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MEXICO'S UNIVERSAL TELECOMMUNICATIONS SERVICE POLICIES AND REGULATORY ENVIRONMENT IN AN INTERNATIONAL PERSPECTIVE, 1990-2010

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What happens to "universal service" commitments when there is a weak institutional framework and a marked imbalance of power between the regulatory authorities and the dominant telecom operators? Commitments are abandoned and service breaks down, according to the author. Using Telmex in Mexico as a case study, and using national, regional, and international comparative data, she builds econometric models that indicate shortcomings in the design and enforcement of telecommunications policies and regulations. These account for the gap in coverage for Mexico's lower-income population.

INTRODUCTION

The aim of the present article is to analyze the design and implementation of telecommunications regulations and policies targeting the poorest regions of Mexico between 1990 and 2010, and to present the main research results regarding these policies. In order to put Mexico's progress on this subject into perspective, the study presents international comparisons of communications density from over the last decade (2000-2010) in those regions that have the largest proportions of developing countries, namely Latin America, Asia, and Africa. In the light of available evidence, this article discusses possible explanations for the apparent failure of the universal service or social coverage policies that were implemented to bring telecommunications services to Mexico's neediest people, as well as the difficulties faced by the government and regulatory bodies concerning the design and implementation of pro-competition and social coverage policies.

This study also analyses the impact of institutional variables – such as ICT (information and communication technology) policies and regulations – on mobile service coverage, Internet use, and access to Internet services in the home, school, and workplace; as well as access to broadband services. With this purpose in mind the article proposes a set of econometric models, taking into account data for 118 countries of various levels of economic development.

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Telecommunications service infrastructure is an important factor in attaining greater equality and social inclusion, and when services are available and affordable to all citizens regardless of income and geographic location; and it is a crucial factor for achieving a global network economy. In addition to social goals, telecommunications services play an undeniable role in the economy by being a critical factor for the design, production, and marketing of goods and services. The efficiency of these processes depends ever more on the increasingly widespread use of an affordable telecommunications platform, operating at high quality standards. Taken together, it is estimated that a 10% increase in mobile service penetration may account for a 0.81% increase in the economic growth of developing countries.[1] Likewise, a 10% increase in the penetration of broadband services can mean economic growth of 1.38%.[2]

The 2000s were marked by significant improvement in access to telecommunications services in a large number of developing countries – in Asia, Africa, and Latin America – making it a decade of connectivity. However, this phenomenon of increased adoption of such services did not occur to the same extent in all countries, with some experiencing a less marked improvement during the decade. Among such countries was Mexico: despite the country witnessing a significant increase in coverage of these services, notably mobile networks, universal access to telecommunications services is still far from being achieved.

Frequent sparks of debate have been the challenges posed in offering connectivity to poorer or more remote communities. However, technological innovations in telecommunications services have allowed these difficulties to be substantially overcome: new technologies have considerably reduced the costs of deploying the underlying infrastructure for these services – the case *par excellence* being mobile services and wireless networks.

The preference for cellular or mobile services is to a large extent explained by the advances of mobile communication in developing countries, where mobile network costs are estimated to be only half of fixed network costs and where the build-out for mobile is much faster and more flexible.[3] The mobility, ease of use, flexible deployment, and relatively low and declining rollout costs of wireless technologies enable them to reach rural populations with low levels of income and literacy.[4] While in the developed world, the introduction of mobile services offered a convenient complement to a fixed network that extended to almost every home and business,[5] their impact has been more significant in emerging economies, where the large majority of the population had, and

[1] William Bold and William Davidson, "Mobile Broadband: Redefining Internet Access and Empowering Individuals," in *The Global Information Technology Report 2012: Living in a Hyperconnected World*, eds. Soumitra Dutta and Beñat Bilbao-Osorio (Geneva: Insead and World Economic Forum, 2012), 67-77.
[2] Christine Zhen-Wei Qiang, Carlo M. Rossotto, and Kaoru Kimura, "Economic Impacts of Broadband," in *Information and Communications for Development 2009: Extending Reach and Increasing Impact* (Washington, D.C.: The World Bank, 2009), 35-50.
[3] Ingo Vogelsang, "The Relationship between Mobile and Fixed-Line Communications: A Survey," *Information Economics and Policy* 22, no. 1 (Mar. 2010): 4-17.
[4] Khalil Mohsen, Philippe Dongier, and Christine Zhen-Wei Qiang, "Overview," in *Information and Communications for Development: Extending Reach and Increasing Impact* (Washington, DC: The World Bank, 2009), 3-17.
[5] Mark Rodini, Michael R. Ward, and Glenn Woroch, "Going Mobile: Substitutability between Fixed and Mobile Access," *Telecommunications Policy* 27 (2003): 457-476.

still has, limited access to traditional telephone services.[6] According to Khalil, Dongier, and Qiang the next billion mobile subscribers will consist mainly of the rural poor.[7]

The above information suggests that universal service policy should be targeted predominantly at mobile penetration; in addition, to the extent that universal service policy is directed at telephony and to some extent broadband in rural areas, in developing countries more generally, its lower cost and faster deployment of networks may make it cheaper as well.[8]

A further set of factors highlighted in the literature as having an influence on telecommunications service coverage and adoption concerns shortcomings in public policies and government regulation to encourage investment in the industry and the implementation of pro-competition policies.[9] In addition, public policies and regulation for social development in telecommunications are focused on those sections of society living in poverty.

In Mexico, a broad sector of the population remains without access to telecommunications services. On average, only 60% of households have a landline. Although this deficiency may be mitigated in part by the availability of mobile lines, the distribution of the latter services is biased towards the more prosperous states and larger cities. Poorer states, home to 18% of the country's population and 32% of the rural population, and where availability of household landlines is more limited (34.6%), also suffer from low mobile line density (57.5%).[10]

The present study examines public policies intended to ensure communications service provision to low-income populations in Mexico, taking as its starting point the distinction made in the literature between a "market efficiency gap" and an actual "access gap."[11] In relation to the former, well-functioning competitive markets complement universal and social coverage policies in order to

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[6] Roxana Barrantes and Hernan Galperin, "Can the Poor Afford Mobile Telephony? Evidence from Latin America," *Telecommunications Policy* 32 (2008): 521-530; see also Aniruddha Banerjee and Augustin J. Ros, "Patterns in Global Fixed and Mobile Telecommunications Development: A Cluster Analysis," *Telecommunications Policy* 28 (2004): 107-132; Leonard Waverman, Meloria Meschi, and Melvyn Fuss, "The Impact of Telecoms on Economic Growth in Developing Countries," in *Africa: The Impact of Mobile Phones*, The Vodafone Policy Paper Series No. 2, Mar. 2005, accessed May 24, 2013, http://info.worldbank.org/etools/docs/library/152872/Vodafone%20Survey.pdf.

[7] Mohsen, Dongier, and Qiang.

[8] In contrast with the survey by Vogelsang of the recent literature, Garbacz and Thompson found that for developing countries mobile phones are not substitutes for the wireline market, and instead they may be considered complements. Christopher Garbacz and Herbert G. Thompson Jr., "Demand for Telecommunications Services in Developing Countries," *Telecommunications Policy* 31 (2007): 276-289.

[9] Calvin Djiofack-Zebaze and Alexander Keck, "Telecommunications Services in Africa: The Impact of WTO Commitments and Unilateral Reform on Sector Performance and Economic Growth," *World Development* 37 (2009): 919-940; Wei Li and Lixin Colin Xu, "The Impact of Privatization and Competition in the Telecommunications Sector around the World," *Journal of Law and Economics* 47 (2004): 395-430; Jean-Jacques Laffont and Jean Tirole, *Competition in Telecommunications* (Cambridge, MA: MIT Press, 2000).

[10] Mexico, Instituto Nacional de Estadística y Geografía, "Censo de Población y Vivienda 2010," accessed May 24, 2013, http://www.censo2010.org.mx/; Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT)," accessed May 24, 2013, http://siemt.cft.gob.mx/SIEM/.

[11] Arturo Muente-Kunigami and Juan Navas-Sabater, "Options to Increase Access to Telecommunications Services in Rural and Low-Income Areas," World Bank Working Paper No. 178 (2010), accessed May 24, 2013, http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Options_to_Increase_Access_to_Telecommunications_Services_in_rural_and_Low-Income_Areas.pdf, 2.

maximize social welfare. Countries with a competitive structure have higher service penetration than those with monopolies or partial competition schemes. In sub-Saharan Africa, a recent study concluded that cell phone coverage could increase by at least 95% in all of the countries analyzed given an appropriate regulatory environment.[12] Developing countries could achieve a higher level of penetration and overall usage by addressing basic regulatory bottlenecks – that is, by closing the market efficiency gap.[13] The access gap refers to those situations for which a gap between different population groups continues to exist, since a proportion of the population cannot afford the market prices at which the service is offered.[14]

REGULATIONS AND UNIVERSAL SERVICE POLICIES TARGETED AT MARKET EFFICIENCY GAPS AND ACCESS GAPS: AN INSTITUTIONAL ANALYSIS

Institutional analysis emphasizes the importance of the environment in which policies and regulations are drawn up, ratified, and implemented; such policies and regulations being the result of a process of reconciling the interests of the various groups involved. The various different interests adjust as a whole to the institutional environment and to a given political context, in which economic interests emerge as both political interests and policies. Estache and Wren-Lewis claim that an understanding of the institutional context and its implications are crucial when designing a regulatory framework for developing countries.[15] This institutional environment shapes and limits the government's means of ratifying and implementing policies and regulations.[16]

Policies and regulations aimed at improving the performance of infrastructures, including telecommunication services, in developing countries have had limited success. Evidence suggests that in many instances this is because of key institutional limitations faced in developing countries, such as Mexico, where regulatory policy may be different in the context of a robust institutional environment. In designing policies and establishing regulatory frameworks to ensure access to telecommunications services, governments have seen their ability to implement policies and enforce

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[12] Ibid.; Juan Navas-Savater, Andrew Dyamond, and Niina Juntunen, "Telecommunications and Information Services for the Poor," World Bank Discussion Paper No. 432 (2002), accessed May 24, 2013, http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/telecoms_for_the_poor.pdf.

[13] Navas-Savater, Dyamond, and Juntunen; Peter Stern, David N. Townsend, and Robert Stephens, "New Models for Universal Access in Latin America: Lessons from the Past and Recommendations for a New Generation of Universal Access Programs for the 21st Century," white paper, Regulatel/World Bank (PPIAF and GPOBA)/ECLAC Project on Universal Access for Telecommunications in Latin America, accessed May 24, 2013, www.ictregulationtoolkit.org/en/Document.3511.pdf.

[14] Stern, Townsend, and Stephens, 2.

[15] Antonio Estache and Liam Wren-Lewis, "Towards a Theory of Regulation for Developing Countries: Following Jean-Jacques Laffont's Lead," *Journal of Economic Literature* 47 (2009): 729-770.

[16] Martha García-Murillo and Brenden Kuerbis, "The Effect of Institutional Constraints on the Success of Universal Service Policies: A Comparison between Latin America and the World," *Telecommunications Policy* 29 (2005): 779-796; Brian Levy and Pablo Spiller, "The Institutional Foundations of Regulatory Commitment: A Comparative Analysis of Telecommunications Regulation," *The Journal of Law, Economics and Organization* 10 (1994): 201-246; Oliver E. Williamson, *The Economic Institutions of Capitalism* (New York: Free Press, 1998).

these regulations increasingly hampered. Some of the difficulties relate to the asymmetry between regulatory bodies and the economic influence of operators while exercising market power.

In relation to the market efficiency gap and the absence of vigorous competition in Mexico's telecommunication services market,[17] this article argues that failures in regulation occur as a result of a weak institutional framework and a marked imbalance of power between the regulatory authorities and operators.[18] In Mexico there is a market-dominant conglomerate comprised of Telmex, with 87.7% of landlines,[19] and Telcel, with 69.5% of mobile lines.[20] These are the two largest telecommunication networks, and consequently they comprise the major interconnection capability in the country.

On the question of the access gap, it is argued that Telmex's dominance has led to the various difficulties faced by government authorities in enforcing the social coverage commitments set out in the company's operating license, which was signed in 1990 and the last obligations of which expired in 1998.[21] Subsequently, Telmex was the only winning bidder of the government's social coverage fund program (FONCOS, which existed from 2002 to 2006). The present article documents the achievements of universal service and social coverage policies implemented over the past two decades, from 1990 to 2010.

In addition to the role of regulation, on the question of the access gap, this article examines the policies implemented by the government of Mexico with the aim of guaranteeing both the availability of telecommunications services in rural communities of fewer than 500 inhabitants (1995-2000) and access to Internet services via Digital Community Centers (2002-2012). The article postulates that these schemes have lacked the resources necessary for providing connectivity among the country's poorest citizens, and for that very reason they have not provided an effective response to the challenge represented by the access gap. The latter factor is ultimately of an institutional

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[17] Cristina Casanueva-Reguart and Antonio Pita S., "Telecommunications, Universal Service and Poverty in Mexico: A Public Policy Assessment (1990-2008)," *Journal of Telecommunications and Information Technology*, special edition (2010): 30-42; Patrick Burkart, "Moving Targets: Introducing Mobility into Universal Service Obligations," *Telecommunications Policy* 31 (2007): 164-178; Martha Fuentes-Bautista, "Universal Service in Times of Reform: Affordability and Accessibility of Telecommunication Services in Latin America," in *Communications Policy and Information Technology: Promises, Problems, Prospects*, ed. Lorrie Faith Cranor and Shane Greenstein (Cambridge, MA: Massachusetts Institute of Technology Press, 2002), 347-382.

[18] Organisation for Economic Co-operation and Development, "OECD Review of Telecommunication Policy and Regulation in Mexico," white paper (2012), accessed May 24, 2013, http://www.oecd-ilibrary.org/docserver/download/9311061e.pdf?expires=1369430308&id=id&accname=ocid195625&checksum=4499253C37ED3A98636753104FBE2583; Casanueva-Reguart and Pita S.

[19] This figure includes public booths. Teléfonos de México (Telmex), "Reportes Financieros, Primer trimestre 2012," financial report, Mar. 2012, accessed May 24, 2013, http://www.telmex.com/mx/corporativo/pdf/pt_descarga.jsp?a=01TRIM12n.pdf.

[20] América Móvil, "S.A.B. De C.V. Reporte Financiero y Operativo del Primer Trimestre de 2012," financial report, Apr. 26, 2012, accessed May 24, 2013, http://www.americamovil.com/amx/es/cm/reports/Q/1T12ES.pdf.

[21] Mexico, Comisión Federal de Telecomunicaciones, "La Modificación de su Título de Concesión de Teléfonos de México," white paper (1990).

nature, reflecting the low priority assigned within public policy to serving the needs of the country's poorest citizens.[22]

METHODOLOGY

This study begins by examining the coverage of telecommunications services in various regions of Mexico, ranked according to their respective level of development (and poverty). In the next section, in order to put Mexico's progress into perspective, this article presents a descriptive analysis comparing international developments in communications density over the last decade (2000-2010) in Latin America, East and Southeast Asia, and Africa[23] – for countries in which information was available for both telecommunications service coverage and economic indicators.[24]

This study also analyses the effect of policies and regulations on improving coverage of telecommunications service internationally. To this end, a set of econometric models is proposed, incorporating data from 118 countries of various levels of economic development.[25] More specifically, the analysis consists of a set of linear regression models whose results indicate the extent to which these institutional variables – relating to ICT policies and regulations – affect mobile service coverage, Internet use, and access to Internet services in the home, school, and workplace, as well as access to broadband services. Finally, the study analyses the scope of public policies on universal service provision designed by the Mexican authorities to achieve the goal of social coverage.[26]

The sources underlying this research are the *Household Survey of Income and Expenditure*,[27] recent information on regional economic development based on the Poverty Index measured by the

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[22] Burkart.

[23] This analysis includes all the countries in continental Latin America and the major states of the Caribbean: Puerto Rico, Cuba, Haiti, and the Dominican Republic. The analysis also includes all the countries East and Southeast Asia with the exception of Macau, Laos, and Papua New Guinea. In the case of Africa the availability of information was more limited, so the group of countries there is less representative of the continent as compared to the other two regions analyzed.

[24] Much of the country-specific information was obtained from ChartsBin, accessed May 24, 2013, http://chartsbin.com/. Other sources include International Telecommunication Union, "ICT Facts and Figures: The World in 2010," white paper (2010), accessed May 24, 2013, http://www.itu.int/ITU-D/ict/material/FactsFigures2010.pdf; United States, Central Intelligence Agency, "World Factbook 2012," white paper (2012), accessed May 24, 2013, https://www.cia.gov/library/publications/download/download-2012/index.html; and the World Bank's indicator statistics.

[25] In addition to the variables relating to telecommunications service coverage, the econometric analysis herein also takes into account variables such as income per capita, income distribution (Gini coefficient), service tariffs, and level of education. These variables and the corresponding sources are presented below.

[26] An operational definition of the variables involved in the econometric analysis is included in the next section of this article.

[27] The Household Survey of Income and Expenditure (ENIGH) was based on data from 2010 and published in 2011. Mexico, Instituto Nacional de Estadística y Geografía, "Encuesta Nacional de Ingresos y Gastos de los Hogares 2010," accessed May 24, 2013, http://www.inegi.org.mx/est/contenidos/Proyectos/encuestas/hogares/regulares/enoe/Default.aspx.

National Council for the Evaluation of Social Policy (2010),[28] growth and employment figures from Mexico's Census Bureau (2011),[29] statistics published by the Secretariat of Communications and Transport (2000-2009 and 2011)[30] and the Federal Telecommunications Commission (2012),[31] and documents prepared by those government agencies as they designed and monitored telecommunications policies on universal service. Finally, in-depth interviews were conducted with former representatives of the Office of Rural Telephony, which previously monitored the implementation of social and universal telecommunications policies. The sources for international statistics on service coverage are from the International Telecommunication Union (2000-2010),[32] the World Bank (2012), [33] the United States Central Intelligence Agency (2012), [34] Bank of America/Merrill Lynch (2011),[35] and the World Economic Forum.[36]

In light of the available evidence, this article discusses possible explanations for the apparent failure of pro-competition policies and of the universal service or social coverage policies that were implemented to bring telecommunications services to Mexico's neediest people, as well as the difficulties faced by the design of public policy and regulatory bodies behind the implementation of pro-competition and universal service policies. These could have contributed to improving Mexico's telephone density by offering affordable services in regions without coverage – to close both the market efficiency gap and the access gap.

TELECOMMUNICATIONS SERVICES IN MEXICO

This analysis of the density of residential and non-residential landlines and mobile telephone lines suggests that a significant proportion of communities are left without coverage of these services.

[28] Mexico, Consejo Nacional de Evaluación de la Política de Desarrollo Social, "Medición de pobreza 2010 por Entidad Federativa," accessed May 24, 2013, http://internet.coneval.gob.mx/Informes/Interactivo/interactivo_entidades.swf.
[29] Statistics on non-residential landlines and employment (found in the Survey on Employment and Occupation, ENOE) are from 2010 as these were the latest figures available at the time of writing. Mexico, "Encuesta Nacional de Ocupación y Empleo (ENOE)," accessed May 24, 2013, http://www.inegi.org.mx/est/contenidos/proyectos/encuestas/hogares/regulares/enoe/default.aspx; Mexico, Instituto Nacional de Estadística y Geografía, "Encuesta Nacional de Ingresos y Gastos de los Hogares 2010;" Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT)."
[30] Data compiled from Mexico, Secretaría de Comunicaciones y Transportes, "Anuarios Estadísticos," accessed May 24, 2013, http://www.sct.gob.mx/informacion-general/planeacion/estadistica-del-sector/anuario-estadistico-sct/, for the years 2000-2011.
[31] While statistics on landlines and mobile coverage are from 2011, statistics on non-residential landlines and employment are from 2010 and are the latest figures available at the time of writing. Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT);" Mexico, Instituto Nacional de Estadística y Geografía, "Encuesta Nacional de Ocupación y Empleo (ENOE)."
[32] International Telecommunication Union.
[33] Data compiled from World Bank, "Indicators," accessed May 24, 2013, http://data.worldbank.org/indicator.
[34] United States, Central Intelligence Agency.
[35] Glen Campbell and Steve Hards, "Global Wireless Matrix 3Q 2011: Look Beyond the Macro Storm," working paper, Bank of America/Merrill Lynch, Sept. 28, 2011, accessed May 24, 2013, http://petenowak2000.files.wordpress.com/2013/03/boaglobalwirelessmatrix-3q11.pdf.
[36] Soumitra Dutta and Beñat Bilbao-Osorio, eds., *The Global Information Technology Report 2012: Living in a Hyperconnected World* (Geneva: Insead and World Economic Forum, 2012).

Although, by and large, access to mobile lines offers an alternative form of connectivity, a breakdown of service availability by region should be taken into account.[37]

In 2010, an average of only six out of ten homes in Mexico had access to landline services, and eight out of ten people had access to a mobile line.[38] Mobile services have witnessed significant growth over the decade (2000-2010), averaging 17.2% annually, which may go some way towards compensating for the lack of landlines in homes (see Table 1 below). However, in the most developed states, mobile services go hand in hand with the availability of landlines (see Table 2 below).

Table 1: Number and Average Annual Growth of Landlines and Mobile Lines: 2000-2010 (in Thousands).[39]

Service	Lines	Growth
Residential, 2000	9,034.0	
Residential, 2010	14,326.1	4.7%
Non-Residential, 2000	3,297.6	
Non-Residential, 2010	5,565.4	5.4%
Mobile, 2000	14,077.9	
Mobile, 2011	94,565.3	17.2%

For the purpose of our estimates of the density of non-residential lines, the number of lines per 100 employed personnel is taken.[40] As argued above, telecommunications play a key role in the economy, hence the importance of assessing the density of these lines in workplaces and institutions.

In 2010, there were on average only 4.7 lines per 100 employed personnel, with that number rising to 18.0 lines in Mexico City.[41] In the case of non-residential lines, it is unlikely that access to mobile services could have compensated for the lack of landline services in institutions and workplaces. While mobile services saw an average annual growth of 17.2% between 2000 and 2010, this increase stands in stark contrast to the growth observed for landlines, both residential (4.7% average annual increase) and non-residential (5.4%) for the same period (see Table 1 above). In Mexico City, improved connectivity and density are observed, both in terms of residential landlines (15.8) and mobile lines (241.0).

[37] The available information did not allow socioeconomic regions to be used as units of analysis, because the information was only available at the state level.
[38] Since some households have more than one landline (particularly in urban areas), and a fraction of the population has several SIM cards, the number of households with a landline and persons with a mobile phone is lower than the teledensity figure. Nevertheless, information on teledensity and its growth (see below) allow for an approximation of the coverage and adoption of telecommunication services.
[39] Data compiled from Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT)."
[40] Ibid.; Mexico, Instituto Nacional de Estadística y Geografía, "Encuesta Nacional de Ocupación y Empleo (ENOE)."
[41] The Federal Telecommunications Commission's estimate for Mexico City includes those districts belonging to the neighboring state of Estado de Mexico, now merged with the suburbs of Mexico City.

Table 2: Telecommunication Service in the Six Most Prosperous Mexican States, 2010.[42]

State	Landline density	Resid. Lines	Non-resid. lines	Mobile density	Landline /mobile services ratio (2000)	Landline /mobile services ratio (2010)	% with Internet	% with Pay TV	Poverty Index
Sonora	14.6	55.2	4.4	95.1	0.65	0.17	31.4	50.7	33.8
Baja California	18.2	67.0	4.8	94.5	0.57	0.21	37.2	60.1	32.1
Baja California Sur	17.6	63.9	5.9	110.0	0.78	0.11	28.7	61.8	30.9
Distrito Federal	47.4	175.8	18	241.0	0.75	0.20	36.1	68.0	28.7
Coahuila	18.3	70.5	5.6	100.3	0.73	0.20	25.3	37.9	27.9
Nuevo León	30.5	119.1	10.2	101.0	0.78	0.29	35.3	49.4	21.1
Group average	**24.4**	**62.5**	**8.1**	**123.7**	**0.7**	**0.2**	**32.3**	**54.7**	**29.1**
National average	**15.9**	**48.1**	**4.7**	**84.2**	**1.1**	**0.2**	**21.3**	**28.9**	**45.8**

Notes: The ordering of states is based on the level of poverty (Poverty Index). Residential lines are measured per 100 households. Non-residential lines are measured per 100 employed personnel. Mobile density is the number of cellular lines per 100 people.

While the density of mobile services is high in those states with higher levels of economic development and lower Poverty Index scores, the availability of residential lines is below average except in the states of Nuevo León, Jalisco, Morelos, Aguascalientes, Coahuila, Colima, and Chihuahua – where landline density, while not satisfactory, is above average. Indeed, in 19 out of 32 Mexican states, low landline density is accompanied by higher mobile density.

It is in more prosperous states that better access is observed to both the Internet (32.3% of households) and to pay TV (54.7%) (see Table 2 above). In poorer states, which account for 18% of the country's population and 32% of the rural population, there is a clear shortage of both landline and mobile services. In Chiapas, for instance, only 18.4% of households have landlines and 53.1% of inhabitants have mobile lines. The state of Oaxaca presents a similar picture.[43] In states such as

[42] Data compiled from Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT);" Mexico, Instituto Nacional de Estadística y Geografía, "Encuesta Nacional de Ocupación y Empleo (ENOE);" Mexico, Consejo Nacional de Evaluación de la Política de Desarrollo Social, "Medición de pobreza 2010 por Entidad Federativa;" Mexico, Secretaría de Comunicaciones y Transportes, "Anuario 2011," accessed June 5, 2013, http://www.sct.gob.mx/fileadmin/_migrated/content_uploads/Anuario-2011_01.pdf.
[43] Mexico, Instituto Nacional de Estadística y Geografía, "Censo de Población y Vivienda 2010;" Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT)."

Guerrero, Tlaxcala, Zacatecas, and Michoacán, four out of every ten homes have landlines and between five and six out of every ten people have a mobile line[44] (see Table 3 below).

Table 3: Telecommunication Service in the Six Poorest Mexican States, 2010.[45]

State	Landline density	Resid. Lines	Non-resid. lines	Mobile density	Landline /mobile services ratio (2000)	Landline /mobile services ratio (2010)	% with Internet	% with Pay TV	Poverty Index
Chiapas	5.2	18.4	1.4	53.1	1.5	0.1	5.1	13.7	78.4
Guerrero	11.1	43.4	2.4	53.7	1.1	0.2	15.7	19.6	48.5
Oaxaca	7.2	24.5	1.7	50.1	1.1	0.1	8.4	10.3	67.2
Tlaxcala	10.4	41.4	1.6	58.7	1.5	0.2	9.8	21.4	60.4
Zacatecas	11.5	42.6	2.3	58.0	1.1	0.2	13.0	27.3	60.2
Michoacán	12.2	45.3	2.4	71.4	1.0	0.2	13.3	31.9	54.7
Group average	**9.6**	**35.9**	**2.0**	**57.5**	**1.2**	**0.2**	**10.9**	**20.7**	**61.6**
National average	**15.9**	**48.1**	**4.7**	**84.2**	**1.1**	**0.2**	**21.3**	**28.9**	**45.8**

Notes: The ordering of states is based on the level of poverty (Poverty Index). Residential lines are measured per 100 households. Non-residential lines are measured per 100 employed personnel. Mobile density is the number of cellular lines per 100 people.

The number of nonresidential lines is also extremely low, with an estimated density of two lines per 100 employees. This lack of connectivity is unlikely to be made up for by the availability of mobile lines (see Table 3 above). A shortage of lines in workplaces and institutions is a situation that serves to perpetuate poor productivity, ultimately impacting the creation and widespread availability of quality employment.

In the poorest states, between one and two households out of ten have Internet and pay TV, with the exception of Michoacán and Zacatecas, where almost three out of every ten households have pay TV. The low density of Internet and pay TV is an indicator of these states' low potential for access to broadband in the near future. The increase in poverty in some of these states was dramatic, such as in Zacatecas, where the Poverty Index score rose almost ten points over the decade. Similar though less dramatic cases are those of Veracruz at seven points and Oaxaca at 5.4 points[46] (see

[44] Mexico, Instituto Nacional de Estadística y Geografía, "Censo de Población y Vivienda 2010."

[45] Data compiled from Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT);" Mexico, Instituto Nacional de Estadística y Geografía, "Censo de Población y Vivienda 2010;" Mexico, Instituto Nacional de Estadística y Geografía, "Encuesta Nacional de Ocupación y Empleo (ENOE);" Mexico, Secretaría de Comunicaciones y Transportes, "Anuario 2011;" Mexico, Consejo Nacional de Evaluación de la Política de Desarrollo Social.

[46] The Poverty Index is estimated by the National Council for the Evaluation of Social Policy (CONEVAL). The estimation is based on the Household Survey of Income and Expenditure (ENIGH), and specifically a section on living conditions: education, health, social security, housing, food, and income. The figure estimated by this index varies

Table 3 above). A lack of telecommunications infrastructure and services perpetuates the conditions of poverty.

Often, those living in areas lacking coverage or those with low incomes have turned to mobile services as an alternative means of access to telecom services, where such services are available. The top-up card system allows users with low incomes to monitor their spending in relation to their income and to pay for their devices in installments. A common trend is observed in both poor and prosperous states on the use of mobile as a substitute for landline services, in the case of poorer states for those households and workplaces where such services were available. The ratio between landlines and cellular service is favorable to mobile telecommunication services (see Tables 2 and 3 above).

However, this fails to be an economically viable alternative for the poorest members of society given that Mexico's mobile service marketplace is one of the most expensive among all developing countries. This phenomenon, in addition to establishing the relationship between levels of income (and poverty) and the extent of service coverage, suggests that public universal service policies intended to close the access gap have not been effective in those states with the lowest levels of connectivity.

On the question of affordability in Latin America, Barrantes and Galperin analyzed the costs of a prepaid low-volume mobile basket plan as a percentage of the minimum wage, and also compared the cost of a prepaid low-volume mobile basket plan for individuals relative to the official poverty line. This type of plan was studied on the assumption that the poor, as a result of income volatility, prefer to purchase in small amounts; the study was also based on the potentially convergent trend between prepaid and postpaid prices, as operators compete for consumers at the bottom of the income pyramid.[47] The most interesting result was for Mexico, which fell from a moderately affordable market at the aggregate level, to the least affordable market when one considers mobile tariffs. The study also revealed that a low-volume mobile basket plan is well beyond the means of most of the region's poor, far exceeding the 5% income threshold for those living at or below the poverty line. Brazil, the region's largest market, still stands out for its low affordability levels,

between 0.0 and 100.0: the higher the number, the higher the level of poverty in a specific state. For example, the state of Chiapas (78.4) shows the highest level of poverty among this group of states, followed by the states of Guerrero (67.4) and Oaxaca (67.2). These groups of states show a high level of poverty when compared with the national average level of poverty (45.8). Mexico, Consejo Nacional de Evaluación de la Política de Desarrollo Social.

[47] Barrantes and Galperin. Although various studies have argued on the positive impact that the introduction of pre-payment systems have had on mobile take-up in the developing world, recent studies have questioned this argument, noting that when one considers the actual patterns of mobile use by the poor (i.e. very low outgoing call volumes), prepaid and postpaid costs are roughly equivalent and in some cases even favorable to postpaid. A notable exception is Chile, a highly developed and competitive market where the prepaid option is cheaper. This suggests a potentially convergent trend between prepaid and postpaid prices as operators compete for consumers at the bottom of the income pyramid. See also Rohan Samarajiva, "Preconditions for Effective Deployment of Wireless Technologies for Development in the Asia-Pacific," *Information Technologies and International Development* 3 (2006): 57-71; Judith Mariscal and Eugenio Rivera, "Mobile Communications in Mexico in the Latin American Context," *Information Technologies and International Development* 3 (2006): 41-55.

followed by Peru and Mexico. Not surprisingly, these are the three countries in the sample with the lowest teledensity levels.[48]

High mobile tariffs in Mexico may to some extent be explained by services being excessively dominated by a small number of providers.[49] Higher tariffs in relative terms, and hence more sporadic uptake, have not been a guarantee of quality, with numerous complaints from end users pointing to problems with quality of service.[50]

Table 4: Mobile Communications: Revenues and Market Concentration Index (HHI) in a Selection of 25 Developing Countries, 2011.[51]

	HHI Index	EBITDA		HHI Index	EBITDA
Mexico-Telcel (AMX)	**0.549**	**66.6**	Egypt	0.340	43.0
Philippines	0.396	63.7	Czech Republic	0.348	42.7
Indonesia	0.338	53.7	Peru	0.456	41.8
Nigeria	0.296	53.0	Thailand	0.342	41.7
Morocco	0.378	49.7	Argentina	0.319	40.0
Bangladesh	0.307	49.6	Poland	0.271	37.5
Colombia	0.520	48.9	Pakistan	0.225	36.6
Hungary	0.361	48.7	Malaysia	0.339	35.5
Ukraine	0.351	47.3	Brazil	0.246	33.1
Iraq	0.369	46.4	India	0.180	28.8
Russia	0.245	44.4	Turkey	0.390	26.6
China	0.502	43.3			
South Africa	0.380	43.2	**Country avg.**	**0.343**	**42.8**

The mobile services market in Mexico has seen market power highly focused on a small number of providers, in addition to presenting high profitability in terms of some the highest revenue margins (EBITDA divided by service margin) in a selection of 24 developing countries.[52] These margins can be inferred from Telcel's earnings in Mexico if a comparison is made with companies with the greatest market share in 48 countries. In addition, Telcel has the highest market concentration for these services (see Table 4 above).

[48] Barrantes and Galperin.

[49] As discussed above, in Mexico there is a market-dominant conglomerate comprised of Telmex, with 87.7% of landlines, and Telcel, with 69.5% of mobile lines.

[50] Even though Mexico does not have a culture of complaints among users about lack of quality of service, according to the country's national consumer watchdog (Procuraduría Federal del Consumidor), Telmex and Telcel are the two of the top three companies that have received the most complaints about service failures. Juan Carlos Miranda, "Profeco: CFE, Telcel y Dish, con más quejas," *La Jornada*, July 18, 2011, accessed May 28, 2013, http://www.jornada.unam.mx/2011/07/18/opinion/021n2eco.

[51] HHI is the Herfindahl–Hirschman Index, measuring the size of firms in relation to their industry to assess the amount of competition among them. Estimates are based on the incumbent's market share and revenues, which in the case of Mexico corresponds to the Telcel company. Figures compiled from Campbell and Hards.

[52] Campbell and Hards. Profitability is assessed as EBITDA divided by service margin. EBITDA is a financial indicator, standing for Earnings Before Interest, Taxes, Depreciation, and Amortization.

In summary, it is among rural populations, in the poorest states of the country, that the greatest challenge lies in providing "social coverage" or universal telecommunications services for all citizens.

Before examining social coverage policies in Mexico, it is pertinent to look at the achievements of other developing countries in order to put those policies into perspective. To gain such a perspective, the study thus presents international comparisons of teledensity, over the last decade (2000-2010), in those regions with the largest share of developing countries, namely Latin America, Asia (South, Southeast, and East), and Africa.

INTERNATIONAL COMPARISONS

A comparative analysis of the reach and growth of mobile services sheds light on the universal accessibility and availability of telecommunications services, because mobile services have been a sector in which notable growth has been experienced in developing countries.

Telecommunications, Teledensity, and Growth in Latin America, Asia, and Africa, 2000-2010

International comparisons highlight that, despite the significant growth in mobile lines in Mexico (14.1% annually between 2000 and 2010), this relative growth fell behind that of the majority of developing countries in Latin America, Asia, and Africa. The analysis puts Mexico in 15th place with respect to teledensity of mobile services (80.6 lines per 100 people) out of 22 countries in Latin America, where the average density in 2010 reached 98.5 mobile lines per 100 people.[53] Mexico experienced the slowest growth in the region except for Puerto Rico (see Table 5 below).

[53] There are some discrepancies between information reported by Mexico's Federal Telecommunications Commission and the International Telecommunication Union (ITU) due to different reference periods. Here, ITU data are used for the purposes of comparison with other countries. See Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT);" International Telecommunication Union.

Table 5: Comparison of Telecommunication Services Teledensity and Growth in Mexico and Other Latin American Countries, 2000-2010.[54]

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Panama	14.5	15.7	0.71%	13.9	184.7	26.50%	13,200
Argentina	21.4	24.7	1.33%	17.6	149.8	20.90%	16,700
Uruguay	28.0	28.6	0.18%	12.4	131.7	23.99%	14,600
Guatemala	6.0	10.4	5.09%	7.6	125.6	28.99%	5,100
Honduras	4.8	8.8	5.68%	2.5	125.1	42.75%	4,400
El Salvador	10.5	16.2	3.98%	12.5	124.3	23.21%	7,600
Chile	21.4	20.2	-0.53%	22.1	116.0	16.28%	16,800
Brazil	17.8	21.6	1.80%	13.3	104.0	20.55%	11,700
Ecuador	9.5	14.4	3.43%	3.9	102.2	34.51%	8,100
Peru	6.6	10.9	4.63%	4.9	100.1	31.55%	9,700
Venezuela	10.4	24.4	8.08%	22.3	96.2	14.20%	12,500
Colombia	18.1	14.7	-1.86%	5.7	93.8	29.33%	9,900
Paraguay	5.3	6.3	1.56%	15.3	91.6	17.64%	6,200
Dominican Republic	10.1	10.2	0.03%	8.0	89.6	24.57%	9,200
Mexico	**12.4**	**17.5**	**3.20%**	**14.1**	**80.6**	**17.10%**	**14,500**
Puerto Rico	34.0	23.8	-3.20%	34.5	78.3	7.72%	18,100
Bolivia	6.1	8.5	3.04%	0.7	72.3	23.63%	4,700
Costa Rica	22.9	31.8	3.04%	5.4	65.1	25.43%	11,800
Nicaragua	3.2	4.5	2.99%	1.8	65.1	38.78%	3,200
Belize	14.2	9.7	-3.39%	6.7	62.3	22.50%	8,400
Haiti	0.8	0.5	-4.58%	0.6	40.0	47.71%	1,200
Cuba	4.4	10.3	8.06%	0.1	8.9	57.80%	10,000
Group average	**12.8**	**15.2**	**2.00%**	**10.3**	**95.8**	**27.10**	**9,890**

Notes: The ordering of countries is based on mobile density in 2010. GDP per capita figures are in US dollars (2012). All other numerical figures are per 100 people. These caveats are also true for Tables 6-11 below.

In Southeast and East Asia, mobile services grew by an average of 38.7% annually between 2000 and 2010. In 2000, fewer than 18.6% of people had access to a mobile line; in 2010, service coverage had reached 91% of the population (see Table 6 below, which combines all Asian countries regardless of income).

[54] Data for Tables 5-11 compiled from International Telecommunication Union; United States, Central Intelligence Agency. Note that figures for GDP are based on Purchasing Power Parity (PPP) to prevent problems of calculation caused by exchange rates.

Table 6: Comparison of Telecommunication Services Teledensity and Growth in Mexico and Asian Countries, 2000-2010.

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Mexico	**12.4**	**17.5**	**3.20%**	**14.1**	**80.6**	**17.10%**	**14,500**
Asia average	**16.2**	**18.6**	**5.2%**	**18.6**	**91.0**	**38.7%**	**17,445**

In 2010, in the most developed countries of Asia, average growth was lower because those countries had already seen a high level of coverage since 2000. By 2010 these countries had essentially achieved universal coverage (see Table 7 below).

Table 7: Comparison of Telecommunication Services Teledensity and Growth in Mexico and High-Income Asian Countries, 2000-2010.

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Hong Kong	58.9	61.6	0.4%	81.7	190.2	8.0%	48,200
Singapore	48.4	39.0	-1.9%	68.4	145.2	7.1%	58,900
Malaysia	19.9	16.0	-2.0%	22.0	121.3	16.8%	15,900
Taiwan	56.8	70.8	2.0%	80.2	119.9	3.7%	36,900
Brunei	24.1	20.0	-1.7%	28.5	109.1	13.0%	50,500
Korea (South)	55.7	59.2	0.6%	57.8	105.4	5.6%	30,800
Japan	48.9	31.9	-3.8%	52.7	95.4	5.5%	35,500
Mexico	**12.4**	**17.5**	**3.2%**	**14.1**	**80.6**	**17.1%**	**14,500**
Group average	**44.7**	**42.6**	**-0.9%**	**55.9**	**126.6**	**8.5%**	**39,529**

Next, we give a selection of the less developed countries of Asia, in which the GDP per capita is less than Mexico; however, these countries have experienced significant progress in terms of the teledensity of mobile services (see Table 8 below). As opposed to Mexico, the rate of growth of these services in Asia's less developed countries suggests that those nations should be reaching universal coverage in a few years, whereas in Asia's more developed countries, as mentioned, teledensity is universal.

Table 8: Comparison of Telecommunication Services Teledensity and Growth in Mexico and Low-Income Asian Countries, 2000-2010.

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Vietnam	3.2	18.7	17.3%	1.0	175.3	59.9%	3,300
Maldives	8.9	15.2	4.9%	2.8	156.5	44.1%	8,400
Thailand	9.0	10.1	1.3%	4.9	100.8	32.0%	9,600
Indonesia	3.3	15.8	15.5%	1.8	91.7	43.0%	4,500
Mongolia	4.9	7.0	3.3%	6.5	91.1	27.2%	4,200
Philippines	3.9	7.3	5.7%	8.3	85.7	23.6%	4,100
Sri Lanka	4.1	17.2	13.9%	2.3	83.2	38.6%	5,400
Mexico	**12.4**	**17.5**	**3.2%**	**14.1**	**80.6**	**17.1%**	**14,500**
Cambodia	0.2	2.5	23.8%	1.0	64.6	45.8%	2,100
China	11.4	22.0	6.1%	6.7	64.0	22.7%	7,800
India	3.1	2.9	-0.7%	0.3	61.4	60.2%	3,500
Pakistan	2.1	2.0	-0.4%	0.2	59.2	66.7%	2,800
Bhutan	3.6	2.5	3.3%	0.0	54.3	86.8%	5,700
Bangladesh	0.4	0.6	5.2%	0.2	46.2	64.1%	1,800
Afghanistan	0.1	0.5	11.1%	0.1	41.4	92.5%	900
Nepal	1.1	2.8	9.0%	0.04	30.7	82.2%	1,200
Myanmar	0.6	1.3	7.3%	0.03	1.2	40.8%	1,300
Group average	**3.7**	**8.0**	**7.9%**	**2.3**	**75.5**	**51.9%**	**5,231**

In the case of Africa, growth was even more impressive, reaching an annual average of 52.9% (2000-2010). In 2000, 1.1% of the population had a mobile line; by 2010, nearly half the population (48.7%) had access to mobile service (see Table 9 below).

Table 9: Comparison of Telecommunication Services Teledensity and Growth in Mexico and African Countries, 2000-2010.

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Mexico	**12.4**	**17.5**	**3.2%**	**14.1**	**80.6**	**17.1%**	**14,500**
Africa average	**3.9**	**5.1**	**2.4%**	**1.1**	**48.7**	**52.9%**	**9,505**

Note: Tables 9-11 use a selected number of countries based on availability of data.

In the high- and middle-income African countries, mobile service teledensity experienced 36.3% annual average growth during the decade. In 2000, 9.3% of the population had a cellular line; by

2010, the adoption of the services in those countries was likely to be universal at 101.2% (see Table 10 below).

Table 10: Comparison of Telecommunication Services Teledensity and Growth in Mexico and High- and Middle-Income African Countries, 2000-2010.

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Libya	11.3	19.3	3.5%	0.8	171.5	63.9%	15,000
Seychelles	25.4	25.5	0.0%	32.0	135.9	14.1%	24,800
Botswana	7.9	6.9	-1.3%	12.9	117.8	22.3%	15,800
Gabon	3.2	2.0	-4.1%	9.7	106.9	24.3%	15,800
Tunisia	10.1	12.3	1.8%	1.3	106.0	49.6%	9,800
Gibraltar	81.4	77.3	-0.4%	19.2	102.6	16.4%	38,400
South Africa	11.1	8.4	-2.4%	18.6	100.5	16.6%	10,900
Morocco	4.9	11.73	8.2%	8.12	100.0	25.6%	5,000
Algeria	5.8	8.2	3.3%	0.3	92.4	69.3%	7,400
Mauritius	23.5	29.8	2.2%	15.1	91.7	17.8%	14,700
Mexico	**12.4**	**17.5**	**3.2%**	**14.1**	**80.6**	**17.1%**	**14,500**
Equatorial Guinea	1.2	1.9	4.8%	1.0	57.0	45.2%	18,700
Angola	0.5	1.6	12.1%	0.2	46.7	65.7%	6,000
Egypt	7.8	11.86	3.9%	1.9	87.1	41.3%	6,600
Group average	**14.9**	**16.7**	**2.4%**	**9.3**	**101.2**	**36.3%**	**14,530**

While on average across the African low-income countries, and access to mobile services remained low in 2010 (45.6%), the rate of growth of these services shows signs of reaching universal coverage in a few years (see Table 11 below).

The average annual growth of mobile services in Latin America, Asia, and Africa means we may dub the 2000s the decade of connectivity, given the achievements in coverage of these services. This includes the huge growth potential both in terms of population reach and in terms of the number of services that can be offered through increasingly "intelligent" devices – particularly with the imminent expansion of broadband, a service still in its infancy in these countries.

The following section seeks possible explanations for the relative success observed in the decade 2000-2010 in a large part of the developing world, in contrast to service coverage in Mexico, which saw sluggish growth over the same decade. We examine the effect of public policies and regulations – internationally on mobile service coverage, Internet use and access to Internet services in the home, school and workplace, as well as access to broadband services.

Table 11: Comparison of Telecommunication Services Teledensity and Growth in Mexico and Low-Income African Countries, 2000-2010.

Country	Landlines (2000)	Landlines (2010)	Landlines average annual growth	Mobile density (2000)	Mobile density (2010)	Mobile average annual growth	GDP per capita (2010)
Congo	0.7	0.2	-9.55%	2.3	94.0	40.1%	4,400
Egypt	7.8	11.9	3.86%	1.9	87.1	41.3%	6,600
Gambia	2.6	2.8	0.89%	0.4	85.5	61.8%	2,000
Mexico	**12.4**	**17.5**	**3.2%**	**14.1**	**80.6**	**17.1%**	**14,500**
Mauritania	0.7	2.1	10.1%	0.6	79.3	56.2%	2,000
Djibouti	1.3	2.1	4.23%	0.03	18.6	78.6%	2,600
Congo (D.R.)	0.02	0.1	16.1%	0.03	17.2	78.4%	300
Burundi	0.3	0.4	2.1%	0.3	13.7	43.8%	600
Ethiopia	0.4	1.0	9.9%	0.03	7.9	67.4%	1,100
Somalia	0.3	1.1	11.3%	1.1	7.0	18.4%	600
Group average	**1.6**	**2.4**	**5.4%**	**0.7**	**45.6**	**54.0%**	**2,244**

POLICIES AND REGULATIONS GOVERNING ICT SERVICE COVERAGE: AN INTERNATIONAL PERSPECTIVE

In the previous section, our international analysis of the density and growth of telecommunications services focused primarily on mobile services and their growth during the 2000s.[55] The present section takes a different approach in examining the effect of regulatory and ICT policies on Internet use and access at home, the extent of Internet use in school and business, and access to broadband services (also including mobile subscriptions).[56]

Preceding studies have examined the influence of the institutional environment on access to telecommunication services in Latin America. García-Murillo and Kuerbis have indicated the effect on the number of pay phones, resulting from privatization, competition, universal service fund programs, and the autonomy of the regulator.[57]

Differently from the earlier research, the present study examines institutional variables separately from the economic variables in order to examine the specific contribution, or the differential effect of these two sets of variables, on the coverage of telecommunication services. As described in the *Methodology* section above, this study analyses the impact of institutional variables internationally and

[55] International Telecommunication Union; Mexico, Comisión Federal de Telecomunicaciones, "Sistema de Información Estadística de Mercados de Telecomunicaciones (SIEMT);" Mexico, Secretaría de Comunicaciones y Transportes, "Anuario 2011," accessed June 5, 2013, http://www.sct.gob.mx/fileadmin/_migrated/content_uploads/Anuario-2011_01.pdf.

[56] The opportunity to analyze different telecommunications services has been made possible thanks to the recent availability of detailed information published in *The Global Information Technology Report 2012* from the World Economic Forum. See Dutta and Bilbao-Osorio.

[57] García-Murillo and Kuerbis.

in order to do so proposes a set of econometric models, taking into account data for 118 countries of various levels of economic development.

The tables below provide lists of the variables chosen for the econometric analysis, followed by the seven linear regression models themselves and finally the corresponding results, thus modeling the effects of policy and regulations on access to and use of telecommunications services.

Definition of Variables Adopted

The variables of interest adopted in this analysis are those of the Political and Regulatory Environment Index (*Prindex*) along with regulations governing information and communications technologies (*Lawict*). See Table 12 above.[58]

Table 12: Variables of Interest.[59]

Variable	Definition	Notation
Political and Regulatory Environment Index	Effectiveness of legislative bodies; judicial independence; effectiveness of legal framework in settling disputes and challenging regulations; protection of intellectual property; software piracy rate. The value of the Index is the result of a weighted average of the estimates obtained for the above indicators.	*Prindex*
ICT Legislation	A country's laws relating to the use of information and communication technologies.	*Lawict*

The response variables relate to telecommunications service coverage and adoption: mobile service subscriptions (*Mobilesubsc*), private Internet usage (*Internetuse*), household Internet access (*Internethouse*), fixed (*Internetbroband*) and mobile broadband access (*Mobilebroband*), Internet use in schools (*Internetschools*), and Internet adoption for business use (*Internetbusiness*). Tables 13 and 14 below present definitions respectively of the independent and dependent variables used in the analysis, along with their corresponding notation and sources.

[58] It is worth noting that the potential problem of endogeneity in using these variables is reduced by the fact that the Regulatory Environment Index indicators are not specific to the telecommunications service industry, but rather they cover the economy as a whole. In the case of ICT laws, although these are related to telecommunications services, their effect is not immediate due to the inherent dynamics of these markets. Although the variable *ICT Legislation* is specific to the telecommunications sector, changes in legislation take time and for this reason do not accurately reflect market dynamics. But there is indeed a feedback effect, and thus the coefficients of these variables are interpreted as having a causal relationship.

[59] Dutta and Bilbao-Osorio, 324-383.

Table 13: Response Variables.[60]

Variable	Definition	Notation
Mobile telephone subscriptions	Mobile subscriptions (contract and pre-paid) per 100 inhabitants.	*Mobilesubsc*
Internet users	Percentage of individuals using the Internet, 2010.	*Internetuse*
Households with Internet access	Percentage of households with Internet access at home, 2010.	*Internethouse*
Fixed broadband Internet subscriptions	Fixed broadband Internet subscriptions per 100 inhabitants, 2010.	*Internetbroband*
Mobile broadband Internet subscriptions	Mobile broadband Internet subscriptions per 100 inhabitants, 2010.	*Mobilebroband*
Extent of business Internet use	To what extent do companies within your country use the Internet for their business activities?	*Internetbusiness*
Internet use in schools	How would you rate the level of access to the Internet in schools in your country?	*Internetschools*

Control variables include income per capita (*Gdppc*) and income distribution (*Gini*); service tariffs including mobile service tariff (*Mobiletarif*) and broadband tariff (*Broadbandtarif*); and education-oriented variables such as enrolment at secondary (*Edusec*) and tertiary level (*Eduter*).[61]

Table 14: Control Variables[62]

Variable	Definition	Notation
Country's income per capita (PPP)	GDP per capita (2011).	*Gdppc*
Country's income distribution	Gini coefficient (several years: 2009-2011).	*Gini*
Mobile tariffs (PPP)	Average per-minute cost of different types of mobile (cellular) calls, 2010.	*Mobiletarif*
Fixed broadband Internet tariffs	Monthly subscription charge for fixed (wired) broadband Internet service, 2010.	*Broadbandtarif*
Secondary education enrolment rate (High School)	Gross secondary education enrolment rate, 2009.	*Edusec*
Tertiary education enrolment rate (Higher Education)	Gross tertiary education enrolment rate, 2009.	*Eduter*

[60] Ibid. Note that the final two response variables as listed in this table are based on survey responses.
[61] Control variables are those factors that are held constant to test the relative impact of the "variables of interest" (independent variables); i.e. Political and Regulatory Environment Index (*Prindex*) and ICT Legislation (*Lawict*). Control variables reduce the standard error of estimators, increasing their accuracy. See Dutta and Bilbao-Osorio, 324-383.
[62] United States, Central Intelligence Agency; World Bank; Dutta and Bilbao-Osorio, 324-383. The income variable is estimated on each country's Purchasing Power Parity (PPP).

Econometric Models

Having presented the independent and dependent variables, we now present the seven linear regression models that incorporate these to form our econometric analysis:

Mobile Telephone Subscriptions:
$Mobilesubsc = \alpha + \beta_1 Prindex + \beta 2\ Lawict + \beta_3 X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Mobiletarif*, *Edusec*, *Eduter*

Individual Internet Usage:
$Internetuse = a + \beta 1\ Prindex + \beta 2\ Lawict + \beta 3X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Internethouse*, *Edusec*

Household with Internet Access:
$Internethouse = a + \beta 1\ Prindex + \beta 2\ Lawict + \beta 3X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Edusec*, *Eduter*

Broadband Access:
$Internetbroband = a + \beta 1\ Prindex + \beta 2\ Lawict + \beta 3X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Internetuse*, *Broadbandtarif*, *Edusec*, *Eduter*

Mobile Broadband Subscriptions:
$Mobilebroband = \alpha + \beta_1 Prindex + \beta_2 Lawict + \beta_3 X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Internetuse*, *Broadbandtarif*, *Edusec*, *Eduter*

Internet Access in Schools:
$Internetschools = \alpha + \beta_1 Prindex + \beta_2 Lawict + \beta_3 X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Internetuse*, *Broadbandtarif*, *Edusec*, *Eduter*

Extent of Business Internet Use:
$Internetbusiness = \alpha + \beta_1 Prindex + \beta_2 Lawict + \beta_3 X + \varepsilon$
Where X is a vector of control variables: *Gdppc*, *Gini*, *Internetuse*, *Broadbandtarif*, *Edusec*, *Eduter*

Results

The results of the analysis suggest that those variables related to institutional environment (political and regulatory environment as well as ICT legislation) have a significant influence on telecommunications service access in the group of countries analyzed.[63] In the case of mobile services, adoption rates were aided by the political and regulatory environment and ICT regulation,

[63] These results coincide with the findings of Samarajiva, cited above.

in addition to the levels of education among the population. Internet use *per se* (either in public places or in homes or work places) may be attributed largely to ICT-related legislation. When it comes to broadband access, the political and regulatory environment and ICT legislation have a significant influence.

Table 15: Results of Econometric Analysis.

	Mobile subscriptions	Individual Internet usage	Household Internet access	Broadband access	Mobile broadband subscriptions	Extent of business Internet use	Internet access in schools
GDP per capita (PPP)	0.189 (1.706)	0.0.31 (0.620)	0.409** (8.035)	0.220* (2.845)	0.096 (0.781)	-0.005 (-0.077)	-.020 (0.276)
Gini	-0.055 (-0.730)	-0.070 (-2.296)	-0.158** (-4.524)	-0.193** (-3.642)	0.018 (0.226)	0.041 (0.883)	-.068 (-1.431)
Political and Regulatory Environment Index	-0.477** (-3.256)	-0. 136 (-2.328)	0.201** (2.998)	0.309* (2.879)	0.438** (3.137)	0.036 (0.706)	-.045 (-0.512)
ICT legislation	0.440* (2.814)	0.218** (3.83)	0.107 (1.498)	0.125 (1.127)	-0.018 (-0.113)	0.780** (7.980)	.564** (5.934)
Mobile cellular tariffs (PPP)	-0.082 (-1.227)						
Fixed broadband Internet tariffs		-0.035 (-1.245)		-0.67 (-1.253)		-0.121* (-2.547)	-.014 (9.324)
Individual Internet usage					0.401 (0.353)		.327** (2.908)
Household Internet access							
Secondary education enrolment rate	0.473** (4.272)	0.100 (2.213)	-0.016 (-0.315)	-0.065 (-835)	-0.201 (-1.826)	-0.037 (-0.543)	.029 (0.458)
Tertiary education enrolment rate	0.118 (1.131)	0.034 (0.770)	0.325** (6.823)	0.316** (4.395)	0.401 (3.554)**	.0171** (2.688)	.098 (1.510)
Constant	28.684 (1.353)	0.524 (0.64)	-14.040 (-1.702)	-9.216 (-1.724)	-25.249 (-2.614)	2.129 (7.958)	0.830 (2.016)
N	111	113	112	113	108	113	113
Adjusted R^2	0.512	0.862	0.896	0.765	0.565	0.817	0.846

**Significant at p = 0.01; *significant at p = 0.05

The regulatory variables are significant factors in explaining the extent of business use. Factors observed to have an influence on Internet use in schools are regulatory factors (ICT legislation) along with the levels of Internet use. See Table 15 above, which shows the significance of factors relating to policy and regulation on access to and use of telecommunications services.

Within this context, a central question is raised for Mexico with respect to which factors have influenced the relatively slower growth of services – in this case mobile services, but also landlines, the Internet, and general services offering broadband access. What factors have led to Mexico being left behind compared to the levels of connectivity seen in other developing countries, and compared to the truly exponential growth witnessed in some of those countries? How can such gaps in connectivity and the relatively slow growth in coverage of services in Mexico as compared to other countries be explained, given that in many cases these latter countries have a lower level of economic development and lower income per capita?

In order to investigate the factors that have led to Mexico's shortfall in coverage of telecommunications services, the next section provides a brief analysis of policies aimed at providing for the poorest regions of the country – that is, policies directed towards universal service or social coverage that were instituted from 1990 to 2010.

PUBLIC POLICIES ON UNIVERSAL SERVICE PROVISION

Universal service public policies focus on "… infrastructure accessibility, or service affordability and reliability, [and] are key to assuring network expansion beyond the limits established by free market dynamics."[64] This section discusses the scope of public policies on universal service provision designed by Mexican authorities to achieve the goal of universal access, namely: 1) monitoring by the regulatory authorities of compliance on the part of the incumbent telecommunications operator, Teléfonos de México (Telmex), in fulfilling its social obligations as the dominant operator following the company's privatization in 1990; and 2) government policy aimed at providing connectivity – in the form of basic telephony services – to rural communities.

These policies were mainly deployed by private operators – generally the incumbent operators. Which operators had a stake was based on public tender processes organized by the government, which has resulted in further lucrative business for the incumbent operators but with limited achievements in terms of access to these services by the poor.

Telmex's License: Universal Service Obligations and Network Growth

Although Telmex's license included clauses governing universal service obligations, rural telephony, public telephone booths, and network expansion, Telmex's commitment to these clauses ceased in 1994 and the results fell significantly short of the objective of providing basic universal telecommunications service to rural areas (the obligations officially expired in 1998). The following

[64] Fuentes-Bautista, 349.

paragraphs give a summary of the main clauses relating to Telmex's universal service and network growth obligations. This discussion also includes an empirical analysis showing the outcomes of the implementation of these policies: reflecting the achievements of network growth, rural telephony, and public telephone services or telephone booths (1990-1998).

Rural telephony: Basic telephone service to communities with more than 500 inhabitants (1990-1998). As a result of the negotiations between government policymakers in the field of telecommunications and the group of investors,[65] Telmex's license freed them from their obligation to serve communities with fewer than 500 inhabitants, which according to the Census of 1990 represented 21.16 million people or 47.2% of inhabitants in rural communities in Mexico.[66]

An analysis of the impact of Telmex's rural telephony operations indicates very limited results. The effect on telephone density, following Telmex's compliance with requirements for basic telephone service provision in rural towns, was extremely low. This estimate shows that the country's average telephone density was 1.2 lines per community, in those with 500 to 2,499 inhabitants. Based on this analysis it is possible to assert that fulfillment of the overall requirements, namely provision of rural telephony and the installation of public telephone booths in rural areas, had very much fallen behind the goals set by Telmex's license. This can be seen in the telephone density in the five most prosperous states compared to the five poorest states in Mexico (see Tables 2 and 3 above).

Thus, in spite of the fact that public telephone booths were the strategy most used by Telmex to fulfill its universal or social obligations, compliance with the commitment of providing public access through public telephone booths was insufficient. At the end of 1998, Telmex admitted that it had only installed 3.2 public booths per 1,000 inhabitants.[67] Unfortunately, according to the definition of "universal service" set out in Telmex's license, and because of the government's lack of leverage at the time of privatization, the universal service obligation ceased and areas that were served with at least one public booth increased slightly in 1995 but ceased to grow after 1996 (see Table 16 below).

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[65] The scope of both the content relating to universal service obligations and the schedule for their implementation, as well as their impact on bringing connectivity to the poorest communities, was shaped to some extent by the context in which the privatization of Telmex took place. The structure of the privatization explains the lack of leverage or bargaining power of the authorities, specifically on the subject of social coverage. In the 1980s the Mexican economy was severely indebted; the burden of foreign debt and fiscal deficit had a major impact on the approach adopted in the privatization of Telmex, which focused mainly on expected revenues. The government sold, to a single set of investors, a package that included Telmex and Telnor, in addition to the only nationwide mobile network franchise (as mentioned above), the Federal Microwave Network, and a wide bandwidth allocation. Thus, overnight, the emerging company became a formidable player in the sector. It was allowed to offer all types of telecommunications services with the exception of television broadcasting. See Rafael del Villar, "Competition and Equity in Telecommunications," in *No Growth Without Equity? Inequality, Interests, and Competition in Mexico*, ed. Santiago Levy and Michael Walton (Washington DC: The World Bank and Palgrave Macmillan, 2009), 321-364; Cristina Casanueva and Rafael del Villar, "Infrastructure Regulation Difficulties," in *Critical Infrastructures: State of the Art in Research and Application*, ed. Will A.H. Thissen and Pauline M. Herder (Boston: Kluwer Academic Publishers, 2003), 179-207.

[66] Mexico, Instituto Nacional de Estadística y Geografía, "Censo de Población y Vivienda 1990." accessed May 29, 2013, http://www.inegi.org.mx/est/contenidos/proyectos/ccpv/cpv1990/default.aspx.

[67] Personal interviews with senior civil servant, June 2008 and December 2010.

Table 16: Telmex's Compliance with Requirements of Basic Telephone Service Provision in Rural Towns.[68]

	Accumulated	Annual	% Increase
1990	4,350	2,854	190.8
1994	16,542	4,006	32.0
Average annual growth: 1990-1994:			**39.645**
1995	16,735	193	1.2
1996	16,738	0	0.0
1997	16,738	0	0.0
1998	16,738	0	0.0
1999	16,738	0	0.0
2000	16,738	0	0.0
2000-2010	16,738	0	0.0
Average annual growth: 1994- 2010			**0.001**

According to Telmex's license, the commitment to provide basic service under the overarching aim of universal access through public booths in Mexico is far outweighed by the challenge of providing services to the poorest communities of Mexico. This is true more particularly in the context of a huge shortage of telecommunications services in the country as a whole: on average, there is provision to only six households out of every ten (62%) and 4.7 non-residential lines per hundred employed personnel (see Table 2 above).

Rural Telecommunications Services for Communities of Fewer than 500 Inhabitants: Direct Government Subsidy. This section analyses the policy directly implemented by the Secretariat of Communications and Transport, aimed at providing telecommunications services to rural communities of between 100 and 499 inhabitants. These programs originally focused on small towns and villages with fewer than 500 inhabitants (1990-2002) but later on, with the establishment of the Social Coverage Fund (FONCOS),[69] the focus of these programs shifted to communities of between 400 and 2,500 inhabitants.

The program was directly financed by the Secretariat of Communications and Transport and targeted communities with fewer than 500 inhabitants. The subsidy focused on the neediest rural communities, generally located in remote and isolated areas. Nevertheless, telephone density in these small towns remained extremely low, as was the case of services provided by Telmex in larger communities, where the estimated average of telephone booth density is 0.2 lines per town. This suggests that a large number of towns did not benefit from this program (see Table 17 below). The information provided by the Secretariat of Communications and Transport (Office of Rural Telephony) showed that 173,409 lines were installed between 1995 and 2010.

[68] Mexico, Secretaría de Comunicaciones y Transportes, "Anuarios Estadísticos," for the years 2000-2011.
[69] Everardo Quezada, José Carlos Aguilar, Ramiro Cadavid, and Rafael Ruisesparza, "Estimación del Impacto de FONCOS en la Adopción de Servicios de Telefonía Fija en Localidades Rurales en México," master's thesis, Universidad Pompeu Fabra (2012).

Table 17: Rural Telephony, Lines Installed by the Ministry of Communications, Towns with Fewer than 500 Inhabitants, 1995-2010.[70]

State	Towns with Fewer than 500 Inhabitants	Lines Installed	Estimated Lines per Town	Poverty Index
Chiapas	18,514	2,443	0.1	76.7
Puebla	5,060	1,571	0.3	64.0
Oaxaca	9,191	936	0.1	62.0
Tlaxcala	1,029	117	0.1	59.7
Hidalgo	3,788	1,408	0.4	56.4
Michoacán	8,434	1,666	0.2	54.6
Tabasco	1,693	924	0.5	53.8
Zacatecas	4,259	806	0.2	52.2
San Luis Potosí	6,253	1,190	0.2	51.1
Veracruz	18,818	3,928	0.2	50.7
Durango	5,498	646	0.1	49.4
Morelos	1,243	189	0.2	48.6
Yucatán	2,209	175	0.1	46.5
Campeche	2,627	221	0.1	44.7
Guanajuato	7,827	2,250	0.3	43.8
Guerrero	6,282	1,228	0.2	43.8
México	2,935	2,435	0.8	43.7
Nayarit	2,433	328	0.1	42.5
Aguascalientes	1,816	132	0.1	37.6
Jalisco	10,252	1,777	0.2	36.5
Quintana Roo	1,858	177	0.1	35.9
Querétaro	2,330	507	0.2	35.4
Tamaulipas	7,136	621	0.1	34.0
Coahuila	3,635	374	0.1	32.9
Sinaloa	5,316	843	0.2	32.7
Chihuahua	12,033	776	0.1	32.1
Colima	1,175	82	0.1	28.9
Distrito Federal	506	0	0.0	27.8
Sonora	7,005	609	0.1	26.7
Baja California	4,345	248	0.1	26.3
Nuevo León	5,119	560	0.1	21.5
Baja California Sur	2,790	215	0.1	21.1
Total	**173,409**	**29,382**	**0.2**	**NA**

Information provided by the Secretariat of Communications and Transport (Office of Rural Telephony) showed that 31,083 lines were installed between 1995 and 2006. An analysis of this information also showed very rapid growth in the number of installed lines between 1995 and 2000 (50.7% yearly average growth) and that the pace of growth declined considerably over the following years, during which the yearly average growth observed between 2001 and 2010 was only 1.2%. There was no evidence of growth between 2000 and 2010 (see Table 18 below).[71]

[70] Data compiled from several Secretariat of Communications and Transport annual reports; see also Mexico, Consejo Nacional de Evaluación de la Política de Desarrollo Social.

[71] It is worth mentioning that there is an inconsistency between the information reported by the 2007 Secretariat of Communications and Transport Annual Report and figures furnished by the Office of Rural Telephony: the former

Table 18: Number of Telephones Installed in Communities with Less than 500 Inhabitants, 1995-2010.[72]

Year	Quantity
1995	4,000
1996	9,369
1997	10,545
1998	20,208
1999	23,063
2000	31,083
Average Annual Growth 1995-2000	**50.7%**
2001	31,083
2002	31,453
2003	31,820
2004	32,326
2005	32,841
2006	33,240
2007	33,242
2008	34,658
2009	34,658
2010	34,658
Average Annual Growth 2001-2010	**1.2%**

The results of the former analysis are even more dramatic considering the outcome of fieldwork conducted by Ministry personnel to monitor service quality towards the end of 2009 that aimed to verify the operational state of equipment. Here the data showed that 58.5% of the lines were out of service and abandoned. The former observations raise doubts over the commitment made by the government towards bridging the connectivity gap in the smallest and poorest communities of Mexico. It also raises questions over the nature of the agreements signed by the Secretariat of Communications and Transport and operators undertaking the installation of the telephone lines, specifically their operation and maintenance in accordance with acceptable quality standards.

The personnel interviewed agreed that the contracts included maintenance and quality clauses, which poses additional questions about the strength of the Ministry as a regulator capable of enforcing these clauses. In addition, the limited outcomes witnessed suggest that the level of resources allocated to this issue by the government was insignificant in view of the huge gaps in connectivity existing among the smallest and poorest communities in Mexico.

Social Coverage Fund (FONCOS). The Social Coverage Fund was established in 2002 as a trust fund with an allocation of USD $75 million provided by the Ministry of Finance to the Secretariat of

reported 34,676 installed lines, and the latter reported 33,242; the difference between the two sources being 1,434 installed lines. In its Annual Reports and "Main Statistics on the Communications and Transport Sector" (2008-2010) the Secretariat of Communications and Transport reported a very similar number of installed services from those in 2006, with a note that the number of lines had not changed. Basically the lines were in poor condition and were being replaced. This statement did not agree with the results of the verification of lines in operation conducted by the Office of Rural Telephony.

[72] Data compiled from the "Rural Telephony" sections (2000-2009) in México, Secretaría de Comunicaciones y Transportes, "Anuario 2010."

Communications and Transport. Its main purpose was the funding of social telecommunications services, focused on serving communities of between 400 and 2,500 inhabitants.[73]

The Secretariat of Communications and Transport designed two different public tender processes: STB-1 and STB-2.[74] For STB-1, the subsidy for the chosen operator consisted of both financial and bandwidth resources for ten years (renewable), which were reserved by the government for social coverage purposes. The subsidy to the end user included all expenses relating to the installation and rental of the equipment, so that the end user only had to pay for call traffic via prepaid cards. For STB-2, the subsidy to the successful bidder consisted of bandwidth resources only. The end user was charged for installation costs and call traffic, exonerating him/her from payment for the rented equipment. In this case, the subsidy for the chosen company consisted only of the license to operate bandwidth resources for ten years (also renewable).

In the second round of the tender process, Telmex was the only bidder. In both public tenders Telmex – the incumbent operator – was chosen. There were two changes to the terms of the contact signed between Telmex and the Secretariat of Communications and Transport. The first was related to the infeasibility of serving 737 communities. Telmex argued that these towns lacked an electricity infrastructure or that there were inherent difficulties imposed by weather contingencies. The second change to the original contract consisted of exchanging bandwidth resources reserved by the government for social coverage purposes for bandwidth with high commercial value for Telmex. This change had severe implications both for the implementation of the universal service process and in terms of the dominant control of infrastructure by the incumbent operator. This latter implication had negative consequences due to the lack of competition in the telecommunications services markets, thus affecting Mexican society and the country's economy as whole.

In November 2006, a few weeks before the end of the presidential and ministerial administration that had taken office in 2000, an exchange of frequency bands took place: Telmex's 21 MHz allocation in the 1.5 GHz band, originally allocated by the Secretariat of Communications and Transport to the company as part of the Social Coverage Fund, was exchanged for 10 MHz in the 450 MHz band.[75]

The exchange of frequency bands had the effect of reducing the cost of the deployment of the FONCOS network and in addition proved commercially advantageous for Telmex, since the 450 MHz band was the most appropriate for the provision of wireless services with technology known as CDMA450. The exchange of bandwidth resources dedicated to social telephony for resources with ten years of high commercial value was carried out by the Secretariat of Communications and Transport. This raised questions about Telmex's interest in participating in the social coverage

[73] The total sum is derived from 750 million pesos; the exchange rate between Mexican pesos and US dollars at the time being around 10 Mexican pesos to the US dollar.
[74] Quezada, Aguilar, Cadavid, and Ruisesparza,
[75] Mexico, Secretaría de Comunicaciones y Transportes, "Modificación de Programa Cambio de Frecuencias-Telmex Foncos I," internal document, Nov. 29, 2006, accessed June 5, 2013, http://www.cofetel.gob.mx/wb/Cofetel_2008/modificacion_de_programa_cambio_de_frecuencias__te.

tender process. The Secretariat of Communications and Transport did not exercise its power to monitor the use of these frequency bands.[76]

Former representatives of the Office of Rural Telephony argued that Telmex's true interest was to acquire the use of those frequency bands with a potentially high financial return, thus evading the higher transactional and monetary costs involved in taking part in an open public tender,[77] which in turn has been the allocation mechanism for radio bandwidth resources for commercial use established by the government in accordance with the Federal Law on Telecommunications (1995).[78]

This analysis leads us to consider the role of the government authorities in organizing tender processes and allocating public finance and bandwidth resources for social coverage. In this case, the Secretariat of Communications and Transport played a different role by granting valuable infrastructure resources to be used commercially, at a very low cost for the incumbent operator. Additionally, and based on fieldwork and remote monitoring performed by the Office of Rural Telephony, the audit of services offered by Telmex under the Social Coverage Fund (FONCOS) showed that, out of the program objective of 109,016 telephone lines (75,797 under the STB1 program and 33,219 under STB2), only 88,791 were actually installed, implying that 20,225 lines were never installed.

There was a brief period, after 2006, when the new administration of the Secretariat of Communications and Transport audited the services delivered by Telmex under the Social Coverage Fund. The Office of Rural Telephony identified numerous irregularities: for example, the installation of two landline connections in the same household, which proved less costly for Telmex (19,397). A similar discovery was made of lines that were not connected to any specific household, which prevented verification that they were operational (6,983 lines). In contrast, before 2006, the Secretariat of Communications and Transport had paid Telmex on time, based on the invoices that the company presented. For a brief period of time the Secretariat of Communications and Transport initiated a process to impose sanctions on Telmex and to suspend payments to the company. However, this process was never implemented because different factions within the Secretariat opposed the sanctioning process. Furthermore, the faction that initiated this processes no longer serves in the Secretariat of Communications and Transport.

Here again, the analysis reveals the role of the regulator, firstly in the tender process, and specifically in the process of allocating bandwidth resources with a high potential return for Telmex. Furthermore, the regulator did not supervise the use of these resources, which were specifically allocated for social communications coverage. This finding suggests that the regulator did not

[76] José Luis Peralta Higuera, "Oportunidades para 3G y CDMA450 en México," white paper, Comisión Federal de Telecomunicaciones, unknown date, accessed June 5, 2013, http://www.cdg.org/news/events/cdmaseminar/07_LatinAm/presentations/May16/1-Jose_Higuera.pdf.
[77] Personal interviews with senior civil servant, June 2008 and December 2010.
[78] Article 14 of the Federal Telecommunications Law states that licenses for the use of radiofrequency bands for specific purposes will be granted through an open public auction. The federal government has the right to receive the agreed-upon funds. See Mexico, Ley Federal de Telecomunicaciones, June 7, 1995, accessed June 5, 2013, http://www.diputados.gob.mx/LeyesBiblio/pdf/118.pdf.

exercise its power in preventing the reallocation of resources originally targeted at the country's poorest citizens. So far, the limited success of the different public policies aimed at providing universal service has been presented as being due firstly to the limited extent to which clauses set out in Telmex's license were invoked, and secondly to the irregularities observed on the compliance of various agreements, including the FONCOS contract with Telmex.

Information and Knowledge Society Coordination Program: e-México. The e-México initiative, part of the Secretariat of Communications and Transport's Information and Knowledge Society Coordination program, was launched in 2002 with the aim of providing public access to the Internet and information technology, and thus help in bridging Mexico's digital divide. The connectivity strategy has consisted of setting up telecentres known as Digital Community Centers (CCDs) that provide public Internet access as well as access to computing and printing facilities; and training in the use of such technologies. Moreover, these CCDs are the result of collaboration and joint responsibility agreements between the Secretariat of Communications and Transport and various government offices tasked with developing content in the areas of education and training (64.5% of the CCDs),[79] health (13.6%),[80] and social development (21.1%).[81] CCDs are located throughout the country in schools, libraries, health centers, post offices, and government buildings.[82] See Table 19 below.

Table 19: Content CCDs by Policy Content, 2011.[83]

Content	Number of CCDs	%
Education	3774	64.5
Social Development	1432	21.1
Health	923	13.6
Communications	57	0.8
Total	**6788**	**100**

Over the first decade or so after the e-Mexico scheme was set up (2002-2009), the number of CCDs saw an average annual increase of 19.3%, going from 1,838 in 2002 to 8,971 in 2009. Information for 2010 was unavailable at the time of writing, but the Secretariat of Communications and Transport has published information for 2011,[84] reporting that only 6,788 CCDs were operational –

[79] Of this subtotal, 42.5% of telecentres are managed by the Ministry of Education, 11.7% by the National Institute for Adult Education, 10.2% by the General Public Libraries Directorate, and 0.1% by the National Institute of Anthropology and History. Mexico, Secretaría de Comunicaciones y Transportes, "Anuarios Estadísticos," (2010 data).
[80] Of this subtotal, 7.2% of telecentres are managed by the Health Ministry and 6.4% by the Mexican Institute for Social Security. Ibid.
[81] Of this subtotal, 18.2% of telecentres are managed by the Ministry for Social Development, 2.7% by the National Commission for the Development of Indigenous Communities, 0.8% by public telecommunications services, 0.01% by the Food Aid Programme, and 0.03% by miscellaneous social sector development programs. Ibid.
[82] Ibid.
[83] Mexico, Secretaría de Comunicaciones y Transportes, "Anuarios Estadísticos" (2011 data).
[84] Mexico, Secretaría de Comunicaciones y Transportes, "Anuario 2011."

an annual drop of 13.0% between 2009 and 2011.[85] Regarding the extent of coverage of the CCDs, the analysis revealed that most municipalities in each state have at least one CCD (between 0.7 and 1.0 CCD per municipality). However, this metric does not consider actual satisfaction of the potential *demand* for access to IT services, in particular the Internet.

In an attempt to estimate how well CCD coverage meets potential demand, an estimate was made of the ratio of CCDs to population size. For the purpose of this estimate, we took as our population count the reported number of inhabitants of between 12 and 54 years of age in the poorest states of the country. The result is an extremely high potential demand compared to available telecentres (see Table 20 below). It should be pointed out that in most cases the community in question is likely to have other means of commercial Internet access at its disposal. The estimate presented here is therefore very approximate. Nonetheless, it suggests that the level of provision of both Internet access and other IT services offered by CCDs has been extremely limited compared to the potential level of demand.[86]

Table 20: Potential Demand for CCDs in Six Poorer States, 2011.[87]

State	Population	CCDs	CCDs per municipality	Population per CCD
Chiapas	2,941,511	378	1.0	7,782
Guerrero	2,046,847	194	0.9	10,551
Oaxaca	2,302,561	570	0.7	4,040
Tlaxcala	742,652	166	0.9	4,474
Zacatecas	912,053	614	0.8	1,485
Michoacán	2,677,181	113	0.7	23,692

CONCLUSIONS

There are at least three major findings that can be drawn from the preceding analysis. First, there is low adoption of telecommunications services in the poorer states where most of the rural population lives and works, with the exception of the mobile infrastructure present in some of these areas. This has led end users to rely increasingly on mobile services, which leads us to question the challenges and opportunities offered by the diffusion of wireless services for universal service

[85] Mexico, Secretaría de Comunicaciones y Transportes, "Agenda Digital," white paper, Dec. 2012, accessed June 27, 2013, http://www.agendadigital.mx/descargas/AgendaDigitalmx.pdf.

[86] In 2012, the final year of the relevant presidential and ministerial administration, the Coordinator of the Information and Knowledge Society announced that the number of CCDs would be increased six-fold from 6,000 to 36,000, including 16,000 further sites in rural communities. For these new sites, agreements would be reached with Intel, Microsoft, Red Hat, and Choose Right. This inspires the question of whether such an ambitious target, which far exceeds the progress seen over the past decade, can really be met in a single year. Mónica Aspe Bernal, "Discurso de la Coordinadora de la Sociedad de la Información y el Conocimiento, durante el lanzamiento del portal Club Digital," press release, Secretaría de Comunicaciones y Transportes, Sept. 24, 2012, accessed June 5, 2013, http://www.sct.gob.mx/uploads/media/Parabras_Monica_Aspe_Club_Digital-240912.pdf.

[87] Data compiled from Mexico, Instituto Nacional de Estadística y Geografía, "Censo de Población y Vivienda 2010;" Mexico, Secretaría de Comunicaciones y Transportes, "Anuarios Estadísticos" (2011 data).

policies. The above information suggests that universal service policy should be targeted predominantly at mobile penetration; in addition, to the extent that universal service policy is directed at telephony and to some extent broadband in rural areas, its lower cost and faster deployment of networks should be addressed.

The second major finding, on the question of the access gap, is evidence for various difficulties faced by government authorities in enforcing the social coverage commitments agreed to by the incumbent operator – both those initially set out in the company's operating license signed in 1990, and subsequently when it became operator of the government-funded Social Coverage Fund. This failure of enforcement has resulted in a lack of process transparency in the allocation of resources and little improvement in service availability. Dominant operators evade accountability for commitments undertaken to implement social coverage schemes, limiting the regulator's monitoring efforts.

The third major finding concerns an additional factor related to the access gap that explains the limited results of the social coverage policy, namely the poor level of resources allocated for connecting rural communities of less than 500 inhabitants, and to the CCD (telecentres) policy, aimed at offering public access to the Internet and eventually to broadband services (2002-2012). The latter factor is ultimately of an institutional nature, reflecting the low priority assigned by public policymakers to serving the needs of the country's poorest citizens.[88] Therefore, there is a lack of government responsiveness to the needs of citizens.[89]

In relation to the market efficiency gap, the evidence provided by this study suggests that failures in regulation occurred as a result of a weak institutional framework and a marked imbalance of power between the regulatory authorities and the dominant operators. In the design of policy and regulatory frameworks to facilitate access to telecommunications services, governments have seen their ability to implement and enforce these policies and regulations hampered. The observations made in this article raise doubts about the initial commitment made by the government towards bridging the market efficiency gap. They also raise questions over the nature of the agreements signed by the Secretariat of Communications and Transport and operators undertaking the installation of telephone lines, specifically operation and maintenance in accordance with acceptable standards.

The results of this study indicate the importance of having a robust institutional framework to guarantee proper implementation of policies and regulations, both those designed to promote competition and efficient expansion of telecommunications markets (and hence address the market efficiency gap), and those intended to bridge the access gap. To a large extent, it is shortcomings in

[88] Burkart.

[89] Responsiveness is defined in political theory as one of the key indicators of the quality of a democracy and refers to the extent to which public policy matches the needs of citizens. Larry Diamond and Leonardo Morlino, "Introduction," in *Assessing the Quality of Democracy*, ed. Larry Diamond and Leonardo Morlino (Baltimore: Johns Hopkins University Press, 2005), ix-xliii. Meanwhile, Powell defines responsiveness (to public will) as being "…what happens when the democratic process leads the government to draw up and implement policies wanted (needed) by citizens." G. Bingham Powell, "The Chain of Responsiveness," *Journal of Democracy* 15, no. 4 (2004): 91-105.

the design and implementation of telecommunications policies and regulations that account for the gap in coverage of such services among the lower income population.

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