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TELECOMMUNICATION SERVICES AND ECONOMIC GROWTH: EVIDENCE FROM INDIA

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This paper estimates the contribution of telecommunication (or telecom) services to aggregate economic growth in India. Estimated contribution is distinguished between public and private sectors to highlight the impact of telecom privatization on economic growth. Knowledge of policy determinants of demand of telecom services is shown to be essential to enhance growth contribution of telecom services. Using a recent sample survey data from Karnataka State in South India, price and income determinants of demand for telecom services are estimated by capacity of telephone exchanges Estimation results offer evidence for significant negative own price elasticity and positive income elasticity of demand for telecom services. In addition, survey data are used to show for non-economic factors that influence demand for telecom services including non-awareness of the usage and cost of value added services. These results have implications for design of a national policy for promotion of demand for telecom services and economic growth.

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1. INTRODUCTION

According to the Indian Constitution, telecommunications (or telecom) services belong to the Central Government's List. Hence, all policies for promotion, development, regulation (including pricing) of telecom services are formulated and implemented for the nation as a whole. Since 1991, focused telecom reforms have been introduced for privatization and diversification in competitive provisioning of services, globalization of trade (including under the WTO agreements) and capital by liberalization of imports and foreign direct investment, establishment of an independent regulator (i.e. Telecom Regulatory Authority of India), introduction of cellular mobile phones, universal service access through the formulation of National Telecom Policy 1994 and 1999, and corportitisation of public provider of telecom services (e.g. Bharat Sanchar Nigam Limited for domestic services). India's telecom policies and reforms are best summarized and analyzed in many studies, such as, Dossaini (2002), Kathuria et al (2003), and Noll and Wallsten (2004). Pre-budget, Economic Survey of Government of India has been an important annual source for subsequent update on policy and reforms on telecom sector.

From the supply side, the telecom reforms and policies have been aimed at higher provisioning and wider access to telecom services for business, government, and residential subscribers. Both provisioning and access are preconditions for usage of telecom service, i.e. basic and value added services (including internet and broadband services), as provided by public and private telecom companies over their telephone and wireless networks. Telephone lines provide with access or connection of subscribers to the network. Thus, provisioning, access, and usage are equally important and sequential stages in the process of production through consumption of telecom services.

A change in the value added by the communication services in the GDP is an indicator of its contribution to national economic growth. Communication services include postal and telecom services. This needs to be separated to account for contribution of telecom services. With the introduction of privatization, contribution of telecom services should be separated between the public and private sectors. At present, estimates of these contributions seem to be unavailable in India.

Recent international studies use cross-country empirical models to estimate the impact of telecom services on economic growth in developing countries, mainly due to the availability of data on large number of countries. These studies include El Khoury and Savvides (2006) which captures the impact openness policies (e.g. privatization, deregulation, and competition) in telecom sector as one of the determinants of economic growth. The empirical evidence offers support for the positive impact of telecom openness on economic growth of less developed countries (i.e. 23 countries below a threshold level of GDP that included India). These studies are in contrast to studies, such as, Sridhar and Sridhar (2004) which mainly used penetration indicators (e.g. teledensity of mainline telephones) to estimate impact of telecom on economic growth in developing countries.

Determinants of demand are useful for many policy purposes, such as, estimation of gross value added (in terms of gross earnings, however) by telecom service providers through introduction of new services, changes in price of existing services, and due to changes in purchasing power of people. In essence, this calls for estimation of price and income elasticity of demand for telecom services. Surprisingly, this estimation remains a neglected area of academic and policy interest in India. This is evident, for instance, by the absence of Indian studies in the excellent and recent international survey articles on demand for telecom services [Taylor (2004), and Garbacz and Thompson Jr (2007]. A notable exception is Das and Srinivasan (1999). They estimated the aggregate demand for telephone usage in India, using both time series and panel data models. In time series model (using data from 1964 to 1997), demand for per capita metered call units is estimated as a function of price of per metered call unit, telephone density, share of

services in GDP and per capita GDP. In panel data model (using pooled data for 19 states for the years 1992-93 to 1996-97), determinants of telephone usage are estimated in terms of price of metered call unit, telephone density and share of services in State Domestic Product.

Recent international studies estimate price elasticity of telecom demand in the framework of reforms (i.e. privatization, regulation, and competition) in telecom sector. For instance, Garbacz and Thompson Jr (2007) estimate, among others, price and non-price determinants of demand for telecom services by residential and mobiles services, using a sample of 23 developing countries including India. Telecom prices are distinguished between residential and mobile services. These prices enter into demand estimations both as exogenous variables, and endogenously determined by telecom reform and other variables in a recursive equations framework. Empirical results offer evidence for significant price effects for mobile services.

This paper provides with a simple framework for estimation of direct contribution of telecom services to national economic growth, and to distinguish the contribution by public and private sectors from 1993-94 through 2003-04. Using subscribers' level survey data from the Karnataka State in South India, income and price elasticity of demand are estimated by levels of exchange capacity. Non-economic factors that influence usage demand are distinguished from the survey data. Overall implications of these analyses for current and future telecom policy for promotion of demand and economic growth are highlighted.

Rest of the paper is organized as follows. Section 2 highlights select performance indicators of telecom services during the reform's period. Section 3 presents the framework for estimation and estimates of contribution of telecom services to national economic growth. In section 4, determinants of demand for telecom services are estimated. Section 5 concludes the paper with implications.

2. SELECT PERFORMANCE INDICATORS

Over the years, the implications of telecom reforms have been evident by performance indicators, such as: (a) higher penetration in terms of rising teledensity (= number of telephones per 100 population), especially due to mobile telephony, (b) increasing share of private sector in provisioning of services, and (c) fall in domestic and international long distance call rates.[1] The following basic numbers support for these performances.

Access to telecom services, as measured by teledensity, increased from 0.69 in 1991-92 to 1.31 in 1995-96, 3.57 in 2000-01, and to 7.02 in 2003-04 (**Figure 1**). Since 2000-01, this remarkable increase in teledensity has been largely contributed by introduction of cellular mobiles phone. For instance, teledensity without cellular mobiles phones was equal to 3.22 in 2000-01 and 4.62 in 2003-04. Easy access and low cost handsets have been driving factors for wide spread used of mobile telephones. At the same way, teledensity by rural (or urban) areas increased from 0.9 (or 10.37) in 2000-01 to 1.57 (or 20.74) in 2003-04, but the difference between rural and urban teledensity widened from 11.52 times to 13.21 times. At the international level, India's teledensity in 2003 was lower than in Brazil (42.38) and China (42.32).

Ownership of telecom services is unique between fixed and mobile telephony. For instance, in 2003-04, ownership of fixed phones was dominated by public sector, mobile telephony by the private sector, and overall phones by the public sector (**Figure 2**). This captures for changes in the extent of privatization or private participation in the provisioning of services.

Telecom tariff declined for domestic long distance calls (**Figure 3**). Most importantly, domestic long distance calls, which had remarkable divergence by distance zones, have converged to a uniform rate (i.e. rupee per minute of call) of Rs.1. This rate now equals to local call rate. In the same way, remarkable decline is evident for

[1] Detailed performance indicators of Indian telecom sector are published, on quarterly basis, by TRAI. The latest report is available for September 2007 [http://www.trai.gov.in/Reports_list_year.asp].

international long distance call rates (**Figure 4**). The decline is particularly relevant for countries such as SAARC countries, Sri Lanka, Middle East countries (e.g. Kuwait, UAE, Oman, and Qatar), and rest of world (excluding Europe and North America).

In recent past, performance indicators of telecom services have been used to construct indices of international competitiveness of countries. These indices include World Economic Forum's World Competitiveness Index and Networked Readiness Index, IMD World Competitiveness Yearbook, ITU's Digital Access Index, and A.T. Kearney/Foreign Policy Globalization Index. This emphasizes the need for higher performance of telecom services in global context.

The above performance of telecom services are related to supply of telecom services.[2] From the production side of the national economy, they are contributory to value added by the telecom sector and, hence, contributory for economic growth. A framework for estimation of this contribution is presented in the next section.

3. CONTRIBUTION OF TELECOM SERVICES TO ECONOMIC GROWTH

3.1. Framework for estimation

Following Jalava and Pohjola (2002 and 2007), a framework to accounting for direct contribution of telecom services to aggregate economic growth is presented here. Let the aggregate value added (Y), at any given time (t), consists of telecom services ($Y_{CS,t}$) and non-telecom goods and services (Y_{NCGSt}). Hence, from the production side, national income is equal to gross value added by the telecom services and non-telecom goods and

[2] In addition, improvement in the quality of services should be mentioned as positive fallout of competition between public and private providers, and among private providers. For instance, Telecom Regulatory Authority of India developed benchmarks for quality parameters by fixed and cellular mobile phones, internet service providers, and broadband service providers, and applied uniformly for public and private providers. These parameters are used for quarterly quality monitoring purposes. Details are available on: http://www.trai.gov.in/Reports_list_year.asp It might be added here that quality of telecom services is an indicator of improvement of investment climate in India [World Bank (2004)].

services. It is straightforward to show that $Y_t^* = (S_{CS,t}.Y_{CS,t}^*) + (S_{NCGS,t}.Y_{NCGS,t}^*)$, where * indicates the rate of change or proportional growth rate, and $\{S_{CS,t}, S_{NCGS,t}\}$ are weights and equal to nominal output share of telecom services and non-telecom goods and services. Thus, production of telecom services contributes directly to total value added generated in the economy. This contribution is equal to the product of $S_{CS,t}$ and $Y_{CS,t}^*$.

Value added by telecom services is essential for estimation of $S_{CS,t}$ and $Y_{CS,t}^*$. The framework for determining the value added by telecom services are as follows.

India's GDP from communication services is estimated (using income method) by the Central Statistical Organization (CSO) under the tertiary sector [CSO (2007)]. Communication services include postal and telephones under the public sector. We separate GDP from telecom services (i.e. telephones, telegrams, and overseas communication services) from the postal services (i.e. postal, and money and postal order services) within the public communication sector.[3] Further, GDP from private communication sector is estimated by the CSO from 1993-94, coinciding with the introduction of telecom reforms. We treat private communication services are equal to private telecom services. Accordingly, GDP from public telecom services can be distinguished from the private sector GDP.[4]

3.2. Results of estimation

Results of economic contribution (i.e. value added) of telecom services to India's Gross Domestic Product [at factor cost and constant (1993-94) prices] is presented in **Table 1**. Estimated share of telecom services in the GDP from communication services

[3] Intermediate consumption is not available separately for postal and telecom services. To overcome this data limitation, intermediate consumption is presumed to be distributed between postal and telecom services in the same proportion as that of the share of postal and telecom services in the gross earnings.

[4] At the regional (or State) level, GDP from communication is not estimated. CSO allocates the national level estimates among the regions (under supra-regional sectors) by a combination of criteria [e.g. as elaborated in Chapter 31 in CSO (2007)]. Thus, using the national estimates, regional telecom GDP, and regional public and private telecom GDP are computable in terms of national level proportions.

(i.e. postal and telecom services) increased from 90.56 percent in 1993-94 to 94.96 percent in 1998-99 and to 98.28 percent in 2003-04. This signifies for the increasing (or decreasing) role of telecom (or postal) services in communication GDP during the post-reform years. The declining role of postal services is mainly attributable for growing importance of internet services (e.g. email services in place of postal mail services) and quick electronic banking services (e.g. for transfers of money in place of traditional money orders). Both internet services and electronic banking services are forms of information technology (IT) services, which use telecom network. Thus, increasing applications of IT services has been contributory for the growth of telecom services.

Public sector's share in the total telecom GDP shows interesting trends in the post reform years. First, the share of public telecom services increased from 92.88 percent in 1993-94 to 94.47 percent in 1998-98. This was the period in which mobile telephone was not largely introduced. However, since 1998-99, role of public telecom services declined from 94.47 percent in 1998-99 to 85.05 percent in 2001-02 and to 64.33 percent in 2003-04. This signifies for the increasing contribution of private telecom services, especially in the mobile sector.

Throughout, annual growth of telecom GDP has been higher than the annual growth of total GDP. Contribution of telecom services to output growth show a remarkable increase in the post-mobile telephony period (i.e. since 1998-99). For instance, output contribution of telecom services increased from 0.21 percent in 1993-94 to 0.36 percent in 1998-99 and to 0.59 percent in 2003-04.

Telecom services contributed to total GDP growth by less than one percent in the post reform period. Given the supply of telecom services, however, this contribution can be enhanced in future by increasing the gross earnings (e.g. income from services) of the service providers through improvements in demand for telecom services. Gross earnings are the bases for estimation of value added by telecom services in India's National Income Accounting.

Among the 21 services providers in India in 2003-04, the public sector providers (i.e. Bharat Sanchar Nigam Limited (BSNL), Mahanagar Telephone Nigam Limited, and Videsh Sanchar Nigam Limited) accounted for 79 percent of total sales and 87 percent of gross value added [Government of India (2005)]. Further, BSNL's Profit and Loss Accounts for 2005-06 shows that income from services comprised 90 percent of total income [BSNL (2007)]. Of the income from services, the relative share of major sources is as follows. Fixed telephone (57 percent); Cellular mobiles (18 percent); Wireless in local loop (1 percent); Broadband (0.33 percent); Value added services (1 percent); and Receipt from other operators (or Interconnection charges) (19 percent). Thus, determinants of demand for public telecom services, which can be influenced by policy instruments, assume special significance for economic growth as a policy imperative in India.

4. ESTIMATION OF DEMAND FOR TELECOM SERVICES

Basic and value added telecom services are demanded by business, government, and residential/household subscribers. Basic services are provided to all subscribers without subscription charges.[5] In contrast, value added services need subscription and are provided with distinct charges by services. Dial-up Internet connection is a value added service for subscribers of telecom services.

Data on usage of telecom services is not available from the published sources in India. Hence, it is newly collected from a sample survey of current subscribers of telecom services during January-March 2003. A current subscriber is identified with his/her subscription to fixed telephone or landline connection on the day of the survey, as provided by the public telephone company, viz., Bharath Sanchar Nigam Limited

[5] Basic services include plain telephony (e.g. receiving incoming calls, placing out-going calls), phone-plus-services (i.e. Electronic Locking for long distance calls, Abbreviated Dialing, Hot Line, Automatic Wake-up/Reminder Call), and integrated services digital network facilities (e.g. Call Alert / waiting and Call Transfer/ Call Forwarding, Call Line Identification Particulars or CLIP). Incoming or outgoing calls are divided into three types: Short distance or local calls; domestic long distance or calls, and international calls. Facility for subscribers to direct dialing of (a) domestic long distance calls is called subscribers trunk dialing (STD) and international calls is called international subscribers dialing (ISD).

(BSNL). The BSNL is the largest provider of telecom services in Karnataka State. Administratively, the State is divided into 27 districts. Bangalore (globally known as *Silicon Valley of India, IT Hub of Asia, and IT Capital of India)* is the capital of the State. In each district, the telecom services are organised and provided through a wide network of rural and urban telephone exchanges. At first stage, 1 urban exchange and 2 rural exchanges from each of the 27 districts within the State are randomly selected as sample exchanges.[6] In the second stage, about 20 (or 10) current subscribers (or, in brief, subscribers) are randomly selected in each of the sample urban (or rural) exchanges. In total, the sample comprised 1100 (520 rural and 580 urban) subscribers from 81 (52 rural and 29 urban) exchanges. Questionnaires, directly canvassed by trained investigators, were the instruments of data collection.[7]

The survey explored, among others, the call patterns and responses of subscribers on hypothetical price changes. The results are summarized in **Table 2**. By telecom distance zones, friends and relatives of subscriber are predominantly located in domestic short and long distance call areas in both rural and urban areas. Usage of telephone for social interactions is about 99 percent. Opinion of the subscribers on what would have been their increase in local and long distance calls (i.e. by less than 25 percent, more than 25 percent but less than or equal to 50 percent, or more than 50 percent) if the call rates were to be reduced by 25 percent, show interesting results. For instance, a reduction in local call rate by 25 percent leads to an increase in (a) less than 25 percent calls for 47.1 percent of rural subscribers and 39.1 percent of urban subscribers; more than 25 percent but less than 50 percent calls for 37 percent of rural subscribers and 45.2 percent of urban subscribers. In the same way, a reduction in domestic long distance call rate by 25

[6] Urban exchanges were chosen if their direct exchange lines (DELs) were approximately equal or closer to the average number of urban DELs in their respective districts. For selection of two sample rural exchanges, two alternative criteria are adopted: An exchange with the highest number of DELs among the rural exchanges in the district. Or, an exchange if it's number of DELs was approximately equal or closer to the average number of DELs of rural exchanges in their respective districts.

[7] In particular, separate structured questionnaire for exchanges and questionnaire for subscribers were used. Questionnaire for exchanges sought information on the nature of provisioning of telecom services. Its respondents were the duty-officer (i.e. Divisional Engineer or Sub-divisional Engineer or Junior Telecom Officer) of the concerned telephone exchange. Questionnaire for subscribers aimed at information on awareness and utilization of basic and value added services, as responded by the subscriber.

percent leads to an increase in (a) less than 25 percent calls for 46.3 percent of rural subscribers and 45.3 percent of urban subscribers; more than 25 percent but less than 50 percent calls for 27.7 percent of rural subscribers and 34 percent of urban subscribers. These results are consistent with the fact that large number of friends and relatives of both urban and rural subscribers are located within the local call areas.

The above survey insights have two implications. First, telecom reforms, as they have been related to reduction in call rates, have relevance for subscribers in regard to falling domestic long distance calls. Second, estimation of calls rates on demand for basic telecom services is a policy imperative. This estimation is focused below.

4.1. Economic determinants of demand

Access is essential to usage of telecom services. Thus, usage price of telecom services must be inclusive of access price. For a subscriber of fixed telephone by the BSNL, the monthly access and usage price include rentals and call charges. Call charges (a) are applicable beyond the free or uncharged calls; and vary by (b) exchange capacity and location of subscribers in rural and urban areas; and (c) pulse rates for calls by distance zones. The access and usage prices for basic telecom services for subscribers of fixed telephone by BSNL are presented in **Table 3**.

Using the above information and survey data, an attempt is made below to estimate an approximate price effect on aggregate demand for telecom services by exchange capacity (i.e. number of direct exchange lines). First, all the subscribers are categorized by their location in rural and urban. Second, within rural and urban areas, all subscribers are separated by level of the telephone exchanges. These two categorizations are essential because the rental charges, number of free calls, and call rates are different by exchange levels in rural and urban areas. The distribution of sample exchanges by exchange capacity is presented in **Table 4**. It is apparent that sample subscribers are drawn from exchanges of different capacity in both rural and urban areas.

Next, all subscribers are classified by their exchange levels in rural and urban areas in each telecom district, and their average monthly spending on telephone services are computed by telecom districts. Average monthly expenditure on telephone services is computed for exchanges with less than 1000 lines and between 1000 and 29999 lines. The average monthly expenditure by these types of exchanges is used as a proxy for the access and usage price paid by subscribers for telecom services in their respective telecom districts.[8]

Demand for telecom services (AUD) is regressed on per capita income (PCI), and price for telecom services (PTS), using district level variables. The variable descriptions and data sources are presented in **Table 5**. The regression is run using log.linear functional form. The predicted sign on coefficient of PCI is positive and on PTS is negative.

The estimation results are presented below by Model 1 and Model 2. The essential difference between model 1 and model 2 is in terms of the specification of the variable PTS. In model 1, PTS_1 represents the average monthly expenditure on telecom services by subscribers in exchanges with less than 1000 lines. In model 2, PTS_2 represents the average monthly expenditure on telecom services by subscribers in exchanges between 1000 and 29999 lines.

[8] This approach adds variability in telecom prices across subscribers and districts with a fixed tariff. At the international level, Lang and Lundgren (1991) estimated the price elasticity in a cross section data with fixed tariff by distinguishing telecom prices by six distance and four time zones in Sweden.

Estimated model 1

$$\log (AUD) = -4.800 + 1.780.[\log (PCI)] - 0.456.[\log (PTS_1)]$$
$$(2.984)^* \quad (6.618)^* \quad (1.696)^{**}$$

$R^2 = 0.753$; F=24.364 *; Number of observations=19
* (or **) significant at 1 (or 10) percent level.

Estimated model 2

$$\text{Log (AUD)} = -5.124 + 1.891.[(\log.(PCI) - 0.213.[\log.PTS_2)]$$
$$(4.053)^* \quad (6.176)^* \quad (1.705)^{**}$$

$R^2 = 0.717$; F=20.286 *; Number of observations=19
* (or **) significant at 1 (or 10) percent level.

The estimation results show that in both the models, the income and price variables have predicted sign. The income elasticity is bigger than the price elasticity in both the models, but price elasticity is bigger in model 1 than in model 2. Thus, other things being the same, if per capita income is increased by one percent, aggregate usage demand for telecom services increases by about 1.8 (or 1.9) percent in smaller (or bigger) capacity exchanges. On the other hand, if the price of telecom services is increased, such that the monthly telephone bills go up by one percent, and other things being the same, the demand for telecom services is reduced by about 0.5 percent in low capacity exchanges and by about 0.2 percent in high capacity exchanges. This implies that a differential reduction in telecom prices by exchange capacity would have a higher increase in income from services or gross earning of the public service provider and, hence, higher growth contribution of telecom services. This result provides with an empirical basis and a justification on economic-growth consideration, for the practice of differential telecom

prices by exchange capacity (i.e. lower prices in smaller capacity exchange and higher price in bigger capacity exchanges) in India.

4.2 Non-economic determinants of demand

Demand for telecom services depends on the extent of provisioning, utilization, and awareness of services. The field survey contained insights into these non-economic aspects, as presented below.

Table 6 presents the extent of provisioning of the services by rural and urban exchanges, and utilisation and awareness of the services by rural and urban subscribers. In general, provisioning of services by exchanges is higher than utilisation of the services by subscribers; and awareness of services is higher than utilisation of the services by subscribers. In particular, electronic locking for STD and CLIP are most provided services, and abbreviated dialing and call transfer/forwarding are least provided services, in rural exchanges. In urban exchanges, the most widely provided services are electronic locking of STD, call alter/waiting, CLIP, number haunting and automatic wake-up/reminder calls. Among the other basic services, electronic locking facility is largely used in both rural and urban areas, and awareness is higher for electronic locking of STD/ISD, CLIP facility, and automatic wake-up/reminder call.

Lack of utilization of specific basic services and overall value added services might be attributable for lack of awareness of free of cost services, restricted use of telephones, and lack of usefulness and high cost of value added services. The survey did elicit responses of subscribers on these reasons. Select reasons are presented in **Table 7**. Interestingly, awareness of the free of cost basic services is limited 46 percent in rural areas and 55 percent in urban areas. Restricted use of telephones for merely receiving in-coming calls is relevant for 57 percent of subscribers in both rural and urban areas. Lack of awareness is the most important reason for non-utilisation of value added services for 51 percent of rural and 48 percent of urban subscribers. Other reasons for non-utilisation of value added service include costliness and non-useful of services. High cost prevents

for use of value added services for about 19 percent of rural subscribers and 44 percent urban subscribers. It might be added here that printed telephone directory is supplied, free of cost, to all subscribers. About 87 percent of rural subscribers and 91 percent of urban subscribers possessed telephone directory. The directory gives full information on the nature and cost of services provided, but its usefulness is limited to 17 percent of rural subscribers and 20 percent of urban subscribers.

From the viewpoint of increasing the gross earnings of public telecom providers, provisioning, utilization, and awareness of uses and cost of value added services are important. Field insights reveal the need for improvements on these non-economic determinants of demand for telecom services.

5. CONCLUSIONS AND IMPLICATIONS

This paper focused on estimation of direct contribution of telecom services by public and private sectors on aggregate growth in India. Gross earning of telecom providers is an important determinant of value added by telecom services in India's National Income. Empirical knowledge of price and non-price determinants of demand for telecom services is essential to aim at increase in gross earnings. Thus, estimation of determinants of demand is a macroeconomic policy imperative for India's telecom service sector.

Since 1991, India's telecom reforms have been focused on privatization, deregulation, and competition. Over the years, the impact of reforms have been evident in higher penetration, increased private participation in mobile telephony, and fall domestic and international long distance calls. However, India's public sector continues to be a major provider of telecom services with the highest value added among all the service providers. This implies that changes in demand for public telecom services have a major impact on contribution of telecom services to economic growth in India.

Estimates of determinants of demand for public telecom services offer evidence for significant price and income effects on aggregate demand for telecom services. Magnitude of negative price elasticity is higher in low capacity exchanges than in high capacity exchanges. This is consistent with the practice of telecom price policy of keeping lower prices for smaller capacity exchanges and is justifiable for increasing the contribution of telecom services for economic growth. In addition, awareness of services and their cost for subscribers is essential to promote higher utilization of provided services.

National telecom policies in India and elsewhere in the world aim at providing with universal services. Both access and usage are important for contribution of telecom services to economic growth. Based on the evidence in this paper, a telecom policy to promote for demand may include awareness programmes on uses and cost of services, and differential price reductions for services by exchanges capacity in rural and urban areas. Awareness is especially relevant to promote for access and usage of valued added services, as it leads to higher value added and economic growth.

The evidence and implications in this paper are indicative, as they are based on small sample survey data from within a state and focused on fixed public telephone subscribers in India. An all India sample survey in future, based on the sample design indicators and instruments of this paper, would be useful to establish for generality of results, across the States and at national level of aggregation. Such a survey may focus on collection of data for determinants of demand by fixed and mobile telephones by public and private providers, and test for substitutability and compelmentarity between fixed and mobiles services based on the frameworks in international studies, such as, Garbacz and Thompson Jr (2007). Further, subject to the availability of data, telecom manufacturing and services may be combined with information technology goods and services to estimate the impact of ICT goods and services on economic growth, as developed by Jalava and Pohjola (2007).

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Table 1: Economic contribution of telecom services to national economic growth: 1993-94 to 2003-04

Indicators	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
1. Estimated GDP from telecom services (Rs. in billions)	7.924	9.401 (18.64)	11.391 (21.16)	12.818 (12.53)	15.634 (21.97)	18.894 (20.85)	23.136 (22.45)	28.242 (22.07)	32.711 (15.82)	35.955 (9.92)	42.989 (19.56)
2. Percent of telecom in GDP from communication services	90.56	91.61	92.70	92.96	93.96	94.96	95.84	97.03	99.36	99.48	98.28
3. Percent of public telecom services in GDP from telecom services	92.88	93.29	94.30	94.81	94.72	94.47	93.94	89.33	85.05	74.92	64.33
4. Output contribution of telecom services											
4.1. Growth rate of total GDP (%)		7.25	7.34	7.84	4.79	6.51	6.06	4.37	5.78	3.98	8.51
4.2. Output contribution of telecom services (%)		0.21	0.27	0.17	0.34	0.36	0.45	0.52	0.41	0.27	0.59

Note: Figures in parentheses refer to annual growth rate (%).

Source: Estimated by author, using the basic data in National Accounts Statistics, Central Statistical Organization, Government of India (New Delhi) – Various years.

Table 2: Subscribers' responses to a reduction in call rates

Response from subscribers	Percent of rural subscribers			Percent of urban subscribers		
	Local calls	Domestic long distance calls (STD calls)	International long distance calls (ISD calls)	Local calls	Domestic long distance calls (STD calls)	International long distance calls (ISD calls)
Extent of increase in calls, if call rates reduced by 25 percent						
1. Less than 25 percent	47.1	46.3	2.1	39.1	45.3	5.2
2. Between 25 percent and 50 percent	37.0	27.7	19.6	45.2	34.0	21.6
3. Between 50 percent and 100 percent	12.9]	11.3	0.0	11.2	8.8	0.7

Source: Author's sample survey.

Table 3: Access and usage price for basic telecom services: April 2002- March 03

Nature of price	Rural areas	Urban areas
1. Access price		
1.1. Monthly rentals by exchange capacity: Rs. at current prices		
• Up to 999 DELs	70	-
• 1000 – 29999 DELs	120	120
• 30000 – 99999 DELs	180	180
• 100000 and above	250	250
2. Usage price		
• Number of free or uncharged calls per month in all exchanges	75	60
• Call charges: Rs. in current prices		
➢ Up to 500 calls	0.80	1.00
➢ Above 500 calls	1.20	1.20
2.3. Pulse rate for peak hours (in seconds) by distance in kilometers		
➢ Up to 50	180	180
➢ 51 – 500	18	18
➢ 201 - 500	6.8	6.8
➢ 501 - 999	4.6	4.6
➢ Above 1000	3.5	3.5

Notes: (a) All prices are related to non-commercial users of telecom services over fixed telephones by BSNL.
(b) DELs refer to direct exchange lines.
Source: Telecom Regulatory Authority of India (2002).

Table 4: Distribution of sample exchanges by exchange capacity

Exchange capacity by number of Direct Exchange Lines	Number of rural exchanges	Number of urban exchanges
➢ Up to 999	27	1
➢ 1000 - 29999	25	27
➢ 30000 - 99999	0	1
Total number of sample exchanges	52	29

Source: Author's sample survey.

Table 5. Variables descriptions and data sources for estimation

Variables for estimation	Notation and specification	Source/s of data
Dependent variable		
Aggregate usage demand for telecom services	AUD = Total number metered calls per capita in 2002-03	Records of the Office of the Chief General Manager, Karnataka Telecom Circle, Bangalore
Independent variables		
Per capita income	PCI = Per capita Net State District Product at current prices in 2002-03	Bureau of Economics and Statistics, Government of Karnataka, Bangalore
Price for telecom services	PTS = Average monthly bill paid by sample subscribers in telecom districts in 2002-03	Author's sample survey

Table 6: Provisioning, utilization, and awareness of telecom services

Name of services	Rural areas			Urban areas		
	Provisioning: Percent of exchanges	Utilization: Percent of subscribers	Awareness: Percent of subscribers	Provisioning: Percent of exchanges	Utilization: Percent of subscribers	Awareness: Percent of subscribers
1. Basic services						
• Abbreviated Dialing	19.2	0.2	0.0	27.6	0.5	1.7
• Automatic Wake-up/Reminder Call	32.7	0.2	2.3	75.9	2.6	8.1
• Call Alert / waiting	32.7	0.0	1.0	82.8	0.5	1.7
• Call Transfer/ Call Forwarding	25.0	0.0	1.3	51.7	0.7	3.0
• Calling Line Identification Facility	69.2	0.0	4.8	89.7	4.0	11.2
• Electronic Locking for Subscriber Trunk Dialing (STD)/ International Subscriber Dialing (ISD) facility	92.3	6.9	12.5	96.6	20.2	22.0
• Hot Line	28.8	0.0	0.2	51.7	0.2	1.7
• Number Hunting	28.8	1.2	6.0	51.7	0.5	8.0
• Others (e.g. Absentee subscriber)	15.0	0.0	1.1	20.7	0.2	1.4
2. Value added services						
• Dial-up Internet services	NA	0.2	0.2	NA	0.3	0.3

Notes: (a) Total number of rural (or urban) exchanges is equal to 52 (or 29). (b) Total number of rural (or urban) subscribers is equal to 520 (or 580). (c) NA refers to not applicable, as the dial-up Internet service are not provided through the exchanges.
Source: Author's sample survey.

Table 7: Select non-economic indicators for low usage of telecom services

Indicators of awareness	Percent of rural subscribers	Percent of urban subscribers
1. Aware of free telecom services	46.3	54.7
2. Use of telephone only for receive incoming calls	56.9	57.6
3. Reasons for not subscribing to value added services		
3.1. Not aware of services	51	47.9
3.2. Don't know how to subscribe	2.9	8.3
3.3. Not useful or not necessary	42.7	45.9
3.4. Accessible in other places (e.g. neighbours/friends relatives place)	0.8	0.9
3.5. Costly service charges	19.2	44
4. Provided with printed telephone directory	87	90.7
5. Usefulness of telephone directory to get information on telecom services	16.9	19.7

Note: Free telecom services include: Call alert, Electronic Locking for STD/ISD, Number Hunting, Voice Mail Services, IVRS (Interactive Voice Response System) - Complaint Booking, Bill Enquiry, Payment Reminder, Electronic Clearance Scheme, and Automatic Meter Reading Service.
Source: Author's sample survey.

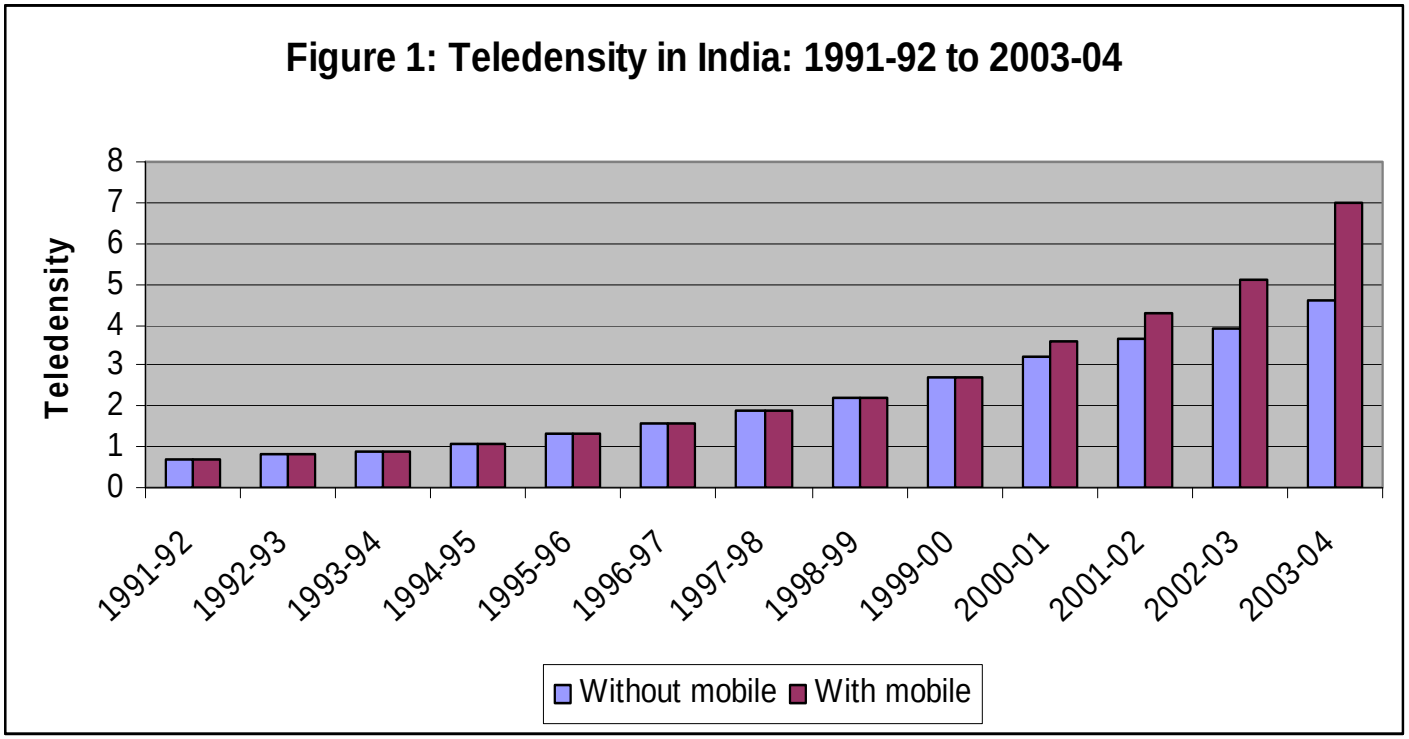
Figure 1: Teledensity in India: 1991-92 to 2003-04
Teledensity
8
7
6
5
4
3
2
1
0
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
Without mobile
With mobile

Figure 2: Ownership of telecom services in India: 2003-04

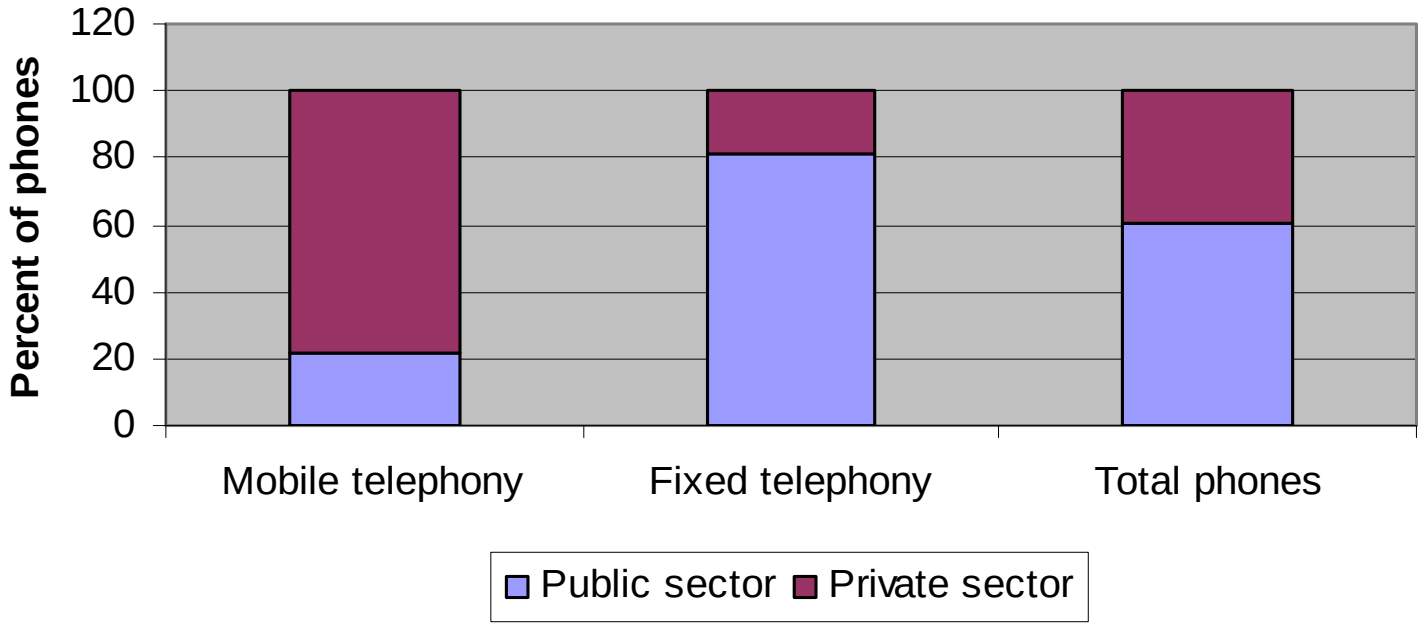

Figure 3: Tariff for domestic long distance calls: 2000-2006

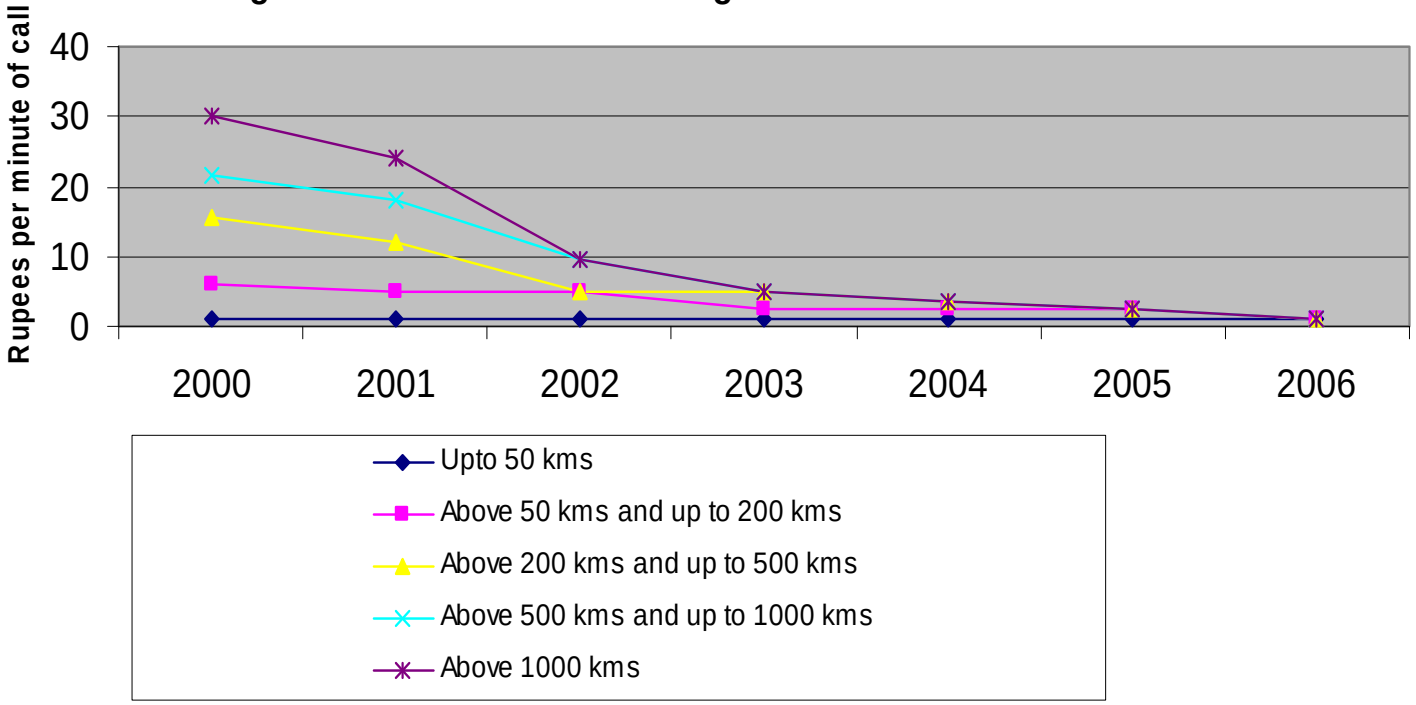

Figure 4: Tariff for international long distance calls: 2003 and 2006