Δlog (CARBON DIOXIDE)	4.94	0.01
Δlog (CARBON DIOXIDE) does not Granger cause Δlog ne	0.39	0.66
Δlog nf does not Granger cause Δlog(CARBON DIOXIDE)	0.80	0.45
Δlog (CARBON DIOXIDE) does not Granger cause Δlognf	0.06	0.93

Electricity has a significant influence on carbon dioxide emission and, recommending a bidirectional connection between them. These findings are reliable with results of (Tang and Tan 2015) for Vietnam, and (Halicioglu 2009) for Turkey, but they are contrast with the results of (Soytas and Sari 2009).

Stability results tests

The CUSUM and CUSUMSQ techniques are employed to find the stability for the coefficients in the model. If the graphs of CUSUM and CUSUMSQ techniques stay between the red boundary lines, then each parameter in the manufactured Error Correction Model (ECM) would be steady. The findings of CUSUM and CUSUMSQ tests are represented by Figures 1 and 2.

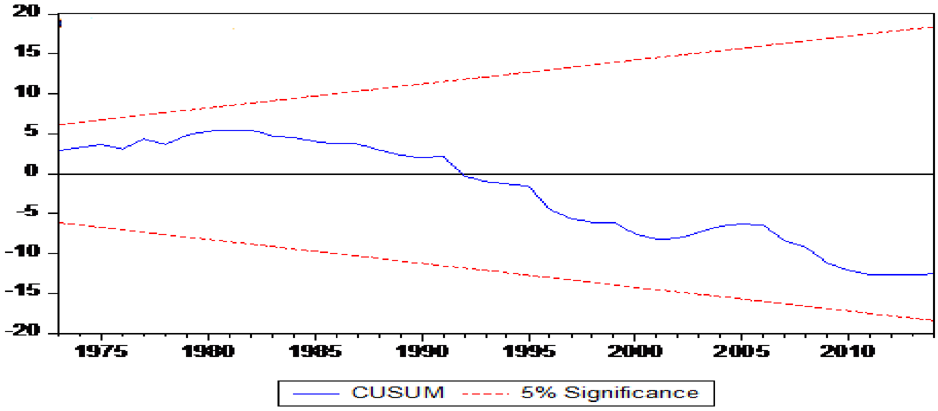

Figure 1: Stabilization of model for analysis

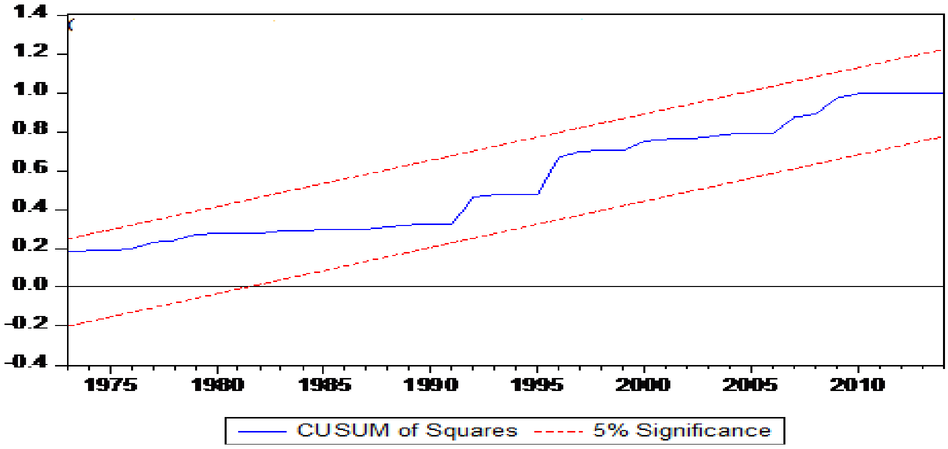

Figure 2: Stabilization of model for analysis

Subsequently, the selected model can be applied for policy making.

Conclusion

This study explores the long-term and short-term relationship among carbon dioxide (CO_2) emission, non fossil-fuel power (nuclear energy), electricity, and economic growth in Pakistan by using an ARDL approach. The OLS regression analysis is examined relationship among carbon dioxide emission, non fossil-fuel power, electricity and economic growth. The use of non fossil fuel power decreases carbon dioxide emissions, while increase of economic growth and electricity increases carbon dioxide emissions. The short-term relationship, among non fossil-fuel power consumption, electricity consumption and economic growth were examined by using ECM. The use of non fossil-fuel power reduces carbon dioxide emanations in the long run but it is insignificant in Pakistan. Electricity power consumption causes a significant increase in carbon emanations in short term, while in long term it remains ineffective. However, GDP per capita does not have any incredible effect on carbon dioxide emanations in the long-run and short-run because it is insignificant. The Granger causality analysis demonstrates one-way causal relationship from GDP per capita to carbon dioxide emanations and other one-way causal relationship from nuclear power consumption to carbon dioxide emanations.

These outcomes have essential ramifications for policy makers. Particularly, the outcomes demonstrate that the use of non fossil fuel power and carbon dioxide discharges will keep on growing over the long- term in the upcoming decades. The raise of allocation of renewable resources and reduction in enslavement on fossil fuels may decrease contamination and brings economic stability and sustainable growth. For paradigm, the government should prepare and execute efficient strategies to promote use of share of non fossil fuel power to control contamination in environment. These findings are reliable with results of (Tang and Tan 2015) for Vietnam, (Halicioglu 2009) for Turkey, Friedl and Getzner, 2003) for Austria, and (Shahbaz, 2012) for Pakistan, but they are contrast with the results of (Soytas and Sari 2009).

References

Al-Mulali, U.; Solarin, S.A.; Ozturk, I. (2016). Investigating the environmental Kuznets curve hypothesis in seven regions: The role of renewable power. *Ecol. Indic.*, 67, 267–282. [CrossRef

Apergis, N.; Payne, J.E.; Menyah, K.; Wolde-Rufael, Y. (2010). On the causal dynamics between emanations, nuclear power, renewable power, and economic growth. Ecol. Econ., 69, 2255–2260. [CrossRef]

.B ento, J.P.C.; Moutinho, V.M.F. (2016). CARBON DIOXIDE emanations, non-renewable and renewable electricity production, economic growth, and international trade in Italy. Renew. Sustain. *Power Rev*., 55, 142–155. [CrossRef]

Chang. T.H, Chiu, C.L.;,. (2009**).** What proportion of renewable power supplies is needed to initially mitigate CARBON DIOXIDE , emanationsin OECD member countries? Renew. Sustain. *Power Rev*., 13, 1669–1674. [CrossRef]

Daskalakis, G.; Psychoyios, D.; Markellos, R.N. Modelling. (2009). Carbon Dioxide Emission Allowance Prices and Derivatives: Evidence from the European Trading Scheme. *J. Bank. Financ*, 33, 1230–1241. [CrossRef]

Dogan, E.; Seker, F.(2016**).** The influence of real output, renewable and non-renewable power, trade and financial development on carbon emanationsin the top renewable power countries. Renew. Sustain. *Power Rev*., 60, 1074–1085. [CrossRef]

Elliott, G.; Rothenberg, T.J.; Stock, J.H. (1996). Efficient Tests for an Autoregressive Unit Root. Econometrica, 64, 813–836. [CrossRef

Friedl, B.; Getzner, M. (2003**).** Determinants of CARBON DIOXIDE emanations in a small open economy. *Ecol. Econ*. 45, 133–148.

Granger, C.W.J. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. Econometrica 37, 424–438. [CrossRef]

Halicioglu, F. An econometric study of CARBON DIOXIDE , emanations, power consumption, income and foreign trade in Turkey. Power Policy **2009**, 37, 1156–1164. [CrossRef]

Irandoust, M. (2016). The renewable power-growth nexus with carbon emanations and technological innovation: Evidence from the Nordic countries. *Ecol. Indic*., 69, 118–125. [CrossRef]

Iwata, H.; Okada, K.; Samreth, S. (2010). Empirical study on the determinants of CARBON DIOXIDE emanations: Evidence from OECD countries. *Appl. Econ*., 44, 3513–3519. [CrossRef

Jaforullah, M.; King, A. (2015). Does the use of renewable power sources mitigate carbon dioxide, emanations? A reassessment of the US evidence. *Power Econ*., 49, 711–717. [CrossRef]

Jalil, A.; Feridun, M. (2011**).** The impact of growth, power and financial development on the environment in China: A cointegration analysis. Power Econ., 33, 284–291. [CrossRef]

Liu, Q. (2005**).** Impacts of oil price fluctuation to China economy. Quant. Tech. Econ., 3, 17– 28.

Menyah, K.; Wolde-Rufael, Y. (2010**).** CARBON DIOXIDE, emanations, nuclear power, renewable power and economic growth in the US. *Power Policy*, 38, 2911–2915. [CrossRef]

Narayan, P.K. .(2005). The saving and investment nexus for China: Evidence from cointegration tests. Appl. Econ, 37, 1979–1990. [CrossRef]

Peng, H.; Tan, X.; Li, Y.; Hu, L. **(**2016). Economic Growth, Foreign Direct Investment and CARBON DIOXIDE Emanations in China: A Panel Granger Causality Analysis. Sustainability 8, 233. [CrossRef]

Pesaran, M.H.; Pesaran, B. (1997) WorkingwithMicrofit4.0: Interactive Econometric Analysis; Oxford University Press: Oxford, UK,

Pesaran, M.H.; Smith, R.J.; Shin, Y. (2001). Bound Testing Approaches to the Analysis of Level Relationships. J. Appl. Econ., 16, 289–326. [CrossRef]

Salim, R.A.; Rafiq, S..(I 2012). Why do some emerging economies proactively accelerate the adoption of renewable power? Power Econ, 34, 1051–1057. [CrossRef]

Shafiei, S.; Salim, R.A. (2014). Non-renewable and renewable power consumption and CARBON DIOXIDE emanationsin OECD countries: A comparative analysis. Power Policy, 66, 547–556. [CrossRef]

Shahbaz, M. (2013). Does financial instability increase environmental degradation? Fresh evidence from Pakistan. Econ. Model. 33, 537–544. [CrossRef]

Shahbaz, M.; Hye, Q.M.A. (2013**).** Economic growth, power consumption, financial development, international trade and CARBON DIOXIDE , emanationsin Indonesia. Renew. Sustain. *Power Rev*., 25, 109–121. [CrossRef]

Shahbaz, M.; Lean, H.H. (2012**).** Does financial development increase power consumption? The role of industrialization and urbanization in Tunisia. *Power Policy*, 40, 473–479. [CrossRef]

Shahbaz, M.; Uddin, G.S.; Rehman, I.U.; Imran, K. (2014). Industrialization, electricity consumption and CARBON DIOXIDE , emanationsin Bangladesh. Renew. Sustain. *Power Rev*. 31, 575–586. [CrossRef]

.Silva, S.; Soares, I.; Pinho, C. (2012). The Impact of Renewable Power Sources on Economic Growth and CARBON DIOXIDE Emanations—A SVAR Approach. *Eur. Res*. Stud., 15, 133–144.

Sokka, L.; Sinkko, T.; Holma, A.; Manninen, K.; Pasanen, K.; Rantala, M.; Leskinen, P. (2016) .Environmental impacts of the national renewable power targets—A case study from Finland. *Renew. Sustain. Power Rev*., 59, 1599–1610. [CrossRef]

Soytas, U.; Sari, R. (2009) Power consumption, economic growth, and carbon emanations: Challenges faced by an EU candidate member. *Ecol. Econ*. 68, 1667–1675. [CrossRef]

Tang, C.F.; Tan, B.W.(2015). The impact of power consumption, income and foreign direct investment on carbon dioxide emanationsin Vietnam. Power, 79, 447–454. [CrossRef]

Tiwari, A.K. A. (2011**)**. Structural VAR Analysis of Renewable Power Consumption, Real GDP and CARBON DIOXIDE Emanations: Evidence from India. *Econ. Bull*., 31, 1793–1806.

Xue, B.; Geng, Y.; Müller, K.; Lu, C.; Ren, W., (2014). Understanding the Causality between Carbon Dioxide Emission, Fossil Power Consumption and Economic Growth in Developed Countries: An Empirical Study. *Sustainability* 6, 1037–1045. [CrossRef]