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IMPACT OF INFRASTRUCTURE DEVELOPMENT ON ECONOMIC GROWTH: A CASE STUDY OF PAKISTAN

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ABSTRACT: *This paper has explored the relationship between Infrastructure development and economic growth in Pakistan. For this purpose we used time series data for the period from 1971 to 2013. Auto Regressive Distributed Lags Model (ARDL) has been applied to examine the short run as well as long run relationship between infrastructure development and economic growth. Infrastructure Development Index (LINDI) is constructed to examine the impact of infrastructure development on economic growth. The empirical findings show a positive relationship between physical infrastructure and economic growth. The results showed that infrastructure development plays a key role to sustain to accelerate the process of economic growth and sustain it in the long-run. Moreover, economic growth can be stimulated by making an investment in the major determinants of economic growth i.e. physical infrastructure.*

KEYWORDS: Development; Economic Growth; Infrastructure; Pakistan

INTRODUCTION

Infrastructure development is considered an effective tool to promote economic growth and welfare level with in a state or country. After World War II various governments invested to promote the quality of infrastructure and encouraged the private sector to make investment for infrastructure development. Due to this, infrastructure development is considered like a public good. Even in different states and countries it is considered that the provision of developed infrastructure is a sole responsibility of state government. Infrastructure is generally divided into two segments the first segment consisted of the construction of infrastructure and send related to the delivery of public services like electricity, gas and water (World Bank; 1994). The construction of infrastructure has remained the basic priority but due to global financial crises and commodity prices hikes it has become very difficult for developing economies to sustain the investment in infrastructure. Due to these challenges it has become difficult to

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continue the running projects, particularly the projects related to the water and energy sectors. However to continue with the running projects related to the infrastructure development it has become necessary for the developing economies' governments to explore the new mode of investment (Lin; 2011).

A sustained economic growth is a key factor to put an economy on the road of progress and infrastructure is considered as a front wheel to lead the economy towards economic growth. Pakistan as a developing country facing the challenges of slower economic growth and mean while coping with the challenges of infrastructure development. The challenges regarding infrastructure can be categorized into three categories which can be related to efficiency, quantity and financing for infrastructure development. Imbalance and unplanned basic Infrastructure development is a basic reason to generate regional inequality due to that people migrate from poor infrastructure regions to developed infrastructure regions. Infrastructure is just like a backbone of the economy of a country. Developed infrastructures promote the foreign trade, living standard of the citizen and promote the economic growth. However, lack of suitable human resources, poor planning, and management skills are basic reasons behind the poor Infrastructure or infrastructure development with in a country. Mostly developing countries facing the challenges to develop the infrastructure because it's prerequisite for sustainable economic growth. Pakistan like other developing economies confronting the challenges of poor infrastructure development. Therefore, this study will highlight and explore the determinants of Infrastructure development in Pakistan and empirical investigation to discover the relationship between infrastructure development and economic growth in Pakistan. To obtain the proposed objectives the study will be composed in following sections.

Research Question

The main research question of this paper is to explore nature of relationship between infrastructure development and economic growth. Other relevant questions are as under:-

(i). Is the development of infrastructure accelerate economic growth?
(ii) Is the development of infrastructure expedite economic growth in short-run?
(iii) Is the development of infrastructure stimulate economic growth in long-run?
(iv) Is the relationship between infrastructure developments is positive or negative?
(v) Why is economic growth slow in Pakistan?

Objective of study

The objectives of this paper are:-

1. To investigate the causes of slow economic growth in Pakistan.
2. To probe whether it is due to poor infrastructure or something else.
3. To empirically analyze whether economic growth can be expedited by developing infrastructure.

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LITERATURE REVIEW

In present section study will provide a glimpse of the literature on infrastructural development and its impact on economic growth with special context to developing countries like Pakistan. Morrison and Schwartz (1992) explored the impact of state infrastructure on productive performance of manufacturing sector of 48 U.S. states. The empirical investigation showed that the infrastructure investment has positive and significant relationship with firm's output in 36 states which confirmed that development in the infrastructure lead towards economic growth. However the relationship between infrastructure investment and firm's production in 12 states is positive but not significant which means that infrastructure development and economic growth although has positive relation with economic growth.

Flynn (1993) determined that enriched infrastructure through public sponsorship support existence of advance technology firms. If advance technology will be adopted by the firms it will also reduce the cost of production. Therefore, infrastructure development on one hand will promote the advanced or modern industrialization it will also help to promote the production level and on other it will improve the economic growth by improved means of production and industrialization.

Madden and Savage (1998) found that the improvement in the infrastructure help to increase the level of national growth rate. Development in the infrastructure helps to change the whole scenario of the economic activity in the country and this lead ultimate improvement in the GDP.

Bougheas, *et al.* (2000) studied a significant positive relationship between infrastructure and degree of specialization and also stated a robust non-monotonic (inverted-U) relationship between infrastructure and growth by using OLS regression models. The variables used are paved roads per thousand kilometers, telecommunication lines per thousand occupants as independent variables while per capita GDP as dependent variable. The results of the study suggested that economic growth increased in the start due to improvement in the infrastructure and when it reached at its peak level, economic growth also touch its highest point and after that it start declined when extra infrastructure installed. Study convinced with this result because it may happened when excess infrastructure create problems to handle it and its maintenance and waste become the permanent source of economic problems.

Yilmaz, *et al.* (2001) indicated the accumulation of telecommunication infrastructure improves the overall productive capacity at the regional level by examining the impact of levels in the United States. Telecommunication infrastructure used as independent and overall productive capacity used as dependent variable for the proxy to the economic developed. Study suggested that increase in the level of telecommunication infrastructure help to improve economic growth as it increase the productive capacity of the economy. The results of the study confirmed that

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improvement in the infrastructure especially telecommunication infrastructure may be a key to the economic development.

Mareno, *et al.* (2003) analyzed that the spatial dimension of infrastructure impact on regional economic growth. They assumed that the effect of infrastructure on productivity depends on the various types of public infrastructure, so that local infrastructures would enhance economic activity in the area where they are located, whereas transportation and communication infrastructure may produce benefits in both regions where they are located and spillovers to other regions.

Canning and Pedroni (2004) examined the long run relation between infrastructure and economic growth. They found that those countries which had developed their infrastructure with the passage of time had better economic condition against those who didn't consider infrastructure development as a path of economic development. Study argued that front line infrastructure especially telecommunication, electricity growth and energy growth, paved roads, basic health and educational facility have direct impact on the country's economic development and also improved the income level of the common people.

Straub, *et al.* (2008) analyzed whether infrastructure investment has contributed to East Asia's economic growth using both a growth accounting framework and cross-country regressions. This study described that the use of macro level data should be considered with extreme caution. They also suggested that infrastructure investment may have had the primary function of relieving restrictions and bottlenecks as they arose, as opposed to directly encouraging growth.

Montolio and Sole-olle (2009) studied the effect of productive infrastructure on output growth. They stated that public investment in road infrastructures as a determinant of Total factor Productivity (TFP) growth for Spanish provinces and stated that the effect of road infrastructures depend on the extent of the road used by the provincial industries. They also considered that the services provided by the stock of roads infrastructures as an impure public good, that is one that is subject to congestion. The study concluded that by using the instrumental variables technique, there is a better solution for possible problems of endogeneity in the regression.

Donaldson (2010) investigated the impact of infrastructure development on economic growth. Study revealed that extension of Rail infrastructure by the great British Empire has significant and positive impact on economic condition of India. Results shown that rail road extension leaded increase in the real agricultural income up to 16% to an average district of India while Impact on the overall economy was enormous. This study strongly supported the phenomena that development in the country's infrastructure has one of the main sources of economic activity and ultimate source of economic growth.

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Straub and Terada-Hagiwara (2011) applied growth regressions and growth accounting technique to investigate the linkages among growth, productivity and infrastructure in the case of some selected developing countries of Asia. The study determined that the infrastructure development has direct and positive impact on different sectors of the economy like improvement in the communication technologies which reduce the time wastage and better educational and health facilities reduces the level of stress of the workers and improve their working efficiencies.

Haider, *et al.* (2012) found out the impact of infrastructure on economic growth with reference to Pakistan. This study found that there is a statistically significant and positive relationship between infrastructure development and economic growth which means that the greater investment in infrastructure development facilitates to achieve high economic growth. Study also found that infrastructure development help other sector of the economy indirectly to grow and in this way it has multiple impact on the economy and wellbeing of the country.

Zhang, *et al.* (2012) analyzed that public infrastructure investments are one of the key engines of economic growth in China. They applied a macro-micro simulation method to assess the effects of Public Infrastructure Investment on the national economy using an inter-temporal dynamic CGE model and its distributive effects on individual households using a micro-simulation. The study showed the results that higher Public Infrastructure Investment substantially raises productivity in all sectors and income in all household categories in China.

Rao and Srinivasu (2013) described the relationship between infrastructure and economic growth by using growth theories through empirical evidences. Study showed that there was a positive and statistically significant relationship between infrastructure development and economic growth, infrastructure development and poverty. Study suggested that more improved infrastructure means that more productivity in the production process and ultimately improvement in economic growth.

Some studies suggests that improvement in the infrastructure is the main source of economic growth while some have viewed that economic growth and infrastructure development have mutual correlation. There are also some studies which suggested that there may be positive relation between economic growth and infrastructure but it may not significant. They argued that infrastructure development may not have direct impact on economic growth but it work through chain like investment in transportation and telecommunication lead to multiple economic activities which ultimately have impact on economic growth. Therefore it can be concluded that the direct impact of infrastructure development on economic growth is still need to be done especially in developing countries like Pakistan. It is believe that this work will help to fulfill the gap of literature with special context of Pakistan.

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DATA AND METHODOLOGY

The time series data used in this study have been taken from Pakistan economic survey (various issues) published by Ministry of Finance, Government of Pakistan, Fifty Years Handbook of Statistics of Pakistan Economy published by State Bank of Pakistan (SBP) and World Development Indicators by World Bank. The study covers the period of 1971-2013.

To measure the infrastructure development, we construct index of infrastructure. Similar infrastructure development index was constructed by Jan, *et al.* (2012) to determine the relationship between infrastructure development and economic growth in Pakistan. For each indicator, the raw data are re-scaled such that the minimum value across all years of the Index (1971 to 2013) receives a score of "0" and the maximum value across all years of the Index score of "100." For each indicator in each year, the score is calculated as follows:

$$\text{Normalize Value of Index} = 100\times\left(\frac{x_c^1 - MIN(x)}{MAX(X) - MIN(X)}\right)$$

Where x_c^t is the raw value for that indicator for country *c* in a year *t* and *X* describes all raw values across all six sub components of an infrastructure index. Because high values may indicate good performance for some indicators and low values good performance for others, we subtract this sum from 100, as appropriation, so that the best performers will always receive the highest value and the worst performers will attain the lowest value.

Model Specification

Model that will be used for the empirical analysis is as follows:

$$LGDP = \beta_0 + \beta_1 LINDI + \beta_2 LPOP + \beta_3 LINM + \beta_4 LGDPP + u_i \quad \rightarrow (1)$$

The expected sign of these explanatory variables are stated in their descriptions, while u is the error term and assumed to be normally distributed. Econometric problems like spurious regression, stationarity, autocorrelation and multicollinearity will be resolved by using statistical techniques. However, an econometric technique will be used for the estimation of mode 1 by using time series data of Pakistan from FY-1972 to FY-2013.

Description of the variables

The variables which are included in this research to capture the impact of infrastructure development on economic growth are being discussed as under;

i. Infrastructure Development Index (INDI): Infrastructure Development Index is a composite index of major infrastructure indicators which has been developed to examine the impact of infrastructure on economic growth. We use Principal Component Analysis to develop

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the infrastructure index by taking six major infrastructure indicator such as (i) Air transport, registered carrier departures worldwide (ii) Roads, paved (% of total roads) (iii) Roads, total network (km) (iv) Telephone lines (v) Improved water source (% of population with access); and (vi) Energy production (kt of oil equivalent)

ii. Gross Domestic Product (GDP): The Gross Domestic Product is a monetary value of all the finished goods and services produced within a country's borders in a specific time period, though GDP is usually calculated on an annual basis.

iii. ***Population (POP):*** A group of individuals of the same species occupying a particular geographic area. Populations may be relatively small and closed, as on an island or in a valley, or they may be more diffuse and without a clear boundary between them and a neighboring population of the same species. For species that reproduce sexually, the members of a population interbreed either exclusively with members of their own population or, where populations intergraded, to a greater degree than with members of other populations.

iv. ***Infant Mortality Rate (INM):*** Infant Mortality Rate measure the probability of dying between birth and exactly one year of age expressed per 1,000 live births.

v. ***GDP Per Capita Income (GDPP):*** A measure of the total output of a country that takes the gross domestic product (GDP) and divides it by the number of people in the country. The per capita GDP is especially useful when comparing one country to another because it shows the relative performance of the countries. A rise in per capita GDP signals growth in the economy and tends to translate as an increase in productivity.

FINDINGS AND RESULTS

Our statistical analysis can be classified into two major segments i.e. elementary analysis of data and empirical or time series analysis of data for the time period from 1971 to 2013. Therefore, the elementary and time series analysis can be explained as follows.

Elementary Data Analysis

Table 1 depict the elementary examination of selected variables which have used in the present study. The mean value of log of Infrastructure development index (LINDI) is 4.39 which shows the average adjustment ratio with variation of 0.86 while for log of infant mortality rate (LINM) has an average value of 4.60 and variation is 0.21. The adjustment ratio of Infrastructure development index has a maximum value of 5.46 and minimum value is reported at 2.08. The log of gross domestic product which has selected in local currency unit (LGDP) has an average value 24.55 with a variation of 0.94. The minimum and maximum bounds for LGDP are reported at 22.56 and 26.18 respectively. Similarly, LPOP has the average values 0.93 with variations of 0.24.

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Table 1: Descriptive Analysis of Variable

Variables	LINDI	LINM	LGDP	LPOP	LGDPP
Mean	4.39	4.60	24.55	0.93	6.25
Median	4.74	4.62	24.60	0.98	6.32
Maximum	5.46	4.91	26.18	1.22	6.69
Minimum	2.08	4.21	22.56	0.50	5.78
Std. Dev.	0.86	0.21	0.94	0.24	0.27
Skewness	-0.94	-0.25	-0.13	-0.45	-0.21
Kurtosis	2.96	1.80	2.32	1.72	1.90
Observations	43	43	43	43	43

Source: Author's own calculation

The variance is used to measure the distribution or spread of the values of variable around the mean value. The standard deviation can be defined as positive square root of the variance. The other moments of distribution are also presented in table 1.1 that are used in shape of probability distribution like kurtosis and skewness. The skewness is zero in symmetric distribution comparing the values of skewness of different variables under analysis. It is obvious from the table that all the variables are negatively skewed.

The Kurtosis are used to examine the flatness or peakedness of economic data. If the value of kurtosis is greater than 3 in probability distribution it means that the distribution is leptokurtic. If the value of kurtosis is less than three it means that the probability distribution is normal and platy-kurtic. The results in table 1.1 show that all variables have kurtosis value less than three it means all probability distributions are normal distributions. Pair wise correlation is commonly used to determine the coefficient of correlation and results of correlation matrices are presented in Table 2. The coefficient of correlation is denoted by 'r' and used to determine the problem of Multicollinearity in an econometric model. The value of coefficient of correlation ($\mathbf{r}\ x_1x_2 \geq 80$) shows severe Multicollinearity among the dependent and independent variables.

Table 2: Correlation Matrix

Variables	LINDI	LGDP	LGDPP	LINM	LPOP
LINDI	1.0000				
LGDP	0.6478	1.0000			
LGDPP	0.7561	0.4846	1.0000		
LINM	-0.7056	-0.8731	-0.5735	1.0000	
LPOP	0.6664	0.7948	0.8066	0.8972	1.0000

Note: Results are based on Author's calculations using Eview 7

The correlation matrix shows the pair-wise correlation between the variables. It shows that LINDI and LGDP have a coefficient of correlation around 0.64 which is less than critical value i.e. 0.8. The value of coefficient of correlation between LINDI and LGDPP is at 0.75 and LINM

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and LINDI have a value at 0.70. The log of Population (LPOP) is also weakly correlated with dependent variable LGDP. Therefore the results of correlation matrix show that there is no problem of Multicollinearity among the dependent and independent variables in first model. Alternatively we can say that all the controlled variables are weakly correlated with the dependent variable i.e. LINDI.

In the next section we will examine the empirical result but to avoid the spurious regression results and to choose the right econometric technique for time series data analysis it is essential to check the stationarity of the time series, therefore to check the stationarity we will use the Augmented Dickey-Fuller (ADF) test.

Empirical Analysis

To embark on time series data analysis it is necessary to check the stationary property of the selected variables used in the study. Generally, to determine the unit root, Augmented Dickey Fuller (ADF) test is used to determine the stationarity. A series is said to be stationary if its mean and variance are constant over time and the value of covariance between the two time periods depends only on the distance or lag between the two time periods. Augmented Dickey Fuller Test for unit root is used to examine the stationarity of time series. By applying the ADF test on all the dependent and independent variables to check the stationary or non-stationary of variables we conclude the following results which have been reported in Table 3.

Table 3: Results of ADF Test

Variables	ADF Statistics at Level	ADF (With first difference)	Order of integration
LINDI	-3.8352	-13.0402	I(0)*
LGDP	-2.1964	-5.5988	I(I)*
PLGDPP	-1.9094	-5.5595	I(I)*
LINM	-3.6610	-2.1858	I(0)*
LPOP	-1.5463	-2.6343	I(I)*

Note: Results are based on author‘s calculations. The rejection of the null hypothesis is based on MacKinnon (1996) critical values. The lag length are selected based on SIC criteria, this ranges from lag zero to lag two. *, ** and *** indicate the rejection of the null hypothesis of non-stationary at 1%, 5% and 10% significant level, respectively.

The results of ADF test indicated that the variables LINDI and LINM are stationary at level. However, LGDP, LGDPP and LPOP are stationary at first difference.As the results of ADF indicated that few variables are stationary at level I (0) while remaining are stationary at first difference I (1) therefore Auto Regressive Distributive Lag Model (ARDL) could be appropriate econometric technique to avoid the spurious regression results. It is a co-integration test through bounds framework which is based on the comparison of upper bound values and the calculated F values. If the value of calculated F ratio will exceed from the upper bound value (critical value) the vectors will be considered as co-integrated. Wald test is generally used to examine the existence of co-integration.

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We will apply Wald coefficient test or joint significance F-test on lagged level variables on the equation 1. The null hypothesis is (all long run variables or one period lagged variables are jointly absent from equation 1. We conduct the Wald test on lagged level variables and compute F-statistics. The computed F-statistics will compare with the Tabulated F-statistics. The table is developed by Pesaran *et al.* (2001). The tabulated F-statistics has two critical bounds, lower bound I(0) and upper bound I(1). If calculated F-statistics is larger than upper bound it means long run relationship is existed among the variables.If calculated F-statistics is less than lower bound long run relationship does not exist and if calculated value is between two bounds the result is inconclusive.

The Wald coefficient test on all lagged explanatory variables used in the equations 1 are reported in table 1.4. Our null hypothesis will be that lagged coefficient of explanatory variables are equal to zero or absent from the model. If we do not reject the null hypothesis it means long run relation among variables do not exist.

Table 4: Results of Bound (Wald) Test for Co-integration

Equation	F-statistics	Upper Bound Critical Value	Conclusion
Model-Equation (1) GDP/ LINDI, LGDPP,LINM,LPOP	4.320 [0.0006]	3.79 (95%)	Co integration exists

Note: Computed F-statistic: 4.021 (Significant at 1% marginal values).Critical Values at k =6-1=5 and k =4-1=3 are cited from Pesaran et al. (1999), Table CI (iii), Case 111: Unrestricted intercept and no trend. The numbers in parenthesis shows the probabilities of F-statistic.

According to ARDL approach explained variables of equation 1 exhibit the long run relationship with targeted explanatory variables because the calculated F value is higher than the upper bound value. Then the null hypothesis (there exists no co-integration) cannot be accepted and that there is indeed an existence of long run relationship among the focused variables. Table 1.4 is demonstrating that variables of equation 1 are co-integrated, so inquiries regarding the relationships between variables in long span of time are not sporious. Results are reported in Table 5.

Table 5: Long- Run Results of Cointegration Test

Dependent variable is LGDP			
Regressor	**Coefficient**	**Standard Error**	**[Prob]**
C	36.259***	2.8990	[.000]
LINDI	0.1621***	0.053028	[.005]
LPOP	0.6747***	0.16929	[.000]
LINM	-3.993***	0.38191	[.000]
LGDPP	1.001***	0.25876	[.001]

Note: Results are based on Author‘s calculations using Microfit 4.1

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From the Table 5 we have observed that the value of regression coefficient of infrastructure development index (LINDI) is 0.1621 which means that the one percent increase in infrastructure development increases the gross domestic product (GDP) by16 percent and this effect is very strong and statistically significant. It would have been expected that the development in physical infrastructure will improve the supply of resources and lower the cost of mobility which may enhance the efficiency of output and leads toward economic growth.

Empirical findings are perfectly in the line with economic theory as well as reflect the actual situation in Pakistan. We have also observed that the value of regression coefficient of population (LPOP) that is 0.6747. This means that the one percent increase in population increases the GDP by 0.67 percent and this effect is statistically significant. Which show the addition in manpower of the country. The coefficient of infant mortality rate (LINM) has a negative impact on economic growth; its value -3.99 indicates that one percent increase in infant mortality rate decreases the economic growth conditions by 3.99 percent. It depicts that worse health conditions badly effect the economic growth process with in an economy. The coefficient value of GDP per capita 1.001 shows the positive and significant impact of per capita income on economic growth. Which means that one unit change in GDP per capita will raise 1.0 percent increase in GDP.

Table 6: Short Run Results of Cointegration Test

Variables	**[d(LGDP)]Coefficient**	**Standard Error**	
Constant	36.75	[4.990]	
d[LGDP1]	0.263	[0.089]	
d[LINDI]	0.028	[0.106]	
d[LPOP]	0.684	[0.210]	
d[LINM]	24.99	[11.80]	
d[LGDPP]	0.106	[0.586]	
ECM(-1)	-0.613	[0.125]	
R-Squared	0.83	Schwarz Bayesian Criteria	45.59
Adjusted R-Squared	0.76	Akaike Information Criterion	54.88
Durbin Watson Statistics (DW)	1.708		

Source: Authors own calculation

[] Standard error is in parenthesis

Short run results are reported in table 1.6 because short run analyses also has an importance because it depicts response mechanism in case of shock or imbalances in focused variables of current study. In other words, short run examination expressed about how much error will be compensated during given lag of time. To provide the soundness to research results this work measured the error correction model (short run analysis) through ARDL framework. Outcomes of short run analysis are presented in table 1.6.

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According to results the 't' ratio of error correction coefficient are statistically significant. It indicates that there is also short run relationship between our concerned variables during the study period. The results revealed that the co-efficient of error correction term (ECM) has a negative sign. It show that the responsive mechanism very effective. Actually, it is convergence of our observed model form short run to long run equilibrium in Pakistan. It is also known as a speed of adjustment. The results are indicating that the coefficient of ecmt-1 is equal to (-0.613) for the short-run model and it implies that our model is corrected as the rate of 61.3 % from short run to long run over a year.

Diagnostic Tests

J-B normality test for residual is conducted to see residual are normally distributed or not because one of the assumptions of Classical Linear Regression Model (CLRM) is that the residual are normally distributed with zero mean and constant variance. In our estimated model the probability value is 0.163 which is higher than 0.05 for a 95% confidence interval and it shows that our residual is normally distributed. Ramsey reset test is conducted to check the misspecification of the model. Ramsey reset test probability value is 0.630 which is higher than the 0.05 for a 95% confidence interval and showed that the model is correctly specified. Breusch-Godfrey LM test is conducted to check the serial autocorrelation in our model. Breusch-Godfrey probability value 0.293 which is higher than the 0.05 for a 95% confidence interval indicates that there is no serial correlation in the models. Autoregressive conditional heteroskedasticity (ARCH) is conducted to check the autocorrelation in the variance of error term. In our model ARCH test probability value is 0.601 which is also higher than 0.05 for 95% confidence interval and indicating that there is no ARCH effect in the model. So, our model passes all diagnostic tests. The outcomes of all these tests in the same order are given in the tables 7.

Table 7: Results of Breusch-Godfrey LM Test

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 1.1946[.274]	F(1, 26)= .8619[.361]
B:Functional Form	CHSQ(1)= 5.6405[.018]	F(1, 26)= 4.5965[.941]
C:Normality	CHSQ(2)= .5349[.765]	
D:Heteroscedasticity	CHSQ(1)= 1.2485[.264]	F(1, 37)= 1.2243[.275]

Source: Author's calculation using Microfit 4.1

Stability Test

In order to check the stability of the coefficients we plot the cumulative sum of recursive residuals CUSCUM and cumulative sum of recursive residuals of square CUSUMS as shown in figure 1.1 and 1.2 respectively. The results show that coefficients in our estimated model are stable as the graph of CUSUM and CUSUMS statistics lies in the critical bounds. The absence of divergence in CUSUM and CUSUMS graphs confirms that our ARDL estimations for short run and long run estimates are stable.

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Stability Test CUSUM and CUSUMS

Figure 1.1

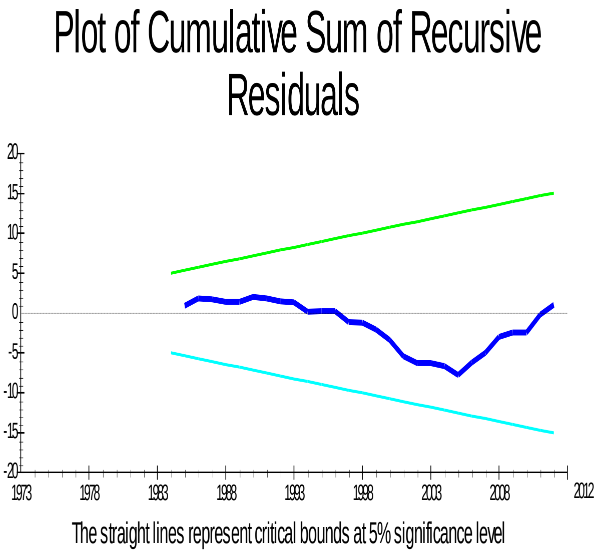
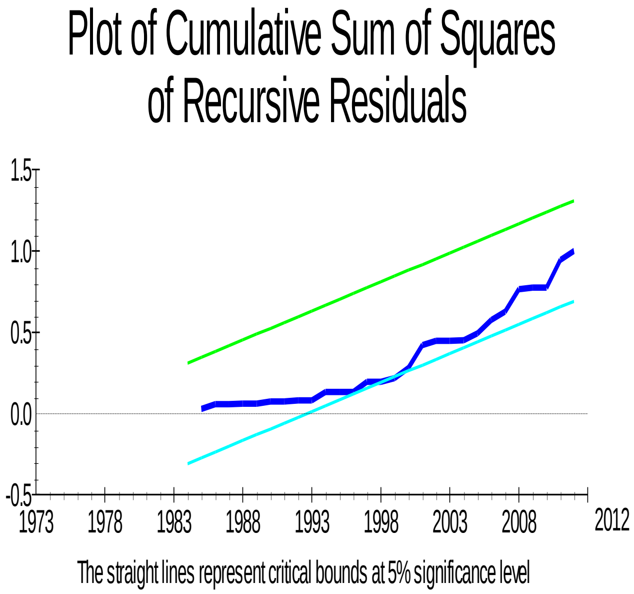


Figure 1.2



Our empirical findings showed a clear-cut positive association between physical infrastructure development and economic growth in Pakistan. However to control the robustness of the results various control variables and diagnostic tests had been performed.

CONCLUSION

The study concludes that infrastructure development plays a vital role in enhancing the economic growth of Pakistan. The empirical analysis suggests a definite positive relationship between infrastructure and economic growth. The robustness of the results has been checked through various diagnostic tests. Results showed that the investment in infrastructural development can stimulate economic growth. The government of Pakistan should take initiative to expand the infrastructure facilities and improve the quality of available infrastructure. The study has provided an empirical evaluation of the impact of infrastructure development on economic growth i.e. larger stocks of infrastructure assets will improved the economic growth. It is concluded that the results reflect causal and not merely coincidental effects of infrastructure on growth. Infrastructure development will not only raised growth it will also be proved a key win-win ingredient for poverty reduction by improving the quality of life of the citizens in Pakistan. This suggests that infrastructure development may be considered as major determinant of sustaining economic growth and alleviation of poverty. However, for policy perspective the study suggests that huge investment is required to develop infrastructure to achieve high and sustain economic growth in developing economies like Pakistan.

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REFERENCES

Bougheas, S., Demetriades, P. O., and Morgenroth, E. L. (2000). International aspects of public infrastructure investment. *Canadian Journal of Economics/Revue canadienned' économique*, *36*(4), 884-910.

Canning, D., and Pedroni, P. (2004). The effect of infrastructure on long run economic growth. *Harvard University*, 1-30.

Donaldson, D. (2010). *Railroads of the Raj: Estimating the impact of transportation infrastructure* (No. w16487). National Bureau of Economic Research.

Flynn, D. M. (1993). A critical exploration of sponsorship, infrastructure, and new organizations. *Small Business Economics*, *5*(2), 129-156.

Haider, S. Z., Amjad, M. U., Ullah, S., and Naveed, T. A. (2012). Role of Infrastructure in Economic Growth: A Case Study of Pakistan. *Journal of Asian Development Studies*, 1(1), 13-21.

Jan, S. A., Chani, M. I., Pervaiz, Z., & Chaudhary, A. R. (2012). Physical infrastructure and economic development in Pakistan. *Middle-East Journal of Scientific Research*, 11 (2), 216-220.

Lin, J. Y. (2011). New structural economics: a framework for rethinking development. *The World Bank Research Observer*, lkr007.

Madden, G., and Savage, S. J. (1998). CEE telecommunications investment and economic growth. *Information Economics and Policy*, *10*(2), 173-195.

Montolio, D., and Solé-Ollé, A. (2008). Road Investment and Regional Productivity Growth: The Effectsof Vehicle Intensity and Congestion. *Papers in Regional Science*, 88(1), 99-118.

Moreno, R., Lopez-Bazo, E., and ArtÍs, M. (2003). On the effectiveness of private and public capital. *Applied Economics*, *35*(6), 727-740.

Morrison, C. J., and Schwartz, A. E. (1992). *State infrastructure and productive performance* (No. w3981). National Bureau of Economic Research.

Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326.

Rao, P. S., and Srinivasu, B. (2013). Infrastructure Development and Economic growth: Prospects and Perspective. *Journal of Business Management & Social Sciences Research*, *2*(1), 81-91.

Straub, S., and Terada-Hagiwara, A. (2011). Infrastructure and growth in developing Asia. *Asian Development Review*, *28*(1), 119-156.

Straub, S., Vellutini, C., and Warlters, M. (2008). Infrastructure and Economic Growth in East Asia. *Policy Research Working Paper 4589*, World Bank.

World Bank. (1994). *World Development Report 1994.* Washington D.C.

Yilmaz, S., Haynes, K., and Dinc, M. (2002). Telecommunication and Regional Development: Evidence from the U.S. States. *Economic Development Quarterly*, 16(3), 211-228.

ISSN: 2053-2199 (Print), ISSN: 2053-2202(Online)

Zhang, Y., Wang, X., and Chen, K. (2012). Growth and distributive effects of public infrastructure investments in China. *In Infrastructure and Economic Growth in Asia*. 87-116.

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