Energy Crisis and Comparative Advantage Industries: Empirical Evidence from the Pakistan Economy

| Malik Saqib Ali[*] | | Sana Zaigham[†] |

Abstract

The core purpose of the study is to analyze the effects of the energy problems on the competitiveness and performance of major selected Pakistani industries. The data used for the study is from the years 1999 to 2015. The industries used in the research are Leather, Textile, Tobacco, Pharmaceutical, and Sugar. The Balassa Index is firstly used to compute the competitiveness of the above-mentioned industries and reveals that except tobacco industries all other industries sustain a comparative advantage even before and during the crisis regime. Secondly, a GMM estimation is done to analyze the effect of energy problems on the performance of the companies. The conclusion of the paper suggests that the supply of energy has a crucial role in enhancing the net return and competitiveness of the industrial sector in Pakistan.

Key Words: Energy Crisis, Comparative Advantage Industries, Net returns

JEL Classification: Q43.

Introduction

"Energy" is a crucial input to the growth and development of all economies in the world. It plays an important part in all three sectors that are industrial, service, and agricultural. The need for electricity is significant to the growth of a country. Moreover, its easy access and supply to the people country have a significant impact on the expansion of an economy. Recently developing countries are facing an issue of energy (power) crisis because of a shortage of its supply. Pakistan is one of the developing countries that is badly affected due to energy issues. The power issues have negatively impacted the growth of its economy. The electricity crisis has decreased the production of all sectors in the country. The prevailing power crisis in Pakistan started from 2006 to 2007. Moreover, with the passing of time, the gap between power production and consumption has increased steadily. The shortage between the power required and supplied has created one of the worst crises in the history of Pakistan. In the year 2009, the power shortage increased to 30 percent. Afterward, the situation became worse when the power shortage exceeded more than 5000 MW from 2010 to 2011. In May 2011, the shortfall exceeded more than 7000 MW. The

[*]Assistant Professor, Department of Economic, National University of Modern Languages Islamabad, Pakistan. Email: maaliksaqib@gmail.com

[†]Visiting Faculty member, Department of Commerce, Federal Urdu University of Arts and Sciences, Islamabad, Pakistan.

electricity shortage surged to 8500 MW in June 2012, which was 40 percent less than the power needs of the country (Amjad & Burki, 2013).

The electricity shortfalls have highly affected the economic growth of Pakistanand this has resulted in the loss of 2 percent of GDP per year (Abbasi, 2011). In the year 2009, it alone caused the loss of $3.8 billion in the manufacturing sector that was equal to 2.5 percent of the country's GDP. Additionally, it caused a loss in Pakistan's exports up to $1.3 billion and resulted in unemployment in the country. Reports of surveys showed that in Pakistan, the electricity crisis caused a loss of 4 percent of the country's GDP.

This research aims to evaluate the outcomes of the power crisis on the profits and competitiveness of the main chosen industries of Pakistan. The Balassa comparative index is used to analyze the industry's comparative advantage (CA) in the periods before and after the electricity issues. The pre-period is assumed to be one when there are no power issues and the supply of electricity is in surplus. However, the time with a shortage of power supply is taken as the post-period electricity crisis.

Objectives

Energy is the focal input for the industrial sector and also for its sustainable growth. Pakistan has experienced an energy crisis in the mid 2000s which affected industrial performance. Therefore, this paper focuses evaluation of the effect of the energy issues on the profits of major selected businesses of Pakistan and also examining the effects of the issue on the RCA (Revealed Comparative Advantage) of those companies.

Literature Review

To investigate the ongoing issue, theoretical and empirical literature needs to be reviewed for the concrete findings. Several studies have been conducted in the past on the matter of Revealed Comparative Advantage (RCA) and Energy crisis.

In 2008, a study was conducted by Abidin and Loke to examine the patterns of RCA for non-resource-based industrial merchandises and showed that the country has CA in electronic products. Furthermore, the study also revealed that exports of the Malaysian economy have shifted to resource-based exports.

Bhattacharyya in 2011 investigated the cheapness of Indian horticultural products. He calculated and compared the comparative advantage of these products with competitors, such as Asia, North America, and the EU. The conclusion of the study suggested India's comparative advantage in vegetables and fruits.

Sinanan and Hosein (2012) examined the RCA for Tobago and Trinidad. In the study, the RCA (Revealed Comparative Advantage) index was measured at a 3-digit HS level. Moreover, other measures, such as Granger causality, Markov chains, mobility indices, Galtonian regressions, and transition, probability matrices were used to find the comparative advantage. The results of the study revealed that Trinidad and Tobago should give preference to the exports of petroleum goods over non-energy goods.

Lalit (2013) conducted the study to measure the RCA index to evaluate the exports of the clothing sector in both India and Bangladesh. The study revealed that in the case of India, the clothing sector's competitiveness has increased from 23 to 25 products. Whereas, in Bangladesh, the number of clothing products having CA has surged from 21 to 29 products over the period.

In 2016, Seleka and Kebakile conducted the study to examine the competitiveness of beef business in Botswana from 1961 to 2011. The Normalized RCA index was used in the study. The findings of the paper found that the beef industry of the country has had competitiveness for the observed time.

Haanes et al. (2011) analyzed the connection between the price of energy and productivity. The study suggested that after the brand reputation, the efficiency of energy is the greatest source for business sustainability. It means that disruption in the supply of electricity lessens business sustainability.

In 2012, Ferhani and Rejeb conducted the study for 90 states to investigate the causal link between the Gross Domestic Product (GDP) and usage of energy. The selected countries are divided into four classes by this study based on their income level. The conclusion of the paper proposes that in both low-income as well as high-income countries, the direction of causality is to the consumption of energy from Gross Domestic Product in the long-run whereas in the case of upper and middle- income countries bidirectional causality has existed between the two variables.

Bayar (2014) studied that in developing countries of Asia, the consumption of power has a significant effect on the economy of these countries. The suggestions were designed followed by the results of the two-way link between the power usage and economic headway of the countries. Moreover, the recommendations were made on the basis of results that an increase in the consumption of electricity promotes economic growth.

It is obvious from the above literature review that several types of research have been conducted earlier to study the competitiveness of trade industries and the effect of the power issues on an economy. A few types of research were conducted in Pakistan to evaluate the impact of the energy issues on Pakistani industries. In this regard, this research paper is important to examine the impact of electricity issues on the performance and competitiveness of the main chosen industries of Pakistan.

Methodology

This research study examines the effect of the power crisis on the profitability of the main-selected Pakistani industries. An energy crisis is said to be the critical shortage in the resources of energy supply. In model 1, the Balassa index is applied to measure the comparative advantage of selected industrial sectors of Pakistan. The Balassa index was introduced by the Bela Balassa in the year 1965 and used to calculate the RCA of nations. Yeats (1985) conducted the study to examine the variation in trade patterns because of the variation in competitiveness. The impact of energy issues on the competitiveness (RCA) of major industries of Pakistan is computed by deploying of the Balassa Index(BI);

$$BI = \frac{X_{ij}}{X_{in}} \div \frac{X_{wj}}{X_{wn}} \qquad \text{Eq. (1)}$$

Equation no (1) infers that Xij is the exports of country *i*, while *j* denotes the commodity exported by the country i. Xin denotes all goods exported by country i, whereas Xwj signifies exports of the world for the same product *j*. Xwn represents the world's export for all the goods. The index ranges between the values 0 and 1. The value 0 infers that a country does not have the RCA in the export of the product whereas the value 1 implies that a country has the competitiveness in the export of goods.

In the second model, the Generalized Method of Moments (GMM) is deployed to examine the connectivity of the net returns of the industrial net return with the energy crisis. In this research paper, electricity is used as a proxy for the energy crisis. The industrial sectors namely textile, leather, cement, pharmaceutical, and sugar are included in the study for analysis purposes. The net returns of the major industries are affected by Power Generation (PG), Power Consumption (PC), Inflation rate (INF), Population growth (Pg) and Error term (ϵ_t).

The generic form of the model is given below;

$$NR = \beta_0 + \beta_1 PC + \beta_2 PG + \beta_3 INF + \beta_4 Pg + \epsilon_t \qquad Eq.\ (2)$$

In equation 2, β_0 is an intercept that shows the net returns (NR) of the industries when there is no other effect. Whereas β_1, β_2, β_3 and, β_4 are slope coefficients, which estimates the change in the dependent variable because of a unit variation in all the independent variables included in the model.

Results and Interpretation

To conduct an empirical analysis, it is necessary to apply primitive diagnostic tests when dealing with data that is the nature of the time series. In fact, concrete findings depend on establishing the assumption of the stationarity of variables.

Univariate Analysis

Panel unit root test checks whether the data is stationary or not. It helps to identify the fluctuations in data over time. It is worth examining the stationarity of data because if it does not hold the condition of stationary, the results may lead to spurious relations of the determinants.

$Yt = \rho Y_{t-1} + ut$ ……………………………………………………………….. *Eq. (3)*

Where p = $-1 \le \rho \le 1$

If the p = 1 then U_t is a white noise error term and Yt has a unit root problem

The study aims to analyze the impact of the power crisis on the RCA (revealed comparative advantage) and profits of the main selected Pakistani industries. The past surveys have shown that the influence of the industrial sector in Pakistan's GDP declines alarmingly due to the power issues in the country (Pakistan Economic Survey, 2016). Since the progression of the industrial sector is mandatory for the sustainable development of an economy, therefore the chief objective of this paper is to evaluate the consequence of electricity problems on the competitiveness and returns of selected Pakistani industrial sectors.

Table 1. Summary of Panel Unit Root Results

Variable	t-stats	Prob	level	t-stats	Prob	1st Difference
NR	-0.03	0.4855	I (0)	-3.65	0.0001	I (1)
PC	-2.72	0.0032	I (0)	-10.47	1	I (1)
PG	-1.64	0.0502	I (0)	-7.00	1	I (1)
INF	-0.42	0.3324	I (0)	-4.93	0	I (1)

*Levin, Lin & Chut-statistical value indicates the significance level at 5% level.

According to the findings of the Panel unit root test, the Net Returns (NR) series is found stationary at first difference and is integrated of order 1. The series of Power Generation (PG) and Power Consumption (PC) are integrated of order zero as they are stationary at level. Inflation is integrated of order 1 as it is stationary at first difference and its value is -4.93, which is significant at 5%.

Model 1 Balassa Index

Table 2 below presents the findings of the the Balassa Index measured for four sectors of Pakistan that are Textile, Pharmaceutical, Tobacco, and Leather. it depicts the Revealed Comparative Advantage (RCA) of Pakistani industries.

Table 2. RCA in Pre-Period Energy Crisis

Year	Textile RCA	Leather RCA	Pharma RCA	Tobacco RCA
1999	10.0	5.81	0.31	0.15
2000	11.0	4.90	0.70	0.13
2001	11.0	5.40	1.04	0.34
2002	11.0	5.11	0.81	0.14
2003	11.0	4.41	1.07	0.18
2004	12.0	4.52	0.98	0.38
2005	12.0	5.01	1.45	0.35
2006	13.0	6.70	1.21	0.18

Table 2 reveals that exports of Pakistan have CA in the leather, textile, and pharmaceutical products except for tobacco. Textile, leather, and pharmaceutical products have RCAs of 13, 6.7 and 1.21 in the years 2006, respectively. Therefore, RCA values are reported for the industries more than 1 which means these industries have CA competitiveness in the pre-energy crisis regime.

Table 3. RCA in Post-Energy Crisis Period

Year	Textile RCA	Leather RCA	Pharma RCA	Tobacco RCA
2007	14.0	5.20	1.0	0.26
2008	14.0	5.1	1.43	0.35
2009	12.0	5.28	1.1	0.19
2010	13.0	3.8	1.45	0.32
2011	14.0	3.4	1.63	0.35
2012	13.0	3.4	1.95	0.54
2013	13.0	3.3	1.5	0.57
2014	13.0	3.4	1.8	0.47
2015	12.0	3.2	1.5	0.27

The values of RCA calculated in table 3 depicts that despite the power issues in Pakistan,

it still maintains the CA for the textile, pharmaceutical, and leather industries, as the values of RCA are greater than 1 for these industries. The results reflected in Table 3 demonstrate that RCA value for textile, leather, and pharma recorded 12, 3.2 and 1.5 respectively. The results depict that these industries maintain a comparative advantage during the energy crisis.

Model 2 GMM Results

The results of the GMM estimation reveal that there is significant as well as the positive impact of power generation on the profits (net returns) of the selected industrial sectors. A unit rise in power generation increases the profits of the industries by 1.1 units. Like other resources, electricity generation is also used as an input for an economy to yield the outputs. A surge in power generation would increase the yield of firms. These findings are compatible with the results of the study conducted by Velasquez and Pichler (2010). The impact of power consumption (PC) is negative on the industrial net returns. The coefficient of power consumption is statistically significant at 5 percent and its value is -2.5. It shows that as the PC surges by a unit the net returns of the industries reduce by 2.5 units. It is because of the shortage of electricity required (demand) and supplied in Pakistan, therefore when the power usage increases it surges the price of electricity in the country. Consequently, the profits of the industries decrease because of the surge in the price of production. The value of the inflation coefficient is insignificant and positive. It is due to the auto-adjustment of inflation in the net returns. The results are reflected in Table 4 below:

Table 4. GMM Results

Variables	Coefficients	Std. Errors	t-Statistic	Prob.
PG	1.1385	0.104	10.9441	0
PC	-2.5253	0.2999	-11.0515	0
INF	6.8748	54.974	0.125	0.9008

The findings are compatible with the results of the study conducted by Husain and Junaid (2010). The problem of endogeneity is resolved in the model by using the instrumental variables. The dependent and independent variables with lagged values are taken as instrumental variables.

Conclusion

The results of this research paper show that despite the power issues in Pakistan it ably maintained the competitiveness of leather, textile, and pharmaceutical industries. Even though the competitiveness of textile, pharmaceutical, and leather industries decreases during the time of power issues in 2007, yet the values for comparative advantages are greater than 1 that concludes Pakistan holds the competitiveness in the said industries. However, the country does not have competitiveness in the industry of tobacco because its value is less than zero for the tobacco sector. Moreover, the profitability of the industrial sector of Pakistan is substantially supported by electricity production while in Pakistan; the cost of producing electricity is high. Consequently, less availability of power and more consumption decrease the profits of the industries.

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