

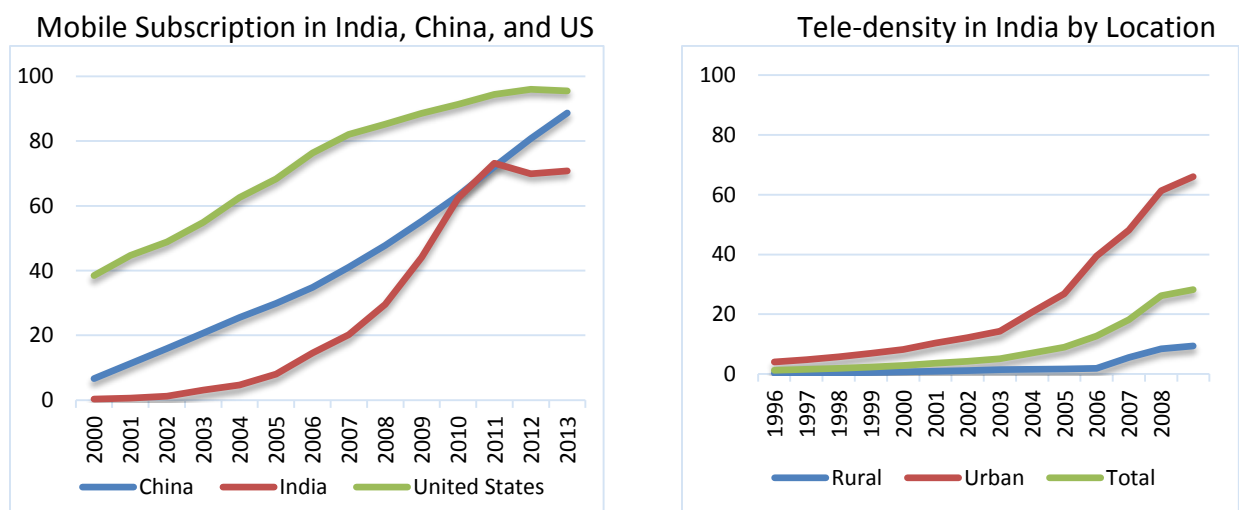
Access to Mobile Telephony and Economic Growth in Rural India

Amit Bubna and Sisir Debnath

Context

Access to mobile telephony has witnessed an unprecedented growth since the beginning of the twenty-first century. Mobile subscriptions in two of the most populous countries, India and China, are poised to converge to that of the developed world. This unparalleled catch-up, particularly for India with a meagre 1.3 telephones per 100 population in 1996, is probably one of the fastest adoption of a new communication technology.

Figure 1: Changes in Mobile Subscription over Time



Source: International Telecommunication Union and *India: The Impact of Mobile Phones*, Policy Paper Series, No. 9, January 2009, ICRIER. The vertical axis measures mobile subscriptions per 100 population.

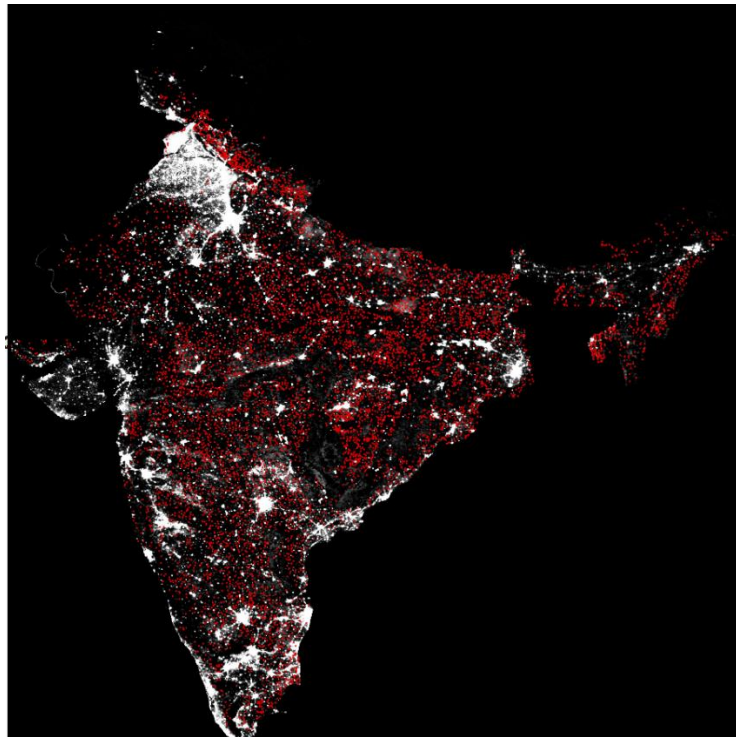
However, mobile penetration in India is heavily skewed in favor of urban areas. In 1996, urban areas in India had 3.7 more telephones per 100 population compared to rural areas. This gap increased to 56.4 in 2008, driven primarily by the lack of adequate mobile infrastructure in the rural areas. Capital cost of providing telecom services in rural and remote areas is much higher due to poor infrastructure and uneven terrain. Besides, sparse population density, low incomes and limited commercial activities fail to attract private capital. As a result, provision of infrastructure for mobile telephony in rural areas is mostly supply-driven encouraged by government policies.

Assessment

Mobile telephony has been touted as a game changing technology in economic development in the emerging economies. The empirical evidence on the effects of mobile telephony ranges from price dispersion, agricultural productivity, financial transaction, among others. Most of these studies have alluded to mobile telephony as a vehicle for economic growth. However, credible direct evidence is limited to cross country studies. To some extent this is due to lack of disaggregated data on economic growth and the endogenous expansion of mobile coverage. Using village level time series data on proxies for economic growth and a government program providing exogenous variation in timing of mobile connectivity enable us to estimate the effects of mobile coverage on economic growth.

The Universal Service Obligation Fund (USOF) was set up in India in 2003 with the obligation to provide affordable telecommunication to unconnected villages. According to the Wireless Planning & Co-ordination's (WPC) report, out of a total of 576,410 villages in India approximately 236,240 remained uncovered by mobile towers in 2006. Based on this report, the USOF identified the set of villages to be considered for mobile connectivity under the Shared Mobile Infrastructure Program (SMIP). SMIP invited bids from public and private infrastructure providers to construct towers. Infrastructure providers received a subsidy to operate and maintain the towers that were built under the program for a period of six years.

Figure 2: Location of Mobile Towers built under the Shared Mobile Infrastructure Program.



In Phase-I (2007-08) of the program, 7,353 mobile towers were installed in villages that did not have fixed wireless or mobile coverage. These towers are spread over 500 districts and 27 states in India. Figure 3 plots the spatial distribution of these towers on a satellite image of India captured at night. Absence of towers in brightly lit areas indicates that the towers were built in rural areas. These towers covered a total of 170,821 uncovered villages and by the end of 2011 the total number of uncovered villages in India fell to 56,399.

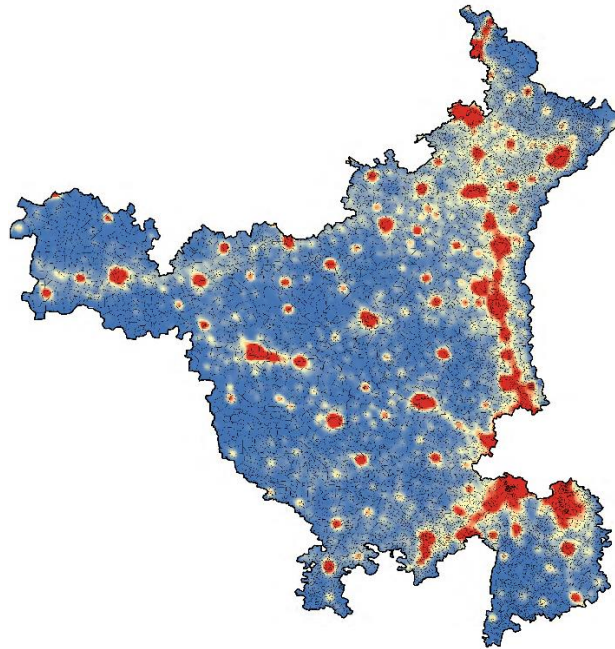
Post installation, the effects of mobile telephony on economic growth needs to be understood. A key methodological challenge in studying the effect of mobile telephony is that economic outcomes such as income and expected growth affect telecom service providers' decision to offer access to mobile telephony. Therefore, towns or villages with access to mobile telephony are not readily comparable to uncovered areas. Besides, areas with high expected growth are also likely to attract other infrastructures which can confound the effect of mobile connectivity. Hence, using changes in coverage induced by SMIP, which were not influenced by market conditions or future expectations, as a source of exogenous variation to study the effects of mobile connectivity provides rich insights.

As SMIP provided mobile connectivity at the village level, it created both advantages and challenges to study the effects. Villages in India are the smallest economic unit and changes in connectivity at the village level provide variation at a disaggregated level to estimate the effects more precisely. However, village level data on demography, household amenities, and facilities are available only from the Census data with an interval of ten years. Since all mobile towers under SMIP were built between 2008--2009, Census data for the years 2001 and 2011 is used. For example, the Primary Census Abstract (PCA) provides information on the distribution of village population over several categories of occupation. The village level infrastructure data, compiled as part of the census, is referred to as Village Directory (VD). This dataset documents size and land use, and primary manufacturing and agricultural commodities produced at the village level. It also provides details of a variety of amenities available in villages including schools, medical facilities, and banks among others.

Another difficulty to be overcome is the unavailability of information on economic activity at the village level. Previous research suggests that luminosity of night-time lights can be used as a proxy for economic growth. The data for the period 1992—2013 has been considered for this purpose. The satellite raster images with nighttime lights are obtained from the National Aeronautics and Space Administration's (NASA) Defense Meteorological Satellite Programs Operational Linescan System (DMSPOLS), a set of military weather satellites orbiting and recording high resolution images of the earth each night. The State Directorate of Census Operations publishes village boundary maps at the sub-district level along with their census code. Luminosity values were extracted at the village level after superimposing the digitized village maps on nighttime raster maps. Figure 4 shows the nighttime lights data superimposed on the village boundary map for the state of Haryana in 2001.

Since all the towers were not built at the same time, it helps to find the effects of mobile towers in villages with and without coverage, before and after commissioning of the towers after conditioning for village characteristics.

Figure 3: Nighttime Lights and Village Boundaries for the State of Haryana in 2001



Notes: The satellite image used from the National Aeronautics and Space Administration's (NASA) Defense Meteorological Satellite Program's Operational Linescan System (DMSP-OLS). The village boundary maps are obtained from the Registrar General of India.

Insights

There is a significant impact of SMIP on mobile ownership and coverage. Analysis using the Census data shows that villages covered under the SMIP were 17 percentage points more likely to have mobile connectivity in 2011 compared to the villages that were uncovered in 2006. Further, it is also observed that SMIP villages on an average had 7 percent more households with mobile phones compared to their counterparts.

Using the nighttime lights data, compared to the uncovered villages, the villages that benefitted under SMIP were more brightly lit at night after the construction of the towers. Compared to the pre-SMIP average villages covered under SMIP experienced a 42 percent increase in luminosity.

The study also establishes important complementarities between mobile telephony and other infrastructure facilities. In particular, the effects of mobile coverage are approximately 61 and 38 percentage points higher in the presence of bus services and easy connectivity to towns.

This suggests that transport facilities and mobile telephone are complementary for economic growth.

Investments in public goods such as education also enhance the effectiveness of better communication. The effect of mobile telephones is 39 percentage points higher in villages where a larger fraction of the population is literate. This suggests that adoption of new technology that reduces barriers to communication and flow of information is much more effective when the population is ready to use the technology to its fullest extent.

References

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