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Energy Consumption-Economic growth accessing the evidence from Turkey

Muhammad Kamran Bhatti[1], Iqra[2], Waqar Badshah[3]

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ABSTRACT

The core objective of the study is to investigate the relationship of the energy consumption and economic growth in the context of the Turkey and used the data period from 1986 to 2018 and data source is World Bank. To achieve the objective of the study different estimation techniques such as Descriptive Statistics, Augmented Dickey Fuller Test (ADF) used to test the unit root and Johansson co-integration test (JCT) used to test the long run relationship among the variables and to check the causation between the variable Pairwise Granger Causality Test are applied. Bi-Variate Co-Integration Results indicate that EC and TO are co-integrated in the long run. The results of the Pairwise Granger Causality Test show TO does Granger Cause GDP, INF does Granger Cause GDP, GDP does Granger Cause LF, LF does Granger Cause EC, INF does Granger Cause DI, DI does Granger Cause LF, all these show the existence of the unidirectional relation. TO does Granger Cause EC and EC does Granger Cause TO. Bidirectional relationship exists between TO and EC in the economy of the Turkey. Study suggests that policy makers would adopt those policies in which exports of goods and services should increase and also give the boost to the domestic investment in the country.

[1]National College of Business Administration & Economics Multan Campus
[2] Government College University Faisalabad (Layyah Campus), Pakistan
[3] Faculty of Business and Management Science, Intanbul Sabahattin Zaim University, Istanbul, Turkey

1 Introduction

Turkey is being looked upon as a growing market and considerable economic entity on the face of earth. Due to increasing population of Turkey and increasing development in cities has caused higher energy consumption. Turkey is surely being considered to have set benchmarks for last 30 years or so. Contrarily, the energy standards which were set by Turkey during 1990s are now being considered to be revamped as those methods are being considered as outdated. Paradoxically, once more in connection with growth rates of economy, Turkish energy sector is setting standards with which other economic indicators are to be assessed. Domestically 37% energy is consumed in Turkey itself and during the span of 2000 and 2010, approximately $55 billion will be required for energy. 81% of this amount is thought of as an investment by the government. Most important resources for energy production include asphalt, hard coal, lignite, petrol, natural gas, hydroelectric energy and geothermal energy. Turkey has a variety of natural energy resources including but not limited to wood, solar energy resources, natural gas and oil. Turkey produces and consumes these energy resources. Non-sustainable resources such as fossil fuel reserves are not present in Turkey. It looks like quite a task to meet the expected future demand of oil,

natural gas and coal. However, Turkey has renewable resources in the form of huge reserves. Turkey is buying gas from Azerbaijan through a pipeline (Baku-Tbilisi-Ceyhan) which connects Azerbaijan to Europe. The total length currently transmitting gas in Turkey is 1076 km and total BTC line is 1768 km.

In the first place, Turkey is an aspirant of European Union membership in the near future and putting together to achieving European Union membership can help somehow turkey in bringing stability in its economy. Secondly, Turkey holds the key position of transit country between Azerbaijan and Europe as oil and gas pipelines go through Turkey, giving it a strategic advantage. Thirdly and most importantly, Turkey economy has seen a booming structure for past few years and it is fascinating to investigate its economic development performance. According to survey conducted by OECD, a long run annual growth rate capacity of 7% can be achieved by Turkey (OECD, 2004).

A comprehensive policy review of Turkish energy condition and environmental issues related to energy upto 2025 was given by UNDP and WB (2003). In a clear contradiction to the general view, that lose governance of Turkey was responsible for Turkish economic crisis, it was strict policies of International Monetary Fund responsible for crisis because of too tight control by IMF, which didn't empower the central bank of Turkey. This step by international monetary fund of disempowering central bank made Turkish economy so much fragile that it was shocked with short term foreign capital in November 2000 and in February 2001. The existence of short-term capital is considered as casino capital in Turkish economy which once drawn overnight can quickly destabilize the economy and bring devastating effects, as was the case of Turkish economic crisis in 2001.

Besides, important Turkish economic indicators have become weak due to Ponzi-schemes which are unsustainable. Moreover, the wave of growth in 2003/2004 is generated by an inflow of foreign capital to keep the Turkish lira strong. This short-term foreign capital is volatile, as the two crises in 2000 and 2001 have shown. In addition, unemployment is still high (10.6% in 2004 according to OECD data) and there has been no growth in wages. There is also room for optimism, because the hyperinflation in the 80s and 90s converged to a single digit rate since 2004.

2 Literature Review

Waheed, Sarwar and Wei, (2019) interrogated the relationship of energy consumption, carbon emission and economic growth in single country as well as multi-country. The results show that energy consumption and economic growth are significant impact on carbon emission and economic growth impact the carbon emission in developing countries on the other hand there is no relationship between carbon emission and economic growth in developed countries. The results also show that energy consumption is highly impact the economic growth in developing countries and less impact in developed countries. The higher energy consumption is the main reason for carbon emission in both developing and developed countries.

Thaker, Thaker, Amin, Pitchay, Nugroho, Pasay and Panennungi, (2019), examined the long run and causal relationships between electric power consumption and real GDP using error-correction model. They showed that electricity consumption has a positive impact on economic growth but there was unidirectional Granger causality running from electricity consumption to real GDP but not vice versa.

Nyasha, Gwenhure and Odhiambo, (2018), investigated the relationship among the energy consumption and economic growth in Ethiopia. The findings show that there is unidirectional causality among economic growth and energy consumption in long run and short run of Ethiopia.

Koondhar, Qiu, Li, Liu and He (2018), examined the relationship between energy consumption, air pollution and economic growth in China and USA. The results show that energy consumption and air pollution are statistically significant. The results also show that energy consumption have positive impact on economic growth in china and air pollution increase due to increase in energy consumption. The findings of USA were exactly opposite the situation of China.

Nadeem and Munir (2016), interrogated the impact of energy consumption (oil, coal gas & electricity) on different sectors of economy and economic growth of Pakistan. The findings show that the long run relationship among the independent variables (aggregate and disaggregate oil, coal, gas and electricity consumption in different sectors) and dependent variable economic growth can exist in Pakistan.

Destek and Ozsoy (2015), examined the Relationships between economic growth, energy consumption, globalization, urbanization and environmental degradation in Turkey using ARDL bound test approach and asymmetric causality tests. the economic growth. Study shows that energy consumption, urbanization level, globalization and CO2 variables are co-integrated. And in the asymmetric causality test results, it is seen that the energy consumption and economic growth led to environmental degradations, but on the other hand, economic globalization decreased the CO2 emission.

Toppali and Alagoz (2014), examined the relationship of energy consumption and economic growth in Turkey. During the short run, there is unidirectional relationship between real GDP per capita to energy consumption per capita which means that with increase in income, there is an increase in consumption of electricity. In the long run there is co-integration between the said variables which means there is bi-directional relationship between the variables.

Nazlioglu, Kayhan and Adiguzel, (2014), investigated the causality between electricity consumption and economic growth of Turkey over the span of 1967 to 2007 using non-linear Granger causality test as opposed to previous studies and found out that there is no causality relationship between these variables and it supports neutrality hypothesis. Hence energy conservation policies can be promulgated.

Ahmed, Zaman, Taj, Rustam, Waseem, and Shabir, (2013), examined the relationship between electricity consumption per capita (ELEC) and real per capita income (y) over a period of 1975 to 2009 using Granger causality test to determine the causal relationship between the selected variables. Study shows bi-directional causality between the electricity consumption per capita and real per capita income.

Aktas and Yilmaz (2008), tried to explore the relationship between oil consumption and GNP of Turkey. The study concluded existence of a bi-directional relationship between the variables in the both short and long run and austerity measures in usage of oil may deter employment and income.

Balat, (2007), analyzed the Energy consumption and economic growth in Turkey the showed that Turkey's gross national production has grown at an average annual rate of 5% since 1983. Turkey's energy demand has risen rapidly as a result of social and economic development. The country's energy consumption has grown considerably since the beginning of the 1980s. The Turkish government encourages foreign and Turkish private sector investors to implement the energy projects and is currently working on a new investment model for the construction of new generation plants to create the additional capacity needed.

Lise and Van Montfort (2007), investigated the relationship between energy consumption and economic growth in Turkey. The findings show that there is a co-integration between energy consumption and economic growth.

The causality between energy consumption to economic growth is bi-directional and economic growth to energy consumption is unidirectional. This situation indicates that increase in energy consumption means increase in economic growth in Turkey.

Altinay and Karagol (2005), studied the causality relationship between energy consumption and economic growth of Turkey during 1950 to 2000. The study reflects that there is uni-directional causality relationship between energy consumption and economic growth of Turkey while using disaggregated level which means that consumption of energy causes increase in the economic growth of Turkey, whereas on aggregated primary consumption of energy there is no causality between the variables.

3 Methodology

This study uses the data period from 1986 to 2018 and data source is World Bank. To achieve the objective of the study, different estimation techniques such as Descriptive Statistics, Augmented Dickey fuller Test (ADF) used to test the unit root and Johansson co-integration (JCT) Analysis used to test the long run relationship among the variables and to check the causation between the variable Pairwise Granger Causality Test are applied. Mathematical model of the study is,

GDP = f (EC, DI, TO, INF, ELF)

The econometrics form of the model is,

Model: $GDP_t=\alpha_O+\alpha_1EC_t+\alpha_2DI_t+\alpha_3TO_t+\alpha_4INF_t+\alpha_5ELF_t+€o$

Where:

GDP= Gross Domestic Product per Capita (current US$ in Millions)

EC= Energy Consumption (kg of oil equivalent per capita)

DI= Domestic Investment (Current US$ in Millions)

TO= Trade Openness (Current US$ in Millions)

INF= Inflation (annual %)

ELF= Employed Labour Force, Total (in Millions)

t= Time Series

€= Error Term

4 Results and Discussion

Descriptive Statistics

Descriptive statistics of data is used to describe the basic structures of dataset such as mean median, and mode are the three measures of central tendency of a random variable (Gujarati,2004). The main feature of descriptive statistics is to present quantitative descriptions of the data in a manageable form like table. Thus, descriptive statistics are estimated for all the variables included in the model.

Table :1 Descriptive Statistics

	GDP	EC	DI	TO	INF	LF
Mean	6223.34	1238.795	116937.5	97747.26	39.05538	23.34547
Median	4496.497	1178.38	64678.04	58321.18	34.61008	21.9097
Maximum	12519.39	1651.361	271147	227780.6	105.215	32.57979
Minimum	1510.677	844.9385	12977.27	10081.24	6.250977	19.23478

Std. Dev.	3827.584	252.2318	92800.12	76552.06	31.78444	3.844812
Skewness	0.329042	0.192153	0.497036	0.44821	0.401739	1.120838
Kurtosis	1.452209	1.66209	1.573748	1.600406	1.705586	3.054672
Jarque-Bera	3.889504	2.664332	4.155762	3.798347	3.19149	6.913644
Probability	0.143023	0.263905	0.125195	0.149692	0.202757	0.03153
Sum	205370.2	40880.25	3858937	3225660	1288.828	770.4006
Sum Sq. Dev.	4.69E+08	2035869	2.76E+11	1.88E+11	32328.03	473.0424
Observations	33	33	33	33	33	33

Source: Software E-Views 9.0

The dispersion of the variables in the series is measured by the standard deviation. The outcomes of the Descriptive Statistics' table show that violence of Domestic Investment (DI) is highly uneven in the standard deviation. The skewness values of Gross Domestic Product (GDP), Energy Consumption (EC), Domestic Investment (DI), Trade Openness (TO), Inflation (INF) and Employed Labor Force (ELF) indicate that distribution is progressive. Kurtosis value of ELF is 3 that is equal to the standard value of Kurtosis that is 3. The platykurtic distribution is shown by the GDP, EC, DI, TO and INF because their values are less than the standard value 3.

Unit Root

To achieve the long run relationship among the variables, we apply the Co-integration analysis. Primary assumption of the co-integration analysis is, data should be stationary. Unit root test is applied to achieve this assumption. Unit root test is a stationarity test (or non-stationarity test). A vital assumption of Augmented Dickey fuller Test (ADF) test which is independently and identically distribution of the error term. Phillips and Perron (PP) use nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. Since the asymptotic distribution of the PP test is the same as the ADF test statistic (Gujarati, 2004). Next assumption is, value of the variance should be constant. Moreover, if we checked the stationarity of data at level but the result is non-stationarity, then we will take first difference and results are stationarity that will be our required results for the co-integration analysis (Gujarati, 2004).

Table: 2 Unit Root Results

	ADF at Level		ADF at 1st Difference	
Variables	t-Statistic	Prob.*	t-Statistic	Prob.*
GDP	-1.69127	0.7318	-6.00223	0.0001
EC	-3.10843	0.1215	-6.57138	0.0000
DI	-2.53405	0.3108	-6.39462	0.0000
TO	-1.61255	0.7655	-5.20069	0.0011
INF	-1.67096	0.7407	-4.51094	0.0058
ELF	-0.55982	0.9748	-6.6128	0.0000

Source: Software E-Views 9.0

Findings of the Unit Root show that all the variables in the study are stationary at first difference by employing the Augmented Dickey Fuller (ADF) Test. After checking the stationarity of the variables, we can move to the co-integration analysis.

Co-integration Analysis

Co-integration shows the long-run, or equilibrium, relationship between the two (or more) time series. (Gujarati, 2004). But the co-integration does not tell about the direction of causality (Hendry & Juselius, 2001).

Table: 3 Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.Value
None	0.73907	121.5262	95.75366	0.0003***
At most 1	0.645151	79.87761	69.81889	0.0063***
At most 2	0.539411	47.75967	47.85613	0.0511*
At most 3	0.381786	23.72693	29.79707	0.2122
At most 4	0.245979	8.818392	15.49471	0.3824
At most 5	0.002127	0.066014	3.841466	0.7972

Source: Software E-Views 9.0

Notes: Statistical significance levels: ***1%; **5%; *10%

Table: 4 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.Value
None *	0.73907	41.64858	40.07757	0.033**
At most 1	0.645151	32.11794	33.87687	0.0799*
At most 2	0.539411	24.03274	27.58434	0.1336
At most 3	0.381786	14.90854	21.13162	0.2954
At most 4	0.245979	8.752378	14.2646	0.3073
At most 5	0.002127	0.066014	3.841466	0.7972

Source: Software E-Views 9.0

Notes: Statistical significance levels: ***1%; **5%; *10%

Findings of the table 3 Trace Statistics and table 4 Maximum Eigen Statistics show that long run co-integration exist among the series of the model.

Table:5 Bi-Variate Co-integration Results

Variables	Eigenvalue	Trace Statistic	0.05 Critical Value	
GDP EC	0.23951	10.38363	15.49471	No Cointegration
	0.05933	1.896064	3.841466	
GDP DI	0.205114	9.152164	15.49471	No Cointegration
	0.063564	2.035897	3.841466	
GDP TO	0.245494	10.17361	15.49471	No Cointegration
	0.045425	1.441162	3.841466	
GDP INF	0.343901	14.21826	15.49471	No Cointegration
	0.036527	1.153524	3.841466	
GDP LF	0.331265	13.50113	15.49471	No Cointegration
	0.03261	1.027745	3.841466	

EC DI	0.283226	11.70551	15.49471	No Cointegration
	0.043622	1.382677	3.841466	
EC TO	0.373486	17.18489	15.49471	Cointegration
	0.083109	2.689769	3.841466	
EC INF	0.157702	5.844003	15.49471	No Cointegration
	0.016752	0.523726	3.841466	
EC LF	0.326352	13.12495	15.49471	No Cointegration
	0.02794	0.878485	3.841466	
DI TO	0.194094	8.652519	15.49471	No Cointegration
	0.061362	1.963093	3.841466	
DI INF	0.328277	13.2541	15.49471	No Cointegration
	0.029207	0.918918	3.841466	
DI LF	0.328629	12.69415	15.49471	No Cointegration
	0.010994	0.342692	3.841466	
TO INF	0.228749	9.923981	15.49471	No Cointegration
	0.0586	1.872013	3.841466	
TO LF	0.28463	10.60657	15.49471	No Cointegration
	0.007167	0.222967	3.841466	
INF LF	0.276926	10.05305	15.49471	No Cointegration
	4.85E-05	0.001504	3.841466	

Source: Software E-Views 9.0

If the trace statistic value is higher than the critical value which indicates that Bi-Variate relationship between the variables exist in the long run. Bi-Variate Co-integration Results indicate that EC and TO are co-integrated in the long run because its trace statistics value is greater than critical value. While other variables GDP EC, GDP DI, GDP TO, GDP INF, GDP LF, EC DI, EC INF, EC LF, DI TO, DI INF, DI LF, TO INF, TO LF and INF LF are not co-integrated in the long run.

Table: 6 Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
EC does not Granger Cause GDP	30	0.14454	0.9321
GDP does not Granger Cause EC		1.18415	0.3376
DI does not Granger Cause GDP	30	0.93593	0.4393
GDP does not Granger Cause DI		0.66736	0.5807
TO does not Granger Cause GDP	30	2.9194	0.0557
GDP does not Granger Cause TO		0.68284	0.5716
INF does not Granger Cause GDP	30	2.58838	0.0775
GDP does not Granger Cause INF		0.45994	0.7129
LF does not Granger Cause GDP	30	1.11493	0.3634
GDP does not Granger Cause LF		2.41279	0.0927
DI does not Granger Cause EC	30	2.23362	0.1114
EC does not Granger Cause DI		0.57494	0.6373

TO does not Granger Cause EC	30	4.45404	0.0132
EC does not Granger Cause TO		2.99214	0.0518
INF does not Granger Cause EC	30	1.29692	0.2993
EC does not Granger Cause INF		0.19284	0.9002
LF does not Granger Cause EC	30	3.35855	0.0363
EC does not Granger Cause LF		1.69596	0.1957
TO does not Granger Cause DI	30	2.23763	0.111
DI does not Granger Cause TO		0.88262	0.4647
INF does not Granger Cause DI	30	3.47041	0.0326
DI does not Granger Cause INF		0.37477	0.772
LF does not Granger Cause DI	30	0.83954	0.4861
DI does not Granger Cause LF		2.82609	0.0611
INF does not Granger Cause TO	30	1.08273	0.3761
TO does not Granger Cause INF		0.77292	0.521
LF does not Granger Cause TO	30	0.31678	0.8131
TO does not Granger Cause LF		1.05799	0.3861
LF does not Granger Cause INF	30	0.47901	0.7
INF does not Granger Cause LF		0.98601	0.4167

Source: Software E-Views 9.0

Notes: Statistical significance levels: ***1%; **5%; *10%

Table 5 show the results of the Pairwise Granger Causality Test. In the table the first column shows the null hypothesis for possible rejection at different significance level. Whereas second column shows the number of the observations third column F statistic and fourth column show probability value. TO does not Granger Cause GDP with probability value 0.0557 that indicate TO does Granger Cause GDP and TO has Positive impact on the GDP of the economy. There is a unidirectional relationship between the TO and GDP. INF does not Granger Cause GDP with probability value 0.0775 that show INF does Granger Cause GDP and INF has positive impact on GDP. Unidirectional relationship exists between the INF and GDP. GDP does not Granger Cause LF with probability value 0.0927 that means GDP does Granger Cause LF, when GDP increased it became the cause to increase in the LF. It also has unidirectional association. TO does not Granger Cause EC with probability value 0.0132 that means TO does Granger Cause EC and EC does not Granger Cause TO with probability value 0.0518 that means EC does Granger Cause TO. Bidirectional relationship exists between TO and EC in the economy of the country. LF does not Granger Cause EC with probability value 0.0363 that means LF does Granger Cause EC. This result shows the unidirectional relationship between the LF and EC. Similarly, INF does not Granger Cause DI with probability value 0.0326 that means INF does Granger Cause DI and INF has positive impact on the DI of the country, also show the unidirectional relationship between the INF and DI. Moreover, DI does not Granger Cause LF with probability value 0.0611 that means DI does Granger Cause LF and DI has positive impact on the LF in the Turkey, also present the unidirectional existence.

5 Conclusion

The core objective of the study is to investigate the relationship of the energy consumption and economic growth in the context of the Turkey and used the data period from 1986 to 2018 and data source is World Bank. To achieve the objective of the study different estimation techniques such as Descriptive Statistics, Augmented Dickey fuller Test (ADF) used to test the unit root and Johansson co-integration test (JCT) used to test the long

run relationship among the variables and to check the causation between the variable Pairwise Granger Causality Test are applied.

Bi-Variate Co-integration Results indicate that EC and TO are co-integrated in the long run. While other variables GDP EC, GDP DI, GDP TO, GDP INF, GDP LF, EC DI, EC INF, EC LF, DI TO, DI INF, DI LF, TO INF, TO LF and INF LF are not co-integrated in the long run. The results of the Pairwise Granger Causality Test show TO does Granger Cause GDP. There is a unidirectional relationship between the TO and GDP. INF does Granger Cause GDP and INF has positive impact on GDP. Unidirectional relationship exists between the INF and GDP. GDP does Granger Cause LF, when GDP increased it became the cause to increase in the LF. It also has unidirectional association. TO does Granger Cause EC and EC does Granger Cause TO. Bidirectional relationship exists between TO and EC in the economy of the country. LF does Granger Cause EC. This result shows the unidirectional relationship between the LF and EC. Similarly, INF does Granger Cause DI and INF has positive impact on the DI of the country, also show the unidirectional relationship between the INF and DI. Moreover, DI does Granger Cause LF and DI has positive impact on the LF in the Turkey, also present the unidirectional existence. Study suggests that policy makers would adopt those policies in which exports of goods and services should increase and also give the boost to the domestic investment in the country.

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