Increase in Electricity Prices and Foreign Direct Investment in Pakistan: New Evidences from ARDL Bound Test Approach

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Abstract

The empirical literature on the determinants of FDI, Energy Consumption and Economic Growth in Pakistan is abundant. However, the relationship between FDI and energy prices in Pakistan is not deeply investigated and hence this study investigated the relationship between energy prices and FDI in Pakistan in the long run and short run. The current study has analyzed that how electricity prices are affecting the foreign direct investment in Pakistan. ARDL Bound test was conducted and it discovered that Cointegration exists among the variables. Optimal Lags were selected using the Akaike info criterion. In the short run, domestic prices and commercial prices has a short run relationship with the FDI in Pakistan while in the long run domestic prices and commercial prices has a relationship with FDI. The Granger causality test was applied to find out the direction of the variables. It suggested that domestic prices and industrial prices have a unidirectional relationship with FDI in Pakistan. The stability of the parameters was checked using the Cumulative Sum and Cumulative Sum of Square test. The test shows that both the Plots remain within critical bound at 5% level of significance.

Keywords: FDI, Electricity Prices, ARDL, ECM, Pakistan

Introduction

Over the past decades, many empirical studies have focused on energy and economic growth (see Narayan and Smith (2008), Wolde-Rufael (2009), Odhiambo (2009). Authors like Sadorsky (2010) empirically found a positive relationship between FDI and energy consumption by using GMM panel data. However, to examine the bi-directional linkages among energy consumption and economic growth, numerous studies analyzed this problem and formulate policies for implication. Likewise, Lee (2005), examined the bi-directional linkages among electricity consumption and economic growth in Malaysia. The result shows the positive effect of energy consumption in economic growth.

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According to Yoo (2006), FDI is another important economic indicator which can be affected by energy prices and that slow down the economic growth of the country. Rise in energy price increases the production cost and that hampered the investment. Whereas, Belaid, found the electricity consumption, petroleum prices and economic growth issue in Algeria. The findings reveal the existence of short and long run bi-directional casual linkage between energy consumption and real GDP. While Tang et al (2011), used the neoclassical Solow growth model from the period of 1971 to 2011. By employing the co-integration and Granger causality test, the result shows the uni-directional causality running from energy consumption to economic growth. Though, Waqas et al. (2013), identified the linkage among electricity consumption per-capita and real- income in Pakistan and as well as relationship among energy consumption per-capita and economic growth. By empirically employed the Granger causality and Johansen co-integration test and declared the causality relationship between energy consumption per-capita and economic growth. In addition, Lean and Smyth (2010), examined that the electricity consumption, exports, labor force and economic growth are co-integrated with each other. Furthermore, they provided sturdy bi-directional causality linkages between electricity consumption and economic growth. The main problem of these above studies is that, they ignore the electricity prices in the nexus of FDI.

Pakistan is an energy importing country and increase in energy prices severely affects the economy through high inflation, low foreign exchange reserves and currency depreciation. Electricity breakdown and non-availability of natural gas has set bad impact on the economy. The economy of Pakistan is in a need for financial investments, but the prevailing energy crisis has hampered the capital inflows. Investors are reluctant to invest because they are afraid that Government of Pakistan is not able to cope with the energy shortfall (Michael Kugel man, 2013)

Another problematic aspect is a tariff structures by NEPRA (National Electric Power Regulatory Authority) with incentives to DISCOS (Directed all Electricity Distribution Companies) and penalty to inefficient in order to reduce their particular distribution and transmission losses. Though, the combined tariff structures that are reported by the government disallow these incentives as a result of unified losses of inefficient Discos that have to be borne by the federal government. Therefore, Electricity is costlier because of expensive input and further losses in distribution and transmission. The government thus intervenes through subsidies realizing that power is the necessity of life and that is not affordable for many consumers. That also results in a

circular debt and when the government has to pay the not sustainable level of circular debt. Therefore, this study addresses the issue of prices of electricity by taking commercial, domestic, industrial and agricultural prices that affecting FDI in Pakistan from the time period of 1970 to 2015.

Review of Literature

Recently studies exhibit the relationship of electricity consumption with various economic indicators. Such as, Tang and Shahbaz (2011), Ahmed and Islam (2010),Fei and Rasiah (2014), Ibrahim (2015), Zaman et al (2012), Polemis and Fafaliou (2014) and Tang and Tan (2011) studied on electricity consumption. Though, Tang and Shahbaz (2011) reinvestigates the causal and long run relationship between electricity consumption, population, foreign trade, income and financial development in Portugal. The result reveals the effect of electricity consumption has a positive effect on all these variables. Similarly, Zaman etal (2012) reinvestigated the multivariate electricity function in Pakistan by using foreign direct investment, population growth and economic growth. The result reveals that electricity consumption is positively co-integrated with the inflow of foreign direct investment, population growth and income in Pakistan. However, Ahmed and Islam (2010) documented the causal link between per capita electricity consumption and per capita GDP. Empirical result reveals that there is an existence of a positive short-run causality clarifies that an increase in electricity consumption directly influences the economic activities in Bangladesh.

On the other hand,Ibrahim (2015) examined the link between renewable electricity consumption, foreign direct investment and economic growth in Egypt. The ARDL test reveals that all variables are co-integrated and have positive long run relationship. Nonetheless, Fei and Rasiah (2014) inspected the long-term and short-term link amongst the electricity consumption, energy prices, economic growth and technological innovation for Canada, Ecuador, Norway and South Africa. ARDL and VECM results exhibit that the developing countries ought to not just decrease their utilization on fossil fuel powered electricity. Similarly, Tang and Tan (2011) found the link between electricity consumption, economic growth, energy prices and technology innovation in Malaysia. In particularly, the finding shows that income has positive effect on electricity consumption, whereas energy prices and technology innovation affect it negatively in a long run. But all of these authors ignored the electricity prices effects on FDI.

However, Tang et al. (2014) studied the relation between energy consumption and economic growth. The findings estimated the positive relation between energy consumption and economic growth. Similarly, Bento (2011) investigates the relationship between primary energy consumption, economic growth and net inflows of foreign direct Investment. The results show all three variables have a long run relationship while FDI has a modest and negative effect on energy consumption.Keho (2015) analyzed the drivers of energy consumption in Sub-Saharan African countries. The empirical results find that energy consumption is co-integrated with foreign direct investment, industrial output, imports, real GDP per capita, urbanization, population and credit to private sector.

Data

It is a time series data and taken for the period of 45 years from 1970 – 2016. This data is collected from the database of World Bank, State Bank of Pakistan, Karachi Electric Supply Company and Wapda Database. Electricity prices are further divided into 4 sections, named as Electricity prices for Domestic users, Commercial users, Agriculture users and Industrial users.

Dependent Variable: Foreign Direct Investment

Independent Variables

Domestic Prices, Commercial Prices, Agriculture Prices and Industrial Prices

The current study used the following regression model.

$$FDI_t = \beta o + \beta_1 DP_t + \beta_2 CP_t + \beta_3 AGRIP_t + \beta_3 INDP_t + e_t (3.1)$$

The Stationary of the time series is essential for avoiding the problem of spurious regression as it is not possible to forecast and estimate using the Non-Stationary Data. The ADF test suggested that the variable of Agriculture Prices and Industrial Prices is stationary at Level only while the other variables are stationary at the 1st difference. Hence, we cannot run simple OLS on this data as the results will lead to have spurious result and will not be considered genuine results (Dickey and fuller, 1979)

In this study, ARDL bound test will be used. ARDL model can be used when the variables are stationary at level and 1st difference. ARDL approach was developed by Pesaran et al. (2001) and it is used to find out the long run and short run relationship among different variables. This approach got a lot of fame due to many econometric advantages as compare to other Cointegration methods and technique.

This approach can be used even though when the variables are not cointegrated at the same order and they are cointegrated at I (0) and I (1) Pesaran et al. (2001) This approach can be used when the variables are stationary at Level and Frist Difference. We cannot use the ARDL approach if the variables are stationary at 2nd difference. In this study ARDL approach is applied as one variable is stationary at level while the rest of the variables are stationary at 1st difference (Pesaran et al., 2001)

$$\Delta FDI_t = \beta_o + \sum_{i=1}^{q} \beta_{1_i} \Delta FDI_{t-i} + \sum_{i=0}^{q} \beta_{2_i} \Delta DP_{t-i} + \sum_{i=0}^{q} \beta_{3_i} \Delta CP_{t-i} + \sum_{i=0}^{q} \beta_{4_i} \Delta AGRIP_{t-i} + \sum_{i=0}^{q} \beta_{5_i} \Delta INDP_{t-i} + \beta_6 FDI_{t-i} + \beta_7 DPT_{t-i} + \beta_8 CP_{t-i} + \beta_9 AGRIP_{t-i} + \beta_{10} INDP_{t-i} + \varepsilon_t \quad (3.2)$$

Where Δ is the first difference operator, q denotes the optimal lag lengths,$\beta_{1,}$ $\beta_{2,}\beta_{3,}$ andβ_4 shows short run dynamics of the model and $\beta_6,\beta_7,\beta_{8,}$ and β_9 are long run elasticities

Error correction model is given as below:

$$\Delta FDI_t = \beta_o + \sum_{i=0}^{q1} \beta_{1_i} \Delta FDI_{t-i} + \sum_{i=0}^{q2} \beta_{2_i} \Delta DP_{t-i} + \sum_{i=0}^{q3} \beta_{3_i} \Delta CP_{t-i} + \sum_{i=0}^{q4} \beta_{4_i} \Delta AGRI_{t-i} + \sum_{i=0}^{q5} \beta_{5_i} \Delta INDP_{t-i} + \lambda EC_{t-i} + \varepsilon_t \quad (3.3)$$

Where $q1$, $q2$, $q3$ and $q4$ represent optimal lag length, λ is the speed of adjustment parameter and EC represents the error correction term derived from long-run relationship as given in equation 3.2.Moreover, DP: Domestic Prices, CP: Commercial Prices, AGRIP: Agriculture Prices, INDP: Industrial Prices and ε_t**:**Error term

Results and Analysis

Table 3.1 - Unit Root Test - Augmented Dickey Fuller (ADF) Test Results

At Level			At First Difference		
Variables	Probability	Results	Variables	Probability	Results
FDI	0.0633	Not Stationary	FDI	0.0001	Stationary
Domestic Prices	0.0961	Not Stationary	Domestic Prices	0.0000	Stationary
Commercial Prices	0.2339	Not Stationary	Commercial Prices	0.0000	Stationary
Agriculture Prices	0.0025	Stationary	Agriculture Prices	0.0000	Stationary
Industrial Prices	0.0264	Stationary	Industrial Prices	0.0000	Stationary

Table 3.1 shows that at Level the variable of agriculture prices and industrial prices is stationary and integrated at I (0) while the other variables are not stationary at Level. Hence by taking the first difference of FDI, domestic prices, commercial prices were found stationary and were Integrated at I (1).

Table 3.2 - ARDL Bounds Test

Test Statistic	Value	k
F-statistic	4.95252	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Table 3.2 Shows that the value of F-Statistics is more than the Upper bound critical Value of Pesaran therefore it be concluded that there exist a Cointegration among the variables. If the Value of F-Statistics is lower than the value of lower Bound than it means no Cointegration exist among the variables. To find out the short run and Long run Cointegration among the variables Autoregressive Distributed Lag (ARDL) approach will be used (Pesaran et al., 2001)

Table 3.3 - ARDL Long Run Results (1, 1, 0, 0)

Variable	Coefficient	Std. Error	T-Statistic	Probability
Domestic Prices	0.090093	0.034069	2.644409	0.0126
Commercial Prices	-0.109521	0.036594	-2.992900	0.0053
Agriculture Prices	-0.006383	0.019702	-0.323983	0.7481
Industrial Prices	0.031324	0.034781	0.900602	0.3745
C	0.881419	0.367791	2.396519	0.0226

Table 3.3 shows that the P-Value of Domestic Prices and Commercial Prices is less than 0.05 and it shows in the long run these variables have significant relationship with FDI. Moreover, Agriculture Prices and Industrial Prices have insignificant relationship with FDI in Pakistan

Table 3.4 – ARDL Error Correction Model Estimation Results (1, 1, 0, 0)

Variables	Coefficients	Std. Error	T-Statistic	Prob.
Domestic Prices	0.408903	0.120365	3.397200	0.0018
Commercial Prices	-0.028030	0.005335	-5.253565	0.0000
Agriculture Prices	-0.001634	0.004997	-0.326920	0.7459
Industrial Prices	0.008017	0.007830	1.023839	0.3136
$\boldsymbol{ECM_t\ (-1)}$	-0.255928	0.070656	-3.622148	0.0010
R-squared	0.896488	Adjusted R-squared	0.873845	
Prob(F-statistic)	0.000000	Durbin-Watson stat	1.939242	

Table 3.4 shows that the P-Value of Domestic Prices and Commercial Prices is less than 0.05 and it shows that these variables have a short run relationship with the FDI. Domestic Price has positive and significant relationship with the FDI while and Commercial Prices has a negative and significant relationship with FDI. Moreover, Agriculture Prices and Industrial Prices has insignificant relationship with FDI in Pakistan.

The P-value of Cointegration Equation is less than 0.05 and coefficient is negative, and it shows a long run relationship among the variables used in the study. If Cointegration equation is not significant or not negative than it shows that there is no long run relationship among the variables.

Discussion and Policy Implications

The aim of current study was to explore the long run and short run relationship of electricity prices and foreign direct investment in Pakistan. The study used Foreign Direct Investment as a dependent variable while independent variables were Domestic Prices, Industrial Prices, Commercial Prices and Agriculture Prices. Time series data of 45 years of 1970-2016 was used for the analysis and it was analyzed using E-Views 9.

Before applying the ARDL Approach, Augmented Dickey Fuller test was applied, and it suggested variable of Agriculture Prices and Industrial Prices is stationary and integrated at I (0) while the other variables are not stationary at Level. Hence by taking the first difference of FDI, Domestic Prices, Commercial Prices were found stationary and were Integrated at I (1). ARDL Bound test proposed that Cointegration exists among the variables used in the analysis. Moreover, optimal lags selection was made using the Akaike info criterion.

ARDL Short run results indicated that the P-Value of Domestic Prices and Commercial Prices is less than 0.05 and it shows that these variables have a short run relationship with the FDI. Domestic Prices has positive and significant relationship with the FDI while and Commercial Prices has a negative and significant relationship with FDI. Moreover, Agriculture Prices and Industrial Prices has insignificant relationship with FDI in Pakistan. The P-value of Cointegration Equation is less than 0.05 and coefficient is negative, and it shows a long run relationship among the variables used in the study. If Cointegration equation is not significant or not negative than it shows that there is no long run relationship among the variables.

In the long run ARDL Results show that P-Value of Domestic Prices and Commercial Prices is less than 0.05 and it shows in the long run these variables have significant relationship with FDI. Moreover, Agriculture Prices and Industrial Prices has insignificant relationship with FDI in Pakistan.

In the results of ARDL it is also found that the R-squared, known as the coefficient of determination, showed a value of 0.896488. It suggests that the 89.64% changes in the FDI is jointly explained by the domestic prices, industrial prices, commercial prices and agriculture prices. The rest 10.36 % percent changes in data can be explained by residuals or other variables. For overall significance, the probability value of F-Statistic is checked which gave the value of 0.007708. Through this value it is interpreted that the overall model is significant. The residual of the model is analyzed by applying certain tests of Autocorrelation, Heteroskedasticity, Multicollinearity and Normality.

The Granger causality test suggested that Domestic Prices and Industrial Prices has a unidirectional relationship with FDI in Pakistan. The stability of the parameters was checked using the Cumulative Sum and Cumulative Sum of Square test. The test shows that both the Plots remain within critical bound at 5% level of significance. Moreover, residuals analysis was also conducted, and it suggested that there is no issue of Serial Correlation, Heteroskedastic and Multicollinearity.

The regulatory agencies in the Pakistan electricity market are mainly the NEPRA and the AEDB. The Alternative Energy Development Board is responsible for the planning and development of renewable energy sources such as wind, solar, geothermal and biogas. The main participants in Pakistan's electricity market are Pakistan Hydropower Development Agency (WAPDA), Karachi Power Supply Company (KESC) and Independent Power Producers (IPPs). Pakistan government to encourage private sector participation in the country appliances capacity building. Pakistani independent power generator project type is relatively simple, mainly to oil or gas power station.

Pakistan's high cost of generating electricity from gas has made Pakistan's terminal consumer tariffs very high compared to the world average, despite longstanding Pakistani policies that have been "benefiting the poor" of. To protect its electricity supply, the Pakistani government provides financial subsidies to importers of fuel and natural gas on the one hand, and on the other hand, it continues to raise the price ladder for end-users.

According to the National Energy Policy 2013-2018 released by the Pakistan Common Interests Board (CCI), the government agreed to

raise tariffs and cancel subsidies. In the "2030 Vision Plan", the Pakistani government proposed to speed up the construction of large and medium-sized hydropower stations in the river mainly based on the Indus, such as PPP and BOT; to develop Tha'e coalfield with an estimated reserve of 180 billion tons and vigorously develop the construction of thermal power station; increased oil and gas exploration and development efforts; to increase nuclear power and energy installed capacity; and through privatization and other measures to improve water and electricity and grid management efficiency, upgrade update transmission grid network.

Thermal power supply in Pakistan should be dominant, with oil and gas as the main fuel. Pakistan has abundant coal resources, but insufficient coal power generation and development efforts, generating capacity is small, and the current coal has become the focus of the Pakistani government's development of electric energy. Hydropower in Pakistan's power system Play an important role. However, due to most of the Pakistani hydropower stations are located in the northern region. The electricity load is mainly concentrated in the central and southern cities and the distance power transmission, coupled with aging equipment, serious power theft and other reasons, a larger transmission loss. Nuclear power is an important concern in Pakistan. However, it is facing the lack of technology and concerns and doubts about neighboring countries and the world's major nuclear powers over the manufacture of nuclear weapons by Pakistan. Currently, three of NPA's nuclear power plants are in operation and another two 340 MW nuclear power plants are under construction.

Conclusion

The shortage of electricity supply is main factor to hinder the FDI in Pakistan. However, Pakistan is a developing country with a low level of industrialization. Energy development and production capacity is weak in a limited number and affecting severely economic and social development. Ongoing power shortages are lifted to the top of the list of big Pakistani problems and the government wants to solve the problem by raising electricity prices, but that is not easy to achieve, and it is the main obstacle to promote FDI in a country. Constant rise in electricity prices is a burden on industrial and commercial units, which increases the cost of production and final commodity prices. The empirical literature on the determinants of FDI, Energy Consumption and Economic Growth in Pakistan is abundant. However, the relationship between electricity prices and FDI in Pakistan is not deeply investigated.

The empirical literature on the determinants of FDI, Energy Consumption and Economic Growth in Pakistan is abundant. However, the relationship between FDI and energy prices in Pakistan is not deeply investigated and hence this study investigated the relationship between energy prices and FDI in Pakistan in the long run and short run. In order to increase FDI and Economic Growth in the country, Government of Pakistan should ensure sustainable and continuous support of electricity and energy. Policies should be made in such ways that decrease in electricity and energy has no harm on the FDI Growth and Economic Growth. Moreover, government should also invest more and more in developing infrastructure for energy and policies should be made for dealing with any adverse effects of FDI and decrease in Energy. Similarly, opportunities should be increased for the new investors and entry barriers should be decreased. Government should also work on decreasing the cost of production and theft of the electricity should be monitored by the authorities. Government of Pakistan should implement new macroeconomic policies and previous polices should be discontinued. As the Private Sector manages 92% business, hence they should be also given a part in making the policies and government should consult them for improving the FDI situation and energy crisis. Coal, Wind and Solar Energy should be used as an alternative source for the production of electricity. In order to improve the FDI situation and energy crisis issue, government should also work for improving the law and order situation in the country.

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