

Details of Service Areas

Sl. No.	Name of Telecom Circle/ Metro Service Area	Areas covered	Category
01.	West Bengal	Entire area falling within the Union Territory of Andaman & Nicobar Islands and area falling within the State of West Bengal and the State of Sikkim excluding the areas covered by Kolkata Metro Service Area.	B
02.	Andhra Pradesh	Entire area falling within the State of Andhra Pradesh.	A
03.	Assam	Entire area falling within the State of Assam.	C
04.	Bihar	Entire area falling within the re-organised State of Bihar and newly created State of Jharkhand pursuant to the Bihar Reorganisation Act, 2000 (No.30 of 2000) dated 25 <sup>th</sup> August, 2000.	C
05.	Gujarat	Entire area falling within the State of Gujarat and Union Territory of Daman and Diu, Silvassa (Dadra & Nagar Haveli).	A
06.	Haryana	Entire area falling within the State of Haryana except the local areas served by Faridabad and Gurgaon Telephone exchanges.	B
07.	Himachal Pradesh	Entire area falling within the State of Himachal Pradesh	C
08.	Jammu & Kashmir	Entire area falling within the State of Jammu & Kashmir including the autonomous council of Ladakh.	C
09.	Karnataka	Entire area falling within the State of Karnataka	A
10.	Kerala	Entire area falling within the State of Kerala and Union Territory of Lakshadweep and Minicoy.	B
11.	Madhya Pradesh	Entire area falling within the re-organised State of Madhya Pradesh as well as the newly created State of Chhattisgarh pursuant to the Madhya Pradesh Reorganisation Act, 2000 (No:28 of 2000) dated 25 <sup>th</sup> August, 2000.	B
12.	Maharashtra	Entire area falling within the State of Maharashtra and Union Territory of Goa, excluding areas covered by Mumbai Metro Service Area.	A
13.	North East	Entire area falling within the States of Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Manipur and Tripura.	C
14.	Orissa	Entire area falling within the State of Orissa.	C
15.	Punjab	Entire area falling within the State of Punjab and Union territory of Chandigarh.	B
16.	Rajasthan	Entire area falling within the State of Rajasthan.	B
17.	Tamil Nadu	Entire area falling within the State of Tamil Nadu and Union Territory of Pondichery excluding the areas covered by Chennai Metro Service Area.	A

Sl. No.	Name of Telecom Circle/ Metro Service Area	Areas covered	Category
18.	Uttar Pradesh- West	Entire area covered by Western Uttar Pradesh with the following as its boundary districts towards Eastern Uttar Pradesh : Pilibhit, Bareilly, Badaun, Etah, Mainpuri and Etawah. It will exclude the local telephone area of Ghaziabad and Noida. However, it will also include the newly created State of Uttaranchal pursuant to the Uttar Pradesh Re-organisation Act, 2000 (No.29 of 2000) dated 25 <sup>th</sup> August, 2000.	B
19.	Uttar Pradesh - East	Entire area covered by Eastern Uttar Pradesh with the following as its boundary districts towards Western Uttar Pradesh : Shahjahanpur, Farrukhabad, Kanpur and Jalaun.	B
20.	Chennai	Local Areas served by Chennai Telephones, Maraimalai Nagar Export Promotion Zone (MPEZ), Minzur and Mahabalipuram Exchanges	Metro
21.	Delhi	Local Areas served by Delhi, Ghaziabad, Faridabad, Noida, and Gurgaon Telephone Exchanges	Metro
22.	Kolkata	Local Areas served by Calcutta Telephones.	Metro
23.	Mumbai	Local Areas served by Mumbai, New Mumbai and Kalyan Telephone Exchanges	Metro

**NOTE:**

1. Yanam, an area of Union Territory of Pondicherry is served under Andhra Pradesh Telecom Circle in East Godavari LDCA.
2. The definition of Local areas of exchanges will be as applicable to the existing cellular operators, i.e. at the time of grant of cellular Licences in Metro cities.
3. The definition of local areas with regard to the above service area as applicable to this Licence is as per definition applicable to Cellular Mobile Service Licences as in the year 1994 & 1995, when those Licences were granted to them. This is in accordance with respective Gazette Notification for such local areas wherever issued and as per the statutory definition under Rule 2 (w) Indian Telephones Rules, 1951, as it stood during the year 1994/1995 where no specific Gazette Notification has been issued.

Source: DoT Website <http://www.dot.gov.in/as/asindex.htm>

*The econometric model employed by Kathuria et al (2009)*

Annex3: The econometric model and detailed results

The Output equation models the level of output (GSDP) as a function of the total investment net of telecom investment, a measure of human capital and the mobile penetration rate. We use a dummy variable for each state, the so called fixed effects approach which controls for unobservable characteristics that are specific to each state. The aggregate production function equation is then as follows:

$$SGDP_{it} = \alpha_0 + \alpha_1 K_{it} + \alpha_2 L_{it} + \alpha_3 MPEN_{it} + \alpha_4 D_i + \varepsilon \quad (1)$$

where SGDP is state gross domestic product, K is investment, L is human capital, MPEN is mobile penetration per 100 persons, and D captures the state specific effect. Subscript  $i=1,2,3,\dots,19$  represents the 19 states and subscript  $t$  corresponds to the 9 periods for which data is available.

Equation (2) models the level of mobile penetration (MPEN) as a function of the level of GSDP per capita (SGDP\_PC), mobile price which is proxied by average revenue per user (PriceM), and the fixed-line price which is revenue per fixed-line subscriber (PriceF).

$$MPEN_{it} = \beta_0 + \beta_1 SGDP\_PC_{it} + \beta_2 PriceM_{it} + \beta_3 PriceF_{it} + \varepsilon' \quad (2)$$

The supply equation (3) assumes that the growth rate of mobile penetration depends on the price of mobile and the geographic area (GA). We estimate the system of equations described above using the three stage least squares procedure using exogenous variables in the system of equations such as population, state domestic product in manufacturing and services as instruments for the endogenous variables (output, the level of mobile and fixed penetration, and the mobile and fixed prices).

$$(MPEN_{it} - MPEN_{it-1})/MPEN_{it} = \theta_0 + \theta_1 GA + \theta_2 PriceM_{it} + \varepsilon'' \quad (3)$$

It is important to note that equations (2) and (3) endogenize telecommunications investment since these equations involve the demand for and supply of telecommunication.

We estimate three specifications of the model (1)-(3). One specification includes all the states, while the other two, classify states as High or Low penetration states according to mobile density. High density states are assumed to be those that have achieved above median penetration of 25% in 2008.

The first specification of model (1)-(3) uses observations from all states to arrive at the estimates. The parameter estimates of the output equation indicate that capital is positive and significantly associated with economic growth. Human capital also picks up a positive coefficient, but is significant only at the 10% level of significance. The coefficient on mobile penetration is both positive and significant and is estimated at 0.12. This implies that 10% increase in mobile penetration delivers, on average 1.2 % increase in output, thus attributing a fairly high impact to mobile. The magnitude of this impact is similar to the one found by Bedi *et al* in their cross country regression of 95 countries. For the demand equation, the estimates show mobile demand is inversely related to price and positively correlated with increases in income. Both these estimates are highly significant. The equation is in double-log form so the coefficients can be interpreted as elasticities of demand. The own-price-elasticity of mobile phones is minus 2.12, which implies that demand is elastic: a 10% price increase would reduce demand by roughly 21%. On the other hand fixed line prices do not seem to have any impact on mobile demand, given that the coefficient is not only of the wrong sign but it is also not significant. One possible explanation for this is the much greater availability and utility of mobile phones across the states, thus rendering demand for mobile phones to be independent of fixed line prices. The positive and highly significant income effect (income elasticity is 2.45) confirms that the causal relationship between telecommunications and economic growth runs both ways. In addition, the estimate suggests that mobiles are 'luxuries' (in the technical sense) since the income elasticity is significantly above one. This conclusion however needs to be tempered with the fact that some of those interviewed during the course of the survey reported higher expenditure on telecom than on other items such as education and electricity, because they perceived it as a basic need and were willing to incur higher costs. At one level, this conflict reveals the difficulty of reconciling micro level survey evidence with macro evidence, at another it suggests that there may be certain other exogenous factors driving demand for mobile telephony, especially among the 'poor'.

	<i>All States</i>	<i>High Penetration States</i>	<i>Low Penetration States</i>
<i>Cross-Section observation</i>	19	8	11

#### Output Equation

Intercept	26.30* (22.80)	25.58* (52.95)	0.10* (51.40)
Investment	0.054* (3.57)	0.07* (4.65)	0.065* (4.02)
Human Capital	0.024*** (1.82)	0.071* (4.31)	-0.01 (-0.75)
Mobile Penetration	0.120* (22.80)	0.131* (23.50)	0.10* (18.83)
<b>R-Square</b>	0.99	0.99	0.99

#### Demand Equation

Intercept	-8.64* (-3.57)	-21.48* (-4.75)	1.19 (0.29)
Per Capita SDP	2.45* (15.10)	2.83* (8.66)	2.34* (7.73)
Price of Mobile	-2.12* (-10.34)	-1.87* (-7.85)	-1.92* (-6.43)
Price of fixed line	-0.384 (-1.19)	0.789** (2.28)	-2.00** (-4.28)
<b>R-Square</b>	0.81	0.65	0.82

#### Supply Equation

Intercept	-4.25* (-6.44)	-2.75** (-3.13)	-3.40* (-2.50)
Geographical Area	0.128* (4.05)	0.067*** (1.81)	-0.005*** (-0.06)
Price of Mobile	0.448* (5.07)	0.289* (2.29)	0.594** (5.32)
<b>R-Square</b>	0.21	0.47	0.25

\* Significant at 1% level of Significance \*\* Significant at 5% level of Significance  
 \*\*\* Significant at 10% level of Significance Note: All Z values in parentheses All variables are in their natural logarithm

For the supply function we find that the geographic area and price of mobiles are both highly significant in explaining telecommunications investments. Larger states do invest more, while higher prices also induce greater investment. More than any other infrastructure, telecom networks are subject to what are called 'network effects'. An implication of network effects or externalities is that the impact of telecommunications on growth might not be linear, as the growth impact might be larger whenever a significant network size is achieved. This would imply that larger

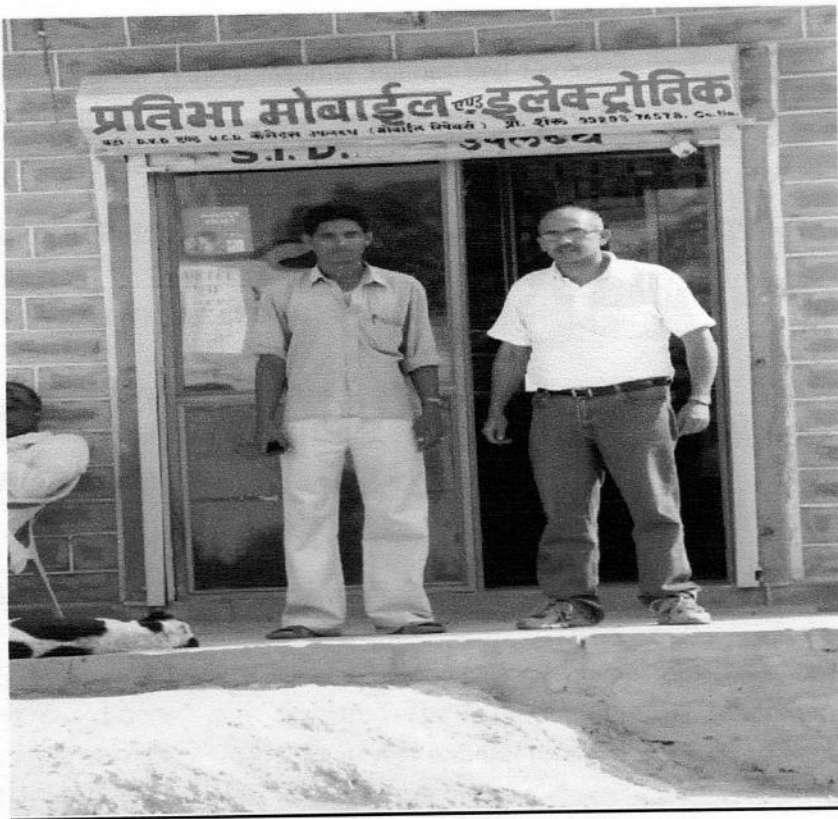
growth effects might be seen in those states that have achieved a **critical mass** in mobile infrastructure. While we do not have a large enough data set to classify states into numerous categories, we do split our sample into high and low penetration states based on the median penetration level of 25% achieved in 2008. In order to test whether such nonlinearities in telecommunications do exist, we estimate the model (1)-(3) for high and low penetration states again allowing for fixed state effects. If the coefficient of mobile penetration of high penetration states is estimated to be greater than for low penetration states then we have support for the critical mass hypothesis. The estimation results of the system are consistent with the idea that telecommunications infrastructure creates network externalities. The coefficient is higher for high penetration states compared to low penetration states, (0.13 versus 0.1) suggesting the need to increase teledensity in those states that are lagging behind. The rest of the coefficient estimates are similar to the first model i.e. own price elasticity is negative and significant and income elasticity is high and significant implying that mobiles are luxuries in the technical sense. The only difference is in the estimate of cross elasticity. In high penetration states, the impact of fixed line price on mobile demand conforms to the idea that fixed and mobile phones are substitutes i.e. the cross price elasticity is positive and significant, although the magnitude is small.

*Source: Kathuria et al (2009), pp.16-7*

**APPENDIX 3: State-wise Trends in Total, Urban, and Rural Teledensity 2006-2008 (see paragraph 4.5)**

	Mar06			Dec06			Mar07			Dec07			Mar08			Dec08		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
A&N	17.97	34.2	8.8	16.5	34.1	6.39	17.39	23	14.17	17.28	23.37	13.69	18.36	25.38	14.2	20.07	28.09	15.2
AP	13.45	43.22	2.34	18.38	61.64	2.24	19.62	53.24	6.84	25.63	67.63	9.63	28.25	74.97	10.44	36.2	96.45	13.2
Assam	5.67	37.09	0.73	7.83	51.84	0.81	9.74	54.65	2.36	12.31	66.97	3.21	14.74	76.3	4.44	18.77	79.84	8.4
Bihar	5.34	45.15	0.66	6.62	57.64	0.62	7.32	52.28	2.05	10.92	79.88	2.83	12.64	91.99	3.33	18.84	113.5	7.7
Chhattisgarh	2.09	7.84	0.51	2.85	11.11	0.55	3.24	11.28	0.99	3.93	13.55	1.2	4.38	14.87	1.39	4.9	16.23	1.6
Gujarat	16.98	39.51	2.69	22.78	54.44	2.52	24.14	45.47	10.43	30.87	55.84	14.68	33.63	60.14	16.37	41.13	70.72	21.7
Haryana	14.47	39.33	3.1	20.6	58.44	2.99	23.11	49.72	10.74	28.06	55.92	14.89	30.39	58.18	17.18	38.26	70.63	22.0
HP	18.78	118.14	7.25	25.03	177.86	7.12	28.57	81.75	22.3	37.64	108.09	29.25	41.16	127.78	30.81	50.93	158.9	37.9
J&K	12.18	44.49	0.85	13.42	48.58	0.98	16.08	47.34	5.08	19.87	56.48	6.89	21.84	61.16	7.87	28.19	69.85	13.3
Jharkhand	2.99	11.18	0.58	3.19	12.03	0.57	3.43	11.33	1.08	3.41	11.15	1.11	3.60	11.67	1.19	3.84	12.23	1.3
Karnataka	17.06	43.17	2.63	23.28	60.47	2.52	25.05	56.44	7.46	32.05	70.26	10.41	34.53	74.98	11.53	41.19	91.93	12.0
Kerala	25.54	68.4	10.65	31.73	91.69	10.95	33.54	69.43	21.11	41.81	92.9	24.14	45.34	110.79	26.18	54.63	119.3	32.0
MP	7.12	23.9	0.79	11.34	38.92	0.88	12.22	36.17	3.28	17.97	53.7	4.55	20.29	60.21	5.28	27.09	74.59	9.1
Maharashtra	13.1	34.45	2.8	17.41	47.42	2.78	18.28	42.29	7.16	24.62	53.36	10.76	27.42	56.97	12.59	33.7	66.02	17.0
NE I	8.11	30.45	1.29	13.2	51.72	1.34	16.56	55.21	4.63	23.53	79.62	6.08	27.67	93.16	7.15	38.9	121.6	12.0
NE II	5.21	19.8	1.26	6.49	25.49	1.33	7.41	22.58	2.89	8.27	26.17	2.89	9.14	28.43	3.33	8.13	25.4	2.8
Orissa	7.57	41.65	1.16	8.59	47.66	1.16	9.51	37.26	4.2	13.17	49.3	6.2	15.0	55.59	7.14	20.54	66.08	11.0
Punjab	27.61	63.57	5.27	34.93	82.54	4.92	37.05	69.77	16.16	44.69	80.24	21.59	47.89	82.79	25.98	52.27	92.2	26.0
Rajasthan	9.65	35.43	1.67	13.51	51.74	1.64	15.49	43.65	6.75	21.56	55.72	10.92	23.74	59.06	12.74	32.86	81.57	17.0
TN	14.7	29.99	2.99	20.34	41.83	3.35	22.55	38.94	9.65	32.06	53.49	14.65	35.09	58.62	15.78	45.07	71.28	22.0
UK	7.46	22.72	1.84	8.54	26.42	1.89	9.5	23.19	4.36	10.4	24.61	5.02	10.61	25.01	5.13	10.88	24.99	5.4
UP E +W	6.87	30.09	0.56	9.83	43.8	0.55	10.77	38.79	3.1	14.75	48.61	5.43	16.19	52.15	6.28	21.88	69.58	8.6
WB	5.53	33.04	1.13	7.71	48.87	1.15	8.63	33	4.69	12.51	50.25	6.39	14.36	57.38	7.38	19.84	70.32	11.0
Kolkata	33.7			42.72			45.09			57.39			64.22			81.26		
Chennai	61.08			77.73			75.46			96.35			103.9			121.8		
Delhi	65.4			82.63			86.89			105.3			110.1			129.3		
Mumbai	56.73			63.91			64.99			78.83			83.48			99.87		
All India	<b>12.74</b>	39.45	1.86	<b>16.83</b>	53.34	1.86	<b>18.22</b>	48.1	5.89	<b>23.89</b>	61.25	8.35	<b>26.22</b>	66.39	9.46	<b>33.23</b>	81.01	13.0

Source: DoT Annual Reports, ERU Unit



*Sheru's retail outlet in Village Bisalpur, Rajasthan (See Box 1)*

*Below Poverty Line use of mobile phone in Rajasthan village (See paragraph 5.3.1)*

