ON DIGITAL DIVIDE AND CONVERGENCE OF ICT IN INDIA

A Dissertation submitted to

University of Hyderabad

in partial fulfillment of the requirements for the award of

MASTER OF PHILOSOPHY

in

ECONOMICS

by

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(17SEHL10)

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Spring Semester, 2017-19

June 28, 2019

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CERTIFICATE

This is to certify that **ADITI** (Roll No. 17SEHL10) has carried out the research embodied in the present dissertation entitled "**ON DIGITAL DIVIDE AND CONVERGENCE OF ICT IN INDIA**" for the full period prescribed under M.Phil. ordinances of the University of Hyderabad.

This dissertation is an independent work and does not constitute part of any material submitted for any research degree or diploma here or elsewhere.

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DECLARATION

I, **Aditi**, hereby declare that the research embodied in the present discussion entitled is an original research work carried out by me under the supervision of **Dr. S Raja Sethu Durai**, School of Economics, for the award of M.Phil, from University of Hyerabad.

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Acknowledgements

First of all, I am grateful to my thesis advisor Dr. S. Raja Sethu Durai, School of Economics, University of Hyerabad, for all his guidance, valuable suggestions and constructive comments. He was very patient with my slow pace of work and lazy behaviour and continued to motivate me for the competition of this work. I thank him for all his advices both at academic as well as personal level.

I am thankful to other members of my research advisory committee, Prof. Naresh Kumar Sharma for his valuable comments and suggestions throughout my research level.

I express gratitude to all my faculty of School of Economicsfor their guidance and support throughout my coursework.I would like to acknowledge the contribution of library of University of Hyerabadfor my research work.

My friends in the university, both my batch mates and hostel-mates have made my stay in the campus a memorable and joy full. I thank each and every one of them and seniors for the kindness you all have shown to me.

Finally, I will never find enough words to express the gratitude that I owe to my parents and family members. Their continued love and affection have given me high strength to move ahead in my career. The all-around support rendered by them provided the much-needed stimulant to steer through the most difficult stages of my life.

Date: June 28, 2019
Place: Hyderabad **(Aditi)**

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Abbreviations

ICT	**I**nformation and **C**ommunication **T**echnology
DD	**D**igital **D**ivide
ITU	**I**nternational **T**elecommunication **U**nion
DoT	**D**epartment **o**f **T**elecommunication
TRAI	**T**elecom **R**egulatory **A**uthority of **I**ndia
MCSPH	**M**obile **C**ellular **S**ubscription **P**er **H**undred population
IUPH	**I**nternet **U**sers) **P**er **H**undred population
OECD	**O**rganisation for **E**conomic **C**o-operation and **D**evelopment

Abstract

Information and Communication Technology (ICT) is rapidly growing day by day.In this regard the utility of Information and Communication Technology is alsorapidly increasing day by day. The rapid growth in ICT has led to generation ofhuge numbers of employment opportunity.Thus, today ICT access and use hasbecome very crucial to everyone. But not all of individuals has access to ICT andhence can not make use of it. Those who "have" access to ICT are benefited in oneor another form, however, those who do "not have" access to ICT are part of"Digital Divide" and remains in disadvantageous position. The study examinestrend of ICT and Digital Divide in India by considering Mobile cellularsubscription and Individuals using Internet as the indicators of access to and use ofICT respectively, for the period of 2005-2017. The study also assesses theconvergence of ICT indicators among developing Countries by using Sigma andunconditional Beta-convergence.The study finds that mobile subscriptions andInternet Users have increased many folds,consequence of it, Digital Divide in ICThas decreased to much extent in India in terms of both the access to and use ofICT. Further, there is convergence in terms of access to use of ICT amongdeveloping countries. The speed of convergence is found to be fast in mobilesubscriptions and slow in internet users.

Chapter 1

Introduction

1.1 Background

"Vasudhaiva Kutumbakam" is a Sanskrit phrase which means the entire world is one family. The enormous potential of Information and Communication Technology has unified the entire humanity by connecting the whole world into one big family (Shashi, 2017). Transforming earth into global neighbourhood is possible only by the use of ICT. Societal development of any country can be observed by the level of penetration of Information and Communication Technology which includes Internet, mobile phone subscriptions. Utilisation of ICT is very vast from getting real time information of weather by forecasting to use of GPS in vehicles and from transmitting ample of data from one part of the earth to other within a span of seconds to saving lives of people from natural Hazards like cyclone. Today ICT has occupied a very important position in common life. Making video calls has become a very common phenomena to everyone. The data generation is way more trafficking than the making voice calls. The habit of using internet or data is continuously increasing, especially watching videos on the smart-phones. Social media platforms such as facebook, instagram and twitter are not just for sharing post and messaging but it has entered into a new digital era of live streaming videos. In order to make use

of fast internet, individuals choose the network which provides fast loading of web pages and no buffering while watching video online or live streaming, which generate competition between the network providers.

Diffusion of ICT spread knowledge and information in the society which changed the pattern of work, from village classroom to virtual classroom, from instant money transfer to online shopping and from back-end offices to building IT empires. Therefore, ICT not only plays crucial role in social inclusion but is essential in all dimensions of the digital society (Warschauer, 2003). The cloud is another transforming technology which have changed the way data is stores. It appears that the fruits of ICTs are everywhere. However, unequal distribution of ICT has digital inequality within and/or between societies, called Digital Divide.

1.2 Digital-Divide:

The word 'Digital' denotes to Information and Communication Technologies where 'Divide' means difference and disparity. Generally, Digital-Divide means those who "have" access to ICTs get benefit of it through using it in employment as well as business set-ups, ont he other hand, thosa do not "have" opportunity to use and access ICT, are at the lower strata of the society in socio-economic terms.Hence, DD creates economic disparity and social division. Briefly, a digital divide is an economic as well as social phenomena in access, use or impact of information and communication technologies (Wikipedia).

Origin of the terminology, Digital Divide, is somewhat a mystery (Pierce, 2018). The concept was used in 1970s but journalists were credited with this term in 1990s (GUNKEL, 2003). Since then, the term Digital Divide began to be widely used, however, there was no specific definition of it. Researchers use the definition of Digital Divide in broader way as the disparity among individuals in access to information and communication technologies, specifically, inequality in access of Internet

(Srinuan, 2012). Since late 1990s, many scholars and international organizations made an attempt to define DD in terms of use and access of ICT.

1.2.1 Definitions of Digital Divide

OECD denotes Digital-Divide as division among households, business and socio-special. Dasgupta et al. (2011) and Zhang (2013) defines Digital Divide as function of inequality in getting access and make use of ICT among individuals.
According to Norris (2001), DD can prevail in a specific country and also among countries i.e. DD is extended. Zhao et al. (2014) also point out two dimensions of Digital Divide through its literature. The two dimensions are : (1) International Digital Divide and (2) Domestic Digital-Divide. International DD means the gap between developed and developing countries due to socio-economic factors, mainly education and income. Domestic DD expresses the disparity between groups domestically in a country. Deewan and Riggins (2005) provide another two dimension of the DD; (1) in terms of "access" of ICT which is first order DD and (2) in terms of "capacity" of ICT use, second order DD. The first order DD is the unequal reach out of the technological innovations to individuals and the second order DD is the inability of individuals to make use of available technological devices.Precisely, there are three types digital divide: (1) Global DD, (2) Social DD and (3) Domestic DD. The digital divide between countries ,developed and developing, is called global DD. The social DD represents division in access and use of ICT between different strata of society in a particular country. Domestic DD represents use of ICT in daily life activities in place of tradintional method of activities.

1.3 Reasons for The Digital Divide

There are numbers of reason for the existence of digital divide. Some can be listed as:

- Lack of electricity, especially in rural areas. Approximately 11 percent of the World population is estimated to be without electricity at the end of year 2018. Nearly 85% of the India's population has access to electricity (World-Bank, 2019).

- Illiteracy: many are still face problem in basic reading and writing which results in incapability of operating of the device like mobile phones and computers. The problem is widely visible in rural areas.

- Gender: Digital Divide based on Gender is called Gender Digital Divide which is more likely to be seen in women since women are 50% less likely to be online.

- Poverty and Affordability: Cost of using ICT through computer is very high than to using through mobile phones. Poor can not afford this cost and hence fall in the Digital Divide zone.

- Language and Local Content: All Devices like mobile phones are not incorporated with the local language, which is preferred by the people. Devices are in English but country like India has language Hindi and many local dialects which are not present in the Digital Devices. Most of the online content is available in handful of languages, lacking of which does not appeal individuals to be online.

- Infrastructure: Infrastructure development is first and foremost reason for Digital Divide. The increasing demand of ICT facilities does not cope up with the existing infrastructure. Government should actively participate to remove the infrastructure bottle-neck in order to bridge Digital Divide.

1.4 Bridging Digital Divide

The use of data usage in electronic gadgets is an better option to get rid of inequality in terms of accessing (DiMaggio et al., 2004). Government's initiatives and policies

that encourage competition in the telecom market, development of broadband plans keeping urban and poor individuals into consideration, proper assessment of spectrum policies and increasing the number of local Internet Service Provider helps in addressing the issue of access of ICT and further the Digital Divide. The issue of skill and training can be overcome by addressing digital illiteracy, through promotion of benefits of using internet and by embedding IT skills curriculum at school level. The reduction of internet inequality is called technological convergence. The digital divide can be bridged by making citizens aware of digital technology, it further helps in lowering inequality in information.

1.5 Initiatives to Bridge Digital Divide in India

There are many initiatives from the Indian Government to bridge existing Digital Divide in India. Some of such initiatives are:

- Digital India: is a milestone initiative to bridge Digital Divide in India with the view to transform India into a knowledge economy. Digital India initiative launched with the view to empower citizens specifically the poor and deprived to look for new oppotunities in their life.
- BharatNet: is another initiative by the Indian Government to connect rural hinterland by optical fibres cable network which will connect all gram panchayats and village blocks and hence bridge the urban-rural Digital Divide.
- Internet Sathi: In India, only 18 per cent of Internet users belong to rural areas and only one among ten is a women, which shows huge skewness towards women for not being able to make use of internet. Internet Sathi is the program launched in 2015 to bridge Digital Divide through enhancing digital literacy among women of rural India.

- UMANG (Unified Mobile Application for New-Age Government):is an initiative under Digital India to develop a unified stage which provide facility to access all government services at one click point.It developed an application which integrates various departments of central, state and local bodies.

- e-Kranti: With the vision of transforming e-governance for transforming governance, the e-Kranti initiative was implemented.

- Common Service Centre scheme: Common Service Centre scheme is the scheme under Digital India Programme which is the access point for all essential public utility services.

- Online Judicial System: Justice system has been strengthened by using technology in several applications like e-Court, e-Police, e-Jails and e-Prosecution.

- Mandating Hindi and Local Language compulsory: The very awaited step taken in Indian is mandating message typing facility in Hindi and regional language along with English both in smart-phones and feature phones. The initiative is taken in line to bridge Digital Divide in India under Digital India vision.

Bank at door steps through post man, Skill India Mission, free public WiFi at railway stations and bus stops are some other remarkable initiatives by the government to bridge Digital Divide in India.

1.6 Objectives of the study

Over the last 15 years, there had been a significant increase in the availability of the information and Communication Technology in developing countries. The mobile phone subscriptions have increased at rapid rate in developing countries. Following the increase in the mobile phone subscriptions, use of Internet has shown upward

trend. Hence it would be interesting to access ICT facilities using Mobile subscriptions and Internet Users. The objectives of the study are:

1. To explore the trend pattern of the DD in India
2. To access the convergence of ICT variables among Developing Economies

1.7 Scope and limitation of the study

Maximum numbers of appended papers explain digital divide in the domain of access and use of ICT and determinants Digital Divide in different parts of the world, but limited papers have addressed problem of digital divide in the Indian context. The thesis put attention towards the pattern of DD in India and the convergence of ICT facilities among developing countries. Mobile cellular subscription and Internet facilities of ICT are considered for this study. Availability of data and source from where data are extracted, one of major factor in selection of different countries for this study.

Chapter 2

Literature Review

2.1 Literature on Digital-Divide

Following relevant studies are considered for literature in DD. Montagnier and Wirthmann (2011) study ICT usage pattern among individuals and households of European Union(EU), Korea and Canada to solve the problem of Digital-Divide. They make use of logistic regression and multi-linear regression models to explain disparity in terms of computer and internet access. The findings show age, income, occupation, presence of children and residing in urban are the most important factors of the DD. Michael and Nicholas (2006) study the extent of internet use and find that internet use is influenced by income, education level and being a student. Dudek (2007) also produce similar results by examining the determinants of residential internet access for Polish by using the probit response model. Cerno and Amaral (2006) examines components of internet demand in Spain by using a probit model. The study results in having income positive effect and negative effect of age.

Ngan and Loo (2012) study effect of mobile communication on DD in China. Both find that use of mobile is having higher potential to narrow down the Digital-Divide in developing countries and the main reason behind is the lower cost of mobile in

relation to landline services, desktops computer, personal computer. Vehovar et al. (2006) put forward different approaches of Digital Divide measurement: the utilization of log-linear modelling to address interaction among factors of DD, by using time distance methodology to enquire the evolution in DD. They criticise the use of bivariate comparison for assessment of digital divide. Chakraborty and Bosman (2005) explained disparity ownership of personal computers with the help of Lorenz curve along with Gini coefficient. Albuja et al. (2015) make use of the Gini coefficient to analyse the gap in access to ICT by considering expenditure in ICT goods and services as consumption flow of ICT products. Marislei et al. (2017) study factors of DD as inequality in Brazil during the period of 2005-2013 through employing logistic regressions and using concentration index of ICT instead of Gini coefficient.The study considers inequality index of mobile phone ownership and internet access to measure ICT use.

E.Prieger (2013) studies level of urban-rural digital divide. The study indicates the existence of large numbers of slow speed internet service providers in rural localities in comparison to urban localities in which have more numbers of services with high speed. Guha (2018) estimates the extent of Digital Divide persist across economic classes and across geographical regions in India across the urban and rural both at state and district level. The study finds the main reasons for the Digital Divide are economic conditions, education, occupation, the socially disadvantage in the form of Scheduled Castes and Scheduled Tribes.

The purpose of the internet use is not only for gathering information but it varies from enhancing human capital, obtaining goods and services to entertainment during leisure. Pantea and Martens (2014) investigate digital Divide in terms of purposes show that low-income individuals use the internet highly for educational purposes and less for leisure. The authors Similar study sought by Sampath Kumar and Shiva Kumar (2018) examines frequency, place and purpose of the use of the computer by urban and rural students.They finds that 20.66% of rural student and 69.70 % of urban students make use of computer for many academic purposes. Further, the prime reason for using computer is the lack of computer skills. There exist disparity

in use and access to a computer by gender. 72% of the female and 63.33% of male students have not used a computer. Sampath Kumar and Basavaraja (2016) state that the reasons varies from lack of support from teachers to unavailability of a computer at home and school. Social-background affects the digital skills and get space for disparity in digital reading. Children from privileged social backgrounds show higher digital skills and are comfortable in reading digitally (Davide and Antonio, 2017).

Today, ICT leaves no sector untapped consider it from IT industry to agriculture. Agriculture farmer make use of ICT to gether information about agricultural marketing like price search. Blattman et al. (2003) analyse the methods and cost at which Indian farmers obtain agriculture related information by using Tobin regression analysis of data collected by stratified random sampling shows that low caste, level of education and income compose a substantial deterrent in terms of access, use and affordability of electronic media and communication.

2.2 Literature on Convergence

This section reviews the literature on convergence. There are enormous of literature present through which it is easy to get conditional convergence of GDP per capita across countries. Neo-classical growth model explains growth of an economy is pushed by technological advancement Solow (1956), As per conditional convergence hypothesis, economics with the same level of technology and population growth rates, having different propensities to save and per-capita income, converge at similar growth rate of capital and output. Barro (1991) used cross-section data of 98 countries to explore convegence. The study concludes positive relation between growth of per capita GDP and initial level of human-capital, conversely, its negative relation between initial per capita GDP, which means growth rate has inverse relation to initial level of per capita income. Tapsin and Koksal (2013) base their

analysis of the convergence hypothesis among Sanghai Cooperation Organization (SCO) countries during 1996 to 2011 per capita data from world bank. For the purpose, authors use panel data of per capita GDP. Kaitila (2004) analyses both σ and β convergence in per capita income levels of European Union countries. Maria and Isabel (2016) review the existing empirical convergence studies and presented Quantile method for analysis.

Many of such studies have been proposed based on β convergence through use of series of time and panel data regression. Such studies draw conclusions in favor of conditional convergence. However, absolute convergence with the poor countries reaching to the rich countries in terms of per capita income is found to be rare. Gilles et al. (2009) evidence the absence of absolute convergence of GDP per capita among developing countries. Conversely, Rupal et al. (2010) base in the ASEAN countries to examine the convergence of GDP per capita for the period of 1990-2008 and find that ASEAN countries are converging towards a common GDP per capita steadily but slowly by using a and ó convergence.

This section reviewed the literature on DD and convergence both at the national and international level. In the literature, we find very few studies examining both DD and coupling among developing countries. Agarwal and Panda (2018) is the paper which analyses both the the trend of DD in across Indian republic and assess the confluence of ICT. Studies reveal the prime factors which describe ICT are predominantly mobile phones and use of internet.

Chapter 3

Data and Research Methodology

3.1 Variables

The study considers two variables: (1) Mobile cellular subscriptions, indicator for the access of ICT and; (2) Internet Users, indicator for the Use of ICT. Mobile cellular subscription includes both total post-paid subscriptions and active prepaid subscription in numbers (meaning that mobiles have been in use at least for last three months). Mobile cellular subscription consists of all mobile subscriptions that offer voice communication.

MCSPH = (Total number of Mobile subscriptions / Total Population)*100

Mobiles subscriptions per 100 population measures the access of ICT but in order to measure Digital Divide in access to ICT, it is going to be calculated as:

DDaccess = 100 - MCSPH

Since Digital Divide does not refers to the Mobile subscriptions but it does to the Mobile Non-Subscriptions. MCSPH refers to the penetration rate of mobile subscriptions as the percentage of the total population of a country has mobile subscriptions. Hence, by subtracting MCSPH from Hundred percent, we get digital divide in access of ICT.

To measure the use of ICT, the study considers Internet Users as the indicator for

use of ICT. Internet users refers to the proportion of population who are using the internet in the country.

IUPH = (Total number of individuals using Internet / Total Population)*100

IUPH is the Internet penetration rate which corresponds to the percentage of the total population of a given country that uses the internet. To measure the Digital Divide in Internet use, implies the number of individuals don't use ICT, will get this by subtracting the total number of individuals make use of internet from cent individuals.

DDuse = 100 - IUPH

3.2 Data Source

The secondary data are collected for the period of 2005-2017 from the Yearbook of Statistics reports, published by International Telecommunications Union (ITU). ITU extracts telecommunication statistics of India from Department of Telecommunication (DoT), Ministry of Communications, Government of India and Telecom Regulatory Authority of India (TRAI). Data for both the variables are extracted from ITU for 53 developing countries along with India in order to assess the existence of convergence terms acquire (access to) and operation (use) of ICT.

3.3 Methodology

The methodology is executed by using the sofware packages R-Studio and STATA. Graphical presentation of the variables are also done using the same two software.

3.3.1 Descriptive and Comparative Statistics

Descriptive analysis consists of two points: (1) explores trend of acquire (access to) and operation (use) of ICT and, (2) assessing Digital-divideD in line of acquire (access to) and operation (use) of ICT.

The study uses comparative statistics to get the pattern of obtaining (access to) and operating (use of) ICT in developing countries at two points for better understanding. The two comparing points are: the average of initial 3 years data (2004-05, 2005-06 and 2006-07) and average data of last 3 years (2014-15, 2015-16, 2016-17) for for the comparison purpose. These two points helps in the understanding, the performance of countries over the period of time in access to and use of ICT and their convergence towards Information and Communication Technology.

3.3.2 Convergence

Neoclassical growth model shows that in the long run, the world growth rate is driven by innovations and discoveries in the technology by the leading economies. The study is an attempt to assess the convergence of ICT facilities among developing economies i.e. finding existence of a common factor between developing countries that eliminates growth divergences in ICT access and use of it in the very long run.

3.3.2.1 Variation in per capita variables: σ-convergence

σ-convergence happens case where the variation in per capita real variables declines with time period. The study measures variation through calculating standard deviation of the considered variables for the period from 2004-2005 to 2016-2017.

3.3.2.2 Initial levels and growth rates: β-convergence

A β-convergence describes a negative influence of per capita variables on the initial levels in a regression of growth. The study analyses unconditional β-convergence for per capita variables of developing countries estimation. The speed of unconditional convergence is estimated by using equation

$$\log y_{i,t} - \log y_{i,t-1} = \alpha + \beta \log y_{i,t-1} + \epsilon_{it} \tag{3.1}$$

$\log y_{i,t}$ in the equation 3.1 is in log(natural) of per capita variable of ith country at time t,α is a constant and ϵ is error term. β-convergence exists if slope of the above equation is negative i.e. $\beta < 0$. The β being negative implies technologically poor countries have faster growth rate than technologically richer ones. Following the same hypothesis, poor countries will eventually catch up with developed ones. Performing above average in obtaining (represents access) and operation (represents use) of ICT is considered as technologically rich otherwise, technologically poor. β-convergence does not necessarily imply σ-convergence if each country's use and access of ICT is persistently subject to random disturbances that affect country-specific growth rates of MCSPH and IUPH (Barro and Sala-i Martin, 1995). In this specification, a negative beta estimate indicates that regions with low initial per capita income level grow faster than richer regions. The hypothesis of absolute income convergence is true if the estimate of σ positive and statistically significant.

Chapter 4

Analysis and Findings

The analysis section of this chapter includes three parts; (1) Descriptive analysis which explore the pattern of ICT and trend in Digital-Divide in line to access and operation (use); (2) Comparative statistics: assessing the changing pattern of the obtaining (access) and operation (use) of ICT among developing countries and (3) the Convergence: assessing the confluence (convergence) of ICT indicators among developing countries.

4.1 Trend in ICT and Digital-Divide in India:

The changing trend of ICT and DD is analysed through the use of two ICT variables such as: (i) mobile phone subscribers and (ii) Internet users. The two variables under study are the main variables to acquire the digital ammunities.

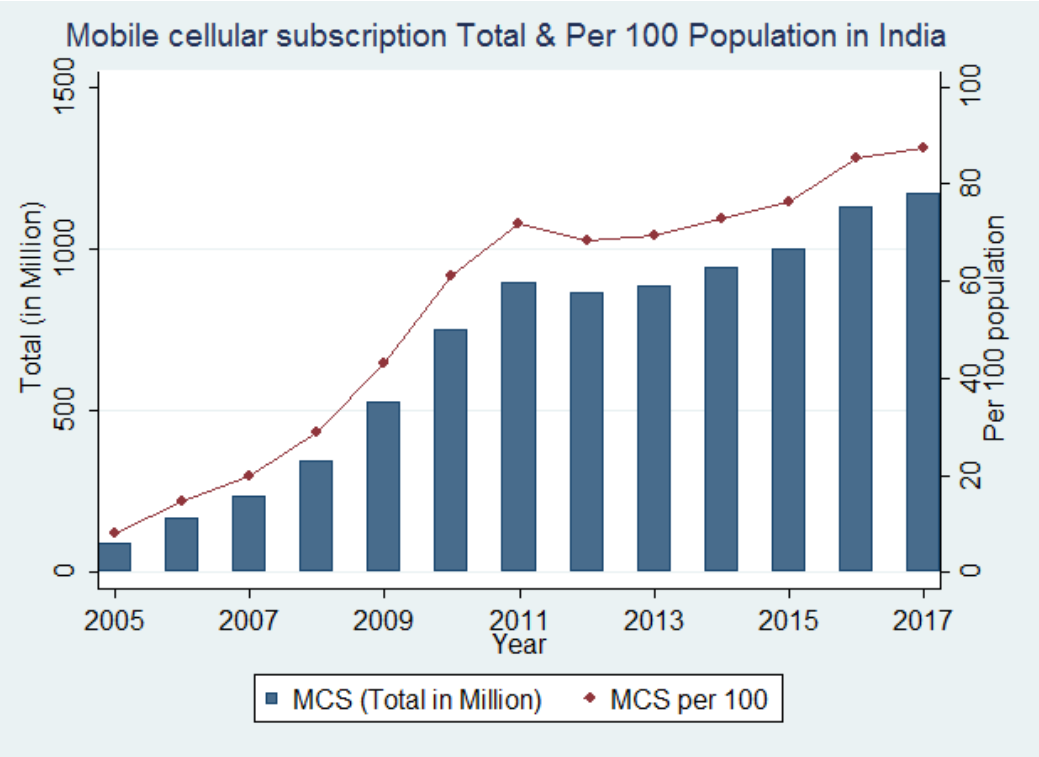

FIGURE 4.1: Mobile cellular subscription Total & Per 100 population in India

4.1.1 Trend in Access and Non-Access of Mobile Subscriptions in India

Today, the life of majority of individuals is incomplete without phone, it has occupied space for itself in everyone's life since it has capacity to connect people through voice calls or through video calls. Figure 4.1 exhibits the inflow of mobile users .It is evident from the figure 4.1 that the obtaining mobile phones is increasing in India during the study period. It is important to note that India has crossed the half way line in the year 2010 in terms of mobile subscriptions, with 61.10 percent of Indians using mobiles. There is sharp continuous increment in mobile phones usage from 2005 to 2011. The year 2012 shows fall in total number & in per cent of mobile cellular subscription from 71.68 per cent of mobile subscribers in 2011 to 68.47 percent in 2012. The reasons the fall may be: unfavourable dollar movements against rupees results in increased mobile phones prices, shifting in technology use

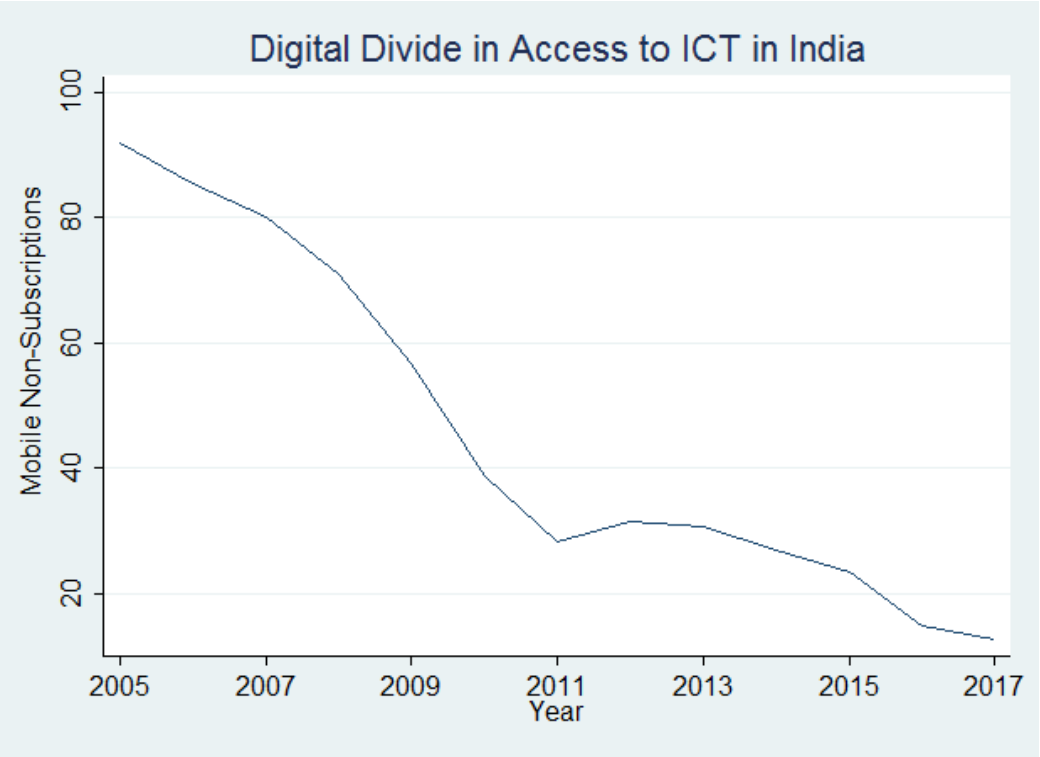

FIGURE 4.2: Digital-divide in "Access" of ICT in India

in mobile from 2g to 3g during 2011-2012 year and some of existing mobile cellular network providers had to exit the market due to spectrum scam verdict of Supreme Court. Further, moderate increment can be seen during 2013-2015 and there is rapid increase mobile phone subscriptions in the year 2016. This strong growth in mobile subscribers in India is mainly due to a very attractive offer provided by Reliance Jio and such initiatives are making more individuals online towards making India Digital. Reliance Jio has come up with 'welcoming offer' of low tariff plan of the data usage and free voice calls which attracted to many individuals. Though to get benefited with Reliance Jio plan, individuals need to spend on buying 4G smart phones worth of 10K, is the one time investment. Since the one time investment amount was very high for poor, many of them choose to stay out. India crossed the line of 1.2 billion mobile subscriptions out of which 30 per cent are smart phone subscription in the year 2017.

Figure 4.2 depicts the Digital Divide in the Access to ICT in India. The digital divide

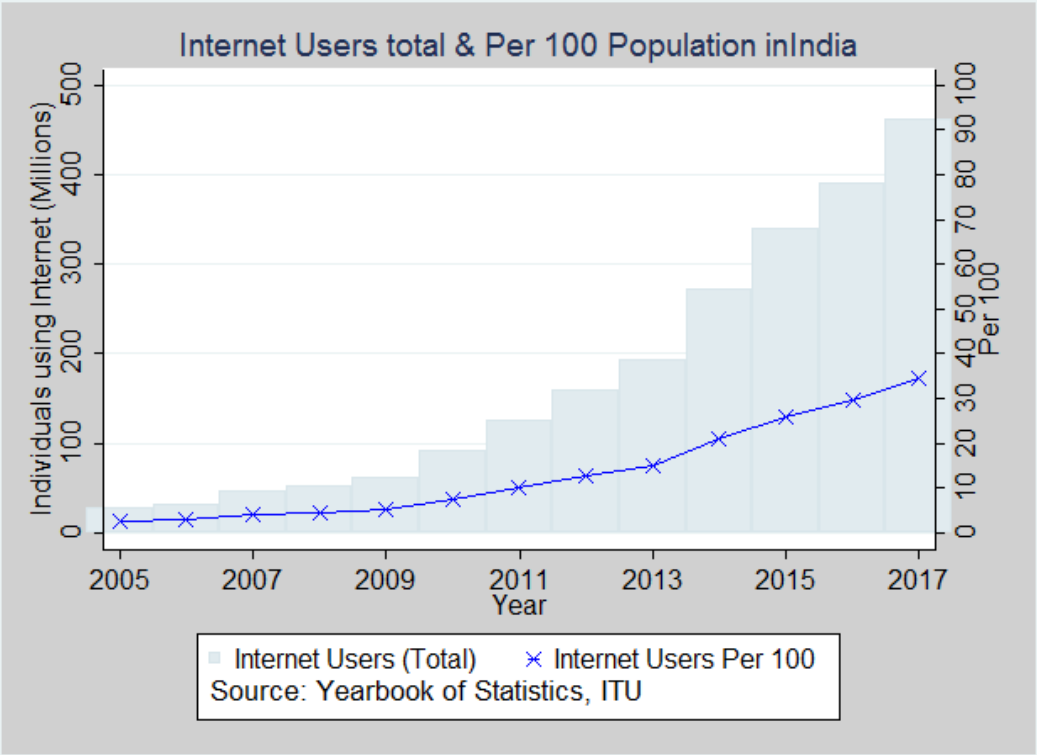

FIGURE 4.3: Individuals Using Internet Total & Per 100 population in India

in mobile subscription is continuously decreasing from the initial year 2005 till 2011. In the year 2011-2012. increase in Digital Divide in Mobile subscriptions can be observed. The reason behind increment in the Digital Divide during 2011-2012 can vary from shifting in technology use in mobile from 2g to 3g during 2011-2012 year to existing mobile network providers had to exit the market due to spectrum scam verdict of Supreme Court. From the year 2012 onward, the Digital disparity declines in access of ICT till the end of study period.

4.1.2 Trend in Internet Users

Figure 4.3 reveals the inflow of Internet per Hundred of population. It is visible from the figure that there is monotonous rise in the use of internet in India during the entire period of study. The impact of technology shift from shifting from 2g to 3g during 2011-2012 and Reliance Jio lowering changes tariffs on Internet is clearly

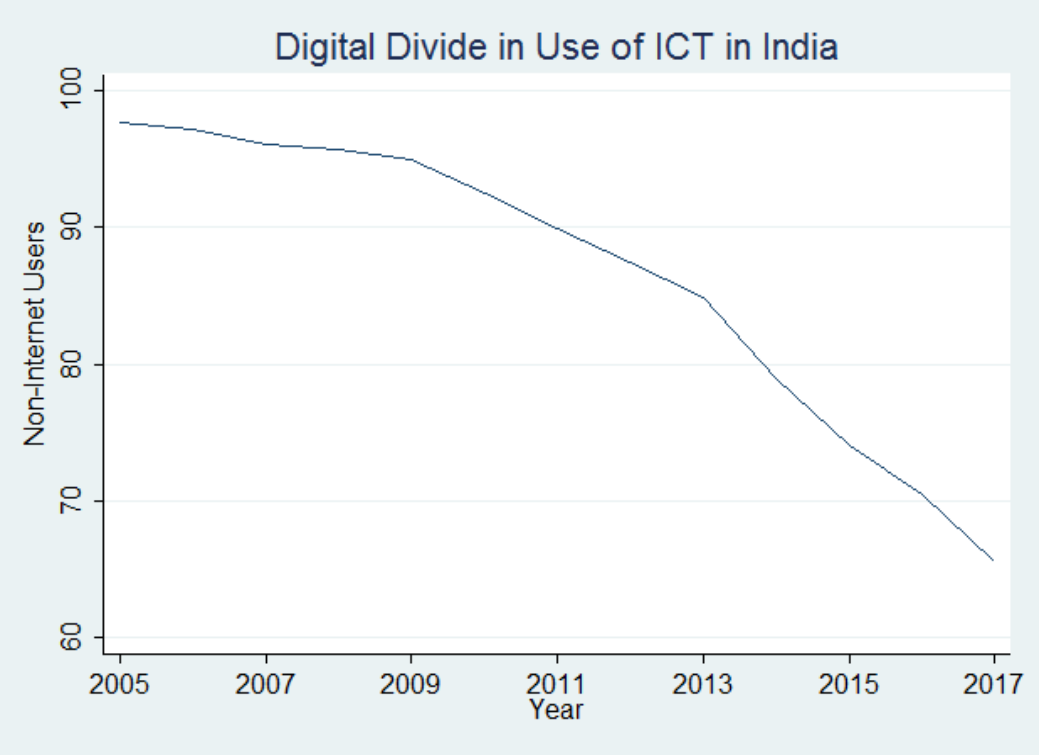

FIGURE 4.4: Digital-Divide in Use of ICT in India

visible in the figure. Important to note that India still has not reached to the half way in using internet in 2017. "Internet of India 2017" report states that the number of internet users stood at 481 million in December with an increase of 11.34 per cent over December 2016. Urban India stood at 64.84 per cent of internet penetration, while rural India stood at 20.26 per cent. Digital Divide in internet use between urban-rural exist. Figure 4.6 In the figure 4.4 Digital Divide in Use of ICT is declining through out the study period. Initially, It was observed declining at moderate rate till the year 2009. In the year 2009, Indian government came up with rule for Procedure and Safeguards for monitoring and collection of traffic Data or other information which let internet users feel safe to use internet and hence plenty of citizens decided to go for internet use. Similarly, there is hump in the year 2013. From 2013-2017, it can be observed thought decline in the Digital Divide.

4.2 Pattern of ICT in Developing countries

The section analyses pattern of Mobile cellular subscriptions per Hundred population and individuals using internet per Hundred population among developing economies. The average of initial Three years (2004-05, 2005-06 and 2006-07) and last years (2014-15, 2015-16, and 2016-17) of considered period of data set is taken for parallel analogy.

TABLE 4.1: Changing Position of Countries in Access to ICT (MCSPH)

Country Number	Country Name	Overall Average 2005-2007	Country Average 2005-2007	Overall Average 2015-2017	Country Average 2015-2017	Country Performance
I	Algeria	42.66	59.87	112.57	111.74	High to Low
II	Argentina	42.66	80.29	112.57	142.52	Remained Above
III	Armenia	42.66	38.42	112.57	118.42	Low to High
IV	Azerbaijan	42.66	38.69	112.57	106.35	Remained below
V	Bolivia	42.66	29.91	112.57	95.59	Remained below
VI	Botswana	42.66	44.54	112.57	148.3	Remained Above
VII	Brazil	42.66	54.37	112.57	118.57	Remained Above
VIII	Cabo Verdc	42.66	23.71	112.57	112.79	Low to High
IX	Cameroon	42.66	17.67	112.57	81.03	Remained below
X	China	42.66	35.18	112.57	98.01	Remained below
XI	Colombia	42.66	64.92	112.57	122.1	Remained Above
XII	Congo	42.66	25.06	112.57	102.11	Remained below
XIII	Costa Rica	42.66	30.72	112.57	169.48	Low to High
XIV	Cuba	42.66	1.44	112.57	34.67	Remained below
XV	Côte d'Ivoire	42.66	26.04	112.57	118.82	Low to High
XVI	Egypt	42.66	28.06	112.57	102.66	Remained below
XVII	El Salvador	42.66	67.71	112.57	152.09	Remained Above
XVIII	Gabon	42.66	65.93	112.57	142.44	Remained Above
XIX	Georgia	42.66	41.1	112.57	140.68	Low to High
XX	Ghana	42.66	23.64	112.57	130.06	Low to High
XXI	Guatemala	42.66	60.05	112.57	113.27	Remained Above
XXII	Guyana	42.66	53.06	112.57	76.3	High to Low
XXIII	Honduras	42.66	36.24	112.57	88.21	Remained below
XXIV	India	42.66	14.11	112.57	82.98	Remained below
XXV	Indonesia	42.66	29.83	112.65	147.94	Low to High
XXVI	Iran	42.66	25.09	112.57	100.36	Remained below

TABLE 4.2: Changing Position of Countries in Access to ICT (MCSPH) continues...

Country Number	Country Name	Overall Average 2005-2007	Country Average 2005-2007	Overall Average 2015-2017	Country Average 2015-2017	Country Performance
XXVII	Iraq	42.66	29.23	112.57	90.04	Remained below
XXVIII	Jamaica	42.66	85.79	112.57	109.86	High to Low
XXIX	Jordan	42.66	74.75	112.57	118.16	Remained Above
XXX	Kazakhstan	42.66	55.65	112.57	145.6	Remained Above
XXXI	Lebanon	42.66	27.49	112.57	74.37	Remained below
XXXII	Libya	42.66	60.89	112.57	124.16	Remained Above
XXXIII	Malaysia	42.66	78.88	112.57	138.93	Remained Above
XXXIV	Mauritius	42.66	64.58	112.57	143.05	Remained Above
XXXV	Mexico	42.66	50.2	112.57	87.22	High to Low
XXXVI	Morocco	42.66	53.04	112.57	121.45	Remained Above
XXXVII	Namibia	42.66	30.09	112.57	106.04	Remained below
XXXVIII	Nicaragua	42.66	32.78	112.57	125.65	Low to High
XXXIX	Nigeria	42.66	21.1	112.57	80.72	Remained below
XL	Pakistan	42.66	22.62	112.57	70.16	Remained below
XLI	Panama	42.66	67.2	112.57	132.93	Remained Above
XLII	Papua Guinea	42.66	2.51	112.57	46.81	Remained below
XLIII	Paraguay	42.66	54.12	112.57	110.88	High to Low
XLIV	Peru	42.66	35.7	112.57	116.74	Low to High
XLV	Philippines	42.66	51.37	112.57	114.16	Remained Above
XLVI	Sri Lanka	42.66	27.68	112.57	124.83	Low to High
XLVII	Thailand	42.66	62.51	112.57	166.58	Remained Above
XLVIII	Tunisia	42.66	68.36	112.57	126.34	Remained Above
XLIX	Turkey	42.66	76.76	112.57	94.95	High to Low
L	Turkmenistan	42.66	4.86	112.57	151.73	Low to High
L1	Uzbekistan	42.66	11.24	112.57	73.45	Remained below
LII	Venezuela	42.66	67.33	112.57	86.43	High to Low
LIII	Viet Nam	42.66	28.45	112.57	127.24	Low to High

4.2.1 Pattern of Access to ICT (Mobile Subscriptions) among Economies

Figure 4.5,is the graphical presentation of Table 4.5, shows the comparative statistics of changing pattern of mobile users among developing countries. The initial 3 years of triennial average of the developing countries is 42.66, presented by the lower horizontal line, and of the last 3 years is 112.57, shown in the figure by upper horizontal line. Bar diagram and spikes in the figure4.5 represents the triennial average of respective countries during 2005-2007 and 2015-2017 respectively. In order to have comparison between countries in terms of performance in mobile usage, one needs to compare height of Bar to the overall triennial average of initial years and

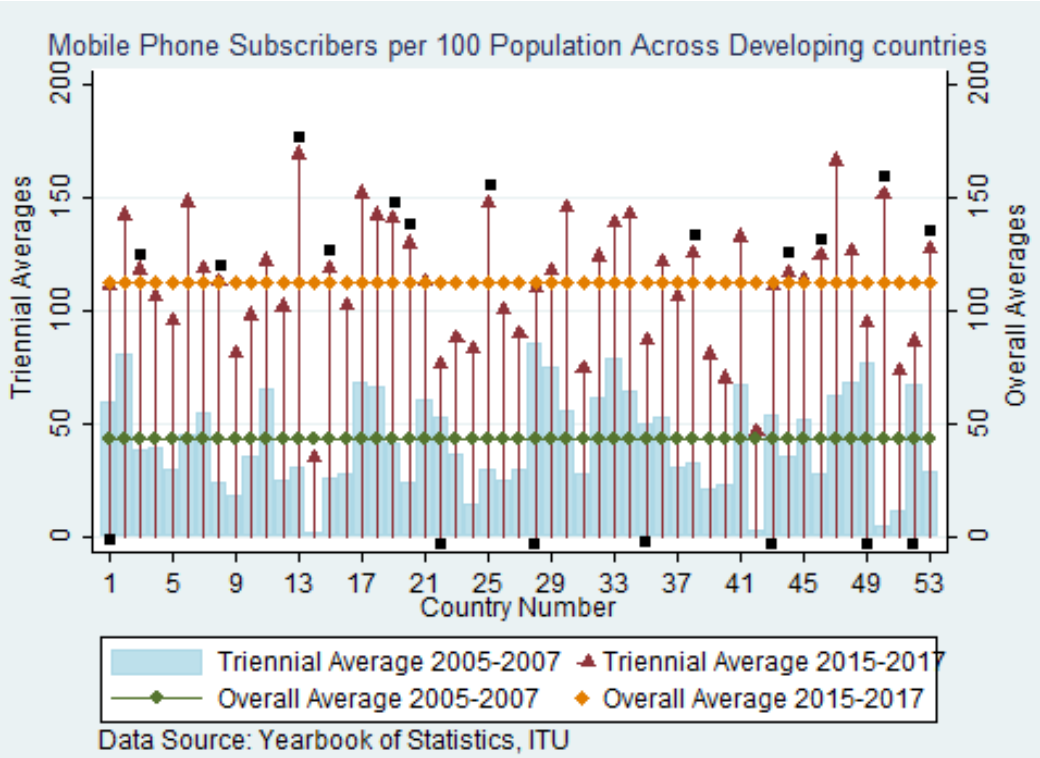

FIGURE 4.5: Mobile subscriptions Per 100 population across Developing Countries

spike to the overall triennial average during the last years. It is to be observed that the countries Armenia, Cabo Verde, Costa Rica, Cote d'Ivoire, Georgia, Ghana, Indonesia, Nigeria, Peru, Sri Lanka, Turkmenistan and Viet Nam are performing below average in the initially but start performing above average at the end of the period. Such of these countries are "catching up countries" since they transition from below triennial average to above triennial average in terms of access to Mobile phones. On the other hand, the countries Algeria, Guyana, Jamaica, Mexico, Paraguay, Turkey and Venezuela shows decline in average access to mobile phone in comparison with the triennial average. These countries are having above average mobiles users initially but later falls below.

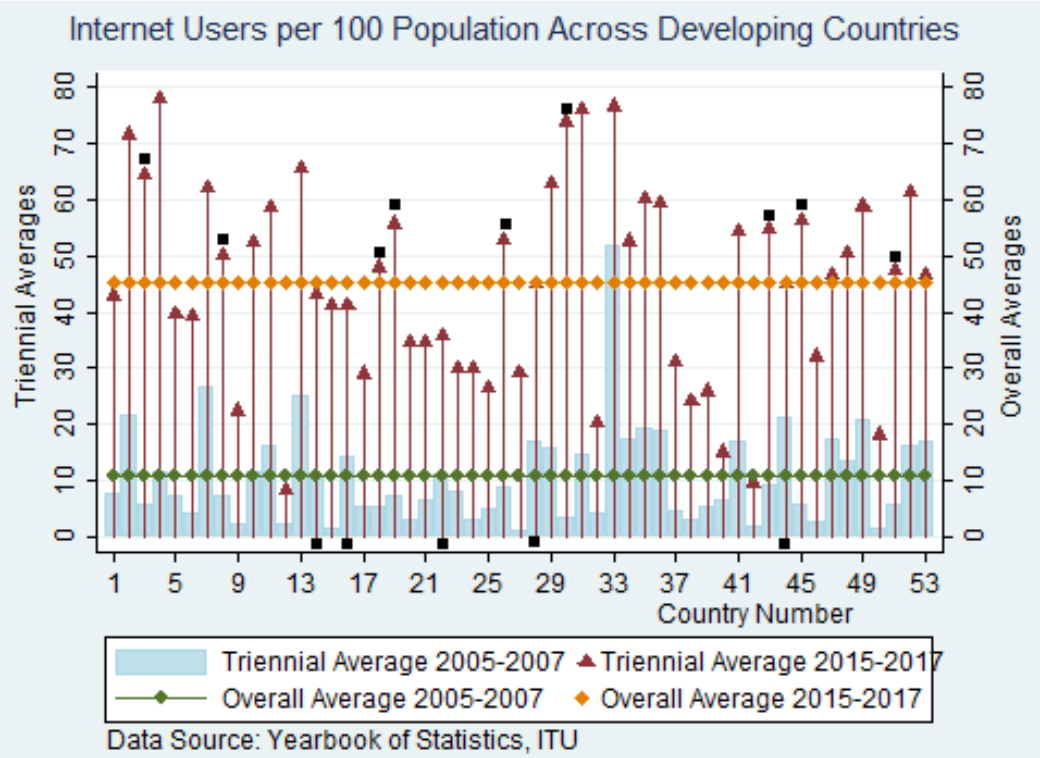

FIGURE 4.6: Individuals Using Internet Per 100 population across Developing Countries

4.2.2 Pattern of Use of ICT (Internet Users) among Economies

Figure 4.6, is the graphical presentation of 4.4, shows Internet users per 100 population across Developing countries. The average of initial Three years (2004-05, 2005-06 and 2006-07), say overall average 2005-2007, is compared with each country's average of the same initial Three years. Similarly, average of last Three years (2014-15, 2015-16 and 2016-17), say overall average 2015-2017 , is compared with each country's average of the same last Three years.

It is observed (from figure 4.6) that individuals in some countries were using internet (per 100 population) below overall average initially but in at the end of the period, individuals in such countries started using internet above overall average. Armenia, Cabo Verde, Gabon, Iran, Kazakhstan, Paraguay, Philippines and Uzbekistan are countries which were using internet below average initially and upgraded to using internet above average in the last years. On the other hand, individuals in some

TABLE 4.3: Changing Position of Countries in Use of ICT (IUPH)

Country Number	Country Name	Overall Average 2005-2007	Country Average 2005-2007	Overall Average 2015-2017	Country Average 2015-2017	Country Performance
I	Algeria	10.74	7.55	45.16	42.95	Remained below
II	Argentina	10.74	21.53	45.16	71.61	Remained Above
III	Armenia	10.74	5.63	45.16	64.39	Low to High
IV	Azerbaijan	10.74	11.52	45.16	78.07	Remained Above
V	Bolivia	10.74	7.31	45.16	39.7	Remained below
VI	Botswana	10.74	4.28	45.16	39.36	Remained below
VII	Brazil	10.74	26.69	45.16	62.22	Remained Above
VIII	Cabo Verde	10.74	7.05	45.16	50.05	Low to High
IX	Cameroon	10.74	2.12	45.16	22.36	Remained below
X	China	10.74	11.68	45.16	52.6	Remained Above
XI	Colombia	10.74	16.05	45.16	58.77	Remained Above
XII	Congo	10.74	2.08	45.16	8.13	Remained below
XIII	Costa Rica	10.74	25.19	45.16	65.79	Remained Above
XIV	Cuba	10.74	10.86	45.16	43.13	High to Low
XV	Côte d'Ivoire	10.74	1.45	45.16	41.16	Remained below
XVI	Egypt	10.74	14.15	45.16	41.34	High to Low
XVII	El Salvador	10.74	5.27	45.16	29.02	Remained below
XVIII	Gabon	10.74	5.38	45.16	48.05	Low to High
XIX	Georgia	10.74	7.29	45.16	55.77	Low to High
XX	Ghana	10.74	2.8	45.16	34.67 "	Remained below
XXI	Guatemala	10.74	6.5	45.16	34.67	Remained below
XXII	Guyana	10.74	11.27	45.16	35.66	High to Low
XXIII	Honduras	10.74	7.9	45.16	29.92	Remained below
XXIV	India	10.74	3.05	45.16	30	Remained below
XXV	Indonesia	10.74	4.72	45.16	26.57	Remained below
XXVI	Iran	10.74	8.78	45.16	52.99	Low to High

countries were using internet (per 100 population) above average initially and in the last years of the period, individuals started using internet below average. Countries Cuba, Egypt, Guyana, Jamaica and Peru are showing transition from above average use of internet to below average use of the internet by the end of the period.

Changing position of countries in their performance is very clear through analyzing the changing pattern of ICT facilities. Some countries are growing very fast such that they perform above average triennial average at the end of the period unlike at the beginning. Conversely, some other countries behave other way. Hence, there is possibility that countries converge.

TABLE 4.4: Changing Position of Countries in Use of ICT (IUPH) continues...

Country Number	Country Name	Overall Average 2005-2007	Country Average 2005-2007	Overall Average 2015-2017	Country Average 2015-2017	Country Performance
XXVII	Iraq	10.74	0.93	45.16	29.27	Remained below
XXVIII	Jamaica	10.74	16.77	45.16	45.12	High to Low
XXIX	Jordan	10.74	15.6	45.16	63.07	Remained Above
XXX	Kazakhstan	10.74	3.42	45.16	73.95	Low to High
XXXI	Lebanon	10.74	14.63	45.16	76.1	Remained Above
XXXII	Libya	10.74	4.31	45.16	20.35	Remained below
XXXIII	Malaysia	10.74	51.99	45.16	76.66	Remained Above
XXXIV	Mauritius	10.74	17.36	45.16	52.63	Remained Above
XXXV	Mexico	10.74	19.18	45.16	60.27	Remained Above
XXXVI	Morocco	10.74	18.78	45.16	59.37	Remained Above
XXXVII	Namibia	10.74	4.42	45.16	31.19	Remained below
XXXVIII	Nicaragua	10.74	3.09	45.16	24.04	Remained below
XXXIX	Nigeria	10.74	5.29	45.16	25.95	Remained below
XL	Pakistan	10.74	6.54	45.16	15.01	Remained below
XLI	Panama	10.74	17.04	45.16	54.36	Remained Above
XLII	Papua Guinea	10.74	1.75	45.16	9.57	Remained below
XLIII	Paraguay	10.74	9.03	45.16	54.73	Low to High
XLIV	Peru	10.74	21	45.16	45.03	High to Low
XLV	Philippines	10.74	5.7	45.16	56.42	Low to High
XLVI	Sri Lanka	10.74	2.74	45.16	32.05	Remained below
XLVII	Thailand	10.74	17.41	45.16	46.57	Remained Above
XLVIII	Tunisia	10.74	13.25	45.16	50.53	Remained Above
XLIX	Turkey	10.74	20.78	45.16	58.92	Remained Above
L	Turkmenistan	10.74	1.24	45.16	18.08	Remained below
LI	Uzbekistan	10.74	5.74	45.16	47.3	Low to High
LII	Venezuela	10.74	16.18	45.16	61.44	Remained Above
LIII	Viet Nam	10.74	16.92	45.16	46.52	Remained Above

4.3 Convergence among Economies

This section studies two types of convergence: σ-convergence and β-convergence. When the dispersion, stanard deviation or variance, of real per capita variable across a group of economies declines over time, implies a σ-convergence. When the partial correlation between growth over time in per capita variable and it's initial level is negative, is said to be β-convergence.

TABLE 4.5: Standard Deviations

Year	Standard Deviation Internet Users	Mobile Subscriptions
2005	7.87	19.24
2006	8.90	22.037
2007	10.26	25.731
2008	11.44	26.77
2009	12.60	29.73
2010	14.24	30.96
2011	15.47	30.72
2012	16.72	31.22
2013	17.23	31.34
2014	17.28	30.27
2015	17.36	29.22
2016	17.72	28.91
2017	17.98	29.62

4.3.1 Sigma(σ)-Convergence of ICT Variables among Developing Countries

σ-convergence computes variation in entry to ICT facilities among developing countries. The study uses sigma convergence to remark the variation in the ICT variables: Internet users and mobile subscriptions. The SD is calculated for sigma convergence. Figure 4.7 reveals the line graph of SD of the ICT variables. The SD_Mobile diverges for the initial 6 years (2005–10) and then converges for the remaining 7 years (2011–2017). The $SD\_Internet$ is diverging very fast for the beginning 8 years (2005-12) and for remaining of the period (2013-17), it converges but at very slow rate; there is slow convergence in variable Internet users per 100. Therefore, some countries among developing increasing faster in terms of obtaining Information and Communication technology facilities i.e. ICT variables follow convergence path though the extent of convergence vary between them; mobile cellular subscriptions per 100 population converges moderately, on the other hand, internet users per 100 population converges very slowly.

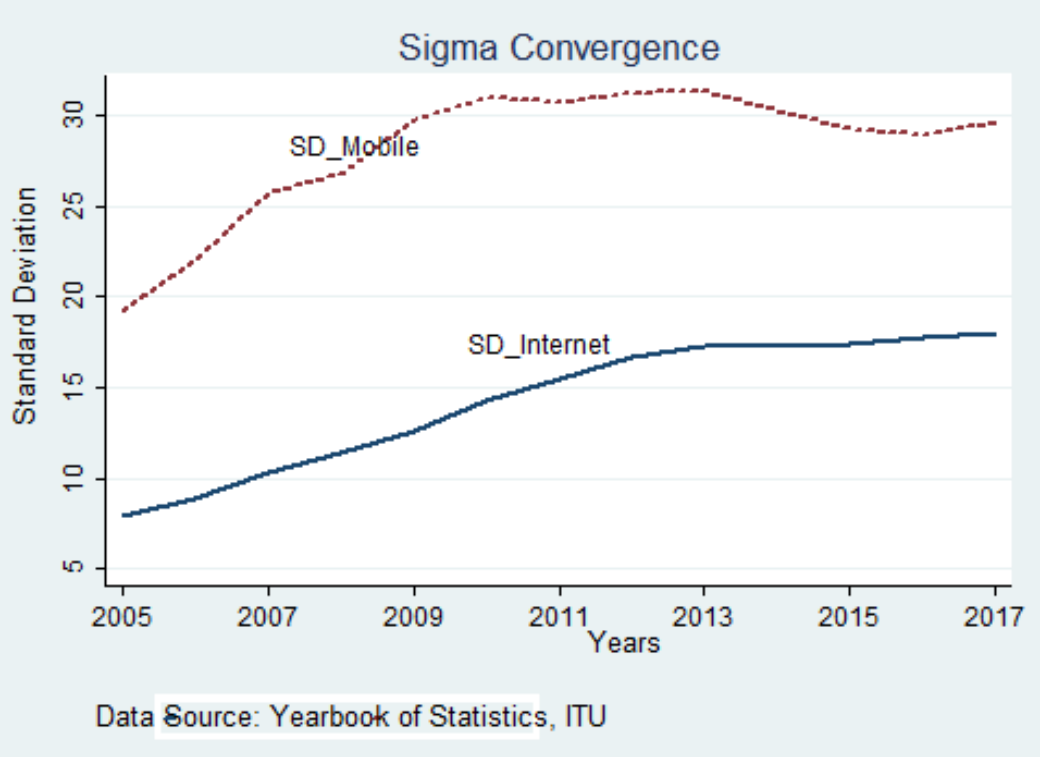

FIGURE 4.7: Sigma Convergence

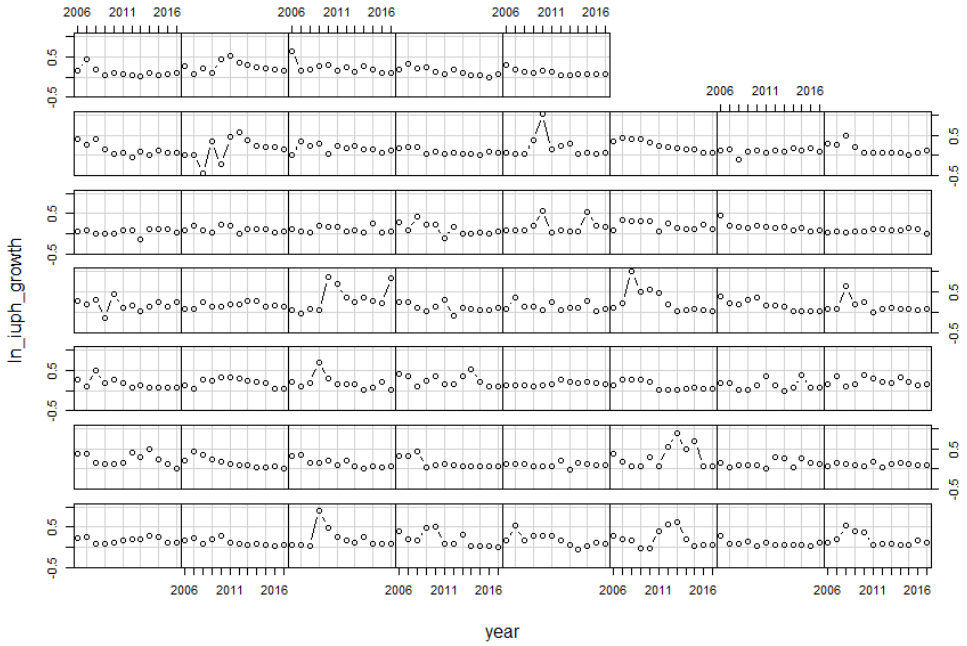

FIGURE 4.8: Growth rate in Internet users across Countries over Time

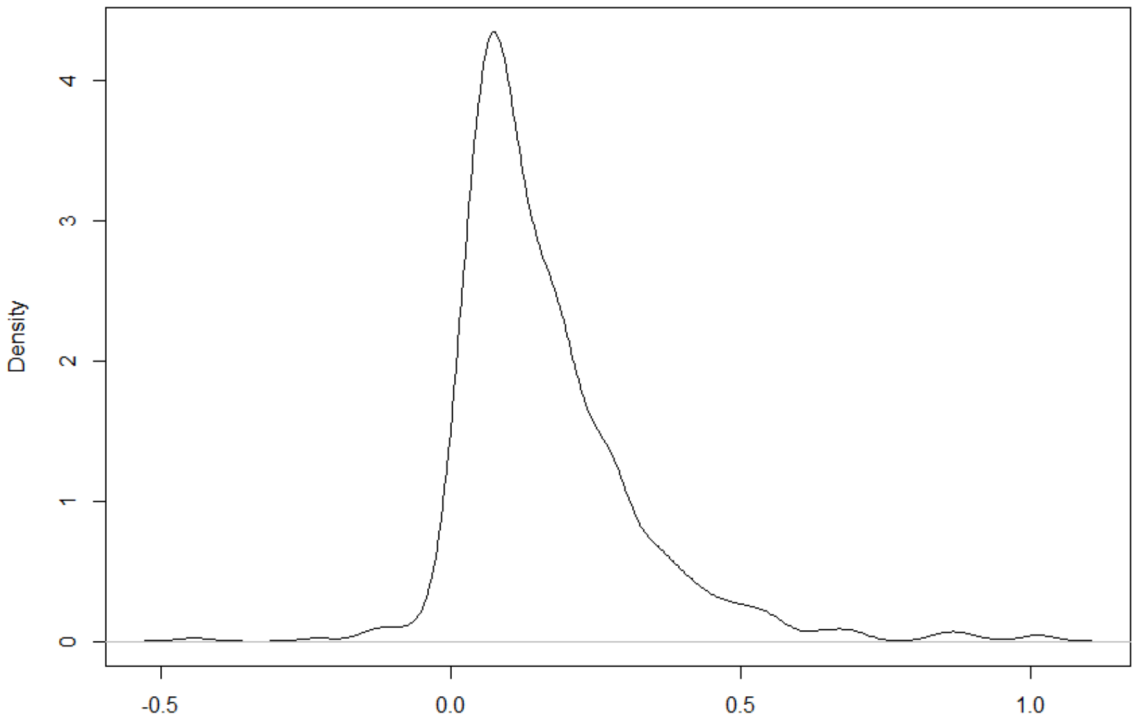

FIGURE 4.9: Density of Internet Users Growth rates

4.3.2 β-Convergence of ICT Indicators among Developing Countries

4.3.2.1 Convergence in Internet Users

As a preliminary analysis, Figure 4.9 shows the density of the growth rate of internet users per capita for the 636 observations considering countries and time periods together. It can be seen that the distribution is tilted towards the right, that means, the sample has a larger number of observations with low growth rate. Figure 4.8 shows internet users per capita growth rate across time and countries. The figure 4.8 depicts that all the countries have different level of growth rate of ICT variable; Internet users (per capita). During the year 2009-2011, most of the countries shows major fluctuations in the per capita growth rate Internet users. At the end of study period, majority of the growth rate of internet users shows stationary pattern. The bars in figure 4.8 at top indicate the countries position from left to right starting

on the bottom row. The figure indicates changing growth rate of countries over the study period. From the preliminary analysis of the series, it is analyzed that the internet users per capita has accumulated over low levels i.e. the distribution is not in accordance with the normal distribution. Hence, the study check unit root of panel data to speak on convergence.

TABLE 4.6: ADF Unit Root Test

Unit Root Test	statistic	Prob
ADF	-9.4115	0.01

Null hypothesis: Unit root
Alternative hypothesis: stationary
(assumes common unit root process)
Series: lniuph
Sample: 2005 2017

In the table 4.2 given above, analyses panel data unit root process. The series included in the table is the natural logarithm of internet user per capita. Since, the probability value < 0.05, the study concludes that the series does not have unit root. Conversely, the series is stationary. In the case when unit root is absent, there is possibility to speak of a convergence. In the study of internet users per capita, it can be concluded that the internet users per capita of developing countries converges to each other within a specific time period.

To get the speed of convergence, appropriate estimation method is to be chosen and related econometric concerns should be taken into consideration before estimating the any model for studying the convergence. The first and foremost concern is the selection of the method for panel data estimation. The methods for panel data estimation are: pooled least squares model (pooled LS), the random effects, the fixed effects model. But which method is appropriate. The pooled LS has many disadvantages if used in panel data as it does not consider the time-invariant and country-specific effects which are possibly to exist if employed in panel data. Precisely, the basic pooled LS regression model does not consider heterogeneity across countries or across years. Hence, simply employing Pooled Least Square method without taking time-invariant and country-specific effects (if exist) results in biased

and inconsistent results from estimation. If such problem exist, the remedy is to employ fixed effects (FE) random effects (RE) or models. Both of these methods include object-specific time-invariant effects. An Fixed Effect model of estimation assumes that differences across countries can be captured in the differences in the constant term.

The study estimates all the three methods of estimation in the equation 3.1 and test which among the three method is appropriate for the given time period and data set. The estimation results from Pooled LS, Fixed Effect and Random Effect are

TABLE 4.7: Unconditional β-Convergence in Internet Users

	Pooled LS	Fixed Effects	Random Effects
$\log y_{i,t-1}$	-0.0590775 (0.001)***	-0.0667459 (0.001)***	-0.0599427 (0.002)**
Constant	0.3340973 (0.001)***	103.843 (0.002)***	0.3365679 (0.004)***
Total Sum of Squares	15.074	12.925	14.622
Residual Sum of Squares	12.952	11.63	12.678
R-Squared	0.14074	0.10022	0.133
Adj. R-Squared	0.13938	0.018278	0.13163
Statistic	F(1634) = 103.843	F(1, 582) = 64.8226	$\chi^2(1) = 97.256$
Observations	636	636	636
Sample: 2005-2017			

Note: p-values in parenthesis; Signif. codes: *** implies significant at 99.99 level of confidence

presented in Table 4.7. All the three methods of estimation shows negative slope which implies the existence of convergence. On the point of which method of estimation to be accepted is to be checked by using F test for Pooled vs Fixed; Hausman Test for Random vs Fixed and LM test for Pooled vs Random. F test, Hausman

TABLE 4.8: Test for Statistical Efficient Estimator (Internet Users)

	Test	H_0	P-Value	Result
Pooled vs Fixed	F test	Pooled is better	0.0311	Reject Null
Fixed vs Random	Hausman Test	Random effect is preferred	0.2275	Accept Null
Pooled vs Random	LM* test	Pooled is better	0.0498	Reject Null

Note: * Lagrange Multiplier Test - (Breusch-Pagan) for balanced panels

test and Lagrange Multiplier test show test for the statistical significance of the difference between the coefficient estimates obtained by Pooled Least Square, Random effect and Fixed effect shown in the table above, having incorporated respective null hypothesis. Among the Fixed effect and pooled least square, F test results that

coefficient estimated using Fixed Effect is efficient. Similarly, results of employing Hausman Test and LM test conclude that random effect estimates are efficient than the fixed effect and pooled estimates. Hence, Random Effect coefficients estimates are efficient and consistent. Random effect method of estimation is preferred as compared to Fixed effect method and Pooled Least Square method. The β coefficients estimated using pooled least square are shown in the table 4.8. The value of slope coefficient β is 0.059 with negative sign implies that there is a negative correlation between the initial ratio of the countries' per capita Internet Users to the per capita growth rate of Internet Users. The interpretation of the coefficient of random method of estimation is tricky as it incorporates both the within and between effects. When the initial value of per capita internet users changes across time and between countries by one unit, the average effect of initial per capita level of Internet users over per capita growth of Internet Users is equal to β which is 0.059 .Thus study concludes that there exists unconditional β convergence across the countries for the period 2005-2017. Hence the Random effect coefficient regression equation can be written as:

$$\log y_{i,t} - \log y_{i,t-1} = 0.336 - 0.059 \log y_{i,t-1} + \epsilon_{it}$$

4.3.2.2 Convergence in Mobile subscriptions

Figure 4.10 shows the density of the mobile subscription per capita growth rate for the 636 observations considering countries and time period altogether. The figure depicts that the distribution of variable is tilted towards right which implies that the larger observations of the sample has low growth rate. Figure 4.11 shows growth rate in mobile subscriptions across countries over the study period. Most of the countries show declining behaviour in mobile subscription. The study employ Augmented Dickey-Fuller Unit Root Test in the panel data to check stationarity of the series in order to speak on convergence of countries in mobile subscriptions. The Null hypothesis is that the series has a unit root. The study rejects the null

hypothesis and concludes that the series is stationary. Hence, study can speak on convergence.

TABLE 4.9: Augmented Dickey-Fuller Unit Root Test

Unit Root Test	statistic	Prob
Augmented Dickey-Fuller	-10.714	0.01
Null hypothesis: Unit root Alternative hypothesis: stationary (assumes common unit root process) Series: lnmcsph Sample: 2005 2017		

TABLE 4.10: Unconditional β-Convergence in Mobile subscriptions

	Pooled LS	Fixed Effects	Random Effects
$\log y_{i,t-1}$	-0.2000217 (0.001)***	-0.2616554 (0.001)***	-0.0599427 (0.002)**
Constant	1.246152 (0.000)***	103.843 (0.002)***	0.3365679 (0.004)***
Total Sum of Squares	26.652	23.52	14.622
Residual Sum of Squares	12.348	8.9247	12.678
R-Squared	0.5367	0.62056	0.133
Adj. R-Squared	0.53597	0.586	0.13163
Statistic	F(1,634) = 734.45	F(1, 582) = 951.821	$\chi^2(1) = 97.256$
Observations	636	636	636
Sample: 2005-2017			

Note: p-values in parenthesis; Signif. codes: *** means 99.99 level of confidence

Table 4.11 results of test for statistical efficient estimator for mobile subscriptions by employing F test, Hausman test and LM test. F test and Hausman test result that coefficient estimated using Fixed Effect is efficient than to pooled estimator and random estimator. Similarly, results of Lagrange Multiplier Test concludes that Random effect estimates are efficient than the pooled least square estimates. Hence, Fixed Effect coefficients estimates are efficient and consistent. Fixed effect method of estimation is preferred as compared to Random effect estimation and Pooled Least Square estimation.

TABLE 4.11: Test for Statistical Efficient Estimator (Mobile subscribers)

	Test	H_0	P-Value	Result
Pooled vs Fixed	F test	Pooled is better	0.001	Reject Null
Fixed vs Random	Hausman Test	Random effect is preferred	0.003	Reject Null
Pooled vs Random	LM* test	Pooled is better	0.0298	Reject Null

Note: * Lagrange Multiplier Test - (Breusch-Pagan) for balanced panels

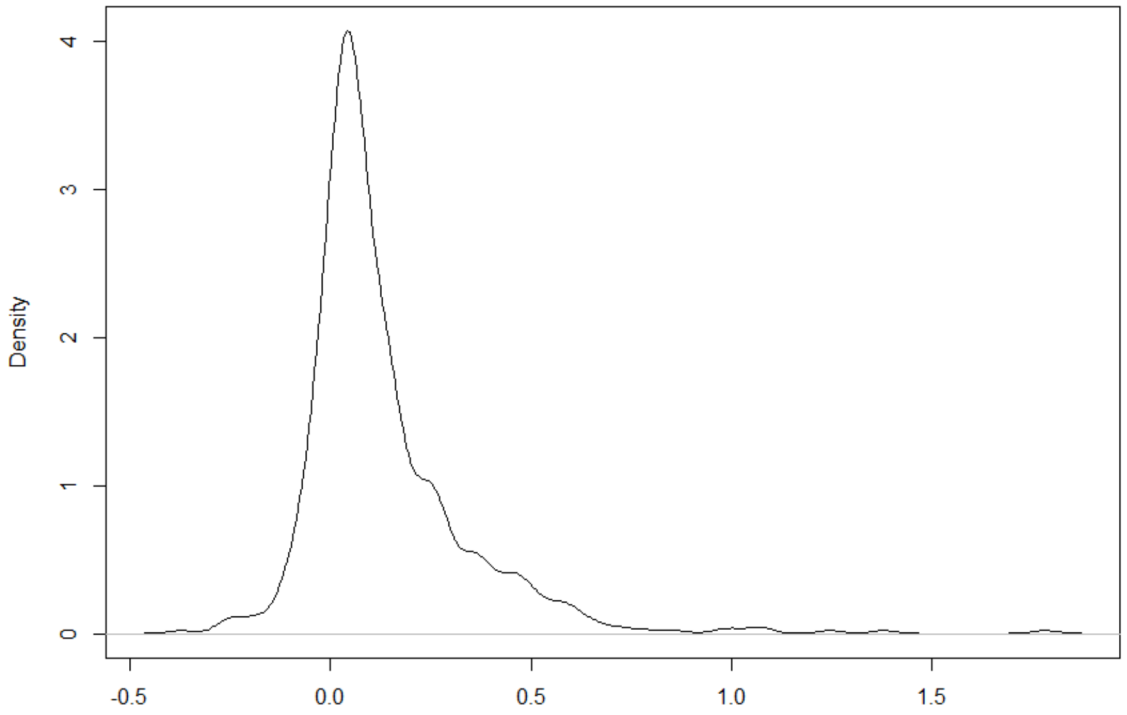

FIGURE 4.10: Density of Mobile Subscriptions Growth rates

The coefficient of initial level of mobie subscription indicates how much The β coefficient of fixed effect estimation is 0.261 with negative sign. The results from table 4.10 conclude that when initial level of mobile subscription increases by one unit, the per capita growth, on average per country, of mobile subscriptions changes by 0.261 overtime.

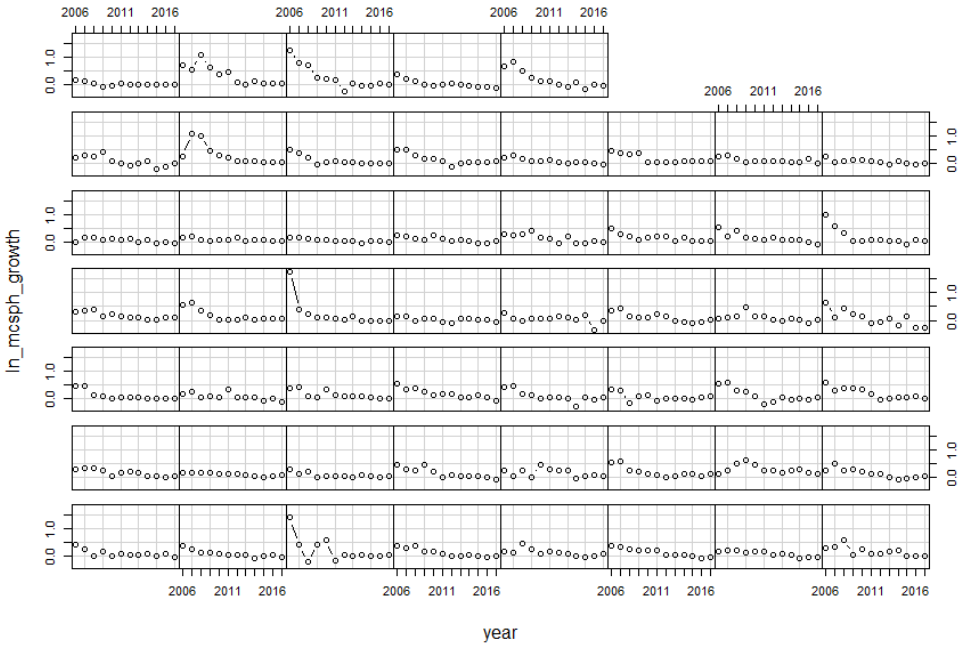

FIGURE 4.11: Growth rate in Mobile Subscriptions across Countries over Time

Chapter 5

Conclusion and Way Forward

The study results that over the period of time Digital Divide goes down as through out, as Digital Divide slops downward in the case of Access to ICT while in Use of ICT, there has been little increment in the Digital Divide of Internet Users in the year 2011. Hence it is a very good sign that the digital divide is being reduced through many initiatives in India.

The underline concept of convergence is based on neoclassical theory of growth model, states that the countries with lower level of per capita variable tend to grow faster. The same concept has been examined in the study within the period of 2005-2017 among 53 developing countries. The convergence hypothesis is examined by using the concept σ-convergence and β convergence. σ-convergence refers to the downward trend in the relative differences in per capita variables. Since, σ is a measure of dispersion, study uses standard deviation of natural log of per capita variable and the per capita growth rate of the same variable. Standard deviaiton of Mobile subscriptions diverges initially but later it converges. On the other hand, Internt users per capita diverges very fast initially but later it turns out to be converging. The study results that there exist σ-convergence in both of the ICT variables; Use of (Internt Users per capita) and Access to (Mobile Subscriptions per capita).

Concluding convergence hypothesis solely on the basis of σ-convergence concept

might be biased, hence β-convergence is necessary for σ-convergence. β-convergence means a negative influence on initial level of per capita variable in the regression of per capita growth of the variable. The study examines unconditional convergence. The panel data regression is employed followed by preliminary analysis of the two variables. Preliminary analysis shows that both the variables are not accounting for normal distribution. The density curve was tilted towards right, hence it is wise to employ unit root test before estimation. Augmented Dickey Fuller test is employed for stationary checking and finds that both of the variable stationary. Under the confusion of which estimation method to be employed, study employs three methods: Pooled Least Square, Fixed Effect and Random effect model. The results from the three regression method are found to be statistically significant. But the problem arises which method to be considered appropriate for the given set of data. Hence, to clear this confusion, F test for individuality test (Pooled vs Fixed); Hausman test (Random vs Fixed) and Lagrange Multiplier test (Random vs Pooled) are employed. Internet users per capita panel data finds Fixed Effect model appropriate and Mobile subscription per capita panel data finds Random Effect an appropriate estimation method. Both of the estimation shows β convergence. Hence, considered developing countries lead to a steady and homogeneous state for the considered time frame.

The study also analyses the changing patter of Digital Divide in India and among Developing countries. Study finds that India is growing in terms of internet users both in total and in per cent. In 2014, only 18 per cent citizens were using internet. Today this number has come up to 35 per cent. This implies that India is adopting technology very fast and that helps in reducing Digital Divide. The access to Information and Communication Technology varies across developing countries.

Countries with High income has greater penetration of digital technology and are over-performer in comparison to countries with less level of income, are under performer. India and China is among the few under performing on access to Information and Communication Technology. ICT benefits country's economy by enhancing productivity but for this gain, pre-requisite skills are required.

5.1 Policy Implications

Majority of the internet users use internet facility on mobile instead of computer because of its low price, easy to handle and carry anywhere and everywhere capability. Hence, to bridge the digital trajectory, India has to make access to the mobile phones at affordable prices to individuals fixing the mobile phone industry at first. Further, there is need of infrastructure development for the delivery of digital services. Digital Skills are to be enhanced for the future since it plays a very crucial role in in terms of improved income, knowledge, access to opportunity and government schemes.

Bridging Digital Divide may not reduce social inequality but it plays role in reduction of cconomic incquality.

5.2 Further Research

Research on Digital Divide is not a very new phenomena, however, one finds less of research on Digital Divide in India. India has plenty of Divide or inequality such as gender Digital Divide, urban-rural Digital Divide etc.. Researcher who is interested in such areas can choose to dig more into the literature but data availability might be problem if someone choose to go for secondary data.

This study was a look into the pattern of DD in India and obtaining and operation of ICT in India, further, it's convergence among developing countries. In line with the same study, one can look the impact of Demonetization on the Access to and Use of Information and Communication Technology with the underlined point that individuals had to buy mobile set and use Internet to make payment online because of cash crunch problem. Similar many studies can be put forwarded for the future.

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