

Telecom Penetration and Economic Growth: An Empirical Analysis

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Abstract: The telecom industry is facing serious issues all over the world, the most burning on is the opening of this sector. Pakistan telecom sector also faced many challenges. The study tries to explore the relationship between telecom sector and the economic growth for Pakistan during the period 1996-2016. Our prime objective is to see the telecoms sector's performance in Pakistan during the study period and also see the impact of this sector of GDP as well. Labor force engaged in telecom sector, investment in telecom sector and teledensity are core variables to estimate the model. Simple OLS technique is employed for estimation based on stationarity test. The study found that teledensity and labor engaged in telecom industry have huge and significant impact on economic growth of Pakistan. In addition, results also showed that capital formation (Investment in Telecom) does not have any significant impact on GDP growth in Pakistan. These results have been useful for policy makers in order to establish strong policy to establish and flourish Telecom sector at advanced level of international standard so foreign investors do attract also.

Keywords: Labor force, Investment in Telecom, Teledensity.

JEL Classification: L19, L29

1. Introduction

In this modern era, telecommunication is one of the core sectors for information dissemination all over the world. Modern technologies and networks at advanced levels surprisingly increase in every walk of life no matter whether it is economic, social, or business oriented. The greatest advantage of using advanced and modern communication network increases the efficiency and develops the competition within the sector. Further it also provides the best quality to the customers at the lowest price. Nevertheless, it is observed that when fast growing modern technology is transforming all over the world, millions of citizens of poor

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countries do not have access to telephone even. European Commission highlighted in its 2002 report that 33 % of the world population could not have access to made a call even (ECR 2002). A big gap has been developed between those who have access and those who do not.

After many years of development telecom sector become stable but now the current global telecom industry, is again going through turbulence phase. This sector is facing number of challenges and issues, which increases day by day. Therefore, healthy competition has developed with the introduction of mobile and then internet increases this competition and many industries structured all over the world.

On the one hand, great services have been provided in developed countries, but in developing countries due to financial constraints and mismanagement this sector could not boost at that level in developing countries like Pakistan. In this regard, Pakistan Telecommunication Authority (PTA) is working utterly to deal with all expected issues for the best possible solution. For that purpose, consultations with renowned consultants in telecom internationally have been carried out for implementation of reasonable policies.

Now IT industry become the most exciting and dynamic one in Pakistan, which has gone through many dramatic challenges and changes in order to make it competitive internationally.

It is interesting to note that Telecommunication industry is expanding in Pakistan every by not only providing telephone access to urban communities but also to the rural as well in very short time. Total land lines in all networks in 2002 were 4.5 million in Pakistan 3% higher than India. It is also observed that trends for the mobile users have increased over the study period drastically till 2014 and then showed declined for one period and then onward it started increasing. Mobile users were just 2.32% in 2002, which increases and reached 69% in 2015-16, which is huge increase, which shows not only the customers trust on this industry

but also take maximum benefit of using this at very reasonable rates. From the figure 1, we may conclude in this digital age, every second citizen is mobile user and using cell phone at huge level to take maximum advantage by disseminating and collecting information of their own interest. It also confirms from the figure 2, that mobile users have continuous increasing trend till 2015-16.

Figure 1: Teledensity trends during 2002-2016 in Pakistan

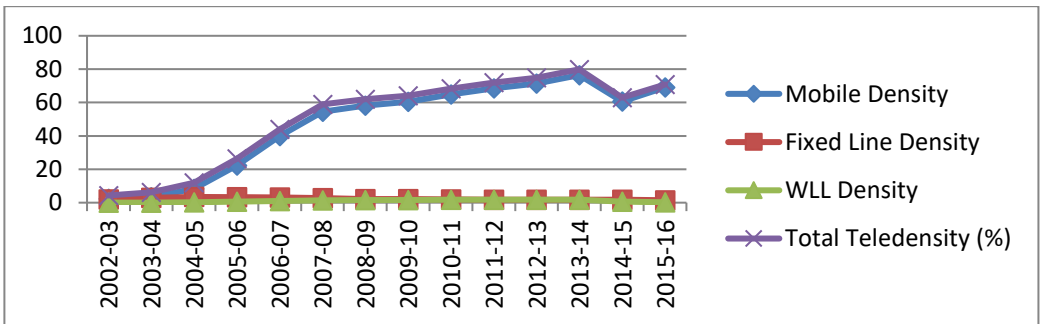
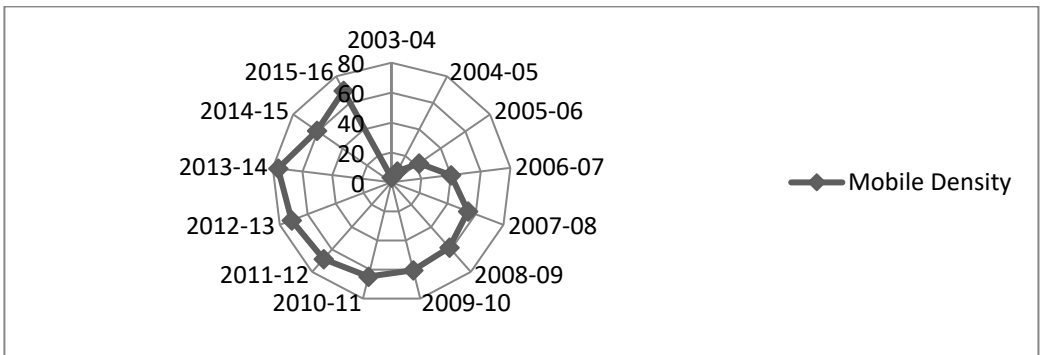


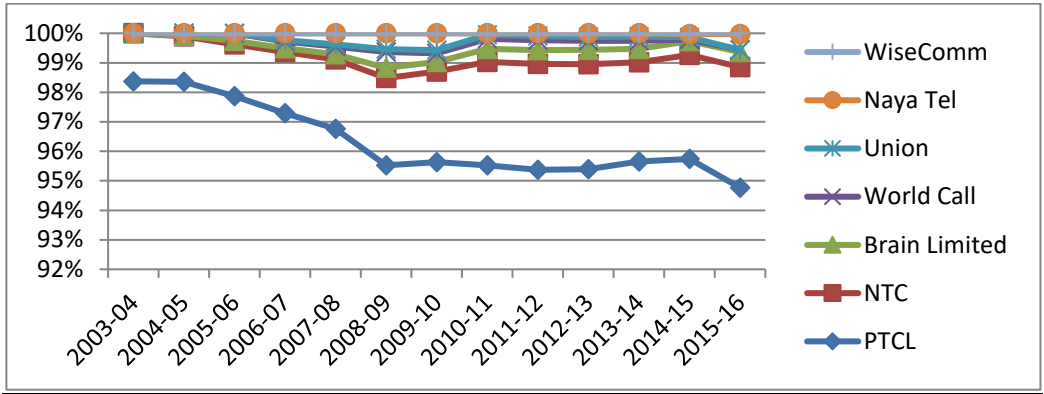
Figure 2: Mobile density during 2002-2016 in Pakistan



There are different companies providing and subscribing mobile users by their own packages and plans. They do provide attractive packages at nominal rates to attract maximum users, due to which PTCL trend of using landline has further declined. Internet services may also provide to the mobile user through packages or through extra payment for the use,

which enhances the use of efficient firms’ provider of good connectivity and internet services as shown in Figure 3.

Figure 3: Trends of service provider during 2003-2016 in Pakistan



There is no doubt; on the one hand, mobile density has sharply increased during the last 14 years, which leads to increase the share in foreign direct investment as a telecom share in Pakistan. It is good for the economy to boost and provide further incentive to telecom industry and provide attractive rates for the mobile users and internet users at reasonable rate. It is also suggested that when telecom sector flourishes and encourage due to positive trend, it may be the one of the highest share added into FDI in Pakistan as well [figure 4]. Maximum revenue received from cellular in telecom sector during 2003 to 2009 and after 2009, 100% share in telecom industry is obtained from cellular density as shown in figure 5.

Figure 4: Telecommunication share in FDI in Pakistan during 2003-2016

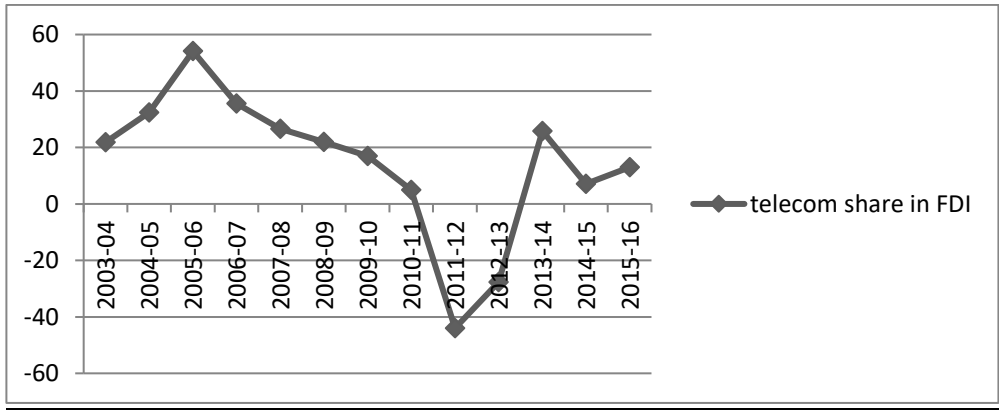
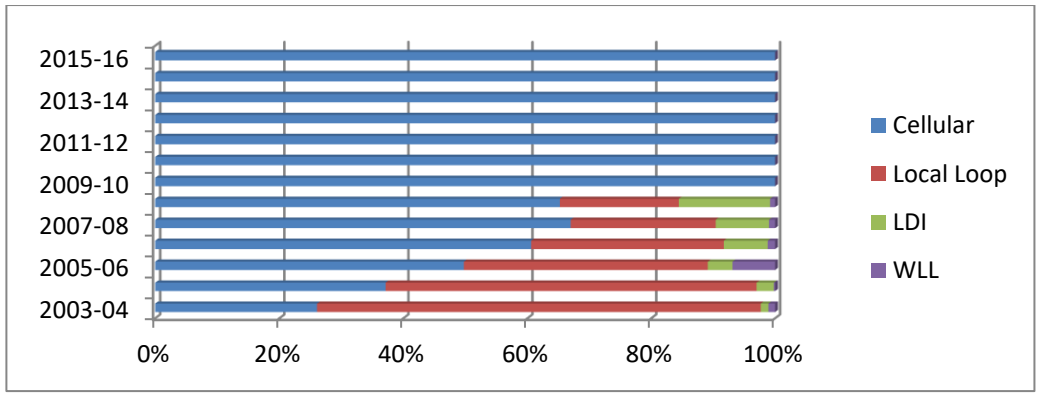


Figure 5: Total Revenue (Rs Millions) in Telecom sector



This study will be very useful for the researchers and for policy makers to see overview of telcom sector performing in Pakistan, and can attract foreign investors to do invest in this sector as there will be high scope and future in Pakistan

2. Literature Review

Roller and Waverman (1996) examined the effect of telecom investment in infrastructure on economic growth using data set of 21 OECD countries for twenty years. They have applied structural model using telecom investment demand and supply using nonlinear 3SLS. They found that telecom infrastructure and public infrastructure have big difference and showed insignificant impact on economic growth.

Madden and Savage (2000) estimated the telecommunications effect on GDP growth using 43 countries-including 16 developing countries during the period 1975-1990 following the model used by Mankiw, Romer and Weil (1992). They declared the high significance impact of telecom investment on GDP and viewed that such investment should be encouraged.

Torero, Bedi and Chowdhury (2002) analyzed IT sector using panel data for 113 countries. Main findings reveal that high income countries already reached at the optimum level and therefore any nominal change may have very limited effect on the marginal output in telecom industry output. Also there is some significant impact on output of this infrastructural change in high income countries but such change has not been observed in low income countries.

Sridhar (2004) analyzed telecom sector impact on economic growth for developing countries. He tried to study that how economic development could be possible with the enhancement of ICT penetration. He examined the feasibility of telecom sector and viewed that this is one of the core determinant for economic development.

Ding and Haynes (2004) analyzed the importance of telecom sector for China using panel data and explored the regional economic growth through telecom sector. They analyzed the relation between growth of population and telecom infrastructure and declared investment in telecom is the primary source of economic growth and found positive and significant effect.

Cox and Lee (2005) estimated the efficiency in telecom sector for developing countries. They viewed that there is potential for privatizing this sector as independence regulatory authorities can run this sector more efficiently. They concluded that both privatization and existence of independent regulatory body do not helpful or network expansion in case of Asia Pacific region, though privatization has some positive effect on industrial units.

Negash and Patala (2005) analyzed the telecom sector and economic growth impact by utilizing data of economically developing countries (EDC's). They found high correlation existed between investment in telecom sector and GDP growth rate. They further viewed that these EDC's has allocated large proportion of their budget for telecom investment.

Tella, et al. (2007) examined the effect of telecom and economic growth using data set of Nigeria using simultaneous equation model applied 3SLS for the purpose of estimation on the given set of equations. Their findings reveal that there is some good indication of this sector for the growth of an economy and further viewed that land line and cell phone penetration have positive and significant impact on the economic growth of Nigeria. Choudhary, N Khan, Aisha, and Salman (2008) viewed after going through in detail about telecom sector reforms in Pakistan. There is no doubt there is difference between public and private sector impact which was analyzed by various survey based studies. They viewed that now more than ninety percent coverage has been provided for mobile users and it could be further improved with the investment in telecom infrastructure and related industries.

Shiu and Lam (2008) estimated the relationship between telecom development and economic growth using panel data for 27 years. They divided the data into lower and higher income groups and found bidirectional relationship European countries part of high income group, while the unidirectional result found for low income countries.

Narayana (2008) also explored the relationship between telecom sector and economic growth using data set for India by further dividing the public and private sector. He estimated the own price elasticity and income elasticity for this sector and found negative and positive respectively.

Lee, et al. (2009) analyzed the mobile users' growth impact on economic growth for Sub Sahara African countries. They examined two important dimensions for the purpose. One, they estimated the potential endogeneity between telecom expansion and economic growth. Two, they have also measured the degrees of substitutability between mobile cellular and land line telephone explicitly. The results found the positive and significant relationship exist between telecom capital and economic growth.

3. Methodology

Different studies measured the relationship of telecom investment and economic growth by using different variables and different techniques starting from OLS to 3SLS depending on the nature of the data. We have used GDP, Labor force in telecom sector, teledensity, and investment in Telecom industry as main variables followed by the studies (Waverman (2001) Sridhar (2004), Tella (2007) and Narayana (2008).

3.1 Model

The following Cobb Douglas production function [Waverman (2001), Tella (2007) Narayana (2008)] is used for the analysis of the telecom sector and economic growth:

$$GDP = F(K_t, LF_t, TPEN/MTEL/CELL_t).$$

$$\text{Log}(GDP_t) = \alpha_0 + \alpha_1 \text{log}(K_t) + \alpha_2 \text{log}(LF_t) + \alpha_3 \text{log}(TPEN/MTEL/CELL_t) + \varepsilon_{1t} \quad (1)$$

Where,

GDP=Gross domestic product

K_t = investment in Telecom (millions)

LF_t = Labour force worked in telecom industry (millions)

TPEN/MTEL/CELL = Number of telephone per 100 population/sum of main line/cellular teledensity.

In order to make the model linear, we have used double log model as indicated in equation 1.

Due to non-availability of the data on number of telephone per 100 population/sum of main line/cellular teledensity, we have used the total density (TD) as a proxy measured in %.

$$\text{Log}(GDP_t) = \alpha_0 + \alpha_1 \log(K_t) + \alpha_2 \log(LF_t) + \alpha_3 \log(TD) + \varepsilon_{1t} \quad (2)$$

Where, α 's show the $E_{GDP/K}$, $E_{GDP/LF}$, $E_{GDP/TD}$ Respectively.

3.2 Data Sources:

This study used data set of 21 years telecom related variables from 1996-2016 of Pakistan. Data have been compiled from Economic Survey of Pakistan, International Financial Statistic (IFS) and Pakistan Telecommunication Authority.

3.3 Variables Definition:

3.3.1. Gross domestic product

Final good and services produced in any country for both resident and non residents are defined as nominal GDP, which is further divided by GDP

deflator in order to convert into real GDP, which is used for the analysis in million rupees.

3.3.2. Labor Force(LF):

All the workers who are working in telecom industry during the study period is the part of our data, and data has been gathered from IFS, given in millions.

3.3.3. Telecom investment(K):

All kinds of software and hard ware technology used in telecom sector is the part of telecom investment and may considered as telecom capital as well. It also includes all kinds of installation, existing or new one.

3.3.4. Teledensity (TD):

Teledensity is simply defined as the number of telephones available for the citizens of that particular country in that particular year. This TD is the core variable mostly used in order to show the telecom advancement or development.

4. Results and Discussion

Table 1: Result of Unit Root Test

		H_0 = Series are stationary			H_1 = otherwise			
Variables	Lags	1 ST Difference			Lags	2 nd Difference		
		Intercept	Trend and intercept	none		Intercept	Trend and Intercept	None
Log GDPG	0	-0.92	-1.6	0.47	0	2.17	2.09	2.22*
		(-3.42)	(-4.35)	(-1.99)		(3.55)	(4.58)	(2.00)
Log LF	0	4.82*	4.39*	1.41	0	4.83*	3.76	5.35*
		(3.42)	(4.35)	(1.99)		(3.55)	(4.58)	(2.00)
Log K	0	2.78	2.84	1.95	0	3.35	2.90	3.67*
		(3.42)	(4.35)	(1.99)		(3.55)	(4.58)	(2.00)
LogTD	0	3.34	5.62*	2.52	0	4.53*	3.30	4.63*
		(3.42)	(4.35)	(1.99)		(3.55)	(4.58)	(2.00)

Note: *shows significant level at 5% point.

We have checked the stationarity of the data before estimating the model. All the variables including GDP growth, labor force, capital and

teledensity are stationary at levels confirming that we can Ordinary least square for analysis. We have estimated the equation (2) taking GDPG as dependent variable and LF, telecom investment (K), and TD as explanatory variables in order to see the impact of telecommunication on economic growth of Pakistan during the study period.

As all the variables used in the model are continuous variables.

Also after checking the stationarity it is further confirmed to apply OLS as they are at level. therefore it is most appropriate to apply simple OLS method for estimation.

Table 2: Regression Results

Telecommunication Sector in Pakistan (1996-2016)

Variables	Coefficients	Standard error	T - Statistics
<i>C</i>	-0.3209	0.4808	0.7049
<i>logTD</i>	0.0624	0.0302	2.0386*
<i>logLF</i>	1.1160	0.2708	4.1012**
<i>logK</i>	0.0213	0.0229	0.9301
R-SQUARED	0.9541	F-STATISTIC	68.1557
ADJUSTED R-SQUARED	0.9101	P (F- STATISTIC)	0.0003

Note: * and ** indicates significant at 5, and 1 percent point respectively.

$$\text{LogGDP}_t = -0.3209 + 0.0624\text{LogTD} + 1.1160\text{LogLF}_t + 0.0213\text{LogK}_t$$

Double log has taken for the estimation of Eq (2) in order to make equation linear and apply simple Ordinary least square. Teledensity (TD), labor force (LF), capital (K) are used as independent variables, while growth rate of gross domestic product was used as dependent variable. Findings reveal that both variables TD and LF are highly significant, indicating 6.24% increase in GDP with one percent increase in TD, which is good sign also. There is no doubt that the telecom sector is flourishing significantly and help in increasing GDP of Pakistan, as in Pakistan every second person is using cellular facility, internet user and many digital devices. It is not only increase the GDP but also help in increasing the awareness and to the common people of having many information and services at hand without taking botheration. This could be further enhanced with the strong recommendations by ministry to the govt for involvement and encourages investment (both domestic and foreign) in this sector and promote these facilities and awareness campaign to the rural sector of Pakistan too. Similarly labor force engaged in telecom sector increases GDP by 1.1160 percent and significantly affects the growth. Huge employment is generated in this sector, which is expected to further increase with the initiation of establishing franchises and such centers all over the Pakistan. From the result shown for the telecom investment, it may indicate that there is very nominal investment is made in this sector, which could play significant part in enhancing GDP as well.

5. Conclusion and Policy Implications

This study has been undertaken the telecommunication impacts on Pakistan economic growth during 21 years including 1996-2016 using Teledensity, labor force work in telecom sector, Telecom investment and GDP growth rate as core variables for estimation.

The aim of study was to explore that influence of telecom sector's performance on GDP growth during study period. Findings shown in result section indicates the positive association between these two main variables, which is also reflecting that this sector is fast growing and it confirms the peoples' trust on these offered networks to the great extent. Obviously, it rising trend provides the initiatives and encourages investors to invest more in this sector. With huge increase in teledensity, GDP per capita also improves and showing positive trend.

Most of the related literature indicated that the relationship between telecom sector and economic growth are bidirectional which reflects not only the people's use and trust which on the one side increases their use increase overall economic growth, but also when there is high GDP share in this sector, government of that particular country invest more in this sector of better quality as well. But unfortunately, we do not have bidirectional relationship in developing countries.

We have observed unidirectional relation exist between these two variables, which show that govt could not increase their investment in this sector when there is huge income earned from this sector. Reasons may be priorities, financial constraints or some other reasons as well.

Therefore, there is no doubt that telecom is very important sector and we could not forget its contribution, but for the optimum utilization, we should check its productivity on regular bases and provide health competition. Further research is required to explore how could be optimally mange our funds and resources to get maximum benefits from this and for that we have to opt internal well-structured policies set by developed countries but managing and changing according to our resources, will be very helpful for all in Pakistan.

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Appendix
Table A: % of total teledensity

Years	Mobile Density	Fixed Line Density	WLL Density	Total Teledensity (%)
2002-03	2.32	1.92	0.07	4.31
2003-04	3.23	3	0.02	6.25
2004-05	8.3	3.43	0.17	11.89
2005-06	22.21	3.37	0.66	26.26
2006-07	39.94	3.04	1.08	44.06
2007-08	54.6	2.7	1.4	58.9
2008-09	58.2	2.2	1.6	62
2009-10	60.4	2.16	1.6	64.1
2010-11	64.8	1.9	1.7	68.4
2011-12	68.5	1.7	1.8	72
2012-13	71.4	1.7	1.8	74.9
2013-14	76.46	1.73	1.69	79.89
2014-15	60.7	1.73	0.6	62.9
2015-16	69.12	1.46	0.23	70.81

Table B: Annual Fixed Local Line Subscribers during 2002-2016.

years	PTCL	NTC	Brain Limited	World Call	Union	Naya Tel	Total	Total (millions)	Cumulative
2003-04	4,428,900	73,330			-		4,501,171	4.5	4.5
2004-05	5,190,899	81,027	1,520	4,100	-		5,277,531	5.28	9.78
2005-06	5,128,442	92,163	5,880	13,327	200		5,240,012	5.24	15.02
2006-07	4,676,204	99,665	6,089	10,748	2,500	11,000	4,806,206	4.81	19.82
2007-08	4,273,548	103,991	7,376	11,502	3,500	16,500	4,416,417	4.42	24.24
2008-09	3,375,103	104,538	12,234	18,850	3,700	18,850	3,533,275	3.53	27.77
2009-10	3,268,642	104,819	11,267	9,874	3,700	19,500	3,417,802	3.42	31.19
2010-11	2,881,684	105,954	13,280	10,085	4,200	1,649	3,016,852	3.02	34.21
2011-12	2,847,597	107,095	14,076	9,830	4,175	2,860	2,985,633	2.99	37.19
2012-13	2,885,144	107,631	14,662	8,977	4,175	3,699	3,024,288	3.02	40.22
2013-14	3,034,361	106,738	14,410	8,887	4,175	3,773	3,172,344	3.17	43.39

2014-15	3,007, 807	110,9 57	14,41 0	1,97 7	2,15 0	3,69 9	3,141, 700	3.14	46. 53
2015-16	2,658, 538	114,5 35	14,41 0	1,97 7	3125	15,0 00	2,805, 255	2.81	49. 34
