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Energy Crisis: Effects on Industrial Growth of Pakistan

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ABSTRACT

This study investigated the impact of electricity shortage on industrial growth of Pakistan for the time of 1989 to 2022. Industrial sectors transform economy from raw material base to a more active, advance, and productive economy. So, for the economy to attain economic growth it is necessary to have a well-developed, vibrant and efficient industrial sector. But due to the severe electricity shortage the industrial growth rate decreases from 7.2 percent in 2022 to 7.8 percent in 2021. The electricity shortage found worst all the time in 2011 and it caused a huge loss to industrial sector. Due to the important role of electricity in industrial sector, the study investigated the long run relationship among the desired variables including Industrial output Growth Rate, Electricity Shortage, Gross Fixed Capital Formation, Industrial Growth Rate of Electricity Consumption, Industrial Consumption of Oil, and Industrial Imports. After checking stationarity of the data ARDL technique was conducted and found that Electricity Shortage and Industrial Imports have negative and significant impact on Industrial output Growth Rate. Industrial Annual Growth Rate of Electricity Consumption, Gross Fixed Capital Formation and Industrial Consumption of Oil have positive and significant impact on Industrial output Growth Rate in long run. In short run the model is in State of disequilibrium but is going to restore very quickly during this period.

KEYWORDS: Electricity Shortage, Industrial Output Growth Rate, Industrial Growth of Electricity Consumption, Gross Fixed Capital Formation, Industrial Consumption of Oil, ARDL model, Industrial Sector of Pakistan.

Introduction

Electricity is a life preserver of any economy and plays an important role in the socioeconomic development of a country. Electricity is pivotal for running machinery in factories and industrial units, for powering our vehicles and lighting our houses. The industrial sector enables a country to fully utilize its resources and to depend less on imported material for its economic development, growth, and sustenance. The industrial sector greatly supports the agricultural and service sectors of the economy. Industrial sectors create employment opportunities and can generate great revenue for the government in the form of taxes. Energy shortage including gas and electricity crises, badly affected the overall production level in industrial sector. Electricity shortage caused losses to the industrial sector, resulting closures of many industries and loss of jobs for people. Due to the industrial development, transmission losses, rapid population growth and electricity demand, electricity theft, poor infrastructure, poor policy implementation, circular debt, and reduction in hydropower capacity due to seasonal variations electricity shortage emerged and have worsened the power sector situation (Islamabad Chamber of Commerce and Industry, 2012).

For Pakistan being developing country, it is a great challenge to ensure electricity access for industries and to the poor parts of the population. In Pakistan two main organizations, Karachi Electricity Supply Corporation (KESE), which served the city Karachi and its surrounding area, and the rest of country serve by Water and Power Development Authority (WAPDA), are engage in three main activities including power generation, power distribution and power transmission and for proper regulation National Power Regulatory Authority (NEPRA) has been established in 1997 (Islamabad Chamber of Commerce and Industry, 2012). In FY 2020 the hydroelectric contributed 30.9 percent, thermal contributes 58.4 percent, nuclear and renewable contributes 8.2 and 2.4 percent to the total electricity generation (Government of Pakistan, 2020) while in 2023 their contributions reduce were respectively 28.6 percent, 46.2 percent, 21.0 percent 4.2 percent (Government of Pakistan, 2023).

Since from 2005, due to peak demand and limited electricity supply serious electricity crises are experienced by almost all sectors of economy including the household consumption and industrial sector consumption (National Electric Power Regulatory Authority, 2016). In year 2008 there were witnessed a severe electricity shortage in Pakistan and more importantly in industrial sector and manifestation of this problem can be seen from the protests and press conferences by industrial consumers and from the complaints by chamber of commerce and industry in different time periods. Chamber of commerce and industry reported that due to persistently electricity shortage the level of production has been decreased in different industrial units more specially in electricity intensive industries including the paper products, minerals products, basic metals, textile and leather products etc. In 2008-09 at micro level the industrial sector declined by 6 percent and macro level there were double digits declined found in the production of many goods in industrial sector of Pakistan (Government of Pakistan, 2008). The industrial growth rate estimated at only 1.40 percent in 2019 as compared to 5.80 percent in 2018 mainly due to decrease in growth rate by 2.06 percent in large scale manufacturing and 1.96 percent decline in quarrying and mining sector and beside that electricity shortage caused closer

of many factories and industrial units and it was estimated that around 7.5 percent labor force got unemployed because of this power crisis (Government of Pakistan, 2019).

Industrial sector is considered one of the important sectors in an economy of Pakistan and it has great shares in Gross Domestic Product growth. From the last decade the problem of electricity shortage has been facing by Pakistan. No proper step has been taken, nor any proper planning has come into existence by the government or private sector for the industrial sector to cope with electricity shortage. If the problem of electricity crisis has not been solved then it would negatively affect the overall growth of economy (Kotani, 2014). There is a strong and positive relationship between the electricity consumption and growth of Gross Domestic Product, but electricity shortage affected the consumption rate of industrial sector and resultantly the Gross Domestic Product grow at slow rate (Naseem & Khan, 2015).

Thus considering the role of electricity playing in industrial growth an attempt is made to investigate the extent to which electricity shortage created by the difference between demand for electricity and supply of electricity for industrial sector along other important factors that are industrial annual growth rate of electricity consumption, gross fixed capital formation, industrial consumption of oil and industrial imports can affect the industrial output growth rate for the time period of 1989 to 2022 which includes recent years in context of Pakistan. There is a need to find out the impact of electricity shortage/deficit on the industrial output growth rate of Pakistan.

Literature Review

Many studies are conducted by different researchers both in developed and developing countries to address the problem of energy crisis and its impact on industrial sector and on economy. Yasmeen et al (2022) investigated the impact of power outages on textile firm productivity for the period of 2014 to 2019, by employing firm level data. The study assessed that the duration of power outage of 1 hour reduce the firm revenue by 24 percent and textile export by 0.286 percent. Similarly, Abbas et al (2021) analyzed the role of industrial sector's electricity consumption, gross domestic product and price. By applying VECM and Dynamic Variance Decomposition technique, the study found that all variables are cointegrated and there is long run relationship among the variables. Moreover, the study proposed proper assurance of electricity to industrial sector at a reasonable price.

Hashemi et al (2018) evaluated the cost of electricity outages to the industries in Nepal. By employing secondary data and using Contribution Approach to measure the cost of power outages, the study found that power outages raised the cost of production by investing in other sources like installing generator or setting idle waiting of power.

Junjo & khoso (2018) examined to what extent the industrial output growth is affected by electricity shortage. By employing Multiple regression analysis, the study found industrial consumer percentage, industrial annual growth rate of consumption of electricity in percentage, industrial output growth percentage, industrial electricity consumption in GWH had a significant impact on industrial output growth rate. Kiran (2016) examined the impact of electricity crises on textile industry in case of Pakistan, by using the multiple regression analysis, the study found that the impact of electricity crises on production, wages, textile exports and employment opportunities are significant. Bee (2016) measured the impact of electricity outages on

production of manufacture sectors in 135 less developed countries by using ordinary least square and stochastic frontier analysis results shows that electricity outages reduced output in manufacturing sector by causing almost 48 percent technical inefficiency in Africa.

Gisaor & darius (2015) used ordinary least square multiple regression techniques and Augmented Dickey Fuller, Johansen Co-integration and Vector Autoregressive approach for the period of 1970 to 2013, the results shows that electricity supply, capacity utilization and exchange rate negatively affect manufacturing sector output in Nigeria. Shahbaz (2015) investigated the impact of electricity shortage at sectorial level including industrial, agricultural and service sectors for the time period of 1991-2013 in Pakistan for which production function of these sector were estimated including the capital and labor as additional factors. By employing an ordinary least square approach, the estimated results shows that both electricity shortage and capitalization affect productivity of each sector. Similarly, Chinedum & Nandi (2015) found the significant relationship between electricity supply and output of manufacture sector through Johansen Co-integration and Vector Autoregressive tests in Nigeria.

Bukhari et al (2015) found that output of all the selected firms in state of Hayatabad were negatively affected by electricity load shedding. Moreover, the study revealed that smaller firms were affected more as compared to larger firms. Mostly the smaller firms borrow from external sources to fill their energy demand from alternate sources. similar results were found by Yakubu et al (2015) that electricity supply, capital and labor have significant effects on the manufacture sector output both in short run and long run through the Autoregressive Distributed Lag testing approach in case of Nigeria.

Khurshid & Anwar (2013) investigated the impact of energy crises on different industries in Pakistan for the period of 2004-2009. After analysis through descriptive and paired sample mean comparison, the result shows that energy crises badly affect the KSE listed industries that are textile, cement and engineering. While impact on chemical and sugar industries were found insignificant. Yasmin & Qamar (2013) investigated the role of electricity generation and industrial consumption of electricity in de-industrialization in Pakistan for time period of 1970-2010. By using Johansen Co-integration, Variance Decomposition technique, Impulse Response Function and Error Correction Model, the study found that uncertain industrial consumption of electricity and electricity generation in GWH, industrial imports in million dollars and inflation rate have significant impact on industrial share to Gross Domestic Product in Pakistan.

While Sabir et al (2013) estimated the demand function of electricity in industrial sector for the time of 1976 to 2008 in Pakistan. By using the ordinary least square method for analysis the result shows that price of oil and price of electricity are negatively related to dependent variable that is demand of electricity by industrial sector. In the case of industrial share to gross domestic product the relationship was found positive. Afzal (2012) employed multiple regression technique and found that electricity crisis and interest rate are inversely related to the output of textile industry in Pakistan.

Ellahi (2011) analyzed joint effects of electricity supply and development of industrial sector on economic growth. By employing Autoregressive Distributed Lag approach, the study found that there is significant relationship among labor, capital, electricity supply and industrial

development. But the contribution declined in 1990 and 2000 from 17.68 percent to 16 percent due to uncertain electricity supply.

It is shown by the literature that there is a relationship between industrial growth rate and electricity shortage. Electricity works as a backbone for economy both for developed and developing countries. According to Shahbaz (2015), whenever electricity shortage increases industrial output growth rate decreases. Similar in the case of other independent variables that are industrial annual growth rate of electricity consumption (Junejo & Khoso, 2018), Industrial consumption of oil and Gross fixed capital formation (Yakubu et al., 2015) seen have positive impacts on industrial output growth rate. Industrial imports are inversely related to industrial output growth rate (Yasmin & Qamar, 2013). So, on the basis of their close relationship, we aim to analyze the impacts of electricity shortage on industrial output growth rate.

Research Methodology

Production function shows the relationship between given level of output and given level of inputs that are required to be used in process of production. There are two main factor inputs of production function that are capital and labor. Nonetheless from empirical evidence (i.e., Yakubu et al., 2015) used other important explanatory variables too for finding their impacts on output level. In this research study the main objective is to investigate is the impact of electricity shortage on industrial output growth rate in Pakistan, and to find out the role of other explanatory variables on industrial output growth rate in long run. Here's the basic form of the Cobb-Douglas production function.

$$\mathbf{Q(\ L,\ K)= A^{*}\ L\beta\ ^{*}K\alpha}$$

Where A= Total Factor Productivity, Q= Quantity Produced, L= Number of Labor, K= Physical Amount of Capital and alpha and beta reflect the output elasticity of the inputs.

The econometric model to be estimated is given as

$$\mathbf{IGRt= \beta0 + \beta1\ IAGRECt+ \beta2ESt+ \beta3GFCF+ \beta4ICOt + \beta5IMt+Ɛt}$$

Where, IGR= Industrial Output Growth Rate i.e., In Industrial sector the overall annual production of manufacturing goods is counted, therefore the industrial growth rate is referred to the percentage change of the industrial production within a specific period. This variable is used to check the industrial performance in the economy.

IAGREC= Industrial Annual Growth Rate of Electricity consumption. The use of electricity to produce output in different industries of the country is known as industrial electricity consumption. Electricity consumption is continuously increasing due to the emergence of the new firms in existing industries and by lunching of new industries in both in developed and developing countries. That is why the annual percentage increase in its consumption which is known as growth of electricity consumption is getting much importance in modern research.

ES =Electricity Shortage/shortfall created by Industrial Demand for Electricity and Supply of Electricity in Mega Watt per hour, Industrialization is vital for growth and development which needs resources of energy. But mostly developing countries and especially Pakistan is facing a

situation in which the electric power system is fail in providing sufficient electricity to consumers and producers of manufacturing goods which is known as electricity shortage. This electricity shortage can be obtained from the difference of demand and supply of electricity which is expected to be negative.

GFCF= Gross Fixed Capital Formation as (% GDP). The addition to the exiting capital stock in a country is known as capital formation and when it is measured before the deduction of depreciation of capital then it is called Gross Capital Formation. When this is measured only in fixed assets during a given period it become Gross Fixed Capital Formation which is the most important determinant of industrial growth, therefore this variable is taken as an explanatory variable in the present research study.

ICO = Industrial Consumption of Oil in (Tones). The use of oil for running engines, generators and vehicles during industrial production is known as Industrial Oil Consumptions. This variable is also closely related to the production of Industrial goods in a country. Because this is an alternate source of energy used for running the production activities in almost all industries.

IM = Industrial Imports in Million Dollars. All those equipment's, machinery, finished goods and services hired and are brought from different countries of the world are called industrial imports, its annual market value is used as an explanatory variable in this research study, which can affect the local production and growth in a country.

The β's are the also known as parameters of the model, among which the β0 is intercept and β1, β2, β3, β4and β5 are the slope coefficients of Industrial Annual Growth Rate of Electricity Consumption, Electricity Shortage, Gross Fixed Capital Formation, Industrial Consumption of Oil and Industrial Imports respectively and μ is the disturbance term which shows all the excluded factors of the model.

Data for the chosen variables were collected from the following sources, International Financial Statistics, Economic Survey of Pakistan, Various State of Industry Report (NEPRA) & Asian Development Bank, Power System Statistics, Pakistan Energy Yearbooks and Pakistan Bureau of Statistics.

Analysis & Discussion

Before conducting the long run analysis with the help of Bound Testing Technique or Auto Regressive Distributed Lag (ARDL) model for the time series, it is necessary to find the order of integration. For this purpose, Augmented Dickey Fuller (ADF) test is applied to check the level of stationarity of the concern variables. In table 1 the results of this test are shown.

Table No 1 Results of A.D.F test

Var	A.D.F Test.Value	Critical value @ 5% Level of Sign	Level of Integration
IGR	-3.182533	-2.963972	I (0)
ES	-3.014895	-2.963972	I (0)
GFCF	-5.851671	-2.967767	I (1)
IAGREC	-4.486269	-2.963972	I (0)
ICO	-5.043366	-2.967767	I (1)
M	-4.818333	-2.967767	I (1)

Source: Results obtained by analyzing data through E-views 9

The procedure of Augmented Dickey Fuller test is that if the ADF test value is less than the critical value then the concern variable is said to be stationary. There are three different levels of significance, which are 1%, 5% and 10%. But usually, researchers take the 5% level of significance. In this table the ADF test value of the Industrial Output Growth Rate (IGR) is -3.182533 which is less than -2.963972 that is a critical value at 5% level of significance at zero level of integration which is called level form of the variable. Similarly, the ADF test values of Electricity Shortage (ES) and Industrial Annual Growth Rate of Electricity Consumption (IAGREC) are also less than their critical values at level form.

The variable Gross Fixed Capital Formation (GFCF) was nonstationary at level form but came stationary when its first difference is taken. It is shown in the table that -5.851671 is the ADF test value of GFCF, which is less than the critical value of -2.967767, at the level of first difference.

Same is the case with Industrial Consumption of Oil (ICO) and Industrial Imports (IM) which are stationary at first difference and their ADF test values are -5.043366 and -4.818333 respectively which are less than their corresponding critical values. So, the results of ADF test shown in the table 1 fulfill the assumption of ARDL model used for the data analysis.

The next step is to select the order of lag which is necessary for short run analysis when ARDL model is applied. There is different criteria shown in table 2 like the Sequential modified LR test statistic, Akaike Information Criterion (AIC), Final Prediction Error (FPE), Schwarz Information Criterion (SIC), & Hannan-Quinn information criterion (HQ). With the help of these criterions, one can find which order of lag will be optimal for applying ARDL model. The results show that four out of five criterions suggest a maximum of 2 order of lag for the variables which can be reduced to one later on for the purpose of getting efficient and significant results.

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Table No 2 VAR Lag Order Selection Criteria

Lag	LogL	L.R	A.I.C	S.C	H.Q
0	-1046.990	----	80.99921	81.28954	81.08281
1	-954.2158	135.5926	76.63199	78.66430*	77.21722
2	-902.0144	52.20138*	75.38573*	79.16001	76.47258*

Table 3 shows, the estimates of the long run coefficients along with their corresponding standard errors, T-Statistics and their probabilities. There in this model some variables are in percentage form, and some are in absolute form like the dependent variable that is Industrial Output Growth Rate (IGR) is in percentage and some independent variables like Industrial Annual Growth Rate of Electricity Consumption (IAGREC) and Gross Fixed Capital Formation are in percentage form. So, it follows the Log-Linear or double log model. Therefore, their coefficients are measuring Elasticity and the other independent variables like Electricity Shortage (ES), Industrial Consumption of Oil (ICO) and Industrial Imports (IM) are in absolute form, which follow the Log-Lin form and their coefficients are measuring the semi elasticity. It means that the coefficients of ES, ICO and IM measure the proportionate or relative change in dependent variable that is IGR for a given absolute change in the values of Independent variables that are ES, ICO and IM respectively. Practically these coefficients are multiplied by 100 to calculate their percentage changes or Industrial Growth Rate.

Table 3 Long.Run Coefficients

Var	Coefficient	Std. Er	T-Stat	Prob
ES	-0.000423	0.0002115	2.00000	0.0495
GFCF	0.516355	0.229363	2.251254	0.0481
IAGREC	0.232086	0.097799	2.373098	0.0391
ICO	0.000001	0.000001	1.959525	0.0785
IM	-0.000137	0.000047	-2.919083	0.0153
C	-1.151500	5.579948	-0.206364	0.8406
@TREND	0.191795	0.116961	1.639823	0.1321
R-Squ		0.933410	**Adjusted R-Squ**	0.833524

F-Stat	9.344802	**Prob(F-Stat)**	0.000552

SOURCES: Results obtained by analyzing data through E-views 9

The results shown in the table 3 that the dependent variable is Industrial output Growth Rate (IGR) and the coefficient of the variable that is Electricity Shortage (ES) is -0.000423 which means that a one-unit absolute increase (one Mega Watt per hour) in the electricity shortage will reduce the industrial growth rate in Pakistan by (0.000423) when it is multiplied by 100 we get 0.0423 percent. The result is statistically significant because its corresponding T-Value is (2.00000) and the Probability Value is (0.0495) which indicates that the results are statistically significant. Economically the results are also significant and follow the economic theory because whenever there is an increase in Electricity Shortage (ES) it will lead to reduce the Industrial Growth Rate (IGR). The result is also according to this theory.

As the variable Gross Fixed Capital Formation (GFCF) is in percentage form therefore the coefficient of GFCF is 0.516355 which means that a one percent increase in GFCF will increase IGR by 0.516355 percent. This result is both economically and statistically significant because it was expected earlier that GFCF leads to increase IGR. And statistically the T-Value of the coefficient of GFCF is 2.25 which is greater than 2 and its probability value is also less than 0.05 (5% level of significance).

The coefficient of the Industrial Annual Growth Rate of Electricity Consumption (IAGREC) is 0.232086 and again the explanatory variable is in percentage form therefore it means that if there is one percent increase in industrial annual growth Rate of Electricity Consumption then there will be 0.232086 percent increase in IGR. The result is statistically significant because the absolute T-Value is 2.373098 which is greater than 2 and its probability value is less than 0.05 also.

The Industrial Consumption of Oil (ICO) has a coefficient which is equal to 0.000001 and this variable is also in absolute form it is multiplied by 100 to get the Industrial Growth Rate (IGR) with respect to ICO. It became 0.0001 percent after multiplication of 100 which means that if there is one percent increase in the ICO then there is 0.0001 percent increase in IGR.

Economically it is significant because in case of Electricity Shortage (ES) the use of Oil Consumption is an alternate source which increases the Industrial output Growth Rate but statistically it is insignificant because the T-Value of this Parameter is 1.959525 which is less than 2 but if the T-Value is rounded became it is very much near to 2 so it became statistically significant also.

The Industrial Imports to a country can negatively affect the local industries in a country and similar result is found here in this research study. The coefficient of Industrial Imports (IM) is -0.000137 and it is also in absolute form therefore by multiplying 100 to it we get -0.0137 which shows that a one percent increase in industrial imports will reduce the industrial growth rate by 0.0137 percent. Statistically the result is significant because its T-Value is 2.919083, which are greater than 2 and its P-Value is 0.0153 which is less than the 5% level of significance.

The intercept of the model is -1.151500 which shows that in the absence of all the explanatory variables the industrial growth rate is reducing at the rate of 1.151500, although this estimate is statistically insignificant. Similarly, the coefficient of the time variable (Trend) is 0.191795 which shows that in Pakistan the Industrial Growth rate is 0.191795 units annually.

The value of R2 is 0.933410 and the Adjusted R2 value is 0.833524 which means that the overall the model 83.3524 percent good fit. Similarly, Probability value of F-Test is 0.000552 which is less than 0.05 so, it is highly significant. The value of the Durbin-Watson Statistic is 2.572355 which proves that there is no Auto Correlation in the model.

Table 4 The Bound Test Values

Null Hypothesis is that there is no long-run relationships exist.

Test Stat	**Val**	**K**
F-stat	15.05019	5
Critical Val Bounds		
Signi	**I(0) Bound**	**I(1) Bound**
10 %	.75	.79
5 %	.12	.25
2.5 %	.49	.67
1 %	.93	.23

SOURCE: Results obtained by analyzing data through E-views 9

In the Bound Test, if the value of F-Statistic is greater than the Upper Bound Value then the Null Hypothesis of no long run relationship among the variable is rejected and alternatively it means that the long run relationship exists among the variables of interest. Here in table 4, the value of F-Statistic is 15.05019, greater than all the Upper Bound values given in this table. So, it proves that there exists a long run relationship among the variables.

Table 5: Error Correction Mechanism

Vari	**Coefficient**	**Std. Error**	**t-Stat**	**Prob**
D (ES)	0.000511	0.000244	2.096021	0.0625
D (ES(-1))	0.000292	0.000209	1.399046	0.1920
D (GFCF)	0.089206	0.307242	0.290345	0.7775
D (GFCF(-1))	1.130637	0.270244	4.183762	0.0019
D (IAGREC)	-0.162171	0.065714	-2.467820	0.0332
D (IAGREC(-1))	0.214071	0.067785	3.158104	0.0102
D (ICO)	-0.000001	0.000001	-0.801550	0.4414
D (IM)	0.000231	0.000113	2.043910	0.0682
D (@TREND())	0.236982	0.156277	1.516427	0.1604

CointEq(-1)	-1.235604	0.158064	-7.817132	0.0000

SOURCE: Results obtained by analyzing data through E-views 9

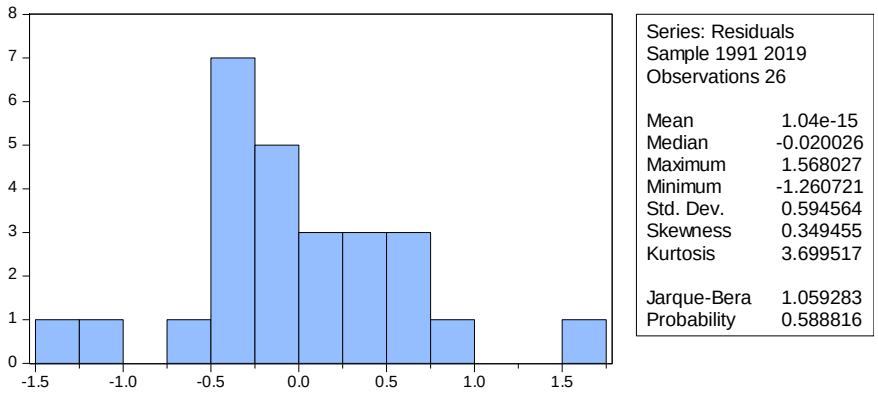
In the short run ES and GFCF both have positive effect on IGR in Pakistan, but ES is statistically significant and GFCF is insignificant. Similarly, IAGREC has positive and statistically significant effect on IGR, but ICO has negative and insignificant effect on IGR in this research study. IM has positive and significant effect on IGR during the short run analysis of this study.

The coefficient of ECM is -1.235604 which shows that 123.5604 percent of the disequilibrium is corrected every year. The coefficient of ϵt-1 is -1.235604 is nonzero and negative shows that the model is out of equilibrium in the short run and is quickly restoring (Gujrati, 2005).

Diagnostic Testing

An order to fulfill the assumptions of Ordinary Least Square (OLS) estimation, the following diagnostic tests has been carried out to achieve the best linear unbiased estimator (BLUE).

Figure 1 Jarque-Bera Normality Test



SOURCE: Results obtained by analyzing through E-views 9

Jarque-Bera test is a goodness-of- fit test of whether the sample data or residuals have the skewness and kurtosis matching a normal distribution. The null hypothesis for the test is that the residuals are normally distributed. And the alternate hypothesis is that the residuals are not normally distributed. In figure 1 the probability value of Jarque-Bera is greater than 0.05 level of significance. So, we accepted the null hypothesis that the residuals are normally distributed.

Table 6 Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) Test

F-statistics	1.860935	**Prob. F (2,8)**	0.2170
Obs*R-squ	8.255390	**Prob. Chi-Squ (2)**	0.0161

SOURCE: Results obtained by analyzing data through E-views 9

The Breusch-Godfrey test is test for autocorrelation in the error term in a regression model (Gujarati & Porter, 2005). Null hypothesis is there is no serial correlation and alternate

hypothesis is there is serial correlation in the residuals. So, in table 6, the value of F-statistic is less than critical value, so it proves that there is no serial correlation problem.

Table 7 Heteroscedasticity Test: ARCH

F-statistics	0.360680	**Prob. F(1,22)**	0.5543
Obs*R-squared	0.387122	**Prob.Chi-Squared(1)**	0.5338

SOURCE: Results obtained by analyzing data through E-views 9

Heteroscedasticity is a situation where the variance of the residuals is unequal over a range of measured values (Gujarati & Porter, 2005). Null hypothesis is there is no heteroscedasticity and alternate hypothesis is there is heteroscedasticity. The F-statistic value is less than critical value or the probability value of Chi-Squared is less than 0.05 percent level of significance. Means that there is no heteroscedasticity.

Conclusion

The results of this study indicated that there is a significant relationship between the dependent variable and independent variables. Electricity Shortage and Industrial Imports have a negative impact on Industrial Output Growth Rate. Industrial Annual Growth Rate of Electricity Consumption, Gross Fixed Capital Formation and Industrial Consumption of Oil have positive impacts on Industrial Output Growth Rate in the long run. In the short run the model is in a state of disequilibrium but is expected to be restored very quickly during this period. Heteroscedasticity, Non- normal distribution, and serial correlation were not found in the model. So, on the basis of results, the alternative hypothesis (Ho) that electricity shortage has significant impacts on the industrial growth in Pakistan was accepted.

Recommendations

Based on findings, it is recommended that,

- Government should provide the priority electricity to industrial sector by running scheme of providing fund so they can easily generate electricity for their sector. The government should give tax breaks and subsidies to the industrial sector so they can meet their demand for electricity via installing generators and solar systems in short run.
- The industrial sector can produce more output by accelerating the production process during the time when electricity is available.
- To attract the foreign and local investors to make investment in electricity generation, the government and all chamber of commerce and industries should work as a team to provide the infrastructural and financial incentives to meet the growing electricity demand of the industrial sector.

- Moreover, energy saving devices should be adopted and unnecessary usage of electricity, especially at domestic level, should be discouraging as a result large amount of electricity can be provided to the industrial sector.
- Government of Pakistan should revise energy policy to control the consumption of oil as energy. For this alternate and cheap electricity generation sources should be used like converting coal into natural gas, solar energy, and hydro energy by building small water dams' resources should be utilized.
- Both industrial import substitution policies and industrial export promotion strategies should be redesigned.

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