Telecom Infrastructure and Economic Development of Pakistan: An Empirical Analysis

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Abstract

This study empirically examines the impact of telecommunication infrastructure on economic development of Pakistan by using time series. Data has been taken for the period from 1968-2007. Economic development was taken as predictand. While teledensity and investment in telecommunication sector were taken as predictors. By using the multiple regression model in log-linear form, we obtained the results (co-efficient given in the text) in which both variables teledensity (62.27788) and investment in telecommunication sector (79.66789) showed their positive and significant impact on economic development. This study helps to conclude the importance of telecommunication infrastructure in economic growth.

Key Words: Pakistan, Telecommunication Sector, Tele density, Gross Domestic Product .Jel Classification: B22, B23, C01, C22, C87.

Introduction

Role of telecommunication sector is indispensable for economic development. Telecommunication infrastructural investment can lead to economic growth in several ways: transaction cost of data collection, placing and receiving orders have greatly reduced due to the availability of advanced telecommunication infrastructure. It has put a positive effect on the output of individual firms and in aggregate overall economy.

In the beginning of 1960 researchers started to study the effects of telecommunication infrastructure on economic output. There are a lot of studies [Jip (1963), Riaz (1997), Norton (1980)] that empirically prove the positive relation between telecommunication infrastructures and economic growth

Communication tools such as internet and telephone are progressively more important for the economic development. No one can ignore the importance of internet for the society. The internet provides all types of information related to the business, health, education, culture, weather etc as needed by the different users. Distance learning is only possible through advanced telecommunication tools. It has also allowed educational institutions to deliver online lectures. Main purpose of this study is to illustrate the empirical relationship between telecommunication infrastructure and economic development from Pakistan view point. This study is organized as follows:

- Review of literature by including the theoretical and empirical findings
- Description of research methodology and about dependent and independent variables.
- Interpretation of regression results and analysis.
- Conclusion.

Literature Review

Here we take review of few important studies:

Jipp (1963) used following model to see the relationship between teledensity and GDP in less developed and industrially advanced countries.

$$\mathbf{D_{it} = \alpha\ Y\beta_{it}} \qquad \mathbf{(1)}$$

or

$$\mathbf{LnDit = \alpha + \beta\ lnY_{it}} \qquad \mathbf{(2)}$$

Where

$\mathbf{D_{it}}$ = telephone density in DEL/100

$\mathbf{Y_{it}}$ = GDP for the country in year t

Results revealed positive and significant relationship between GDP per capita and telephone density indicators.

Alleman *et. al* (2003), developed following two models to show the relationship between telephone penetration and GDP in 9 countries of Southern Africa.

ln (GDP)= α +β ln (DEL-1) (1)
ln (DEL)= α +β ln (GDP) (2)
By applying the data they proved positive relationship between telecommunication investment/ telephone penetration and GDP in both cases.

Riaz (1997, a, b), studied the effect of telecom sector on economic development in Malaysia and found that advancement in telecommunication infrastructure resulted in overall economic development of the country.

Hardy (1980) studied 15 developed and 45 developing countries for the period from 1960-73 to find the impact of telecommunication on economic growth. He concluded the positive and significant impact of telephone per capita (teledensity) on economic growth while, other communication tool like radio showed its insignificant contribution.

Nortan (1992) empirically investigated the role of telecommunication infrastructure in the economic development for the period from 1957-1977. He took the data of 47 countries. He concluded the positive and significant relationship of telecommunication infrastructure with economic development. He further argued that telecommunication infrastructure reduces the transaction costs since output rises.

Roller and Waverman (2001) empirically studied that investment in telecom sector fosters growth, estimating a structural model that endogenizes telecom investment, a data from 21 OECD countries over a 20 year period. They showed that there exists a significant positive relation between investment in telecom sector and economic growth.

Ding and Haynes (2004) investigated the role of telecommunication infrastructure on long run economic growth in China for a sample of 29 regions for the period from 1986-2002. They used following model:

$$GRTH_{it} = \acute{\alpha} + \acute{\eta} + \beta_1 GRTH_{i,\,t-1} + \beta 2\ Ln\ (GDP)\ i,\ t_{-1} + \beta 3\ POP_{it} + \beta 4\ INV_{it} + \beta 5 TELit + ut$$

Where

GRTH $_{it}$ = annual growth rate of real GDP per capita
GRTH $_{i,\,t-1}$ = lagged growth rate of real GDP per capita
GDP i, t_{-1} = lagged real GDP per capita

POP = population growth rate
INV =share of fixed investment in GDP
TEL =teledensity

Results revealed the positive and significant impact of teledensity and the percentage of telecom sector investment in GDP on economic growth. While the impact of population was negative on economic growth. Results reveal investment in telecommunication sector is most successful in those countries which are in the process of development.

Datta and Agarwal (2004) empirically investigated the role of telecom infrastructure on economic growth. In his study he took the data of 22 OECD countries, considered14 years period from 1980-1992. They proved the positive and significant impact of telecommunication sector on economic growth.

Colin (2003) stressed the importance of ICT and explained existing barriers to universal access. He was in view that market inefficiency and misappropriation of fund for investment in telecommunication sector negatively effect the development of telecom sector. He concluded that liberalization of telecom sector can have more positive effect on economic growth.

Easterly and Rebelo (1993) investigated that investment in telecommunication is significantly related with economic growth.

Research Methodology

This work is based upon the model of Alleman *et. al* (2003) who studied the relationship between telephone penetration and GDP in 9 countries of South Africa. Here it is used in modified form. For this study time series data have been taken for the period from 1968-2007.The functional equation is based on theoretical formulation, developed earlier in this section. The equation is given in log –linear form as:

$\mathbf{GDP = \beta_0 + \beta_1 LTEL + \beta 2\ L\ IT + ut}$ Where

GDP = Gross Domestic Product
TEL = Teledensity
IT = Investment in Telecommunication Sector
ut = the stochastic disturbance term, capturing left over effects, having zero mean and constant variance.

It is hypothesized that

$\mathbf{\partial L\ GDP / \partial\ L\ \delta_1\ L\ TEL > 0}$

$\mathbf{\partial L\ GDP / \partial\ L\ \delta_2\ L\ IT > 0}$

Gross Domestic Product (GDP) is taken as dependent variable. To show the values of economic development GDP was taken. It is expected from the past studies that both independent variables will have positive relation with GDP.

Teledensity (TEL) is an independent variable. It is calculated as the total number of fixed telephone and mobile phones per population (in millions) of the country. **Investment in Telecommunication Sector (IT)** is also taken as an independent variable. Investment in transport and communication sector is taken as a proxy for investment in telecommunication sector. Data for all dependent and independent variables have been taken from various issues of Economic Survey of Pakistan (1987-88, 2001-02, 2003-04, 2005-06,2007-08).

Regression Results and Analysis

This section deals with the results and interpretation of the impact of telecom infrastructure on economic development. Various summary statistics, correlation table, results of Augmented Dickey Fuller (ADF) test and regression results are given below:

Table 1 SUMMARY STATISTICS
(Sample period: 1968-2007)

Variables	LGDP	LTEL	LIT
Maximum	15.5194	-0.79762	13.1777
Minimum	10.3016	-5.9955	7.5262
Mean	12.2323	-4.5348	9.7514
Std. Deviation	1.7127	1.2767	2.0266
Coef of Variation	0.14001	0.28153	0.20782

Table 2 CORRELATION BETWEEN GDP AND OTHER VARIABLES

	L GDP	L TEL	L IT
L GDP	1.0000		
L TEL	0.91703	1.0000	

L IT	0.97636	0.89826	1.0000

Table 3 RESULTS OF ADF TEST

Variables	Level/Difference	Without trend	Conclusion
GDP	Level	0.49328	
	First difference	-5.6218	I(1)
TEL	Level	1.1287	
	First difference	-13.2337	I(1)
IT	Level	0.37109	
	First difference	-5.5738	I(1)

95% critical value for ADF Statistics for all variables: -2.9422(without trend)

Table 4 Ordinary Least Squares Estimation

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Dependent variable is DLGDP 40 observations used for estimation from 1968 to 2007

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Regressor	Coefficient	Standard Error	T-Ratio [Prob]
Constant term	9.10712	0.046567	2.3004[0.028]
LTEL	50 .10545	0.080185	2.3151[0.0197]
LIT	72.094081	0 .13303	2.70719[0.0484]

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R-Squared	0 .89829	R-Bar-Squared	0.88671
S.E. of Regression	0.34472	F-stat. F(3, 35)	7.7225[.000]
Mean of Dependent Variable	12.2323	S.D. of Dependent Variable	1.7127
Residual Sum of Squares	2.3041	Equation Log-likelihood	-0.17534
Akaike Info. Criterion	-4.1753	Schwarz Bayesian Criterion	-7.5025
DW-statistic	1.2832		

Table 5 Ordinary Least Squares Estimation (Error Correction Model)

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Regressand is LGDP 39 observations used for estimation from 1969 to 2007

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Regressor	Coefficient	Standard Error	T-Ratio [Prob]
Constant term	6.9796	1.0256	6.8056[.000]
DLTEL	62.27788	0 .098388	2.8243[.008]
DLIT	79.66789	0 .061980	10.7758[.000]
K(-1)	-70.59704	0 .12625	-4.7292[.000]

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R-Squared	0.99157	R-Bar-Squared	0 .98949
S.E. of Regression	0.25657	F-stat. F(2, 37)	462.8419[.000]
Mean of Dependent Variable	11.2127	S.D. of Dependent Variable	0.5127
Residual Sum of Squares	4.3968	Equation Log-likelihood	-12.5975
Akaike Info. Criterion	-15.5975	Schwarz Bayesian Criterion	-18.1308
DW-statistic	1.5832		

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The empirical investigation on the impact of telecom infrastructure on economic development of Pakistan uses time series, data have been taken for the period from 1968-2007.

Various summary statistics (table 1) and correlation between variables (table 2) were also estimated. To determine the order of integration of variables, we employed ADF test (table 3) for unit roots to find out that the variables are concluded to be integrated of the same order. Test shows that all variables have stationarity in the levels of 95% critical value without trend. Regression results (table 4) indicate the positive and significant impact of both regressors (TEL & IT) on regressand (GDP). Standard errors were too low and coefficients were high. Lower values of Akaike Information Criteria and Schwarz Bayesian Criteria also indicated the fitness of the model. But the value of Durbin Watson (DW) statistics was lying in undefined area. So to handle the problem of serial correlation an error correction model (table 5) was applied. Again both variables showed their positive and significant impact on economic development. No serial correlation lies and residual

also found significant. Result also indicates that the rate of adjustment was 70%. All results were obtained, as they were hypothesized so null hypothesis is rejected.

Conclusion

There are a lot of studies in the world to show the impact of telecom sector investment on economic development, however this important area has gained little attention of scholars in Pakistan. The focal point of this study was to show the empirical relation between telecom infrastructure and economic development.

For the purpose of analysis time series data had been chosen for the period from 1968-2007. Gross Domestic Product was taken as regressand, while teledensity and investment in telecommunication sector were the regressors of the regression model. Both variables showed their positive and significant impact on GDP. It reveals that the role of telecom infrastructure is indispensable for economic growth. Since the use of various telecom instruments in all sectors of economy is common.

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