Analyzing the Influence of Electricity Generation on Employment in Pakistan: An Empirical Evidence

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ABSTRACT

The objective of this study is to present the influence of Electricity Generation on Employment. The current research uses annual time series data ranging from 1972 to 2014. Unit root test is used to examine stationarity of variable. Long run results are revealed using Johansen Cointegration test and it finalizes that Energy Generation, Employed Labor Force, Real GDP, Exports, Foreign Direct Investment and Exchange Rate are positively associated with Employment in Pakistan. Error correction term results confirm convergence towards long run equilibrium by doing approximately 2 percent annual adjustments if any disturbance occurs in the short run.

Keywords: Electricity Generation, Employed Labor Force, exchange rate, exports, Real Gross Domestic Product, Foreign Direct Investment.

JEL Classification Codes: C32, E24, F16, Q4.

1.   INTRODUCTION

The economy of Pakistan is underdeveloped and productive activities are restrained due to lack of technology and unsatisfied energy infrastructure. Nowadays load shedding is common in Pakistan and electricity demand increases day by day. Khan and Ahmed (2009) presented that in 2009 the electricity productivity in Pakistan was around about 11,500 MW per day. But according to the situation of 2013-14, the economy needed about 15,000 MW electricity per day and now its requirement is more than 20,000 MW per day. In energy sector of Pakistan, there is huge difference between the demand and supply shows that the economy is facing serious and main issue of electricity.

In the present study our purpose is to estimate the long run relationship between electricity generation and employment in Pakistan. In the previous literature Sarker & Alam (2010), Atif & Siddiqi (2010), Shahbaz et. al. (2012); Ahmad et al. (2012) have analyzed electricity and energy with GDP or growth rate. But there are few studies related to electricity generation and employment in Pakistan. That's why it is necessary to analyze it in case of Pakistan.

Nishantha (2011) explored the Determinants of Employment Growth in Small Enterprises in Sri Lanka. The researcher conducted 97 interviews in 2008-2009. The study highlighted the importance of social capital for employee growth. Organizational networks with network maintenance and resources sharing with SEs had greater positive influence on employee growth.

Yuan et. al (2006) explored the Electricity consumption and economic growth in China. Three techniques as unit root test, co-integration technique and Error Correction method were used in the research. The study found that real GDP was positively related to electricity consumption. China increased electricity productions which lead to regular growth and the electricity supply to lead the economy growth. According to the study, electricity was a leading indicator for the business cycle.

Adebola (2011) explored the study of Electricity Consumption and Economic Growth. The Study used time series data from 1980 to 2008 in Botswana. Co integration test was used in the research. The study found that capital and electricity were positively related to Real GDP. The research concluded that improving electricity could improve income generation. If the current situation was sustained, then the problem of electricity gap was likely to worsen in Botswana. According to study, one additional benefit of solar energy was that it was cheaper to generate locally.

Chaudhry et. al (2012) explored the influence of Energy Consumption on Economic Growth of Pakistan. They used time series data from 1972-2012. The research found that the energy consumption, economic growth, trade openness were positively related to economic growth.

Javid et. al (2012) explored the impact of Electricity consumption on economic growth of Pakistan. The study used time series data from 1971-2012 of Pakistan. Co integration technique was applied in the research. The study found that electricity consumption and GDP were positively related to each other.

Morimoto and Hope (2001) explored the Impact of Electricity Supply on Economic Growth in Sri Lanka. The study took time series data from 1960 to 1998. Electricity consumption was positively related to Real GDP.

Akinwale et. al (2013) explored the Causal Relationship between Electricity Consumption and Economic Growth in Nigeria. The study used time series data from 1970 to 2005. The study found that electricity consumption and economic growth were positively related to each other. The study concluded one-way causality running from economic growth to electricity consumption.

The current study of electricity generation with its impact on employment in Pakistan fills up this gap in the literature. Apart from Introduction in first section, Data and methodology is discussed in section two. After disclosing results in section three, the last section concludes the whole research.

2.   DATA, METHODS AND MODEL

2.1   DATA AND SOURCES

The current study uses annual time series data from 1972 to 2014. Log – log form of the model is used in the research by taking natural log of all the variables. The data sources are Handbook of statistics on Pakistan Economy 2010 which is published by State Bank of Pakistan and Economic Survey of Pakistan 2014 – 15 which is published by Federal Bureau of Statistics, Pakistan.

2.2   ESTIMATION METHODS

Trend of time series data creates different issues in econometrics results due to spurious regression. Mostly in models some variables are used as trended. In this way spurious regression highly come in economic models. There is a solution of this problem by taking difference of the series until to achieve the stationary then uses stationary series for analysis of regression. One thing in mind, it is not a perfectly solution. Apply the first difference of the variables which would lead to loss of long run properties. The best idea is that if there is time series data uses in economic model and all variables of the model are integrated of same order as "One" or I (1). So Johansen cointegration technique is considered as best one for such type of data. Johansen (1988), Johansen and Juselius (1990) arranged few steps for correct results discussed as under.

1. For the application of Johansen Co-integration approach, all variables which are related to time series and included in the study should be integrated of order one or I(1).
2. In step second, we choose the lag length in VAR model on the basis of minimum of Schwarz Information Criterion, Hannan - Quinn information criterion (HQ) and Akaike Information Criterion (AIC).
3. In step three, correct model regarding the deterministic parts in the multi-variated system are to be opted.
4. In fourth step, Maximum Eigenvalue statistics and Trace Statistic are used for number of co-integrated relationships and for the values of coefficients according to the econometric model.

2.3   MODEL BUILDING

The present study focuses on the impact of electricity generation on employment in Pakistan. For this purpose, the study specifies the following employment model in which electricity generation is taken as core variable and remaining explanatory variables are considered as supporting variables to the employment model as shown below;

$$LEMPL = \alpha_0 + \alpha_1 LEG + \alpha_2 LRGDP + \alpha_3 LEXR + \alpha_4 LEXPT + \alpha_5 LFDI + \mu_i$$

Where $\alpha's$ and u_i are respectively parameters and error term of the regression equation.

2.4   DESCRIPTION OF VARIABLES

The definitions of the variables are given as;

2.4.1   EMPLOYED LABOR FORCE (LEMPL)

Employed Labor Force means shows the proportion of labor force which is employed in a given time period. It is taken as dependent variables and measured in millions.

2.4.2   REAL GROSS DOMESTIC PRODUCT (LRGDP)

Real Gross domestic product is the total market value of all final goods and services produced in a country in a year. It is measured in Million rupees as market prices. The relationship of real GDP with employment is expected to be positive because increase in real GDP will increase per capita income which leads to an increase in investment. Higher investment requires more labor to be employed. Hence, employment will increase in this way.

2.4.3   ELECTRICITY GENERATION (LEG)

Electricity generation is procedure of producing electric power from the various sources of primary energy. The unit of measurement of electricity generation is GWH. The expected relationship of electricity generation with employment is positive because higher production of electricity will induce investors to produce more at cheaper energy prices. To expand production, there would be expansion in employment.

2.4.4   EXPORTS (LEXPT)

Exports mean sale of products or services from domestic country to foreign country. In current study, it is taken in million rupees. The expected relationship between exports and employment may be positive because higher exports increase the income of country and people. Higher income means higher investment and higher employment levels.

2.4.5   FOREIGN DIRECT INVESTMENT (LFDI)

Foreign Direct Investment means transfer of foreign investment or resources into domestic nation. In the research, its unit is million rupees. The expected relationship between Foreign Direct Investment and employment is positive. Due to more investment, there would be need of labor and in response; there would be rise in employment levels.

2.4.6   EXCHANGE RATE (LEXR)

Exchange Rate shows price of one currency in terms of another currency. It is measured as the number of units of Pakistani rupee equal to one US Dollar. Positive relationship is hypothesized between exchange rate and Employment because depreciation of domestic currency leads to higher exports. Higher exports need more investment in the economy. Hence, it would increase employment level of Pakistan.

3.   DISCUSSION OF ECONOMETRIC RESULTS

In the study, a long run relationship is investigated between employed labor force, exchange rate, exports, electricity generation, foreign direct investment and real GDP. To empirically estimate the long run relationship, Johansen Co-integration Technique is utilized.

3.1   AUGMENTED DICKEY FULLER TEST (UNIT ROOT TEST)

The section is concerned with establishing the order of integration of variables by applying Augmented Dickey Fuller test for the existence of unit root in the level and first differences of each of the variables of the model. ADF test statistics check the stationary of series and results are shown in Table 1. It reveals that all variables are found stationary at their first differences.

Table 1:   **Augmented dickey Fuller (ADF)**

Variables	Tests for Unit Root in	Include in Test Equation	Test Statistics		Result
			ADF Test	Critical	
LEMLF	Level	Intercept	-0.301815	-2.606857	I(1)
		Trend and Intercept	-1.463027	-3.194611	
	1st Difference	Intercept	-3.513855	-2.607932	
LEG	Level	Intercept	-2.402555	-2.607932	I(1)
		Trend and Intercept	-1.324228	-3.194691	
	1st Difference	Intercept	-3.137296	-2.607932	
LRGDP	Level	Intercept	-0.577313	-2.606857	I(1)
		Trend and Intercept	-2.529633	-3.194611	
	1st Difference	Intercept	-4.706108	-2.607932	
LEXPT	Level	Intercept	-2.144056	-2.606857	I(1)
		Trend and Intercept	-2.372198	-3.194611	
	1st Difference	Intercept	-5.576839	-2.607932	
LEXR	Level	Intercept	0.225987	-2.606857	I(1)
		Trend and intercept	-1.528192	-3.194611	
	1st Difference	Intercept	-3.831890	-2.607932	
LFDI	Level	Intercept	0.241260	-2.607932	I(1)
		Trend and Intercept	-2.761344	-3.194611	
	1st Difference	Intercept	-3.340180	-2.607932	

3.2   UNRESTRICTED COINTEGRATION RANK TEST

The study finds out number of co-integrated equations using trace statistics and maximum Eigen value statistics. Both are presenting long run relationship between all the variables. According to probabilities given in tables 2 and 3, the analysis shows that Null Hypothesis of no co-integrated vector is rejected. High association between all the variables is proved and showing long term relationship between dependent and independent variables.

Table 2: Trace Statistics

Hypothesized Number of Co-integrated Equations	Eigenvalue	Trace Statistic	Critical Value at 5 percent	Probability
None	0.732491	138.9319	103.8473	0.0000
At most 1	0.654461	87.50644	76.97277	0.0063
At most 2	0.447484	46.06307	54.07904	0.2128
At most 3	0.302638	22.92541	35.19275	0.5333
At most 4	0.144182	8.867827	20.26184	0.7485
At most 5	0.069173	2.795603	9.164546	0.6196

Table 3: Maximum Eigen Statistic

Hypothesized Number of Co-integrated Equations	Eigenvalue	Max-Eigen Statistic	Critical Value at 5 percent	Probability
None	0.732491	51.42547	40.95680	0.0024
At most 1	0.654461	41.44337	34.80587	0.0070
At most 2	0.447484	23.13767	28.58808	0.2127
At most 3	0.302638	14.05758	22.29962	0.4567
At most 4	0.144182	6.072224	15.89210	0.7798
At most 5	0.069173	2.795603	9.164546	0.6196

3.3   LAG LENGTH SELECTION

 Johansen Co-integration technique contains the selection of correct lag length using proper information criterions. In the study, Akaike information criterion, Schwarz Information Criterion and Hannan – Quinn information criterion are used for this purpose and results are shown in table 4. The appropriate lag length in current analysis is assumed to be '1' at which the values of information criterions are minimum.

Table 4: VAR Lag Order Selection Criteria

Lag	Akaike Information Criterion	Schwarz Information Criterion	Hannan-Quinn Information Criterion
0	1.273749	1.529681	1.365575
1	-9.358341*	-7.566813*	-8.715556*
2	-9.131449	-5.804326	-7.937706

3.4   LONG RUN ESTIMATES

In table 5, five columns are shown as variables, coefficients, standard errors, t-statistics and significance. Real Gross Domestic Product has positive relationship with employment with significant coefficient value. Reason may be that when Real GDP increases then per capita income also increases. In this way, private and government investment increase in the economy. When government and private investment increases in different sectors then more labor is required. It increases employment opportunities. On the average, a rise of one percent in real GDP would increase employment by 0.08 percent in the long run.

Foreign Direct Investment is found to have positive influence on employment having significance at 1 percent level. It may be justified as when FDI increases then new industries are established which require more labor to be employed. In this way, employment will increase in Pakistan. On the average one percent more FDI will lead to 0.20 percent rise in employment.

Electricity generation is positively related to employment. It is significant at 1 percent level of significance. It may be justified as increase in electricity generation will make energy prices cheaper. Investment will increase due to lower input prices. Higher investment would require more labor to be hired creating demand for labor and employment opportunities. On the average, employment would rise by 0.63 percent due to one percent more electricity generation in Pakistan.

Table 5: Long run Results

Variables	Co-efficient	Standard Error	T-Statistics	Significance
LRGDP	0.084343	0.02534	3.32780	Yes (1%)
LFDI	0.207853	0.02572	8.08104	Yes (1%)
LEG	0.631747	0.10943	5.77323	Yes (1%)
LEXR	0.374305	0.07511	4.98335	Yes (1%)
LEXPT	0.687986	0.11834	5.81363	Yes (1%)
Constant	0.948248	-----	-----	-----

Exchange Rate is positively associated with employment and significant at 1 percent level of significance. It may be justified as depreciation of local currency makes exports of country cheaper. It increases demand for exportable commodities. Higher exports need more domestic production. In a result, more investment would be taken place leading to higher employment levels of Pakistan. On the average, one percent rise in exchange rate would increase employment by 0.37 percent in Pakistan.

Exports are also positively related with employment. Statistically, it is significant at 1 percent level of significance. Reason may be that higher exports would be cause of establishing more industries in the economy generating more job opportunities and employment. On the average, one percent increase in exports would be cause of 0.68 percent more employment generation in Pakistan.

3.5   SHORT RUN ESTIMATES

Table 6 reports the results of vector error correction model which is used for short run estimates of the employment model. In the table, error correction term is having its importance. It shows us the convergence and

divergence of short run results towards long run. Negative sign of Error Correction Term clearly reflects that the short run model converges towards long run equilibrium if any disturbance arises in the short run.

Table 6: Vector Error Correction Model

Variables	Coefficient	Standard Error	t-Statistics
Error Correction Term	-0.019788	0.00616	-3.2100
D(LEMLF)	-0.187593	0.20740	-0.90448
D(LRGDP)	0.021657	0.01635	1.32487
D(LFDI)	0.017380	0.01056	1.64632
D(LEG)	-0.004507	0.09303	-0.04845
D(LEXR)	0.036368	0.10329	0.35211
D(LEXPT)	-0.031578	0.05972	-0.52879
Constant	0.025872	0.01380	1.87464

4.   CONCLUDING REMARKS AND POLICIES

Electricity generation plays an effective role in generating employment opportunities in Pakistan. The objective to conduct this study is to present the influence of Electricity Generation on Employment of Pakistan. The study uses employed labor force to represent employment and electricity production in GWH for electricity generation.

The current research utilizes annual time series data ranging from 1972 to 2014. The data is obtained through different sources like Hand Book of Statistics on Pakistan Economy 2010 and Economic Survey of Pakistan 2014 – 15. Log – Log forms of the models is utilized. For reliable results Augmented Dickey Fuller unit root test is applied for examining stationarity. Akaike Information Criterions, Schwarz Information Criterion and Hannan – Quinn Information Criterion is used for selection of appropriate lag length. Johansen Cointegration for the purpose of estimating long run estimates is utilized in the study.

Unit root test suggests that all the variables are stationary at first difference. Favorable lag length is "1" at which the values of information criterions are minimum. The study concludes existence of long run relationship among all the variables using trace statistics and Maximum Eigen statistics. Long run results reveal that Energy Generation, Real GDP, Exports, Foreign Direct Investment and Exchange rate are found to be positively associated with Employment in Pakistan. Error Correction term suggest that economy converges towards long run equilibrium because coefficient of error correction term contains the negative sign.

On the basis of our results, it may be suggested that government, in order to increase employment, must increase the production of the electricity. For this purpose the government should construct new dams and should start Thar Coal Power Project immediately. Government must focus on increasing exports and reducing imports. Government should encourage the private sector to invest more so that the labor force may get the employment opportunities.

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