

Short Research Article

The Relationship between Electricity Consumption and Economic Growth in Five Developing Countries

Abstract:

This paper explores the relationship between electricity consumption and economic growth of the developing countries. This study incorporates the data of 5 developing countries ~~like~~ namely Pakistan, China, India, South Africa and Malaysia from 1990-2012. Hausman specification test and random effect model is used in this paper. Our result shows that Electricity consumption is ^{Highly} greatly significant in developing countries because when companies use more electricity in factories, industries for the production of different products. Employment rate will be increases because a lot of opportunities will be generated in country that ultimately leads to boost the economy with export of produced products. Inflation is significantly but negatively correlate with economic growth. Level of Inflation increase will reduce the economic growth at the same arrangements. Study reveals that different policies are formed for electricity production so that electricity consumption can be meet appropriately which leads to boost employment rate in economy that ultimately improves the economic growth in developing countries. Developing Governments must take some measures in order to control the inflation for the betterment of economy as a whole.

Once the r/ship is found, no need of detail explanation, here in abstract. you can do that in the discussion section

list some of them

Key words: Electricity Consumption, Inflation, Economic Growth, Employment, Developing

Countries, Panel Data should be listed alphabetically, and preferable if key words are not more than five

JEL Codes: L94, P24, F43, J21

27 **1: Introduction:**

28 The importance of energy has been realized by humans in the beginning of creation. For
 29 economic growth and development it is necessary to extract the energy resources from the
 30 environment. Energy consumption in different countries is different depends on development
 31 level, because development level of each country is not the same. Energy resource includes oil,
 32 coal, gas etc. Each country spent a significant portion on the energy consumption. (Zamani,
 33 2012), period should be after the citation

34 Electricity is the basic energy resource. It plays important role in the development of each
 35 country. It is used to manufacture goods, to create capital and to provide services. Due to
 36 dynamic environment, rapid development and innovation the consumption of electricity has also
 37 mounted. (Hey & Riaz, 2008)

38 In their research paper Ramzan and supporters (n.d.)^{year} said that energy is the elementary
 39 instrument for the socioeconomic development of every country especially in undeveloped
 40 countries. Among all energy resources electricity takes crucial part.

41 The electricity generating process is so sophisticated in the developing countries as compared to
 42 the developed countries. Many countries use different methods to produce the electricity. The
 43 emerging countries still tried to produce electricity efficiently but are not successful. (Atif &
 44 Siddiqui)^{year} One important thing that is discussed in this paper is to produce resource efficiently not
 45 for only the purpose to reduce the cost but also to enhance the revenue that will cause to increase
 46 the wealth. This will show the economic development.

47 In most of the developing countries including Pakistan the electricity is generated, transformed,
 48 distributed and then retailed to the public sector services. E.g. in Pakistan the electricity is
 49 retailed to the Water and Power Development Authority for all over the country except Karachi.
 50 Karachi Electric Supply Corporations is for Karachi and adjacent areas. (Rustam et.al, 2012).

51 The demand and supply of electricity consumption in each country is different. So in some
 52 countries there is access of electricity and some countries face shortage due to exceed of demand.
 53 It results the shortfall and badly affect many industries and businesses specifically to which their

54 work is completely depend on electricity. The shortage of demand is tried to meet through load-
55 shedding. (Shahbaz & Feridun, 2011)

56 So to see the impact of electricity consumption on Gross Domestic Product either it electricity is
57 crucial for development or not. Effect on electricity consumption how much affects economic
58 growth and development. Many studies have been already conducted and reveal that it is
59 positively related with the GDP of the country because it is the central part of many businesses
60 due to lack of the availability could stop do working and heighten the unemployment level
61 (Gbadebo & Odularu, 2009).

62 By analyzing the global economy we can say that electricity consumption is one of the most
63 important factors of economic growth. Moreover the increased demand of electricity
64 consumption will create swear problems in the whole world. All of the above discussion aimed to
65 explore that economic growth and electricity consumption plays a side by side role in developing
66 economies as well as in the whole world. So this paper has designed to demonstrate the
67 relationship between electricity consumption and economic growth in developing nations by
68 seeing the impact of real GDP on economic growth. That will provide the strong insight for
69 policy makers in order to form the best policies for power generation that leads to enhance
70 economic productivity in the developing nations and dramatically boast their economies.

71 ^{This study is} ~~The paper can be~~ arranged as follows: The next section will give insight about literature review.
72 Third section will demonstrate the methodology. Fourth section will explain the results and
73 interpretations. Whereas fifth section will conclude the paper by presenting the conclusion.

74

75 2: Literature Review:

76 From last few decades the aggregate energy demand is going to increase which motivates us to
77 study the relationship between energy and economic growth. So it is great decision that how we
78 utilized particular policies to preserve or restore the energy without affecting the productivity in
79 economic growth (Zahid, 2008).

80

Your concern is the r/ship b/n Electricity consumption and Economic growth, but how do you see the impact of real GDP on GDP growth/ Economic Growth.

Some analyst argued that there is a direct relationship between the use of electricity consumption and the growth of gross domestic product (GDP).The relationship between electricity consumption and economic growth is one of the basic issues for several years. The causality is the basic subject that is under discussion from several years by economists, econometricians and policy makers. It provides guidelines to make energy policy.

According to the economic literature the production is generally categorized into three factors land, labour and capital as the production factor. In contrast many theorists and economists considered electricity as another factor of production. Some economists such as Cleveland suggested electricity the main and prior the other factors. Some neoclassical theorists do not believe that electricity is important factor for production. According to the David Stern's some neoclassical theorists and economists believe that electricity consumption strongly affects the economic growth. His research mainly focused on to find the correlation between electricity consumption and economic growth. Finally he has considered that electricity is the important factor in Gross domestic product (Zamani, 2012).

Every country's production and consumption activities are dependent on electricity consumption, because the industrial growth and economic productivity need electricity that leads to economic development. So electricity is considered as a basic input for industrial growth and economic development. Modern economies can attain more than half of the industrial growth with the help of electricity whereas cost of production can be reduced more than ten percent (Barney & Franz, 2002).

Electricity consumption is considered the main factor for economic and social development. The higher the use of energy indicates the more economic growth. The global electricity demand has been increasing and is expected to increase two third of the global demand and half of the share in 2030 in developing countries especially Asian countries like India and China (Chontanawat).^{year}

There has been great use of information and communication technologies (ICT) which transits into digital economy that effect on electricity consumption particularly electricity consumption in the country. People became more dependent on internet and other ICTs also include digital cameras, mobile phones, digital music players, personal computers, laptops etc (Lee, 2005).

Electricity consumption has been improving not only the living standard of the people but also plays important role in the scientific advancement and technological development. To deal with increasing electricity demand and economic growth, the causal relationship between electricity consumption and economic growth should investigate to make appropriate energy policy (Mehrrara, 2007).

It is stated that there is causality between electricity consumption and economic growth (GDP) in Philippines but when we observe Republic of Korea then this causality seems to have reverse effect. The relationship between electricity consumption growth and GDP growth is bidirectional Taiwan that is the province of china (Hwong, et. al.1991). “It is stated that the causality from economic growth to electricity consumption and from energy consumption to employment without feedback in Taiwan Province of China” (Cheng and Lai, 1997).

A study proves to be helpful for Pakistan similar to nature in the above studies in case of policy formation for the sake of electricity consumption and other sectors. Causal approach can be used to find the relationship between the electricity consumption and economic growth so that proper policies are formed (Aqeel and Sabihuddin, 2001).

Several indices has been developed and used for measuring electricity consumption in macroeconomic and industrial sectors. Some of the indictors are: “Energy Consumption (Million barrels of oil equivalent), Growth of electricity consumption (%), Average Growth during the period(%), Value Added (Billion Rials), growth of value added (%), average growth during the period (%),electricity coefficient, average electricity coefficient during the period, electricity consumption intensity (%), average electricity consumption intensity (%),electricity efficiency (Billion Monetary units per 1 per one million Barrels) and the average electricity efficiency during the period (Billion Monetary units per a million barrels)”. (Zamani, 2012)

Pakistan is using huge amount of electricity like other developing economies in order to meet its growing demand for electricity consumption. So like many other countries that are not oil producing Pakistan is also trying to meet its needs by importing. Pakistan has 6.4 percent annual consumption growth rate for energy. Form this percentage 40 percent is used for gas electricity and oil. Whereas from this percentage more that 30 percent is only used for electricity and

remaining for other uses. Pakistan is facing sewer problems while managing the emerging need for electricity because it has shortage of energy supply and do not has appropriate strategies, policies for the usage of electricity consumption (Riaz, 1984, and Chisti and Mahmood, 1980).

3: Methodology:

This research paper is using electricity consumption, inflation, Gross domestic product employment rate, as an independent variables while economic growth (GDP) as dependent variable. 5 developing countries ^{namely} ~~like~~ Pakistan, China, India, South Africa and Malaysia are included in order to see the impact of independent variables on economic growth of these countries. Data source ^{for this study} ~~that is used by Researchers~~ is “World Bank” and the annual data from 1990-2012 is collected from this source.

Variables	Symbol	Expected sign	Theories/ Model	Data source
Electricity consumption	EC	+	Subject Under Empirical Study	World Bank
Inflation	INF	+/-	Interest rate parity	World Bank
Employment rate	EMP	+	Keynesian theory of Employment	World Bank
Gross DP	GDP	D.V		World Bank

156

157 **Economic Growth Measures:**

158 **Inflation:**

159 The level at which prices of goods and services increases and relatively purchasing power of
 160 people decreases is called inflation. Inflation has a positive correlation with electricity
 161 consumption because when inflation increase then cost of electricity consumption will increase
 162 which leads to decrease the economic growth because the prices of goods and services will
 163 increase and less subsidies will be provided so it shows that there is negative relationship
 164 between inflation and economic growth.

165 **Gross Domestic Product (GDP) per capita:**

If you are sure the chain, why you hypothesises it in the above table.

166 Economic growth measures in term of GDP. GDP is used to measure the overall country's output
 167 to that takes gross domestic product and it is divided by total number of people in the country is
 168 called Gross Domestic Product (GDP). ^{per capita} GDP is the proxy of economic growth, so it considers
 169 that when the economic growth of the country will increase leads to stimulate the economic
 170 activity due to which the chances of employment are also increase. When employment of the
 171 country increase then peoples have more money to spend due to which demands of the luxuries
 172 increase which leads to increase the inflation.

why not per capita income. Because GDP could not help for international comparison. But Per capita income has such advantage

173 **Electricity consumption:**

174 Amount of energy (e.g. electricity) consumed in a process or a system by organisation or a
 175 society in the country is called electricity consumption. Electricity consumption has positive
 176 strong correlation with economic growth.

177 **Employment rate:**

178 The proportion of country's population that are employed under age 15 and above is called
 179 employment rate. It is also called working age population. When companies start their
 180 production and install new units then employment rate will increase which leads to increase in
 181 economic growth. So employment rate has positive impact on economic growth.

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183 **Hypothesis:**

184 H1: There is a relationship between inflation and economic growth.

185 H2: Electricity consumption affects economic growth.

186 H3: There is a link between employment rate and economic growth.

187

188 **Regression Equation**

$$189 \quad EG = \alpha + \beta_1 EC + \beta_2 INF + \beta_3 EMP + \varepsilon_i$$

190 In the above equation:

191 EG: Economic growth

192 C: Coefficient

193 EC: The electricity consumption

194 INF: Inflation

195 EMP: Employment rate

196 ε_i : Error term

197 β_1 to β_3 : Coefficients of independent variables

198

199 **Panel unit root test:**

The study use

200 To check the stationarity of three variables that are included in this paper we use Panel data unit
201 root test. The specifications for the LLC unit root test are given below:

$$202 \quad \Delta \mu_{it} = \alpha_i + \mu \mu_{it-1} + \sum_{k=1}^{pi} p_i \Delta \mu_{it-k} + \varepsilon_{it} \dots \dots (1)$$

Here Δ is the first difference, μ_{it} represents the dependent variable showing observation for the country i at time t ; ε_{it} embodies the error term which is distributed independently for all i, t . the null hypothesis for the test is $\mu_x = \mu = 0$ for all i ; against alternative hypothesis $\mu_x = \mu < 0$ for all i .

	I(0)			I(1)		
variables	Levin, Lin & Chu	Im, Pesaran and Shin W-stat	ADF - Fisher Chi- square	Levin, Lin & Chu t^*	Im, Pesaran and Shin W-stat	ADF - Fisher Chi- square
EC	5.02257	3.70730	6.24408	2.25932**	1.98922**	24.3467**
EG	4.78520**	4.29620**	36.0456**	7.36419**	8.01806**	69.9743**
EMP	0.87142	1.53356	6.06327	5.28682**	4.87336**	41.3513**
INF	3.45850**	3.20620**	27.3757**	8.48470**	7.23592**	65.5917**

Hausman specification test:

This test is used in order to choose the alternative tests. Validity of test is checks with the help of Hausman specification test it shows that which one test is describe the variables movements in the series in the better way so these tests are fixed and random effects models. If the result of chi square is less than 0.05 then we use the fixed effect model in Hausman specification test.

When a sample variable reveals the whole population then we use fixed effect model (Abrevaya, J. 2000).

Equation can be written as econometrically:

$$A_{it} = \alpha + \beta B_{it} + \mu_{it} \dots \dots \dots (2)$$

Where A_{it} is the economic growth of the country which is our dependent variable, α is the intercept, β is the coefficient variable of all illustrative variables whereas μ_{it} is the disruption term. In fixed effects models the disruption term i is disintegrated into specific effect, μ_i , and the residue disruption, $\hat{u}_{it}$.

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$$A_{it} = \alpha + \beta B_{it} + \mu_i + \hat{u}_{it} \dots\dots\dots(3)$$

H_0 = Fixed effects model is appropriate

H_1 =Random effects model is appropriate

Probability >chi2 = 0.7003

Chi square value indicates that our data is rejecting the null hypothesis and accepting the alternative hypothesis. So we will use random effects model of panel regression.

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4: Results and Interpretation:

Random GLS model result demonstrates that Inflation, Employment rate, Electricity consumption are affecting significantly to economic growth of countries. Moreover our result is proving the same relationship of independent variables with GDP that are prescribed in the previous studies. Electricity consumption enhances the economic growth which ultimately leads to increase the employment. Because when electricity consumption will be increase then economy will grow and generate employment opportunities in the economy of the country (Aqeel, Butt. 2010).

As per the result, the justification should be yours, and that might be similar with that of Aqeel and Butt. So, first you should justify, then you can say this is similar with that of Aqeel and Butt. Reconsider it

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Our result shows that Electricity consumption is greatly significant in developing countries because when companies use more electricity in factories, industries for the production of different products. So due to these industries employment rate will be increases and lot of opportunities will be generated in country that ultimately leads to boost the economy with export of produced products.

GDP	Coef	t-value	p-value	Std.Err
Inflation	-.0301126	-0.49	0.628	.0620569
Employment rate	0.658968	1.98	0.04541**	.331294
Electricity consumption	.2242696	4.27	0.000**	.0524779
Cons	-8.163787	-2.69	0.007	3.037304
R squ	0.355			

** indicate significance at 5% level.

How it is significant??

How do you see R-square. what is 35%. Do you think that the included variable have a power to explain the explained one. How about Adjusted R-square

Results shows that inflation is significantly but negatively correlate with economic growth. One study shows that inflation has significantly negative impact on economic growth. Level of Inflation increase will reduce the economic growth at the same arrangement e.g. 10 percent increase in inflation leads to 3 to 4 percent decrease in economic growth (Barro, 1998).

An empirical result demonstrates that employment rate and electricity consumption are the main variables that shows the positive impact on economic growth of developing countries. Electricity consumption and inflation can be control by policy makers whereas employment rate is not determined by policy makers.

Nee explanation

5: Conclusion:

This study exhibit the impact of inflation, employment and Electricity consumption on economic growth in developing countries economy. Study used annual data annual from year 1990 to 2012 for five developing countries i.e. Pakistan, china, India, Malaysia and South Africa. The variables like inflation, employment and Electricity consumption and economic growth are taken for in depth analysis by the use of panel test.

I(0) and I(1)

At first stationarity of data is checked by performing the unit root test. Unit root test explores that economic growth and inflation are stationary at level whereas employment and electricity consumption are stationary at first level. So after taking the first difference of these two values data is processed in strata in order to check the relationship of independent and dependent

275 variables. So the result ensures that employment and Electricity consumption have direct impact
276 on the economic growth whereas inflation has negative impact on economic growth of country.

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278 Study reveals that different policies are formed for electricity production so that electricity
279 consumption can be meet appropriately that leads to boost employment rate in economy that
280 ultimately improves the economic growth in developing countries. Developing Governments
281 ~~must take some measures~~ in order to control the inflation for the betterment of economy as a
282 whole.

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