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Energy Consumption and Industrial Sector Performance in Pakistan

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ABSTRACT

Energy consumption has central value to evaluate the performance of manufacturing sectors. The purpose of this study is to look into consumption of energy and performance of industrial sector in Pakistan. The period of analysis is from 1980 to 2016. The long run results showed oil and electricity consumption has positive affiliation with performance of industrial sector. Total renewable consumption of energy, energy imports and gross capital formation have negative connection with Pakistan's industrial sector performance. Moreover, the trade and labor force are found for the positive relationship with performance of industrial sector. The study advised that the government ought to target their renewable energy resources to urge get advantage from their renewable energy resources which is able to improve the industrial sectors' performance and economic growth of Pakistan.

1. Introduction

In the contemporary world, economic enlargement is the basic objective. In increment of financial expansion is realized by increasing production level of an economy. In this respect, industrial sector plays an imperative role. The economic process is augmented by increasing the production level with the help of industrial sector. However, energy plays key role in industrial development. Industrial production cannot be increased with short supply of energy.

In the world of today, demand for energy for industrial sector is huge. Several countries do face the difficulty of shortage of energy. It has now become a massive obstacle in the way of industrial expansion. The demand for energy is accumulated in consumption as well as production sector therefore the entire economic behavior is changed. Therefore, large amount of countries are switching towards some of the renewable energy sources. At the globe, power enlargement is straight a way connected to the welfare and prosperity. Industrialization is essential to realize economic prosperity. But there must not be any deficiency of energy sources towards the industrial sector of particular state. The industrial sector provides jobs opportunities, useful towards economic development, and plays vital role in overcoming socioeconomic issues of a country.

Power is vital source of economic enlargement. The economic development rests on the sturdy ease of power and from affordable sources, straightforward to urge, as importantly environment friendly. Resources of power are the foundation of economic development and contemplate being the

life-line of the nation. No country can possibly meet the goals of economic development in the presence of an expensive energy source. (Shair & Qureshi, 2007).

Pakistan is facing of diverse challenges such as termism, energy insufficiency, unemployment, immense population, low income per capita, inequitable resource distribution, corruption, inflation, and low living standards. To archive the goal of economic development inexpensive resource of power must be available to generate the cheap production.

Energy is contemplated as significant towards information technology, industry, transport, home and agriculture. The requirement of energy is increasing by every passing moment however availability is not increasing as desired. Oil is additionally the necessary supply of energy within the world. However increment in the oil costs within the previous year increment the cost of production that badly has an effect.

The purpose of this study is to measure connection between power usage and industrial segment of Pakistan. The objectives of study are;

1. To find out the sector wise trends of energy consumption in Pakistan.
2. To discover the sources and contribution of various form of energy in Islamic Republic of Pakistan.
3. To estimate the link among the power use and industrial section act in Islamic Republic of Pakistan.

2. Theoretical Review

A lot of researches are polishing off to search the rapport amongst power usage and industrial production in Pakistan. Currently energy sector is considered a vital sector for an expansion of economic development and growth.

Aqeel & Butt (2001) declared relations of employment, consumption of energy, and economic growth of Pakistan .The outcome exposed that economic growth and electricity consumption had underlying connection. Comprehensively, consumption and production in industries are accrued that ends up in economic growth of Pakistan.

Ghosh (2002) noticed causal association of consumption of energy and energy growth of India during 1950 to 1997. The granger causality test was employed to search the linkage of economic growth and consumption of energy in India. The result found one sided causality from consumption of electricity to economic growth.

Hu & Lin (2008) explored the relationship between the energy consumption and gross domestic product. The study employed frame work of non-linearity to check out equilibrium among consumption of energy and GDP. To check the stationary of data unit root test has been employed. This study used the ADF test on entire variables that recommended the use of co integration technique of vector ECM.

Sari *et al*. (2008) founded the linkage at consumption of divagated energy in USA and production of industrial sector employment level. The data was collected from 2000:1 to 2005:6 and 2000 is used as based year. The ARDL model helped exploring the consequences of the long run

which showed that; employment, industrial sector's production and energy consumption had distinctive relationship.

Loganathan *et al*. (2010) explored that Malaysian Govt. took thoughtful actions for the achievement of the energy requirement that is helpful for the augmentation of the pace of economic development. The study used data range of 1971 to 2008. ARDL and ECM were worn to trace the association of unusual variables. The significance of the revise revealed bidirectional causal relation among gross domestic product and EC.

Ellahi (2011) assumed that industry is incredibly vital for economic development. Countries improve their industrial sectors of country that nations are such as China, Korea and growth rate is very high due to the industrialization. The data was chosen from 1980 to 2009. The result of the analysis showed that there is capital, labor, and electrical energy that provide manufacturing sector a segment of growth which later play an imperative part in country's economic growth.

Akpan and Akpan (2012) found that energy sector achieves a thoughtful considerations by the developing and developed nations. Currently, energy is chosen as the most significant factor in any economy. The data was from 1970 to 2008. Vector ECM was used to find empirical connotation between consumption of electricity, economic growth and carbon emission. The results showed that emission of carbon raised due to addition in consumption of electricity in the country.

Akhtar *et al*. (2012) scrutinized energy sector to be a prerequisite of economic growth. The foremost sources of energy are coal, oil gas, and electricity that are used in Pakistan. The outcome of the research showed that enterprise can improve the financial presentation and can show an imperative role in country's economic growth. Energy and fuel sector performance play a crucial part in the growth of country and they also enhance the opportunities of employment in the country.

Naseem & Khan (2015) mentioned that crisis of energy has bad effect on country. Crisis of energy means that increment within costs of electricity, supply deficiency of resources to accomplish the energy need. Currently, back bone of manufacturing sector is energy and lack of the same can have disrupted effects on the socio-economic stature of country. Secondly data was chosen from 1982 to 2011. The findings exhibited positive affect of consumption of energy on an economic growth.

Sadia & Hammami (2015) investigated energy sector as a significant player of an economy in the contemporary world. The encumbrance of resource of power (renewable) is growing by every passing day because of increment in the demand of energy. The penal data of different countries has been chosen from the year 1990 to 2012. The major variable that has been used is consumption of energy per capita, co2 emission, economic growth, capital stock, labor force, total population, and financial development. Generalized methodology of instant was worn to discover the empirical connotation among financial increment, co2 emission, and power use. The result showed significant effects on financial growth.

Bernard and Oludard (2016) believed that the objective of economic development can be achieved with an expansion of industrial sector and it is impossible without the energy. The data was collected from year 1980 to 2013 from Nigeria. The ECM was used to trace empirical relationship between power usage and Nigeria's manufacturing sector. The consequences of study depicted connection between industrial production and power use.

3. Data, Model and Methodology

3.1 Data Source

The secondary data on energy and industrial sector are collected from Economic Survey of Pakistan, World Bank Indicators, Bureau of Statistics (Pakistan) and State Bank of Pakistan. The data are ranged from 1980 to 2016.

3.2 Model Specification

According to the research objectives, the performance of industrial sector is a dependent variable. Meanwhile explanatory variables are energy (renewable and nonrenewable). The others are energy imports, GCF, labor force, and trade. Performance of industry is effected by consumption of energy. If the consumption of energy is further, it diversifies the production and improvises the industrial production. Therefore, the econometric model is constructed upon the past studies of Hu and Lin (2008) and Ewing *et al*. (2007).

We model is written as:

$$\ln INDPER_t = \alpha_0 + \alpha_1 \ln ENELEC_t + \alpha_2 \ln ENOIL_t + \alpha_3 X \ln ENIMP_t + \alpha_4 \ln RENEN_t + \alpha_5 \ln TRADE_t + \alpha_6 \ln GCF_t + \alpha_7 \ln LABFR_t + \mu_i \quad (1)$$

Here,

INDPER = Industrial Performance

ENELEC = Energy Consumption (Electricity)

ENOIL = Oil Consumption of Energy

ENIMP = Energy Imports

RENEN = Energy Consumption (Renewable)

TRADE = Trade

GCF = Gross Fixed Capital

LABFR= Labor Force

Equation (1) calculates the effect of consumption of energy on industrial. In this equation, the log of regressors and regressand is ln. The α's are coefficients, intercept, and slope of variables. t's show variables w.r.t time. The μi is showing the ECM term.

4. Results and Discussion

4.1 Descriptive Statistics

This section gives the summarization of descriptive statistics. The descriptive analysis is rested on the statistical concepts such as mean, minimum, maximum, median, standard deviation, kurtosis and skewness to analyze the statistical attributes of specified model. The Table 1 is allocated for descriptive statistical analyses and is given below:

Table 1

Descriptive Statistics

	LINDPER	LENELEC	LENOIL	LENIMP	LRENEN	LTRADE	LGCF	LLABFR
Mean	3.137	5.793	6.065	3.081	3.928	3.514	2.873	17.519
Median	3.157	5.884	6.104	3.131	3.931	3.526	2.908	17.471
Maximum	3.299	6.187	6.261	3.323	4.062	3.661	3.035	18.041
Minimum	2.963	4.912	5.759	2.741	3.782	3.224	2.647	17.168
Std. Dev.	0.080	0.378	0.144	0.145	0.079	0.094	0.097	0.288
Skewness	-0.193	-0.905	-0.651	-0.321	-0.046	-0.948	-0.694	0.301
Kurtosis	2.525	2.655	2.154	2.239	1.753	4.138	2.471	1.622

4.2 Stationarity Test

After descriptive statistics, it is mandatory to diagnose stationarity status of entire variables. Table 2 is allocated for this purpose and is given below:

Table 2

Stationarity Test

	Level		first difference		Decision
Variable	**Constant**	**Intercept**	**Constant**	**Intercept**	
LINDPER	-1.88	-2.39	-6.41***	-6.63***	I(I)
	(0.33)	(0.37)	(0.00)	(0.00)	
LENELEC	-4.58***	-1.73	-4.03***	-5.30***	I(I)
	(0.00)	(0.71)	(0.00)	(0.00)	
LENOIL	-3.27	-0.17	-4.47***	-5.51***	I(I)
	(0.02)	(0.99)	(0.00)	(0.00)	
LENIMP	-2.33	-2.25	-5.32***	-5.28***	I(I)
	(0.16)	(0.44)	(0.00)	(0.00)	
LRENEN	-0.55	-1.90	-4.84***	-4.76***	I(I)
	(0.86)	(0.62)	(0.00)	(0.00)	
LTRADE	-1.43	-2.13	-7.19***	-7.30***	I(I)
	(0.55)	(0.51)	(0.00)	(0.00)	

	Level		first difference		Decision
Variable	**Constant**	**Intercept**	**Constant**	**Intercept**	
LGCF	-1.55	-2.57	-6.10***	-6.03***	I(I)
	(0.49)	(0.29)	(0.00)	(0.00)	
LLABFR	3.05	-2.67	-3.79***	-4.71***	I(1)
	(1.00)	(0.25)	(0.00)	(0.00)	

*** show significant at 1 percent.

The ADF results show that all the variables are integrated of order I(1). Whereas, LENELEC is stationary at level i.e. integrated of order I(0) as well as I(1). Due to I(1) orders of integration, the technique of Johansen (1991) cointegration is suitable to find out the regression results.

4.3 Johansen Cointegration Results

Table 3 of Johansen cointegration test is categorizing the affiliation between energy consumption and performance of Pakistan's industrial sector. LINDPER is the dependent variable. The results show significant positive effects of LENELEC, LENOIL, LLABFR, and LTRADE on industrial performance. However, significant negative relationship is found with LGCF and LENIMP.

Table 3

Johansen Cointegration Results

LINDPER (Dependent Variable)			
Variable	**Coeff.**	**S.E**	**t-Stat.**
LENELEC	0.041***	0.015	2.733
LENOIL	0.553***	0.163	3.392
LENIMP	-0.347***	-0.073	-4.753
LRENEN	0.066	0.047	1.404
LTRADE	0.059**	0.029	2.034
LGCF	-0.361***	-0.093	-3.881
LLABFR	0.513**	0.234	2.192

** and *** show significant at 1 and 5 percent, respectively.

4.4 Short run Analysis

Now, latest to long run relationship, the short run connection is also needed to be calculate. For short run examination, the ECM is incorporated. ECM is used for diagnosing speed of adjustment in order to calculate the results of industrial sector performance and energy consumption in Pakistan. The results are summarized in Table 4.

Table 4

Vector ECM Correction Model

D(LINDPER) (Dependent Variable)			
Variable	**Coeff.**	**S.E**	**t-Stat.**
D(LENELEC(-1))	0.0278	0.217	0.128
D(LENOIL(-1))	0.4087	0.638	0.639
D(LENIMP(-1))	0.2783*	0.115	2.403
D(LRENEN(-1))	0.6132	0.565	1.084
D(LTRADE(-1))	0.1042	0.107	0.966
D(LGCF(-1))	-0.1309	0.151	-0.868
D(LLABFR(-1))	0.3041	0.655	0.463
ECt-1	-0.7304**	0.201	-3.62
R-squared	0.615		
Adjusted R-squared	0.497		
F-statistic	5.206		
Prob(F-statistic)	0.000		

* and ** show significant at 5 and 1 percent respectively.

In Table 4, the results are given of short run association between energy consumption and the industrial sector's performance in Pakistan. In case of long run, it was estimated the overall effect during the specified time period. But in short run, it is seen the effects in previous year however insignificant except that of LENIMP. Both the non-renewable and renewable energy consumption presented the irrelevant relationship with performance of industrial sector performance.

4.5 Stability Test

The stability test are applied to check the reliability of the regression results. For this purpose, Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Recursive Residuals Square (CUSUMSQ) are applied. The details of CUSUM and CUSUM square are given in Figure 1 and Figure 2, respectively.

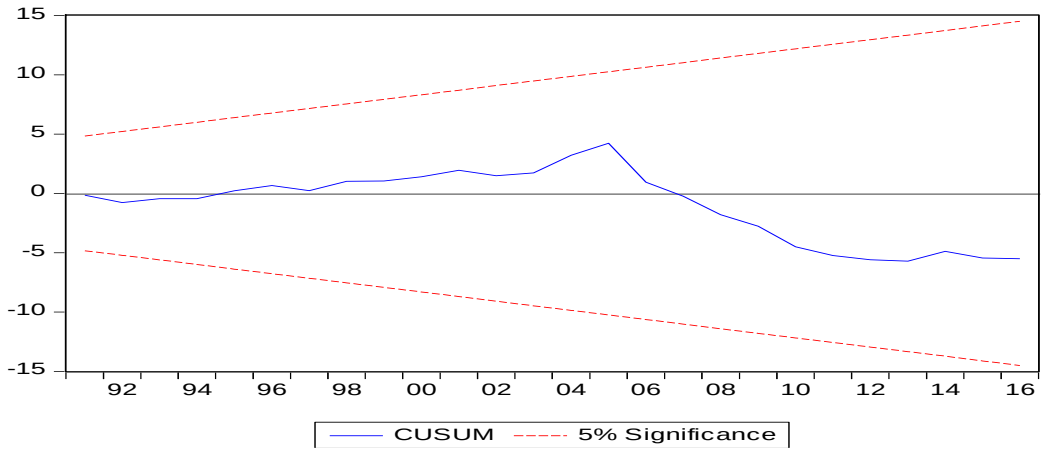

Figure 1

CUSUM Test Results

The main drive of CUSUM and CUSUMSQ is to check the stability of model. The CUSUM line is within lower and upper bound. The test value of CUSUM and CUSUMSQ is significant at 5 percent. Therefore, not showing any problem in the model and thus it is concluded that the model is stable and there is no problem of instability between estimated consumption of energy and Pakistan's industrial performance.

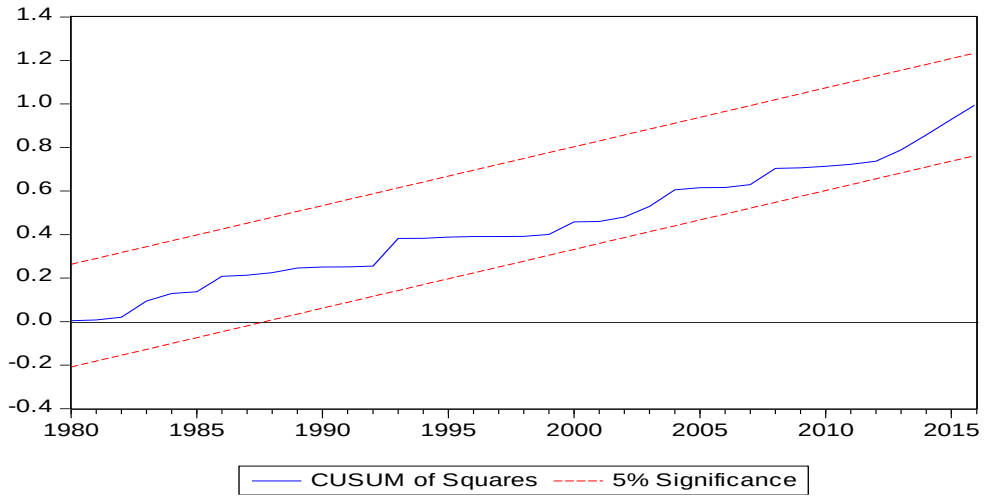

Figure 2

CUSUMSQ Test Results

In graphs of CUSUM and CUSUMSQ, the results are significant at 5 percent. The calculated graph is located within the upper and lower bound. Therefore, there is not found any issue of structural inconsistency on the estimated regression results. The estimated models are thereby stable.

5. Conclusion

This study analyzed the consumption of energy and Pakistan's industrial sector performance. Two of the forms of energy i.e. renewable and nonrenewable are incorporated to see Pakistan's industrial sector performance. In the foremost, descriptive statistical analyses was run to check the attributes of

variables on mean, median, standard deviation, skewness, and kurtosis. Afterwards, the unit root test of ADF were applied to search out status of stationarity. Since entire variables were integrated at I(1), so technique of Johansen cointegration was incorporated.

The regression results revealed the non-renewable consumption of energy in form of oil and consumption of electricity energy to have positive and significant effect on Pakistan's industrial sector performance. Conversely, the renewable consumption of energy presented the insignificant connection with Pakistan's industrial sector performance. The GCF and energy imports had negative relationship with Pakistan's industrial sector performance in long run. Further, labor force and trade were also exposed for positive consequence on performance of industrial sector. Therefore, the Johansen cointegration test showed that the overall results were good and proved for the good effect of energy consumption on industrial sector performance in Pakistan.

The ECM results exposed that nearly all variable were showing the trivial relative with that of industrial sector except energy imports. At the end, the stability test in the form of CUSUM and CUSUMSQ was run to see the model's stability in terms of structural instability. The results confirmed accuracy in the model.

6. Policy Recommendations

1. Government should take steps for the improving the production of energy within the country. Doing that so will increment Pakistan's industrial sector performance.
2. Industrial sector development are useful in cumulative the employment opportunity in the country so free industrial sector are increased in the country those are supportive to grow the living standard of people.
3. Trade activities are decreased with the downfall of industrial production. The industrial production is connected with increment of energy source. So government should try to further the investment in projects of energy those are supportive in realizing the upcoming need of industrial sector.
4. Government must take step to search oil and gas wells within the country. It is because, it would be low-priced source of energy. Moreover, would help in raising Pakistan's industrial sector performance.
5. Government is required to provide equivalent opportunity to investors within the country that is useful to further extend the foreign direct investment within the country.

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