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The Relation between Covid-19 and the Teledensity of India: A Boon or Bane for the Digital Divide*

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ABSTRACT

Digital connectivity is viewed as a great leveller; however, when access to digital connectivity is skewed, those able to wield it benefit from profitable opportunities while those left behind the times have to play catch up. This gap creates a hindrance to the economic development of a country. This situation can be observed in India, where certain strata of the society are left behind due to geographical, prejudicial, and political reasons. However, recently Covid-19 has posed an anomaly. There has been uncertainty in the telecommunications climate due to the pandemic. Moreover, if the pandemic were to help telecommunications and teledensity, it has to be wielded correctly, supplemented with quick and decisive policies; it would lead to a net positive in India's efforts to bridge the digital divide. A study using the teledensity data sets of 17 regions from January 2014 through October 2021 was run to analyse the correlation between Covid-19 and the teledensity of these regions. We observed that the relation between Covid-19 cases and teledensity was positive and statistically significant at the 5% level. With a 1% increase in Covid-19 cases, the teledensity increased by 8%, and a rise in Covid-19 cases could explain 27% of the variance in teledensity.

JEL classification: L96, I15, O38

" Technology as a means to empower and as a tool that bridges the distance between hope and opportunity."
—Shri Narendra Modi, Hon'ble Prime Minister of India

Introduction

The telecommunications landscape has changed drastically in the past few decades, with new technological advances rendering the old ones obsolete. Moreover, it has emerged as a vital component of any developed country, as a backbone of all the three sectors -primary, secondary, and tertiary. It is crucial for logistical purposes, human resource development, ease of access, data collection and publication, and basic economic processes; it has also opened eCommerce platforms and online banking avenues. The Indian telecommunications industry is one of the fastest growing in the world. The Indian telecom network, with about 671 million connections in June 2010, is the third-largest in the world. With 635 million subscribers, India has the second-largest mobile subscribers. Moreover, Reliance Jio has exploded on the scene, capturing almost 428 million users as of 2021, increasing the horizons of the already large sector by increasing price competition, emphasizing infrastructural development, increasing network speeds, and increasing the investment in the sector. The increased competition, coupled with favourable government policies for the sector, has revitalized the efforts to bridge the" Digital Divide" and create a level playing field. According to Hardy (1980), telecommunications increase GDP and total factor productivity by reducing the transaction cost of communication, and this effect increases as production processes become more information-intensive. Moreover, telephones lower the fixed costs of acquiring information by streamlining communications in all the three sectors, reducing variable costs of participating in markets Norton (1992). Madden and Savage (1998) used panel data from transitional countries of Central and Eastern Europe. They found that the share of telecommunications investment in GDP was a

statistically significant variable in explaining the rate of growth of GDP. Datta* and Agarwal (2004) analyzed 22 OECD countries using the dynamic data panel method and showed a significant and positive correlation between telecommunications infrastructure and economic growth- after controlling for several other factors and proving the necessity of exemplary communications networks on the region GDP. Developments in the telecommunications sector have a significant positive relationship with the growth of a country, as proven by Norton (1992) using a sample of 47 countries from the post-WW II period until 1977. In the case of India, Kathuria (2009) looked at the impact of telephones on Region GDP in India for the period 2000-2008 for 19 regions and found that Indian regions with higher mobile penetration were projected to grow faster, with an increase in mobile penetration rate. Moreover, Chakraborty and Nani (2003), utilizing Granger Causality tests within a panel cointegration framework for a panel of Asian countries, found bidirectional causality between telecommunications investment and economic growth. A survey conducted by Sarin and Jain (2009) has shown that mobiles improve the ability to plan and coordinate to search for better prices and lower costs; they also enable some users to increase their range of work over a large geographical area, helping people to find work or do business beyond their immediate vicinity. The importance of telecommunications in the development of a country has been made evident through studies like the ones presented above as well as it is a two-way street that leads to the growth of the other; moreover, telecommunications helps create a level playing field offering more opportunities to those deprived due to the inaccessibility to telephones. However, the situation in India has been precarious as is since the partition of 1947. India is a continent-sized nation characterized by tremendous economic and social disparities across and within regions Kurian (2000). The growth of telephony is concentrated in a few regions and the urban centres within the regions. The number of connections per 100 inhabitants in a region like Delhi in 2009 was over 100, but only 15 in Bihar. Thus, several pockets where the critical mass of users has not been achieved may counteract the impact of telecommunications in other regions, where the critical mass has long been surpassed Ghosh (2012). Furthermore, Ghosh (2012) indicates that subscribers in the rural hinterland have low per capita incomes leading to lower ARPUs. Their demand is as volatile as their incomes. Therefore, it is also imperative to promote demand by reducing the cost of the handset and providing relevant content and services through accessible voice-based interfaces. It is evident that the relationship between telecommunications, economic growth and GDP is statistically significant, positive, and bidirectional, which creates the fundamental necessity to improve the telecommunications sector to reach the aspired levels of development in India. Moreover, as highlighted above, mobile devices help remedy the economic disparity between the digitally literate and illiterate, another goal for the government. However, as Ghosh (2012) discussed, the low ARPUs of rural households due to volatile demand and low income, an incentive is necessary to promote the use of handsets and other devices and create an easily understandable interface. The novelty of the Covid-19 pandemic has been a cesspit of uncertainty. However, it also provided an opportunity, as lockdowns laws would tighten around the country, work from home and online school would further promote mobile and other handheld devices, leading to a surge in the teledensity of India, as well as individual regions of India. The opportunity would act as a double-edged sword, as the information-rich would find it easier to increase or switch to online modes, whereas the information poor would either find little to no reason to switch or struggle to make the switch. The paper sought to research the impact of Covid-19 and its subsequent lockdown laws on the teledensity of 17 regions of India using multiple regression analysis. The results are positive and statistically significant at the 5% level. With a 1% increase in Covid-19 cases, the teledensity increased by 8%, and a rise in Covid-19 cases could account for 27% of the variance in teledensity. The paper is organized as follows: Section 2 outlines the source of the datasets, their organization, limitations, and relevancy, Section 3 defines the formulas used for the grouping, Covid-19 index, and multiple regression, and section 4 presents the results of the multiple regression, section 5 presents an interpretation of the results and the limitations of the study, section 6 conclude the policy implications and future research.

Data

This paper researches the relationship between Teledensity and Covid-19 cases in 17 Regions of India. A rich dataset has been built to carry out this analysis, and its key elements are described below.

Teledensity

The teledensity data is collected by the Telecom Regulatory Authority of India (TRAI), a government organisation in effect from 20th February 1997 that regulates telecom services- including services previously vested in the central government. TRAI collected the teledensity figures by using the telephone subscriber data provided by the access service providers. TRAI incorporated UTs like Goa into the closest region, Near capital region (Noida, Faridabad, Gurugram, Ghaziabad) into Delhi (https://trai.gov.in/release-publication/reports/telecom-subscriptions-reports). The monthly publications include six sections: Total Telephone subscribers, Category-wise Growth in subscriber base, Wireless subscribers, Growth in Wireless Subscribers, Active Wireless Subscribers, and Mobile Number Portability. This study only employed a sub dataset in the Total Telephones subscribers, namely, the teledensity graphs of seventeen regions. Due to illegible data, the study extrapolated the teledensity figures for some months, which were not a part of the
multiple regression.

Covid-19 Cases

The confirmed Covid-19 cases dataset was compiled by PRS Legislative Research (PRS), a not-for-profit organisation established in September 2005 as an independent research institute to make the Indian legislative process better informed, more transparent, and participatory. They used the cases reported by the Ministry of Health and Family Welfare, Government of India and compiled them into a dataset from 31st January 2020 to ongoing. The study used the dataset from 13th March 2020 to 13th October 2021. The dataset contains confirmed Covid-19 cases, active Covid-19 cases, and deaths caused by Covid-19 or medical problems in India and its regions and UTs. The study used confirmed Covid-19 cases for the 17 selected regions. While PRS is an independent research institute, the datasets were created using government-provided data, which puts the data at the risk of under-reporting and misevaluated figures. However, the paper cross-checked Covid-19 figures from other platforms to eliminate such bias.

Population

The population figures used in the Covid-19 index were collected by The Census 2011 conducted by the Census organisation of India. The Census organisation conducted the census in two phases, house listing and population. The census collects data using grassroots operations to launch welfare schemes. The census covered all 28 regions and 7 UTs, of which the study analysed 17 regions. The Indian population census covered population, the growth rate in population, literacy rates, population density, and sex ratio. The study used the 2011 population figures for the 17 regions to create relative index values for the confirmed cases of overpopulation. A highly reputable government body conducts the census of India, and its reliability is of the utmost importance.

Methods

The study aimed to find the correlation between the increase in Covid-19 cases and the change in teledensity of the regions of India.

Grouping

They were grouped to compare regions with similar tele densities; this helped in accounting for different development rates in factors that support the increase in teledensity. This also reduces the variation among the 17 regions by combining them and using their aggregates.

1 was the formula used to find the average of the regions to group them

$$Teledensity_{g,t} = \frac{\sum_{s=1}^{S} Teledensity_{s,t}}{S} \quad (1)$$

where *s* is the region, *t* is the month, *y* is the year average, and *g* is the group.
Further, groups were created on class intervals, and these intervals are shown in

$$G_1 = 50 < Teledensity_{g,t} < 75 \quad (2)$$

$$G_2 = 75 < Teledensity_{g,t} < 100 \quad (3)$$

$$G_3 = 100 < Teledensity_{g,t} < 125 \quad (4)$$

$$G_4 = 125 < Teledensity_{g,t} \quad (5)$$

Table 1: Grouping

Region
Group 1
Bihar
Assam
Madhya Pradesh Uttar Pradesh
Group 2
Odisha
West Bengal
Rajasthan
Haryana
Andhra Pradesh
Group 3
Gujarat
Maharashtra

	Karnataka
	Tamil Nadu
Group 4	
	Kerala
	Punjab
	Himachal Pradesh
	Delhi

Groups based on average teledensity through 2019 1 and class intervals 2

Covid-19 and The Population Index

The other variable is the Covid-19 index, derived from the confirmed cases of a state's total population. It provides us with confirmed cases per 1000 citizens of that state. 6

$$Covid_s = (ConfirmedCases_s / Population_s).1000 \quad (6)$$

Where s is the state, $Covid_s$ is the Covid index per 1000 $ConfirmedCases_s$ is the number of confirmed cases in that state, $Population_s$ is the population of that state as of 2011

Multiple Regression

To derive the relationship between the two variables $Teledensity_{g,t}$ and $Covid_s$, we ran a multiple regression and analysed its results.

$$Teledensity_s = \beta_1 Covid_s + v_s \quad (7)$$

$$Teledensity_s = \beta_1 Covid_s + \beta_2 Population_s + v_s \quad (8)$$

Where $Teledensity_s$ is the teledensity of the region and $Covid_s$ is the Covid index of the region.

Time Periods

The study is split into two distinct periods. The first one is before Covid-19 impacted the 17 regions, and the other is from the onset of Covid-19. The first period sets up the growth rate of regions and their respective groups from July 2018 to January 2020[1]; the other depicts the impact of Covid-19 on these regions, starting from February 2020 to September 2021. January 2014 to July 2018 is only used to reference the introduction of" Digital India" and other pre-2018 landmark decisions.

[1] There was a significant drop in the % teledensity in July 2018 due to a change in the procedure of measuring teledensity.

Results

The multiple regression was run twice. The first time without adjusting for population and the second time with changing for the people. This was done to maximise the accuracy and infer the population's role as an external factor.
From the results we obtained from the multiple regression 7, the impact of Covid-19 on teledensity is positive and statistically significant at the 5% level. For a 1% increase in covid, teledensity increases by 8%. Moreover, 27% of the variance in teledensity can be explained by the rise in Covid-19 cases.

From the results obtained by controlling for population- using 8- we observed no significant impact on the relationship between the Covid-19 cases and the teledensity of a region. The magnitude of the R-square and P-value remained similar to the previous regression. The R-square was 27.21%, and the P-value was observed to be 0.04

Discussion

The study of the 2-year analysis of the correlation between Covid-19 and the telecommunications sector yielded a positive and significant relationship between confirmed Covid-19 cases adjusted for population and teledensity. The relationship reinforces beliefs that the pandemic was a masked opportunity for the telecommunications sector; with increasing confirmed Covid-19 cases, the teledensity would also increase, further leading to developments in the telecommunications sectors, culminating in the increases in GDP Hardy (1980). Moreover, in the case of Indian regions, Kathuria (2009) found that higher mobile penetration would lead to increased growth rates, which could be witnessed during the past two months. The R-square was 27%, implying that approximately only 1/4th of the variance in teledensity could be explained by rising Covid-19 cases. The rest would have to be explained by confounding variables that played hand in hand with Covid-19 and could explain both the rising Covid-19 cases and increasing teledensity. The disparity within a region was not a part of the study. Further research into each region's urban and rural areas could provide insight into bridging the intraregional digital disparity. Even though the study tried to mitigate different region reactions due to their geographical location or government by grouping them, some regions likely experienced lesser demand increases due to their specific industry specialisations. Studies exploring avenues such as segregating based on newer population data, industries, urban-rural proportions, private investments, geographical location, and per-capita income could provide fruitful insights.

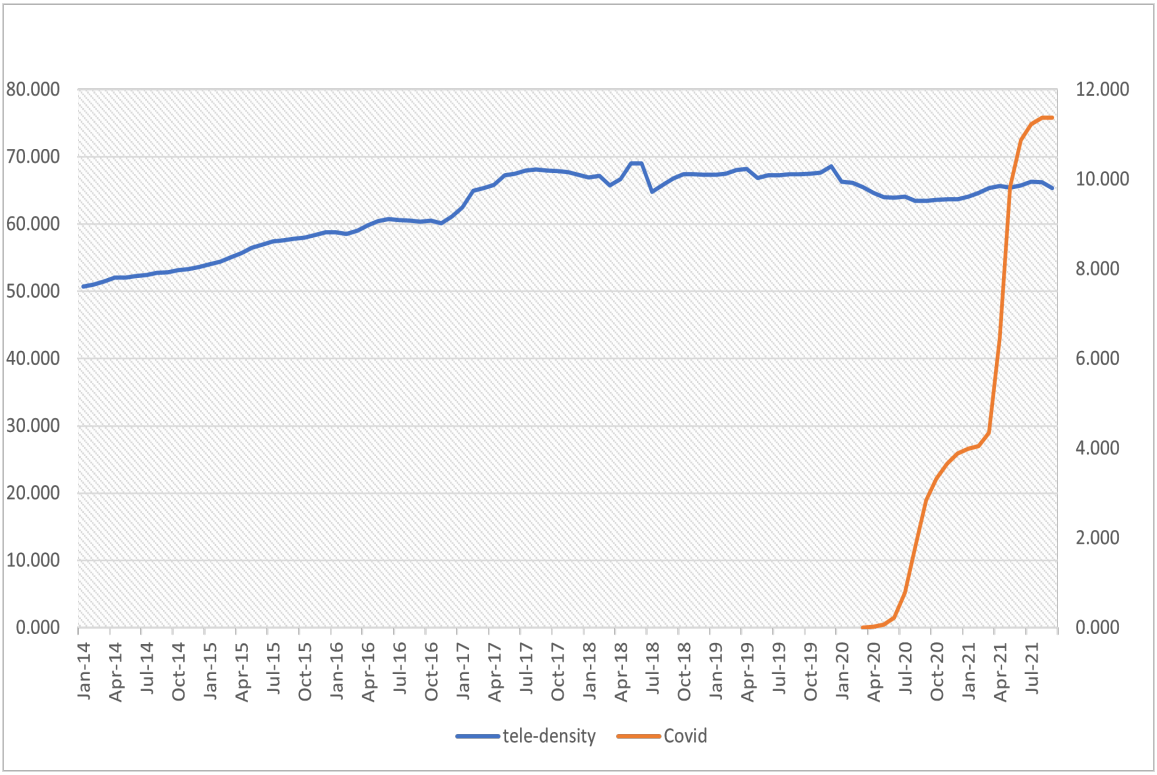


Figure 1: The Graph of Teledensity and Covid-19 Index for Group 1: Bihar, Assam, Madhya Pradesh, Uttar Pradesh

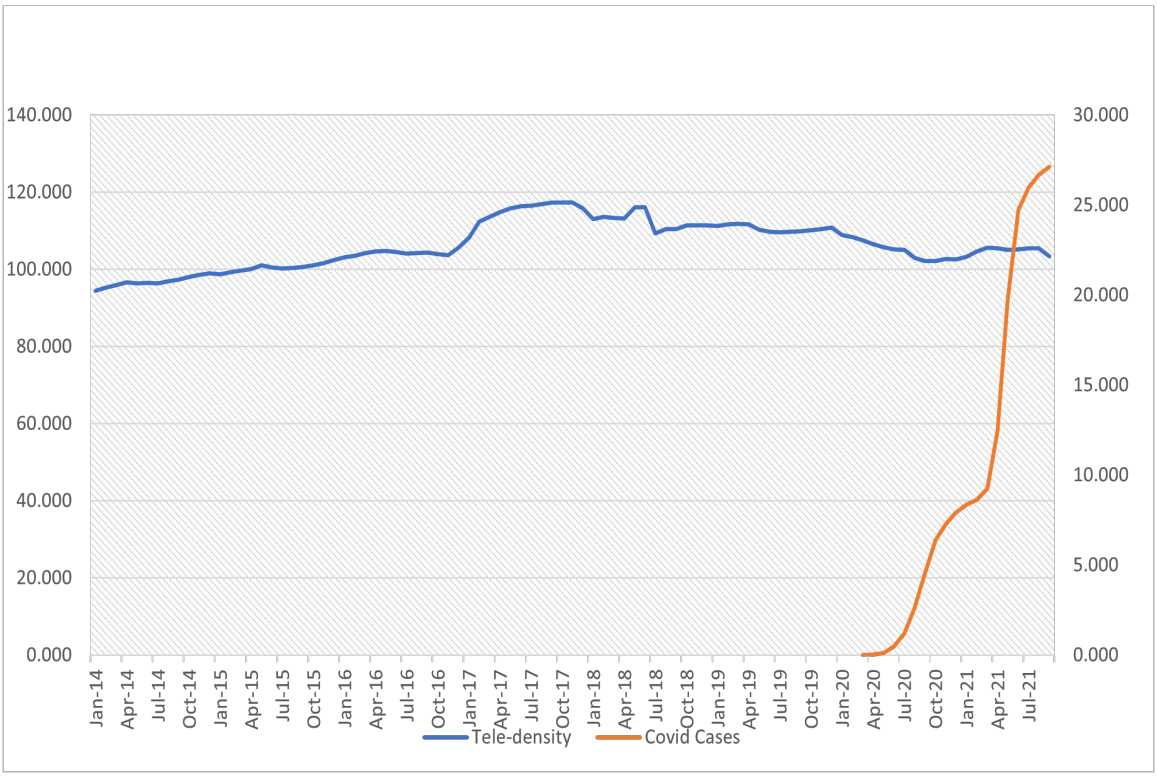


Figure 2: The Graph of Teledensity and Covid-19 Index for Group 2: Odisha, West Bengal, Rajasthan, Haryana, Andhra Pradesh

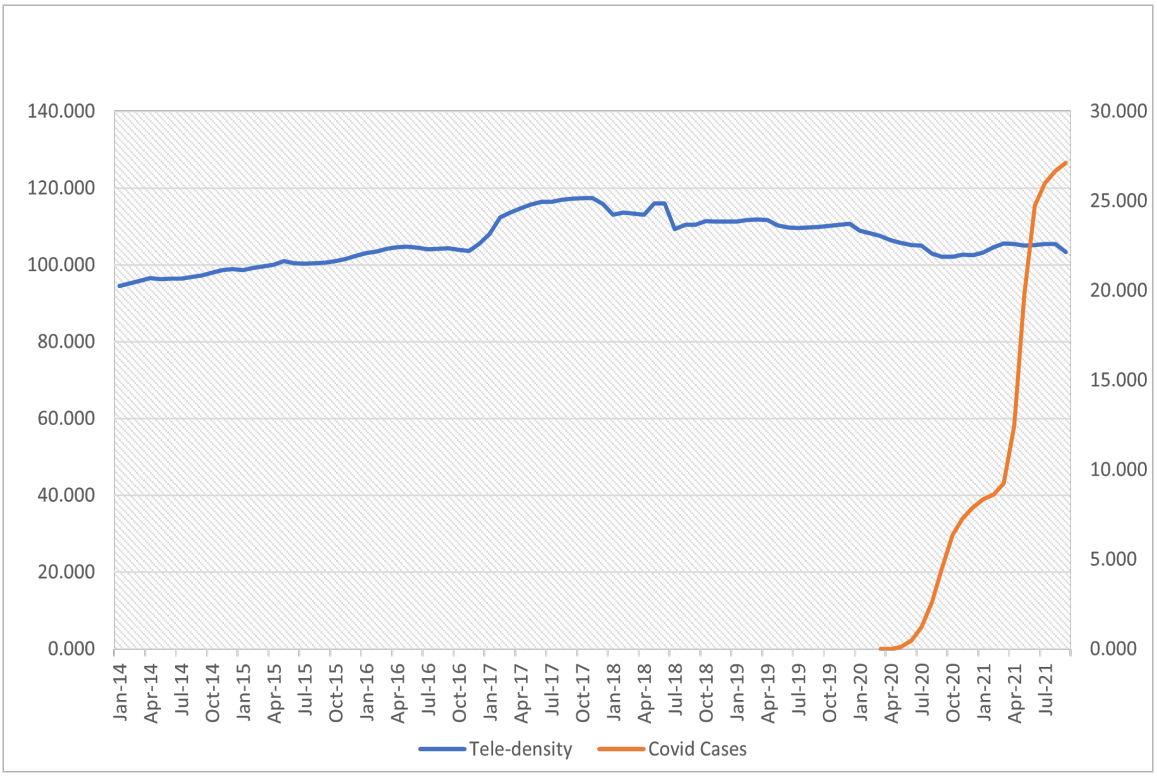
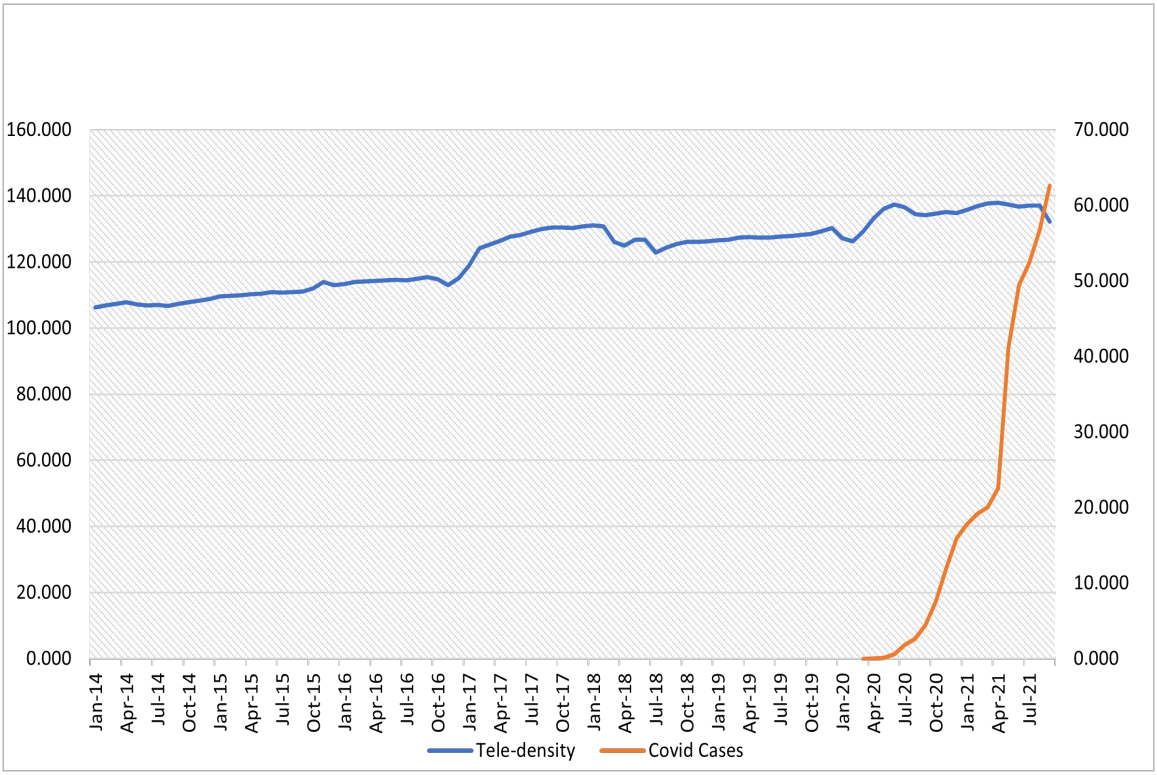


Figure 3: The Graph of Teledensity and Covid-19 Index for Group 3: Gujarat, Maharashtra, Karnataka, Tamil Nadu

Figure 4: The Graph of Teledensity and Covid-19 Index for Group 4: Kerala, Punjab, Himachal Pradesh, Delhi



Conclusion

As the world went through turmoil, the lucrative telecommunications sector realised a masked opportunity. By testing the correlation between confirmed Covid-19 cases in seventeen regions and their respective teledensity from February 2020 through October 2021, this study established that rising confirmed Covid-19 cases have a positive relationship with that region's teledensity.

However, the Covid-19 index for the seventeen regions did not account for the population and Covid-19 cases for any UTs part of the regions defined by TRAI. Even though the relative values might not represent the exact Covid-19 index for a few regions, the grouping aims to mitigate this effect by assuming average values for the group. This implies that even though a positive relationship might exist, it is vital to evaluate individual regions on their teledensity and Covid-19 index. Overall, a positive relationship for all the seventeen regions might not explain a particular region's growth rate. If approached correctly, by creating policies to incentivise the use of telecommunications devices during the pandemic, albeit for work, education, leisure, healthcare services, and other sectors where it is feasible for e-services to exist; we will be able to observe a positive trend for teledensity during the pandemic. Some measures have already been taken post the time periods present in the scope of the study to promote the use of telecommunications devices like mobile handsets for government processes. Lastly, even though this study provides evidence for the existence of a positive relationship, it is crucial to break down such relationships into further smaller units and conduct further research into the grassroots impact of the pandemic on the telecommunications sector.

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