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Original Research

Relationship Between Industrialization and Economic Growth: An Empirical Study of Pakistan

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Abstract

The purpose of this paper is to investigate the long run relationship of Industrialization and Economic Growth in Pakistan. The time series data from 1976-2015 is used. The main source of data is World Development Indicator (WDI). Gross Domestic Product is used as dependent variable, while Industrial Output, Foreign Direct Investment, Saving and Inflation are used as the independent variables. The ARDL testing Approach has been applied on the data. After it, the stability of the function was tested by CUSUM. The results of ARDL bound testing reveals the long run association between industrial output and GDP. This study shows that an increase in Industrial Output increases the Gross Domestic Product in Pakistan. In the end, the stability of results is confirmed by CUSUM test.

Keywords: Foreign Direct Investment, Gross Domestic Product, Saving

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Introduction

Industrial Sector plays an important role in Economic Development of any Country. The Countries that rely on Agriculture have remained underdeveloped, while the nations that gave priority to industrial Sector achieved high Economic Growth. It has been suggested by Acemoglu (2009) that the long run economic growth could achieve by technical progress and labor productivity.

As per as Pakistan is concern, it is consider as a Developing Country. In 1947, at the time of Partition, Pakistan had only 34 Industries. But as time passed, Pakistan flourished its Industrial Sector. Today Pakistan's Industrial Sector accounts for about 24 percent of GDP. But despite this, the present economic situation of Pakistan is still not as bright as it should be. The fact is that the Growth rate of Industrial Sector of Pakistan is very low as compared to other countries of the world. Large Scale Manufacturing (LSM) Industry was not meeting its growth target in last year. Whereas in FY2016, the growth rate of Industrial sector was only 6.5%. Figure 1 shows the share of Industrial sector in GDP of Pakistan from 1960 to 2012.

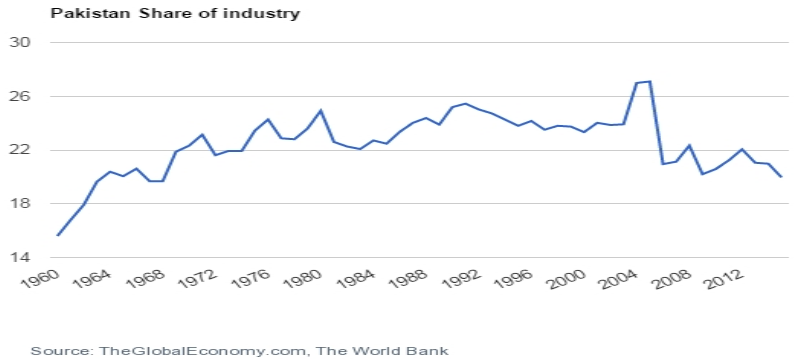

Figure: 1 the Share of Industrial Sector in GDP of Pakistan

The purpose of this study is to explore the importance of Industrial sector in the developing countries. The paper examines the link between industrialization and economic development in the country of Pakistan. The rest of the paper is organized as follows. Section 2 presents the Theoretical framework and review of existing literature that has been done in Pakistan and other countries. Section 3 discusses the model of study. Section 4 and 5 consists of data and Methodology that has been used in this paper. Section 6 explores the result and findings of the study. Finally section 7 concludes the paper and gives suggestion.

Growth in Industrial Sector: A Comparison of Pakistan with Other Developing Countries

In this section, we will make a short comparison of Industrial Growth in Pakistan with other developing countries like India, Bangladesh, Bhutan and Nepal. Table 1 shows the data of Industrial Performance of these Countries from 2005 to 2015. It has been cleared from the table 1 that in 2005, Pakistan had higher Industrial Growth as compared to all

four countries. But after it, the growth pattern of Pakistan become very worst and in 2015 it was only 4.8% i.e. lower than India, Bangladesh and Bhutan.

Table 1: Industrial Value Added (Annual % Growth)

Years	Countries				
	Pakistan	India	Bangladesh	Nepal	Bhutan
2005	12.1	9.7	7.9	3	3.8
2006	4.1	11.6	9.8	4.5	8.8
2007	7.7	7	9	3.9	4.7
2008	8.5	4.4	7	1.7	6.3
2009	-5.2	9.2	6.9	-0.6	3.5
2010	3.4	7.6	7	4	12.5
2011	4.5	7.8	9	4.3	4.1
2012	2.5	3.6	9.4	3	6.8
2013	0.8	5	9.6	2.7	3.9
2014	4.5	5.9	8.2	7.1	3.7
2015	4.8	7.4	9.7	1.5	8.1

Source: World Development Indicator

The same thing is also shown with the help of figure 2. Figure 2 basically shows the overall trend of Industrial Growth in all five countries. It has been seen from the Figure that the Industrial Growth rate of Pakistan had a declining pattern until 2009. After it, the industrial Growth has increased but the rate of Growth is very slow as compared to other Countries specially Bangladesh and India.

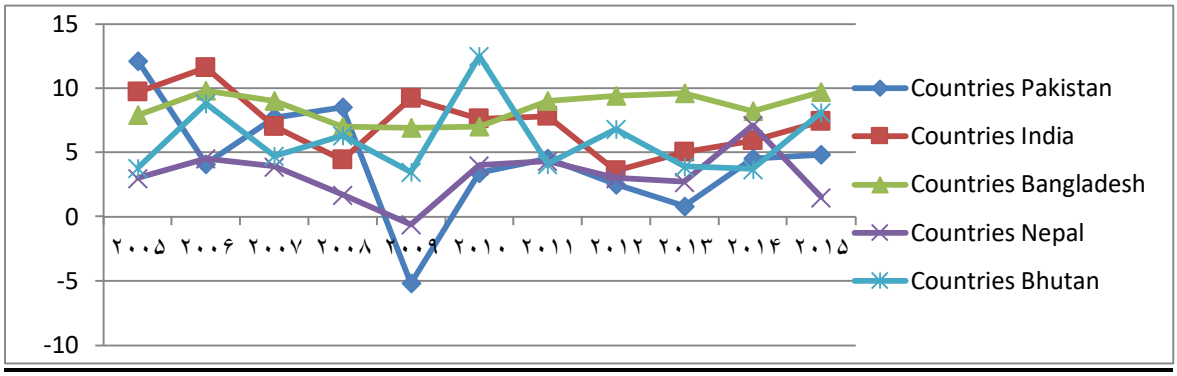

Figure 2: Industrial Value Added (Annual % Growth)

Review of Literature

The recent economists have contributed many theoretical and empirical literatures about the industrial development and economic growth. The results achieved by the contributors at international and national levels are outlined below.

International Studies

Koo and Lou (1997) examined the link between the agricultural and Industrial sectors in Chinese Economic Growth They used Panel Data of 20 Provinces from 1988-1992. They estimated two equations simultaneously by using the least Square technique. Industrial output and Agricultural output were used as endogenous variable while arable land, total labor which are employed in agricultural sectors, total labor which are employed in Industrial Sectors and the total invested capital in agriculture and Industries were treated as exogenous. The data was collected from Statistics Yearbook of China and Statistics Yearbook of China Rural Economy. The result revealed that Industrial Growth Contributes to Agricultural Growth but agricultural growth does not contribute to Industrial Growth.

Carmen and Pilar (2004) investigated the impact of manufacturing sector growth on real GDP and employment for China. They used quarterly time series data from 1979 to 2002. They used dynamic econometric technique of estimation. The study revealed the positive and long run relation between Economic growth and manufacturing growth. Knilvila (2007) describes the role of industrial development on the growth of seven countries like China, India, Korea, Taiwan, Indonesia, Mexico and Brazil. She found that industrial development has been an important basis for economic growth. In order to achieve sustained long run growth and poverty reduction, the industrial development is essential.

Sultan (2008) investigated the long run relationships among different variables in Bangladesh. The variables include export, import, industry value added and Gross Domestic Product. He used annual time series data for 1965-2004. World Development Indicators was the major source of data. Gross Domestic Product was used as the dependent variable whereas export, import, Industry Value Added was taking as independent variables. The findings revealed that there was exists a significant relationship between the Value added of Industry and GDP.

Aggarwal and Kumar (2012) analyzed the linkages between Structural Change, Industrialization and Poverty. They used data of Indian Economy for the period of 1950-2010. The study revealed that there was a substantial improvement in India's GDP Growth performance. This growth comes due to Structural changes which in turn reduces of poverty through the expansion of valued added and employment in Industries.

Dan and Wanjuu (2012) investigated the impact of industrialization on economic growth in the county of Nigeria. The main source of data was Central Bank of Nigeria (CBN) Statistical Buellton (2010) and UNCTAD (2011) Statistics database online. They used capital industrial output ratio and labor industrial output ratio as explanatory variables and per capita output as explained variable. They found a negative impact of industrialization on economic growth in Nigeria. Ibbih and Gaiya (2013) did a cross sectional analysis of 54 African Countries and analyzed the relationship of Industrialization and growth. They used Generalized Least Square weight Regression Method on the cross Country data of 54 African Countries. The data was obtained from World Bank data base (2012). They used GDP as dependent variable and Domestic Credit to Credit Sector, GDP Growth, GDP per capita, Industry value Added, Growth of Industry

Value Added, Manufacturing Value added and Growth of Manufacturing Valued Added were taken as independent Variables. The Result revealed that there was relationship between industrialization and Economic Growth but that relationship was not strong.

Alexanda et al. (2015) studied the effect of industrialization in the economic development of Nigeria. The time series data for the period of 1973-2014 was used. National Statistical bulletin was the main source of data. They used GDP as the dependent variable. Whereas Foreign Direct Investment, Industrial output, total savings and inflation are the variables that was used as the independent variables. The result revealed that the relationship between industrial output and economic growth is positive but not statistically significant.

Z.Isiksal and Chimezie (2016) used Johansen Co-integration testing approach in order to analyze the relationship between GDP, Agriculture, Industry and Services Sector in Nigeria. They used Secondary data from the Central Bank of Nigeria Statistical Bulletin (2012). The dependent variable was GDP whereas Industry, Agriculture and the Services were independent variables. The data was collected from First Quarter of 1997 to the fourth Quarter of 2012. The result revealed that there was a significant positive relationship between GDP, Agriculture, Industry and Services.

National Studies

Dutta and Ahmed (1999) investigated the impact of trade policies on industrial growth of Pakistan. They selected a time series data for 1973-1995. Industrial value added was taken as dependent variable, while Capital input, labor inputs, Human capital and index of trade liberalization were selected as independent variables. They used Co integration and error Correction modeling approach of Econometrics. The result showed the significant relationship between trade liberalization and industrial Development.

Ellahi et al. (2010) described the empirical relationship among the trade openness, industrial value added and economic growth of Pakistan. They used annual time series data from 1980 to 2009. In order to find the direction of causality; they used OLS techniques of estimation and Granger Causality tests. They used real GDP as dependent variable while imports, exports and industrial value added as independent variables. World Development Indicators (WDI) and International Financial Statistics (IFC) were the major sources of data. Their study revealed that imports and exports affect positively to economic growth when industrial value added as taken into account. Zaman et al. (2011) did the investigation on the impact of industrialization on Water Resources of Pakistan. They selected a data from 1975-2009. The data was collected from World Development Indicator. Water Consumption was taken as an independent Variable whereas GDP, Industry Value added, Liquid liabilities were selected as dependent Variables They used Bounds testing Approach to examined the relationship between the variables. The study revealed that Industrialization caused water Pollution, thus reduces the economic Growth.

Khan and Ahmed (2013) investigated the impact of trade liberalization on industrial Production of Pakistan. They selected a data for period of 1972-2012 from Pakistan Economic Survey and State Bank of Pakistan. They constructed a trade liberalization

index by Principal Component Method. The Independent Variables that they choose was GDP, Industrial Value Added, Agriculture Value Added, Industrial Sector labor force and Private Investment in Industrial Sector. The result of the study revealed that the trade liberalization have both direct and indirect impact on Industrial Productivity.

Ajmair (2014) investigated the impact of Industrialization on GDP of Pakistan. He took time series data from 1950 to 2010. The data was collected from Economic Survey of Pakistan, Pakistan Bureau of Statistic and State Bank of Pakistan. He used Growth of GDP as dependent variable while Growth of Industrial Sector, Growth of Mining and Quarrying, Growth of Manufacturing Small Scale, Growth of Construction, Growth of Electricity, Gas and water supply Distribution were choose as independent Variables. The result of the study revealed a positive relationship of all components of Industrial Sector with GDP.

Above literature review reveals that in some country industrialization leads to betterment of society because it increases the economic growth of the country. At national level, the study shows that industrialization has indirectly effect on economic growth i.e. the industrialization leads to increase trade which in turn increases growth rate. Thus, I am going to investigate the direct effect of industrialization on economic growth in Pakistan. This is the things that differentiate my works to others. For the purpose of this, I replicate the work of Alexenda et al. which has been done in Nigeria on 2015.

The Economic Model

On the basis of empirical study of Alexanda et al. (2015) we use GDP, Industrial output, saving, Foreign Direct Investment and Inflation Rate for the estimation of relationship between Industrial output and GDP. The model will be written as:

GDP=f (IND, FDI, SAV, INF)

Where:

GDP = Gross Domestic Product (Current US $)

IND = Industrial Output (Million $)

FDI = Foreign Direct Investment, (% of GDP)

SAV = Saving (% of GDP)

INF = Inflation, GDP Deflator (% of GDP)

This functional relationship can be written in Econometric model as:

$$GDP_t=c+c_1IND_t+c_2FDI_t+c_3SAV_t+c_4INF_t+E_t \quad (1)$$

Data Sources

In order to find the long run relationship, the time series data of the period of 1976-2015 is used. The data is collected from the World Development Indicators.

Methodology Framework

The study uses time series data which is mostly non-stationary. If OLS procedure will run on non-stationary variables then the result will be inappropriate and useless. That is why, we first check Stationarity by using ADF test given by Dickey and Fuller(1979).After it we use Autoregressive Distributed Lag (ARDL) co-integration technique to examining the long run relationship between Industrial Output and GDP of Pakistan. This technique is more suitable because it estimated short and long run parameters simultaneously.

The ARDL representation of the economic model written in equation 1 can be constructed as:

$$D(GDP)_t = \alpha_0 + \alpha_1 D(GDP)_{t-i} + \alpha_2 D(IND)_{t-i} + \alpha_3 D(FDI)_{t-i} + \alpha_4 D(SAV) + \alpha_5 D(INF)_{t-i} + \alpha_6 GDP_{t-i} + \alpha_7 IND_{t-i} + \alpha_8 FDI_{t-i} + \alpha_9 SAV_{t-i} + \alpha_{10} INF_{t-i} + \varepsilon_{t-i} \quad (2)$$

In above "D" is used for first Difference. For ARDL, first step is to select the suitable lag order by comparing the values of Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC). After it, the next step is to calculated the F-statistics and compare it with critical values from Pesaran (2001). The comparison of F-statistics and Critical Values will reveal whether co-integration between the variables exists or not.

The Null hypothesis is

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = \alpha_{10} = 0$$

and alternative hypothesis is

$$H_1 = \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq \alpha_{10} \neq 0.$$

If F-statistics greater than the upper Critical value at 5%, then there is no co-integration.

The diagnostic test will also be conducted to test the serial correlation. After it, Error Correction Method (ECM) is used to find short run impact of Industrial Output on GDP. The equation of ECM can be written as:

$$D(GDP)_t = \lambda_0 + \lambda_1 D(GDP)_{t-i} + \lambda_2 D(IND)_{t-i} + \lambda_3 D(FDI)_{t-i} + \lambda_4 D(SAV)_{t-i} + \lambda_5 D(INF)_{t-i} + \eta ECM_{t-1} + \varepsilon_t \quad \mathbf{(3)}$$

Here η measures the speed of adjustment from short run towards long run equilibrium. After estimate this equation, we will conduct the test of serial correlation and stability of result.

Empirical Results

The discussion of the study starts from the test of Unit Root. For this, we choose Augmented Dickey Fuller test. The result of this test is reported in table 2 and 3.

Table 2: Unit Root Test In Levels

Variables	ADF test Statistics	Test Critical Value at 5%	Probability
GDP	1.215841	-3.529755	0.9999
IND	-1.444184	-3.529758	0.8315
FDI	-5.295908	-3.552973	0.0007
SAV	-4.146855	-3.52975	0.0118
INT	-5.848121	-3.5237	0.0001

Test Equation: Trend and Intercept

Table 3: Unit Root Test At First Difference

Variables	ADF test Statistics	Test Critical Value at 5%	Probability
D(GDP)	-5.121071	-3.533083	0.0009
D(IND)	-5.860611	-3.5386	0.0001
D(FDI)	-4.428716	-3.574244	0.0076
D(SAV)	-6.814559	-3.533	0.0000
D(INT)	-7.722006	-3.5366	0.0000

Test Equation: Trend and Intercept

The result indicated that GDP and Industrial output have problem of Unit Root at level. i.e. ADF test Statistics is lower than the critical values. These two are become stationary at first difference. Whereas FDI, Saving and Inflation have no Unit Root problem in level. They are integrated of order zero at levels.

None of the variables are integrated of order two; it means that ADF test can be used. We choose Akaike Information Criterion and Schwarz Information Criterion for the selection of the lag length. The lag will be selected according to minimum value of AIC and SIC. Table 4 shows that the optimal lag length is five (5) because it has lower value of AIC and SIC.

Table 4: Selection of Lag Length

LAG	Akaike Information Criterion	Schwarz Information Criterion
1	48.33415	48.80819
2	47.85836	48.55498
3	47.05264	48.97636
4	46.90391	48.05932
5	46.65133*	48.04301*
NOTE: *Indicates Selected lag order		

After it we estimate the ARDL F-statistics which examines the co-integration between the variables. The result of this is shown is Table 5.

Table 5: Ardl Bounds Test for Cointegration

Estimated Model	GDP=f(IND,FDI,SAV,INF)	
Optimal Lag length	5	
F-Statistics	3.611065	
Critical Values at 5%	Lower Bound	Upper Bound
	2.56*	3.49*
R^2 = 0.8786 F-Statistics = 4.677886		Adjusted R^2 = 0.6903 χ^2 Serial 9.852(0.0644)**
*The Critical Values are from Pesaran et al.(2001) ** LM test for Serial Correlation		

The result of Co-integration indicates that the F-statistics (3.611065) is more than the Pesaran upper Bound Critical Value (3.49).So, Null hypothesis can be rejected in favor of alternative hypothesis. This means that the co integration between the variables is exist. Moreover, there is not a serial correlation between the variables. Because the probability value of chai square is greater than 5%.

Thus all variables will move together in long run. Therefore, the next step is to investigate the long run impact of Industrial output, FDI, Saving and Inflation on GDP in Pakistan. Equation 2 shows the long run relationship between the variables. The estimated result of this equation using OLS is shown in Table 6.

The result reveals that long run relationship between industrial output and Gross Domestic Product is positive. This relationship is significant as p-value is 0.0000. The value of R square is 0.940665 which examines that about 94.06% variation in Gross Domestic Product is explained by independent variables.

Now next step is to investigate the short run impact of Industrial output on GDP. To examine the short run relationship, Error Correction Method (ECM) is used. Equation 3 shows the short run relationship between the variables. The result of regression is reported in Table 7.

Table 6: Long Run Coefficients Estimated by Ols

Variables	Coefficient	t-Statistics	Probability
C	9.09	3.507165	0.0013
IND	908.8	21.68211	0.000
FDI	-1.2	-2.856686	0.0072
SAV	-2.2	-2.215018	0.0334
INF	-8.79	-1.324755	0.1938
R^2=0.940665 Adj. R^2 = 0.933884 F-Statistics = 138.7190 Prob. (F-Statistics)=0.0000			

Table 7: Error Correction Method in Short Run

	Coefficient	P-Value
ECMt-1	-0.131139	0.0284
F-Statistics		2.95183
Prob.(F-Statistics)		0.016
R^2		0.735
X^2 Serial *		6.49 (0.2614)
*LM test for Serial Correlation		

The result shows that the coefficient of ECM_{t-1} is -0.131139 and p-value is 0.0284 which shows the significant result. It reveals that the whole system can get back to the long run equilibrium at the speed of 13.11%. Moreover, result shows there is not a problem of serial correlation between the variables.

Now in the end, we will check the stability of long run and short run model by using Cumulative Sum (CUSUM). If plots of test are moving between the critical limits then our model is stable. The CUSUM of both short and long run models are reported in Figure 2 and 3.

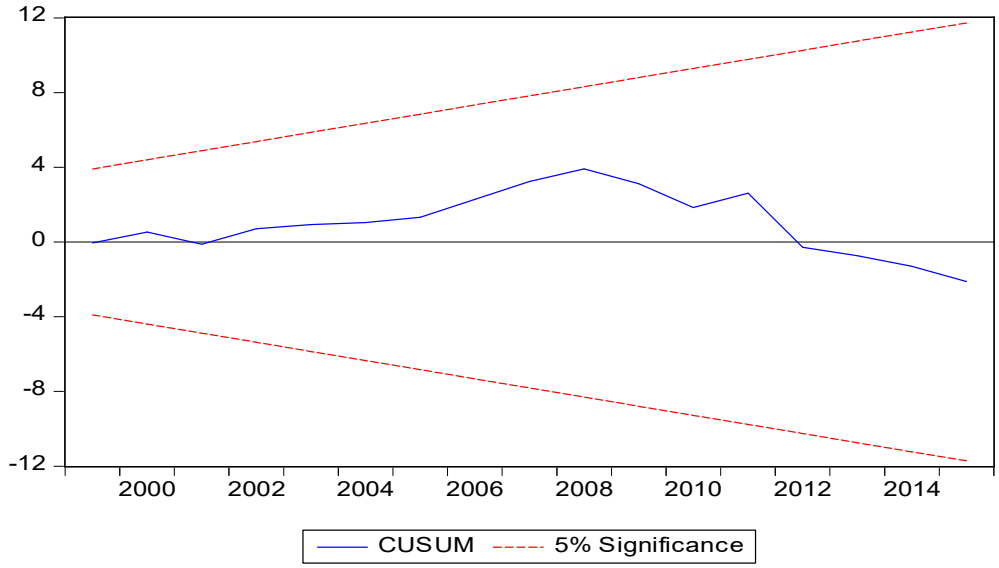

Figure 3: Plot of Cusum in Short Run

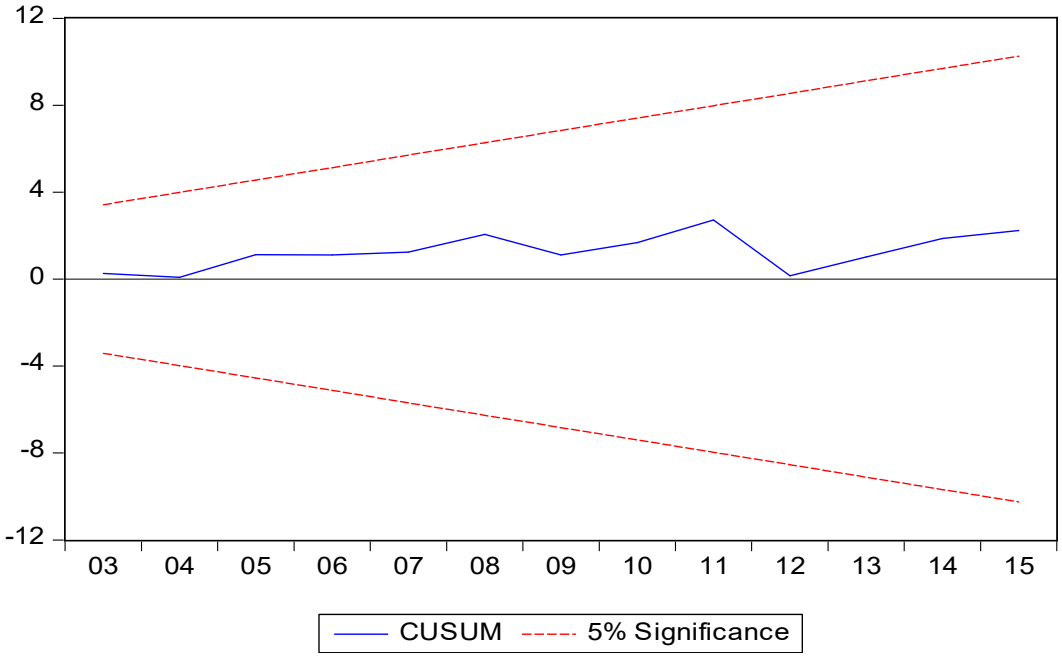

Figure 4: Plot of Cusum in Long Run

The figure shows that the graph lies between the lower and upper critical limits. It means both models are stable are reliable.

Conclusion

The aim of this study is to explore the long run relationship between Industrialization and Economic Growth in the country of Pakistan. For this purpose we have used time series data from 1976-2015. We selected the set of variables that are used by Alexanda et al. (2015). The Augmented Dickey Fuller (ADF) test has implemented for checking the stationarity. The result shows that all the variables are stationary at level except GDP and Industrial output. These are the variables, which are integrated of order 1. Long run co integration between Industrial output and GDP is investigated by ARDL testing approach. Five lag lengths have been selected for ARDL bound test. The result of this test reveals that the long run relationship between the variables is exist. We also used LM test for serial correlation. The result not found any evidence of serial correlation between the variables.

In order to estimate the long run coefficients, OLS technique has been used. The result shows the existence of positive relationship between GDP and industrial output. This result is not consistent with the study of Alexanda et al. (2015) done in the context of Nigeria.

The result suggests that the productivity of Industries should be increased in Pakistan. The new industries should be established that will enhance the contribution of Industrial sector in the GDP. Side by side, loans should be given to industrialists, so that they can run industries smoothly. Other than these, there will also be some incentives given to workers of industries that will develop the industrial sector and uplift the overall

economic activity. It will increase the productive capacity and established new employment opportunity in our country.

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