4. ECONOMIC IMPACTS: DATA AND CORRELATIONS

There is considerable evidence of the positive economic impacts of mobile telephony in different temporal and geographical contexts. While early research into the link between growth in teledensity and economic growth unraveled the causal links and prepared the ground for more intense quantitative interrogation of the relationship, the initial over enthusiasm that found excessive growth effects (Gupta, 2000) was tempered after the robust framework developed by Röller and Waverman (2001) and the empirical results relating to 45 OECD countries flowing from it led to a more sober evaluation of the effects[36].

4.2.1 Growth of telecommunications in India has been a result of the post-1991 liberalization economic policies that were considerably aided by forces of globalization and privatization. The deregulation of the telecom sector, along with separation of the three functions of *policy-making (licensing)*, *regulation*, and *service provision* that were previously vested in one government monopoly to three different successor organizations, coupled with paradigm changes in technology, enabled India significant leverage in 'leap-frogging' to a stage of reasonable parity with comparator administrations, from a previous, laggard status. This positive appraisal however needs to be moderated in view of empirical observations emanating from a holistic study of other indicators of development, as highlighted in Waverman *et al* (2009) who give a 'connectivity score' of 1.88 that places it at 20th place among 25 'resource

[36] The earlier estimates of a 1% increase in teledensity leading to a 3% increase in economic growth have now been scaled back to between 0.05% to 0.15%.

and efficiency driven economies' that were surveyed[37]. On a different scale for 'innovation driven economies', the United States leads with a score of 7.71, with Poland bringing up the rear with 2.49[38]. The score itself is built from a weighted average of inputs to estimate what the authors describe as 'useful connectivity' which

> *"refers to the ability of connectivity to contribute to economic growth, especially through improvements in productivity that are widely held to be the key to sustained economic prosperity"*

4.2.2 The connectivity score is built up from differently weighted performance across the following six sub-categories:

	Weight	*India's score*	*Top score*
a) Consumer infrastructure	0.18	0.20	0.81
b) Consumer usage and skills	0.18	0.31	0.84
c) Business infrastructure	0.25	0.06	0.73
d) Business usage and skills	0.34	0.17	0.74
e) Government infrastructure	0.03	0.47	0.93
f) Government usage and skills	0.04	0.44	0.92

4.3 While the relatively low score on the connectivity index (made more 'shameful' by the comparison to China that clocks in at 15th with a score of 3.19[39]) could give pause to the triumphalism so evident in self-congratulatory analyses of the march towards seamless connectivity and consequential developmental heaven, it

[37] Malaysia tops with a score of 7.07, and Indonesia, Kenya, Bangladesh, Pakistan, and Nigeria report lower scores than India in this group.
[38] However, since the scales are different, Poland would place above Malaysia anyway.
[39] A comedown from a score of 4.45 in 2008 (6th out of 9) compared to India's 1.83 (8th out of 9), but that's quibbling

nevertheless flags the potential for *improvement* along different dimensions that would unleash the 'sleeping tiger' to perform at peak efficiency levels. The story that the present paper would try to take back is one of optimism that is engendered by the gap between empirical evidence and *potential* that is so amply reflected by the low connectivity index.

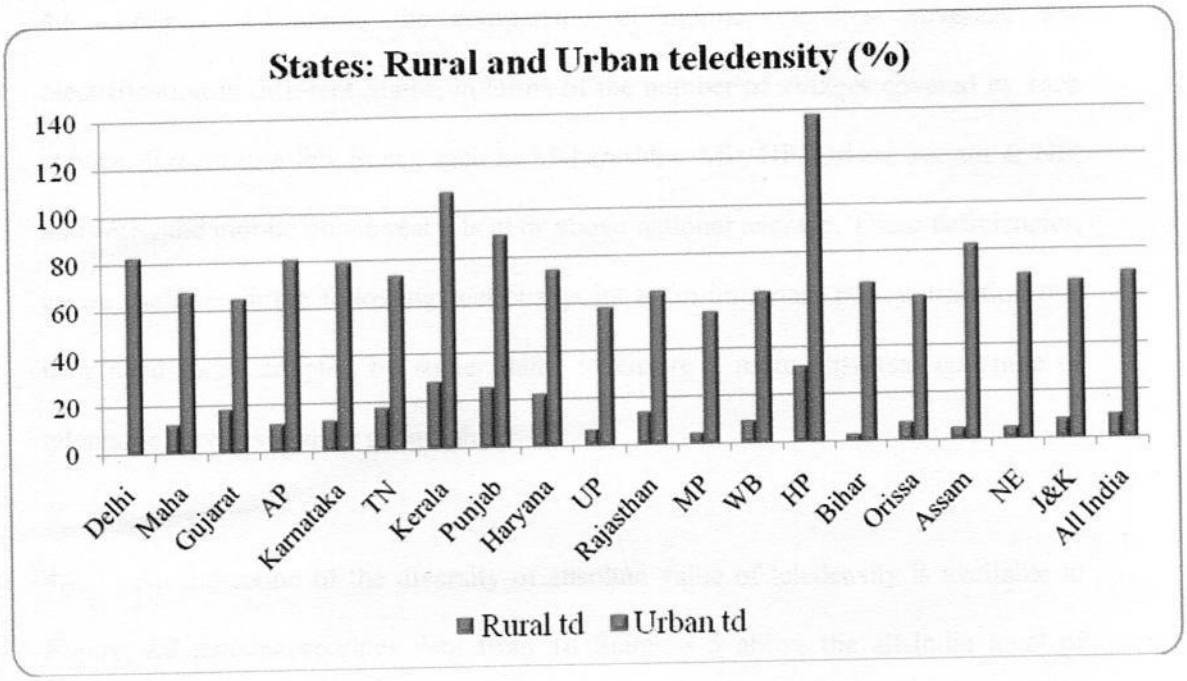
4.4.1 Econometric analysis of the contribution of Indian telephony, and more specifically, mobile telephony, has followed the leads indicated by international research. The most significant results for a 'sub-national' analysis are afforded by Kathuria *et al* (2009) who arrive at a causal relationship that concludes that

> *"10% increase in mobile penetration delivers, on average a 1.2% annual increase in output...."*

4.4.2 A full description of the econometric model and detailed results from Kathuria *et al* is given in *Appendix 2*. This has been annexed in full for the good reason that it establishes causality in the Indian context, and given the constraints of time available to the present author, these results are extremely important in analyzing correlation results that follow in this paper, thus saving attempts that would have merely reinvented the wheel.

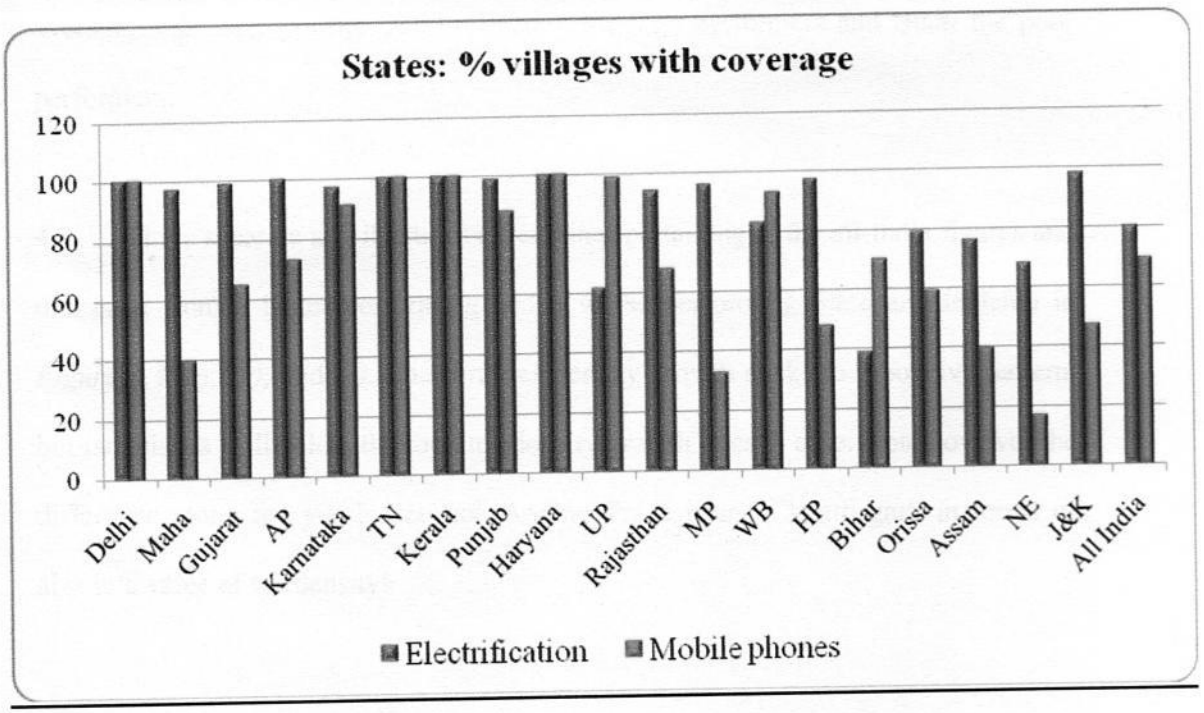
4.5 The State-wise trends of *total, urban,* and *rural* teledensity in the period between 2006 and 2008 is presented in *Appendix 3*. The position in major service areas as in June, 2008 is given below in *Figure 4.1*.

Fig 4.1: Teledensity in June 2008



Data source: TRAI

Figure 4.2: Mobile penetration and electrification (March 2008)



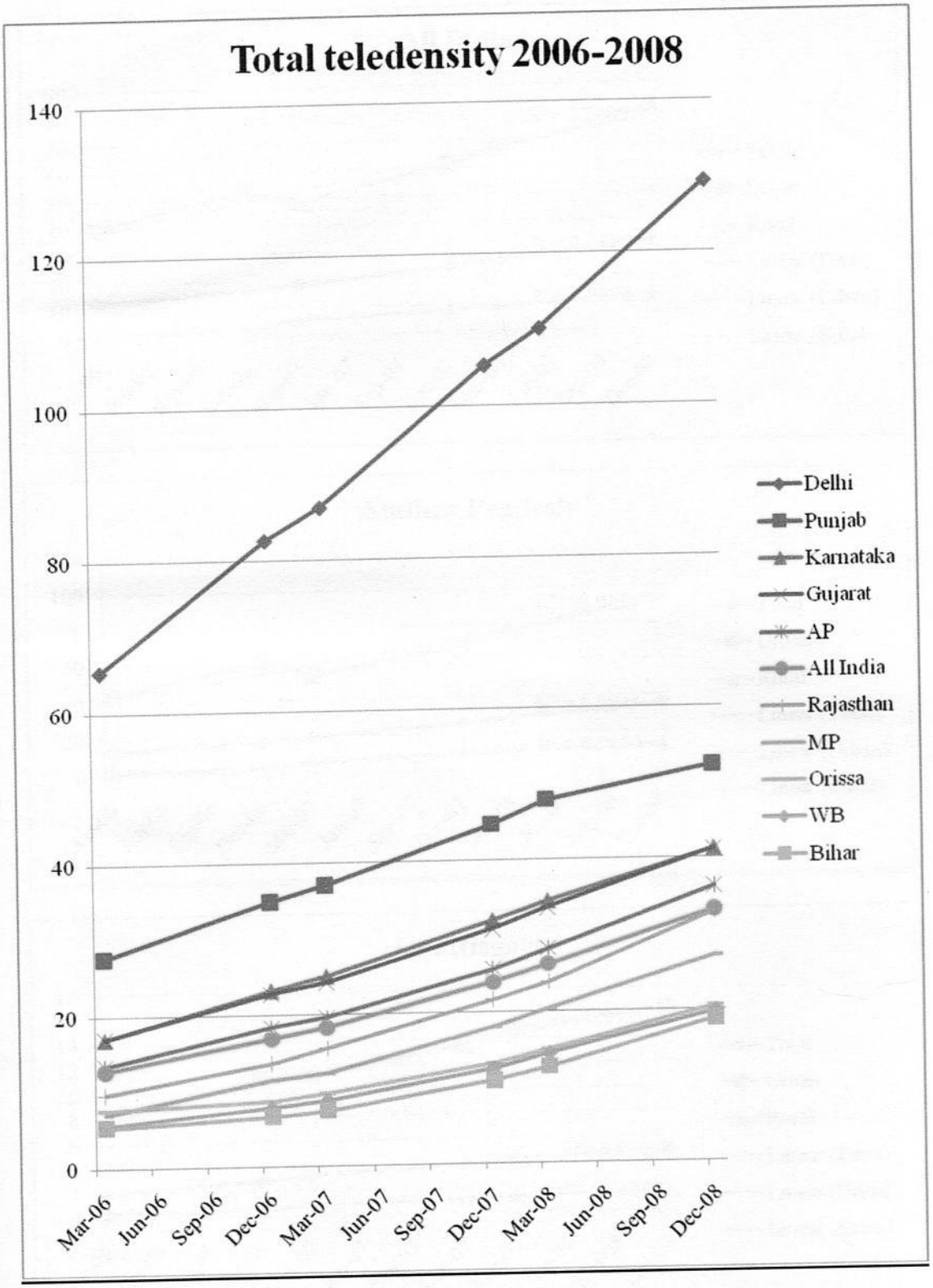
Data source: TRAI

4.6 *Figure 4.2* shows the comparison of mobile telephone coverage and electrification in different States, in terms of the number of villages covered by each service. Except in a few States such as Maharashtra, MP, HP, Orissa, Assam & NE, and J&K, the mobile phone reach is at or above national average. These deficiencies, as we shall see in the following sections, point to an important policy direction that may need to be adopted by some States to ensure a more universal coverage of telephone services in their geographies.

4.7 An indication of the diversity of absolute value of teledensity is available in *Figure 4.3* that incorporates data from 10 States – 5 above the all-India level of teledensity and 5 below, as in December, 2008. It is obvious however that the trajectory of growth in each case is similar and mimics the all-India trend. The States have been chosen to reflect the range of teledensity above and below the all-India average, with metropolitan Delhi reflecting the high performers and Bihar the poor performers.

4.8 Three separate and illustrative trendlines pertaining to the all-India figures and one each from a better performing and a worse performing State are depicted in *Figure 4.4 (a), (b),* and *(c)*. The rural teledensity growth sticks to a positive pattern, but languishes well below the total teledensity growth in each case. Note however the difference along the y-axis between Andhra Pradesh and Chhattisgarh in terms of absolute value of teledensity!

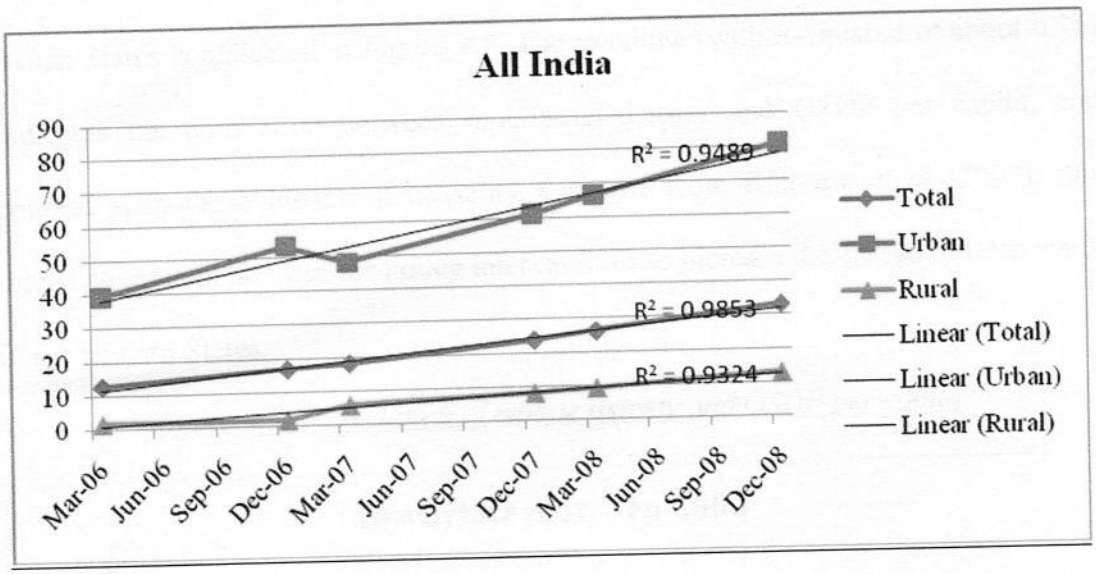
Fig 4.3: Similar trajectories of teledensity growth, selected States

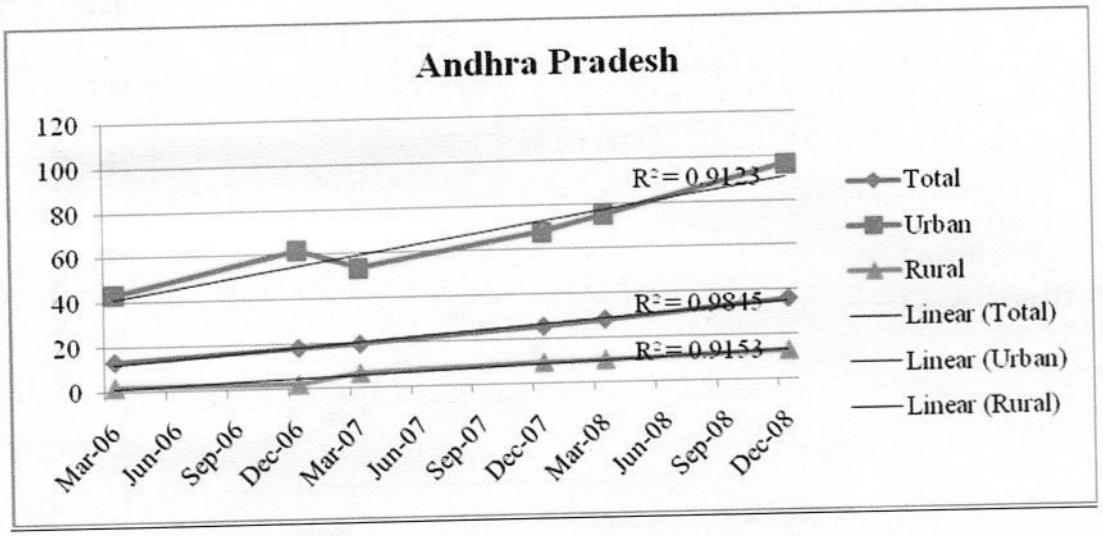


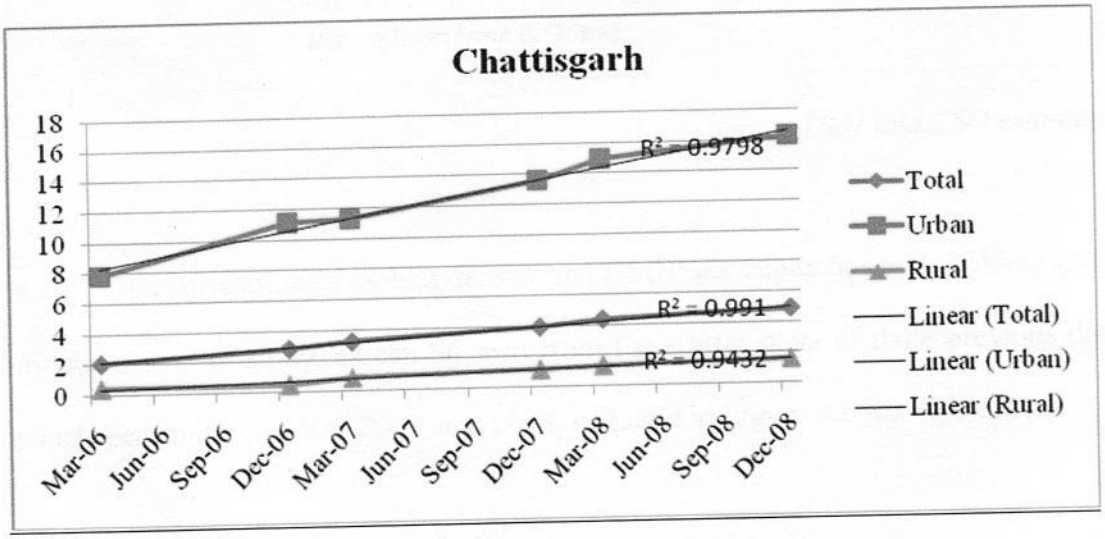
Data source: DoTelecom, Annual Reports and ERU Unit

Figure 4.4: Illustrative cases of lagging rural teledensity

(a), (b), (c)

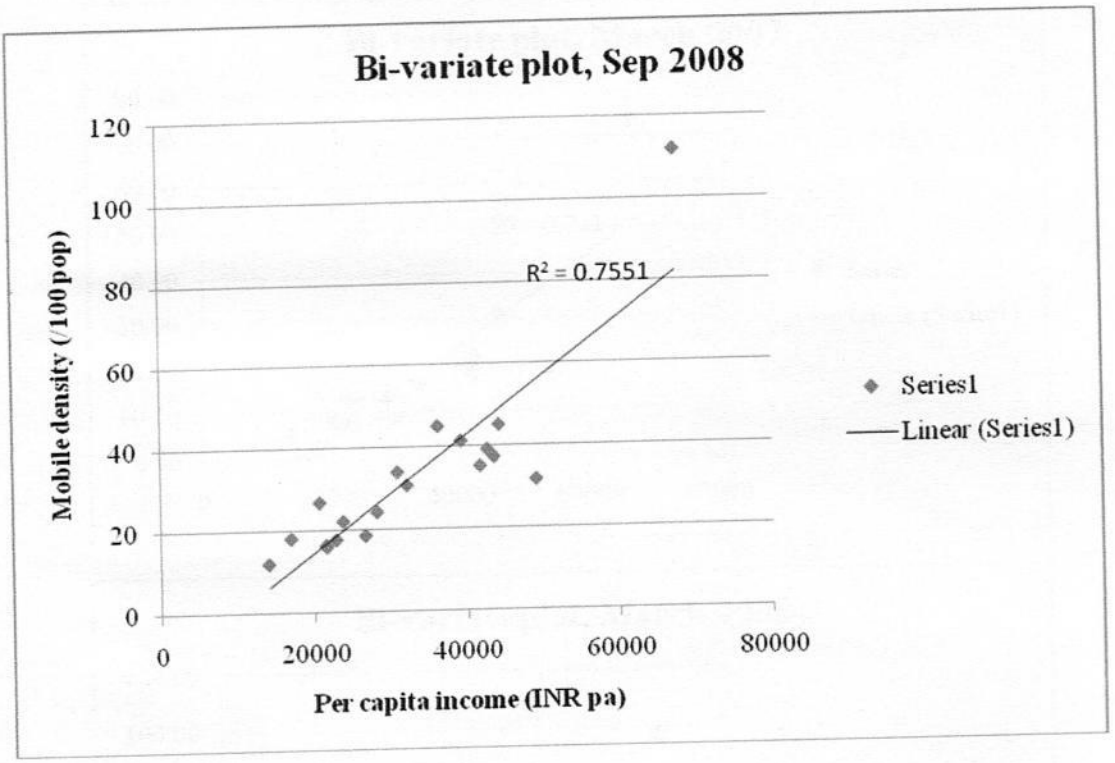






4.9 A representation of mobile density and GSDP per capita across different Indian States is indicated in *Figure 4.5*. The trendline (with R-squared of about 0.76) indicates the correlation between mobile teledensity and GSDP per capita, and coupled with the evidence of causality available from Kathuria *et al* (2009), this would strengthen the case for policy interventions to increase the spread of teledensity in the laggard States.

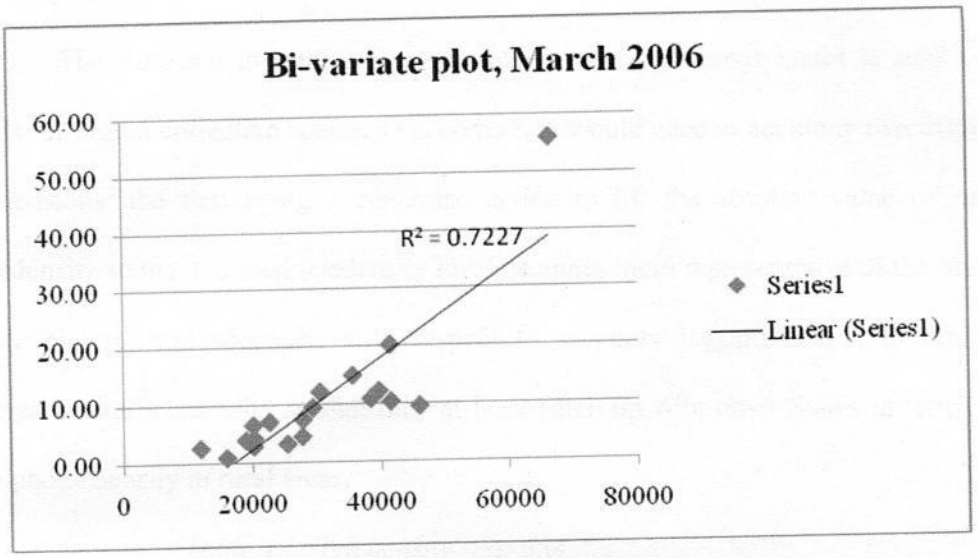
Figure 4.5: Correlation of mobile density and GSDP per capita

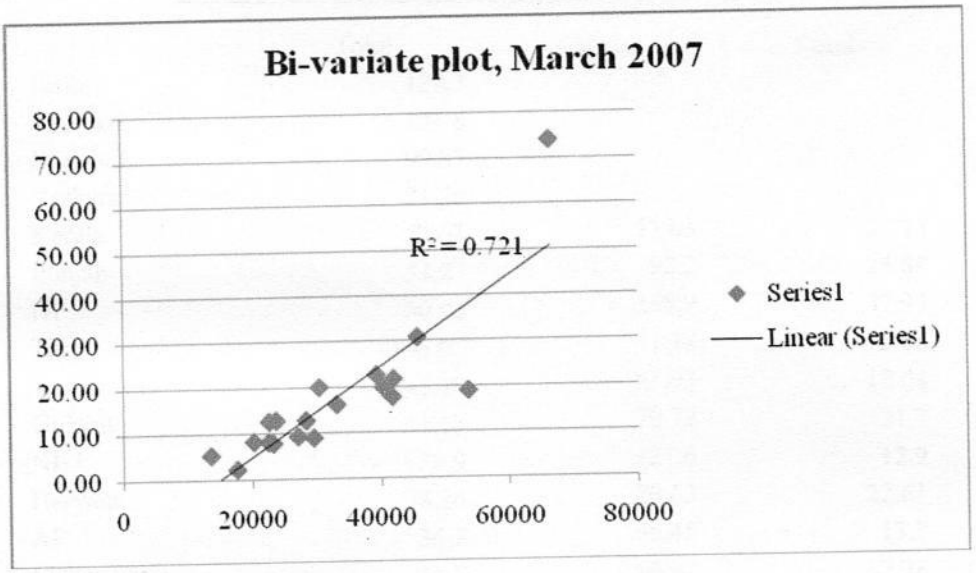


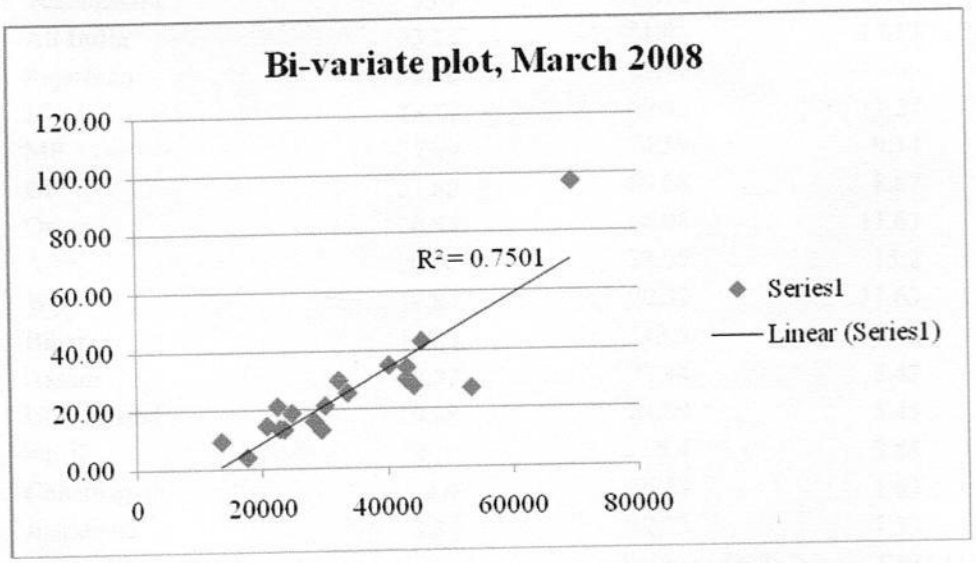
Data source: TRAI and CSO estimates

4.10 The correlation of mobile density and GSDP per capita has been holding good for the period of study, as can be seen from the scatter plots of three previous data panels pertaining to 2006, 2007, and 2008, included in *Figure 4.6 (a), (b),* and *(c).*

Figure 4.6 (a) (b) (c): Correlations for earlier periods







Data source: TRAI and CSO estimates

Analysis

4.11 The variation in rural and urban total teledensity across States is stark and calls for urgent corrective action. This correction would need to act along two distinct dimensions: the first being a concerted action to lift the absolute value of rural teledensity so that the total teledensity level becomes more representative of the State-wide picture, and secondly, with respect to specially laggard States, to rapidly increase rural teledensity so that they at least catch up with other States in terms of telephone density in rural areas.

Table 4.1: Teledensity snapshot (December, 2008)

	Total	Urban	Rural
Delhi	129.3		
Chennai	121.8		
Mumbai	99.87		
Kolkata	81.26		
Kerala	54.63	119.3	32.33
Punjab	52.27	92.2	26.88
HP	50.93	158.9	37.99
TN	45.07	71.28	22.88
Karnataka	41.19	91.93	12.04
Gujarat	41.13	70.72	21.7
NE I	38.9	121.6	12.9
Haryana	38.26	70.63	22.61
AP	36.2	96.45	13.2
Maharashtra	33.7	66.02	17.28
All India	**33.23**	**81.01**	**13.13**
Rajasthan	32.86	81.57	17.66
J&K	28.19	69.85	13.27
MP	27.09	74.59	9.14
UP	21.88	69.58	8.67
Orissa	20.54	66.08	11.63
A&N	20.07	28.09	15.2
WB	19.84	70.32	11.63
Bihar	18.84	113.5	7.72
Assam	18.77	79.84	8.42
Uttarakhand	10.88	24.99	5.45
NE II	8.13	25.4	2.88
Chhattisgarh	4.9	16.23	1.63
Jharkhand	3.84	12.23	1.33

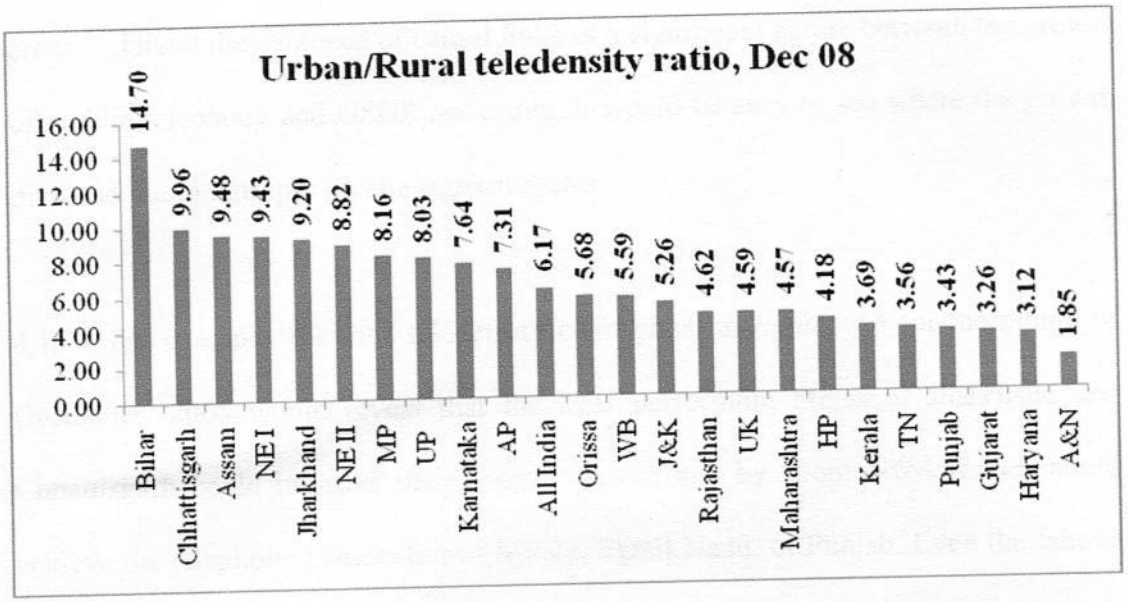
Source: DoTelecom, ERU Unit

4.12 The snapshot of the differences in absolute value of teledensity between urban and rural areas is presented in *Table 4.1* in decreasing order of total teledensity. It is apparent from the table that the all-India average rural teledensity suffers from the poor performance of Jharkhand, Chhattisgarh, Bihar, Assam, Uttar Pradesh, Madhya Pradesh, along with North East II, Uttarakhand, and Orissa. When the penetration of mobile telephones in rural areas of these States is compared with the *coverage* in villages of mobile telephony, it is seen that while MP, Bihar, Assam, and North East suffer from inadequate coverage that could be seen as one contributory reason for relatively lower penetration, the case of Uttar Pradesh stands out in terms of good coverage but characterized by low uptake. In the case of marginally better performing States like Andhra Pradesh, Maharashtra, and Gujarat too, the lack of full coverage appears to be a contributory factor in expanding mobile phone penetration.

4.13 When we turn to the differences in urban and rural teledensity *within* States, it would be useful to examine the evidence presented in *Figure 4.6* of the ratio between urban and rural teledensity in each State based on data available in *Table 4.1* corrected to the extent that Kolkata, Chennai, and Mumbai are here included within the States of West Bengal, Tamil Nadu, and Maharashtra respectively of which they form a part. The ratio of urban and rural teledensity is used to proxy inequality of telephone penetration between urban and rural areas, and the all-India figure for this is around 6.17[40]. The States with a ratio higher than this figure are taken to be States where the difference in urban and rural penetration is particularly stark. As can be

[40] This is subject, of course, to data accuracy. Post January-March 2007 when the data was 'cleaned up' at the instance of the Department of Telecom because of increasing security concerns, the data is assumed to be reasonably accurate.

Figure 4.7: Unequal rural neglect



Data source: DoTelecom, ERU unit

seen, the list of such 'unequal' States is headed by Bihar, and includes Chhattisgarh, Assam, NE I, Jharkhand, NE II, Madhya Pradesh and Uttar Pradesh. Karnataka and Andhra Pradesh follow with only marginally better performance. The policy lesson for these States is rather obvious in that they would need to look closely at the unequal penetration of telephony and take steps to mitigate the 'telephone divide' that may at one level be construed as a component of the larger digital divide.

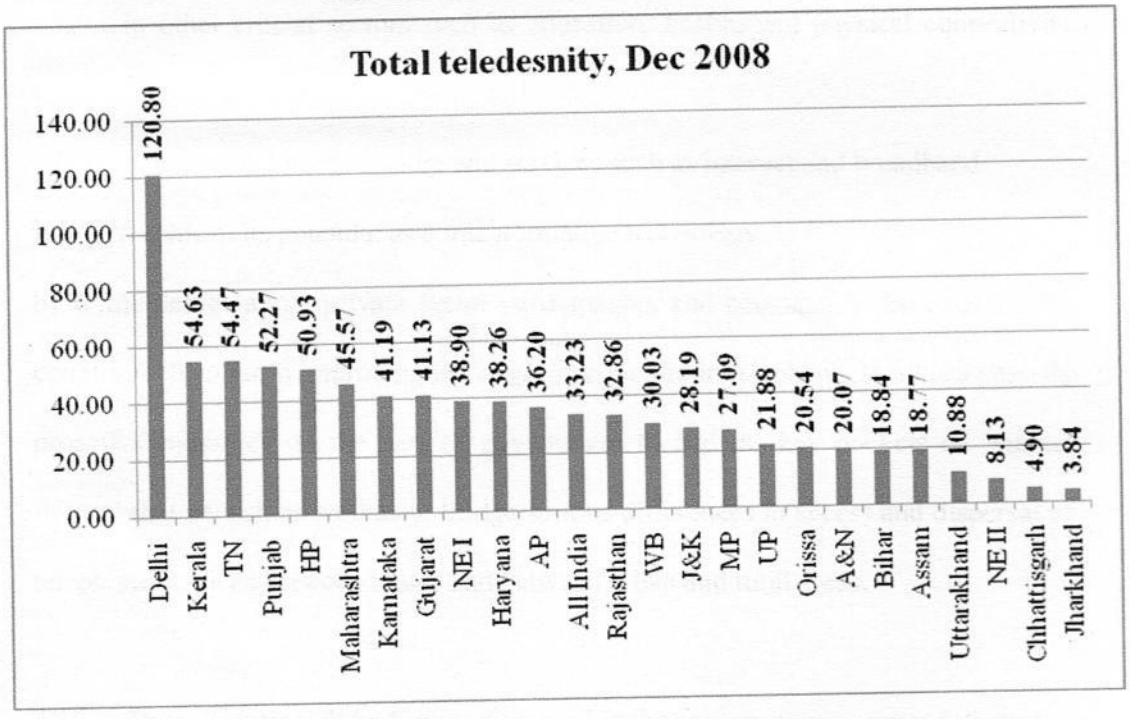
4.14 The second component of the economic analysis deals with the implications of the reasonably high correlation between mobile density and GSDP per capita[41]. The context for this part of the analysis would be the considerable growth momentum shown by the telecom sector in India in the decade or so since the inception of the independent regulator in 1997. However, as has been perceptively noted, 'India lags far behind comparator countries in telecommunications access, and there is huge

[41] Given the higher than 90% contribution of mobile telephones to the total, as well as the declining trend in fixed telephones, mobile teledensity can be taken as a proxy for teledensity.

untapped potential in certain states and in rural areas, and increasingly, in poor urban areas'[42]. Given the evidence of causal links of a significant nature between the growth of mobile telephony and GSDP per capita, it would be easy to see where the growth dividend could multiply for the laggard States.

4.15 For example, the total teledensity chart given in *Figure 4.8* for the month of December, 2008 would reveal that the least performing States of Jharkhand and Chhattisgarh could improve their overall growth rate by about 5-6% if they could achieve the telephone penetration of Kerala, Tamil Nadu, or Punjab. Even the 'above average States like Andhra Pradesh, North East I, Gujarat, and Karnataka, there is scope for improving the growth rate by 1.5 – 2.5 % if the teledensity rates improve to the level of the high performing States. When we agree that there is indeed a 'critical

Figure 4.8: Total teledensity lessons



Data source: DoTelecom, ERU unit

[42] Kathuria *et al* (2009). The comparator countries South Africa, Brazil, Philippines, Pakistan, China, and Sri Lanka, where mobile penetration varied from a high of 90% to a low of about 35% at the end of 2007 when India's mobile density was about 19%.

mass' beyond which network effects are magnified and better growth dividend is yielded, the 15 States that show a penetration level below that of the national average have everything to gain if they encourage growth in the telecom sector.

4.16 This however cannot be a simplistic prescription for a 'telephony-led-economic-growth'. In the context of India's low score on the connectivity scorecard, and previous research conclusions that teledensity growth cannot be a substitute for growth but can be an enabler for it to *trickle down*, and in the near-term market scenario of expansion of high-end services such as 3G and introduction of more competition, two caveats need to be entered:

a) Teledensity growth cannot be seen in isolation from other aspects of economic development. Indeed, in its *avatar* as enabling infrastructure, telecommunications needs to be supported by development

i. in other crucial sectors such as education, health, and physical connectivity such as roads; and

ii. in connected infrastructure and services such as internet and broadband

if it is to achieve its potential as a transformative technology.

b) While deregulation, private sector participation, and competition have served the country well so far in improving the *aggregate* picture in telephony, there is a case for proactive measures on the part of government to address key pockets of 'market failure' that persist, as well as to bridge serious differences in access and dispersal of telephone services between States and between urban and rural areas.

4.17 These aspects will be further discussed in the chapter on recommendations.