THE IMPACT OF BROADBAND POLICY ON THE ECONOMY

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BIOGRAPHY

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ABSTRACT

This paper explores the relationship between telecommunications policy and its impact on the economy. Its focus is the Latin American region, starting by assessing the results of new research on broadband economic impact. Having validated the causality through econometric analysis, it then moves to analyze the importance of public policy in maximizing broadband development. This analysis is based on case studies of Latin American countries (Chile, Mexico, and Venezuela).

KEYWORDS

Telecommunications policy, Broadband, Infrastructure, platform-based competition

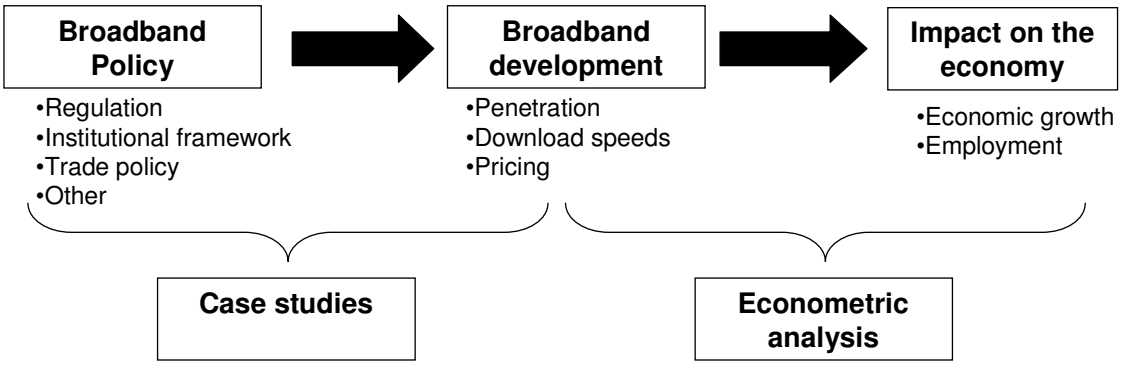
INTRODUCTION:

The purpose of this paper is to explore the relationship between telecommunications policy and its impact on the economy. The assessment of causality is conducted with the purpose of responding to a number of critical questions:

- What is the impact of broadband on the economy?
- Are there policies and frameworks consistently associated with maximum deployment of broadband and, consequently, impact on the economy?
- Do markets with more open, stable and predictable regulatory environments yield higher development of telecommunications infrastructure?
- What non-regulatory policy initiatives successfully promote dissemination of ICT, and how does their success depend on the policy and regulatory framework?

The focus of the paper is the Latin American broadband industry, starting by assessing the results of new research on broadband economic impact. Having validated the causality through econometric analysis, it then moves to analyze the importance of public policy in maximizing broadband development. This analysis is based on case studies of Latin American countries (Chile, Mexico, and Venezuela).

Overall Roadmap and Methodology



The statistical analysis of broadband economic impact focuses on two areas: impact on economic growth and employment creation. The impact on growth is ascertained through econometric analysis of a cross-sectional sample of 24 countries in Latin America and the Caribbean. The impact on employment is conducted through a model of Chilean regional data. With the two analyses confirming the findings of international research, we then move to evaluate the policy frameworks that allow us to maximize the impact of broadband. This evaluation is conducted through case studies that allow us to extract the more relevant qualitative variables.

We recognize that, given data limitations as well as the complexity of some of the relationships, it might not be possible to fully ascertain the impact of policy on broadband development. This is the reason why the conclusions to be derived from this analysis need to be combined with additional statistical work to complement our perspective with the rich combination of analytical techniques.

ECONOMIC IMPACT OF BROADBAND:

1. A review of the literature:

Broadband technology has been found to be a contributor to economic growth at several levels. First, the deployment of broadband technology across business enterprises contributes to the improvement of productivity resulting from the adoption of more efficient business processes (e.g., marketing of excess inventories, optimization of supply chains). Second, extensive deployment of broadband across the population contributes to the acceleration of innovation resulting from the introduction of new applications and services (e.g., new forms of commerce and financial intermediation). Third, broadband leads to a

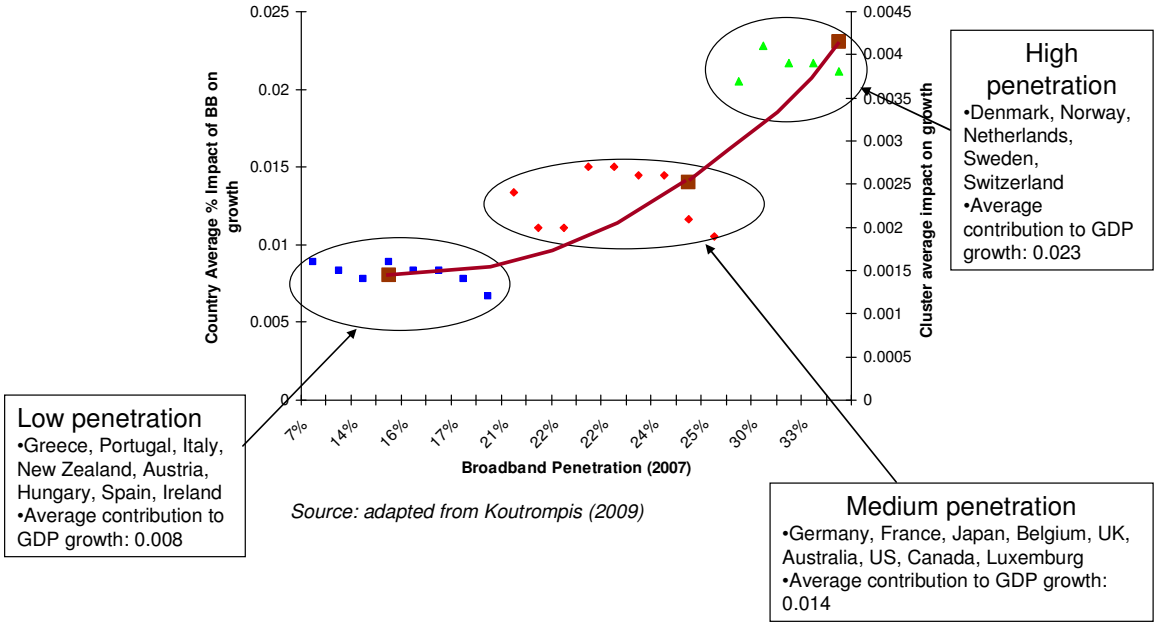
more efficient functional deployment of enterprises by maximizing their reach to labor pools or access to raw materials or consumers (e.g., outsourcing of services, virtual call centers).

These effects have been measured in the aggregate in numerous studies. Katz et al. (2010) conducted a study measuring the impact of broadband on the economic growth of Germany between 2003 and 2006. By relying on disaggregated county-level panel data of population growth, broadband penetration, and GDP per capita for the year 2000 for control purposes, the authors found that an incremental penetration of broadband of 1% yields 0.026% incremental growth in GDP. This result is fairly consistent with Koutrompis (2009) simultaneous equation-based analysis of 22 OECD countries, which found that an increase in broadband penetration of 1% yields 0.025% increase in economic growth. Finally, the World Bank in a recent study (Qiang, 2009) indicated that for high income economies, every 1 percentage point of broadband penetration yielded an additional 0.121 percentage points of GDP growth, while for low and middle income economies, 1 percentage point of broadband penetration yielded an additional 0.138 in economic growth. Though all these estimates are quite different, the conclusion is always the same: broadband penetration increases GDP growth.

In addition to measuring impact on economic growth, several studies have also estimated the effect of broadband deployment on employment creation. For example, Lehr et al. (2005) analyzed US level data disaggregated at the postal code level and found that broadband availability at a community level added over 1% to employment growth. Shideler et al. (2007) conducted a similar study relying on disaggregated county data for the state of Kentucky and found that an increase in broadband penetration of 1% contributes to total employment ranging from 0.14% to 5.32% depending on the industry sector.

In addition to confirming the aggregate economic impact, recent research has begun to establish that the effect of broadband grows with the level of penetration. Katz et al. (2010) have determined that the economic impact of broadband is stronger in those regions reaching higher levels of penetration. By dividing Germany in counties with high penetration of broadband (>34%) and low penetration (<34%), they observed that 1% increase in broadband penetration yielded 0.0238 percentage points increase to GDP in lesser advanced areas and 0.0256 in more broadband penetrated areas. This would validate the notion that, with network effects, the multiplier impact of broadband grows with penetration. These estimates are consistent with growing evidence of the "critical mass" theory of broadband economic impact. Koutrompis (2009) found that for OECD countries, the contribution of broadband to OECD growth increased with penetration (see figure 1).

Figure 1. OECD: Percentage of Impact of Broadband on GDP Growth



Source: adapted from Koutrompis (2009)

2. The impact of broadband on economic growth in Latin America:

In a prior paper, we presented a simple regression model linking Latin American broadband penetration and economic development (Katz, 2009). In this case, we have attempted to advance the research by developing a multi-variate equation based on the endogenous growth model (Barro, 1991) used by several authors to assess the impact of broadband and other

telecommunications technologies on a country's economic growth (Qiang et al, 2009; Crandall et al, 2007; Garbaz et al., 2008).

Given the lack of available time series data regarding broadband penetration in Latin American countries[1], we chose to conduct a cross-sectional analysis with data for the period 2004-2008, relying on OLS with robust errors. Two problems needed to be addressed with this type of analysis. The first problem refers to the fact that the constant does not capture the potential differences among countries in terms of specific factors. One possible solution is to rely on panel data, which would allow controlling for the country idiosyncratic factors. However, the limited availability of data prevented us from relying on this approach. However, by including the technology factor (e.g. broadband), we reduced the problems linked to the omitted variables.

The second problem has to do with the endogeneity between GDP per capita and broadband penetration. Ideally, we would have liked to tackle this problem by relying on an approach similar to Koutrompis (2009), who implemented a simultaneous equations model that endogeneizes the decision to deploy broadband as a function of GDP per capita, pricing, competition and regulation. However, given the lack of time series data on pricing and competition for Latin American countries, it was impossible to rely on this approach. In this case, to control for this problem, we relied on the lag of the broadband penetration variable.

The following variables were used (see figure 2):

Figure 2. Variables utilized to measure broadband impact on economic growth[2]

Type of variable	Data set	Source	Rationale
Economic growth	GDP (2004-8)	World Bank,	Dependent variable
Control for level of development	GDP per capita (2000)	World Bank	Measure for starting point of growth
Control for Investment	Investment/GDP (2004-8)	World Bank	Measure for differences in investment levels
Control for Human Capital	Tertiary education (2002)	Unesco, Earthtrends, University of West Indies, Euromonitor, Government of the Commonwealth of Dominica	Measure for differences in human capital
Broadband penetration growth	Broadband penetration growth (2003-4)	ITU	Independent variable

The results were as follows (see figure 3):

[1] We have broadband penetration data for the majority of Latin American and Caribbean countries alter 2003 (19 countries included in the sample).

[2] See data in Appendix A.

Figure 3. Broadband impact on economic growth in Latin America

GDP growth	Coefficient	Standard error	T-statistic	P>[t]	95% Conf. interval
GDP per capita 2000	-.0006045	.0002142	-2.82	0.011	-.0010528
Investment/GDP	-.0006496	.108927	-0.01	0.995	-.2286365
Tertiary education level	.1900042	.0670932	2.83	0.011	.0495766
Broadband penetration	.0177989	.0061606	2.89	0.009	.0049046
Constant	7.989611	4.063328	1.97	0.064	-.5150321

Number of observations	24
F(4,14)	14.34
Prob>F	0.0000
R2	0.4311
Root MSE	4.7802

As the results indicate, when controlling for educational level and starting point of development, 1% increase in broadband penetration yields 0.0178 point contribution to GDP growth. With this result, we proceeded to estimate the contribution of broadband to GDP growth. According to the IMF projection, the economic growth of Latin America and the Caribbean will be 3.4% between 2009 and 2010, resulting in a total GDP of US 3,925 billion. Our model estimates that the elasticity of broadband with respect to GDP growth is 0.0178% for a period without economic crises (2004-8). Assuming the possibility of sample bias (and given the lack of time series), we consider also the elasticity estimated by Koutrompis (2009) for countries with broadband penetration lower than 20%: 0.008%. Relying on the two extremes of the range, broadband growth between 2007 and 2008 (prorated average of 37%) contributed between US $6.7 billion and US $14.3 billion. This impact includes direct effects (in the telecommunications industry) and indirect (spillover), including not only the incremental impact but also the preservation of an economic growth rate.

3. The impact of broadband on employment creation in Latin America:

In addition to estimating the impact on GDP growth, we proceeded to estimate the contribution of broadband to employment creation. In this case, as defined in our work estimating the impact of broadband to employment creation in Germany (Katz et al, 2009), we needed time series disaggregated by region of a given country. We developed a data set by trimester for 12 regions of Chile (excluding the Metropolitan region because it lacks data by trimester) containing the following information:

Figure 4. Variables utilized to measure broadband impact on employment[3]

Type of variable	Data set	Source	Rationale
Occupation	Occupation rate (2002-9)	Regional Institute of Statistics	Dependent variable
Control for labor intensity of region	Economic activity index (2001-9)	Regional Institute of Statistics	Measure for starting point of growth
Broadband penetration growth	Broadband penetration growth (2002-9)	Subtel	Independent variable

[3] See datasets in Appendix B.

The specific characteristics of each region that have an impact on the labor market (industrial sector, educational level) are controlled by the fixed effects of the panel data.

Figure 5. Broadband impact on employment in Chile

Occupation Rate	Coefficient	Standard error	T-statistic	P>[t]	95% Conf. interval
Control for labor intensity of region (-1)	0.0003509	0.0000595	5.90	0.000	.0002338
Broadband penetration growth (-1)	0.0018118	0.0004708	3.85	0.000	.0008853
Constant	0.8682527	0.0079638	109.03	0.000	.85258283

Number of observations	
F(4,14)	324
Prob>F	0.0000
F(2,310)	60.89
R2	0.2820

According to the model, 1 percentage point increase in broadband penetration results in an increase of 0.18 points in the occupation rate. With an average occupation rate of 93% of the economically active population, the Chilean labor force amounts to 6,500,000 individuals. Of this, broadband contributed 0.18 points in the occupation rate for each 1% of penetration. Chile has reached a broadband penetration of 9.78% which determines that broadband has contributed to 1.76 percentage points to the national occupation rate. This results in 114,500 jobs between direct and indirect effects.

THE IMPACT OF PUBLIC POLICY ON TELECOMMUNICATIONS DEPLOYMENT:

Having provided evidence that broadband has an economic impact in Latin America, we now turn to studying how the policy domain can maximize service deployment and quality (e.g. speed). In doing so, we will identify the variables that are likely to have stronger influence in the growth of broadband penetration. We will start by constructing a theoretical framework based on a review of the research literature and then we will test that framework in the light of case study data, examining the experiences of Chile, Mexico and Venezuela.

1. A review of the research literature of the impact of policy on telecommunications deployment:

The level of development of telecommunications in a given country can be measured by three types of variables: 1) those that measure service adoption, 2) those that measure the rate of new product innovation, and 3) the economic performance of the telecommunications industry. Service adoption variables measure not only penetration (e.g. broadband subscribers per population or households, wireless subscribers per population), but also pricing trends that can stimulate adoption via demand elasticity (e.g. broadband subscription, wireless service revenue per minute, etc.). Product innovation variables focus on product variety, feature functionality and service quality. They can be measured through indicators such as percent of mobile ARPU derived from data services, quality of service (in mobile services, dropped calls, service coverage; in wireline services, mean time to repair, number of faults per total access lines), etc. Finally, economic performance variables comprise industry output and profits (revenues and EBITDA margins), and capital investment.

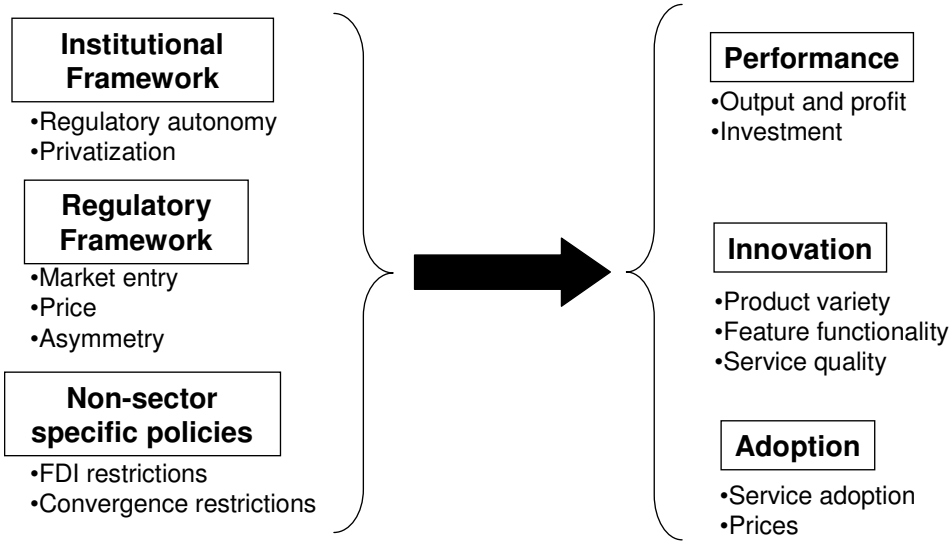
The level of development can be influenced by several policy-oriented variables which can be grouped in three clusters: 1) the institutional framework, 2) the regulatory framework, and 3) non-sector specific policies which can have a spillover effect on the telecommunications sector. The institutional variables comprise the factors assessing the interrelationships between the governmental entities that are in charge of developing policy or regulating the sector and the providers of service. For

example, the variables included in this cluster comprise the overall institutional environment (e.g. scope and scale of national regulatory authorities, enforcement powers, dispute settlement, effectiveness of appeals), the separation between incumbent and regulatory activities, regulatory independence (e.g. autonomy, accountability, clarity of roles, and transparency of process), the existence of an overarching telecommunications law, and the privatization or not of the incumbent service provider.

The regulatory variables comprise all those related to specific policies and regulatory approaches. They include market entry regulation (e.g. vertical separation, local loop unbundling, rights of way, numbering scheme, spectrum management), price regulation (interconnection, mobile termination rates, weighted average cost of capital, retail pricing), investment incentive regulation (e.g. asymmetry), the NRA's regulatory process (e.g. market analysis ex-ante), and the application of regulation by the NRA (e.g. technological neutrality, operational conditions, compliance monitoring).

Finally, non-sector specific policies that can have an impact on the performance of the ICT sector comprise variables such as direct foreign investment restrictions affecting market entry and capital structure, other trade restrictions affecting services supply, proactive long term government planning, and regulation of audiovisual content affecting convergence (e.g. restrictions of telecommunications carriers regarding content distribution). Each group of policy variables can have an impact on the development of telecommunications in a given country (see figure 6).

Figure 6. Relationship between policy variables and telecommunications development



The research literature has generated sufficient evidence regarding the impact of the institutional framework on telecommunications service adoption and sector economic performance. For example, regulatory autonomy has found to have a positive impact on wireless prices and penetration, privatization of state-owned monopolies has a positive statistically significant effect on sector performance (Bouras et al., 2009) and improved institutional framework (e.g. independent NRA, lower corruption, contract enforcement) leads to better sector performance (Maiorano et al., 2007; Waverman et al, 2007).

Furthermore, the regulatory framework, particularly specific policies, has significant impact on telecommunications service adoption and sector economic performance. For example, competition in wireline has a positive statistically significant impact on network deployment (Li et al, 2004; Grzybowski, 2008; Wallsten, 2001). In the case of wireless, the policy framework was found to have an impact on the diffusion and pricing of wireless services. For example, competition and number portability (when combined with regulatory autonomy) have a positive impact on wireless prices and penetration, while number portability has a negative impact on prices (Maiorano et al. (2007); Grzybowski (2005)).

In the case of broadband, access regulation discourages investment by incumbents and individual entrants even as entrants total investment increases. With very few caveats, platform-based competition appears to be the key variable explaining broadband deployment, as concluded by Distaso et al. (2006), Cava-Ferreruela et al. (2006), Boyle (2008), Wallsten (2006) and Garcia Murillo (2005) (although in this case for high income countries). Lee et al. (2008) determine that the impact of platform-based competition is stronger when the share of technologies reaches parity (this related to competitive intensity).

Waverman et al. (2007) determined that unbundling tends to weaken facilities-based competition and reduce infrastructure investment. Conversely, most studies provide limited evidence on the importance of LLU in fostering broadband adoption. There is a small, statistically insignificant positive effect (Distaso, et al., 2006; Cava-Ferreruela et al., 2006), and a small effect which is neither consistently positive nor consistently significant (Wallsten, 2006). Bauer et al. (2004) produced the only study that failed to identify an impact of competition policy on broadband penetration, although this could be related to the early time at which the research was conducted therefore relying on very preliminary data sets, while Ford and Spiwak (2004) determined that unbundling prices had a positive impact on broadband availability.

Beyond these findings, the research literature also found that the impact of policy on level of innovation as well as the comprehensive impact of all policy variables on sector performance has not been yet fully analyzed. More specifically, research on the assessment of the impact of regulation and policy variables on rate of sector innovation is non existent. Similarly, there is limited analysis on the impact of trade regulation on sector performance. Finally, there is no comprehensive study between all regulatory and policy variables and full sector performance. This has led us to focus our case study analysis in the areas that require additional insight in terms of the relationship between policy and sector performance:

- What is impact of specific policies on broadband development?
- What is the impact of the institutional and regulatory variables on broadband innovation?
- What is the impact of non-sector specific variables on broadband deployment and quality?

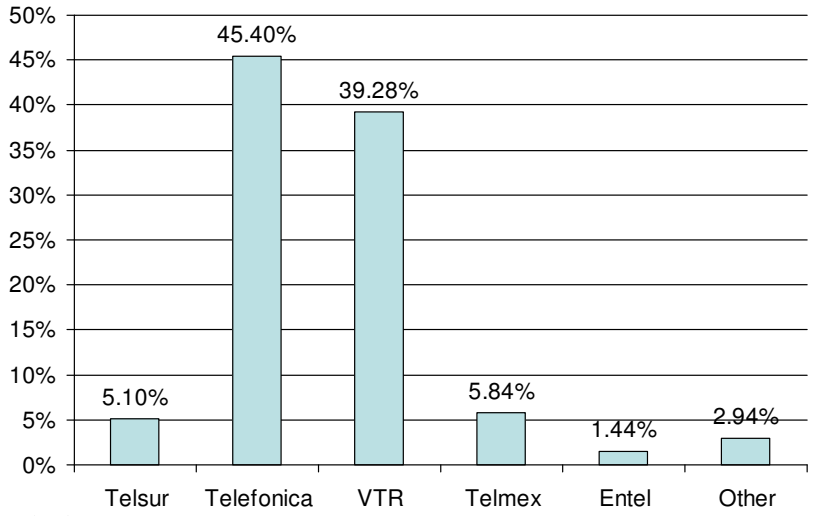
In order to identify likely policy effects on the telecommunications sector, we have constructed three case studies of Latin American countries: Chile, Mexico and Venezuela. In them, we will examine the policies relied upon for the development of broadband services.

2. Chile:

Chile's current regulatory framework is based on free access and full competition in all segments of the telecommunications industry. Licenses are provided to offer services and to operate their respective networks. In this sense, the prevailing competition model is one of platform-based competition. However, there are in the regulatory framework some specific principles that could have opened the way to the enactment of a service-based competitive model. For example, a tariff decree promulgated in 1999 establishes the possibility of unbundling the network in its elements, opening the possibility of entry of virtual carriers. This decree is also supported by the Telecommunications Law which defines a type of license to be given to network operators offering exclusively wholesale services to retail carriers (this license is denominated Telecommunications Intermediate Services). However, due to changes in the orientation of the regulatory philosophy, the unbundling of the telecommunications network is not considered to be part of the current policy agenda.

As a result, Chile's competitive environment exhibits two strong vertically-integrated players (and several smaller ones) competing for the broadband market. Their market shares are fairly distributed which provides an incentive to compete for product development and pricing (see figure 7).

Figure 7. Chile: Broadband Market Shares (2009)



Source: Subtel

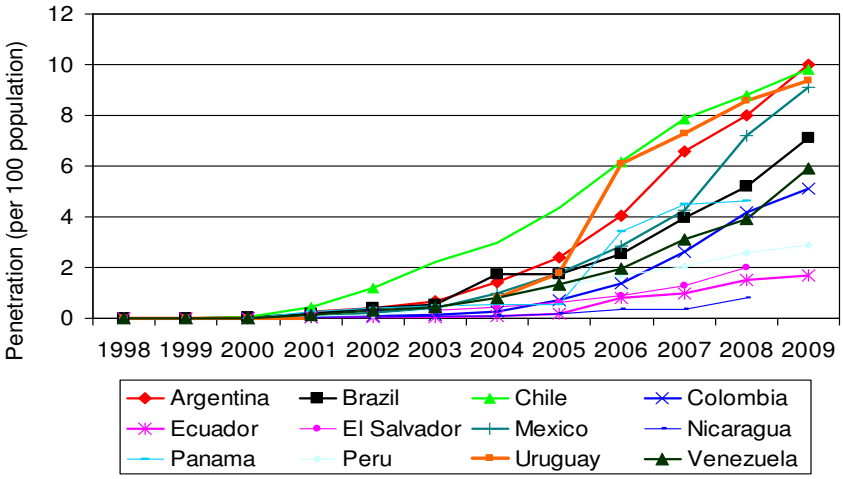
In 2007, the government developed a Strategic Plan for Digital Development for the 2007-2012 period. The vision articulated in the Digital Plan identifies ICT as a key lever to accelerate economic growth, and underlines the need to promote digital literacy, foster the adoption of ICT by the business sector, and the development of software as a means of increasing productivity and the competitiveness of the economy. In the ICT supply side, the objective is to develop products locally and therefore render Chile in an attractive target for the investment in the technology sector. On the demand side, the objectives are to update the intellectual property laws, the protection of personal information stored in digital format, the defense of the Internet consumer rights, and the codification of digital criminal law. The Chilean Digital Agenda is also quite clear with regard to those industries where ICT adoption needs to be focused on: mining, fisheries, forestry and tourism. To increase the competitiveness of sectors, the agenda proposes to conduct a massive adoption of ICT aimed at streamlining business process. In order to achieve this, the Plan recommends doubling the investment rate of ICT in the private and public sectors. To facilitate adoption of ICT by the enterprises and public administration, the Plan proposes the creation of support centers that will provide computer training and information in particular to small and medium enterprises. In addition, the Digital Agenda proposes to create a Portal aimed at promoting Chilean products internationally.

With regards to the development of broadband, the Chilean Strategic Plan stipulated the need to double the number of broadband accesses and outlined several proposals to stimulate broadband adoption:

- Create an "Educational Digital Network", aimed at connecting 70% of the schools, with support of direct subsidies to 4,000 schools
- Redefine the position of public broadband access centers on the basis of better supporting the community
- Promote the offer of telecommunications services in isolated areas in order to increase broadband coverage. The target is to reach 2,300,000 connected households
- Improve quality and reduce cost of broadband access with the objective of providing low cost connectivity to 200 communities
- Double the number of enterprise centers with the objective of providing public access to small enterprises and offering digital training services

These policies have benefited Chile in terms of the development of a broadband network that can be accessed at reasonable prices. Chile is one of the most advanced countries in the Latin American region in terms of broadband (see figure 8).

Figure 8. Latin America: Broadband Penetration (2000-2009)



Fuentes: UIT; autoridades regulatorias

Sources: ITU; Regulatory authorities

According to the data in figure 8, Chile is, jointly with Argentina, the most advanced broadband nation in the region.

Furthermore, platform-based competition has led to an important reduction of broadband prices. In 2002, broadband was offered as a stand-alone product with prices ranging between $ 29.900 (US$ 42) for 512kbps and $ 36.900 (US$ 52) for 1024 kbps. In 2008, broadband was sold within bundles under prices ranging from $ 8.500 (US$ 17.7) for 300kbps and $ 12.500 (US$ 26.1) for 1 Mbps. According to this, the cost of 1 Mbps has decreased from approximately US$ 52 in 2002 to US$ 26.1 in 2008; this represents a decrease of 50%.

Finally, broadband service quality, as measured by download speeds, show Chile as one of the most advanced country in the region (the highest percent of >1 Mbps lines).

Figure 9. Latin America: Broadband access speeds (2008)

	< 256 Kpbs	256-512 Kbps	512 Kbps-1 MBPs	> 1 Mbps
Argentina	3 %	16 %	57 %	24 %
Brazil	13 %	28 %	31 %	28 %
Chile	10 %	25 %	34 %	31 %
Colombia	7 %	15 %	53 %	25 %
Peru	43 %	35 %	18 %	4 %

Sources: IDC/Cisco; Osiptel (Peru); CRT (Colombia)

To summarize, two features appear to be critical in the development of the broadband sector in Chile: platform-based competition and a clearly formulated plan outlining objectives, targets and means to achieve coverage.

3. Mexico:

The Mexican incumbent telecommunications carrier (Telmex) was privatized in 1990 to a group of investors (Grupo Carso, Southwestern Bell and France Telecom). As part of enhancing the sale price and to strengthen it before it would compete with foreign firms, it was awarded a six year monopoly on long distance services and the B Band spectrum for mobile telephony. Local service was open to competition, but no licenses were awarded until 19964. The A Band concessions began offering competitive mobile services in 1989. The mobile sector, following international trends, was structured as a duopoly.

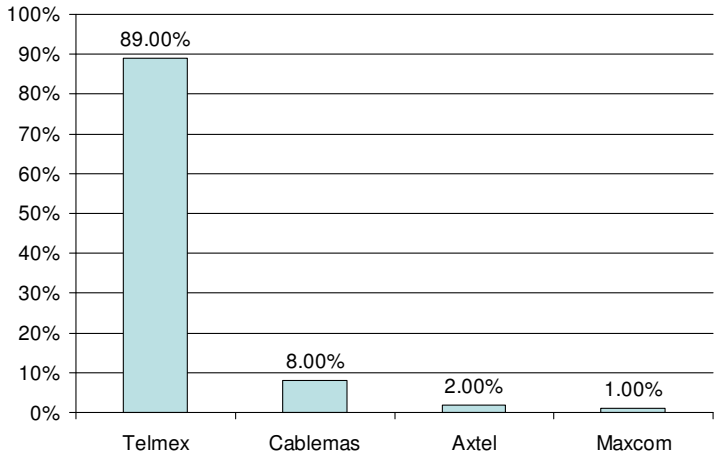
[4] Even so, there were no interconnection regulations that would have allowed competition until 1998.

Intercompany roaming was not available, giving a large competitive advantage to Telmex/Telcel, as they had a nationwide footprint

In 1995, Congress passed the Federal Law of Telecommunications, which is the main piece of legislation regulating the sector. The law fully opened the sector to competition5, created a national independent regulator (Cofetel), and provided a general framework for interconnection. Despite the intended administrative and technical independence of Cofetel, this agency continues to report to the Ministry of Communications, SCT, thus creating an inefficient policy process.

The Mexican broadband industry is extremely concentrated (see figure 10).

Figure 10. Mexico: Broadband Market Shares (2009)



Source: Company reports; analysis by the authors

Telmex controls 89 % of access lines (and 68% of revenues). Broadband penetration in Mexico was lagging Argentina and Chile and until 2004, Brazil. In 2003, when the cable TV operators were authorized to offer broadband services, Telmex responded by launching an aggressive service offer, coupled with subsidized PCs. Based on this effort, Mexico has rapidly reached the level of Latin American country leaders. Currently, broadband policies benefit mostly cable TV operators since the fixed line telecommunications incumbent (Telmex) is prohibited from providing triple play services, therefore reducing the value of its broadband offer.

At this time, the government has defined a target to significantly increase broadband penetration by 2012 by stimulating more competition. For this purpose, a national fiber optic infrastructure will be auctioned in order to be able to deploy a backbone network which would be an alternative to Telmex', with the objective of eliminating specific market bottlenecks. Nevertheless, the government has so far failed to develop and implement a universal broadband policy.

Mexico is still lagging other Latin American countries in terms of broadband speeds. Moreover, the offerings of incumbents in other countries in the region are at least twice the speed of Telmex in Mexico[6] (see figure 11).

[5] The law provided for uncapped foreign direct investment only in mobile telephony (full foreign ownership for fixed and other telecommunications services is still widely discussed in Congress 15 years later).

[6] It should be mentioned that Megacable is the only operator that currently offers speeds above 4 Mb in Mexico, but it still does not provide competitive pressures because the service is not widely available.

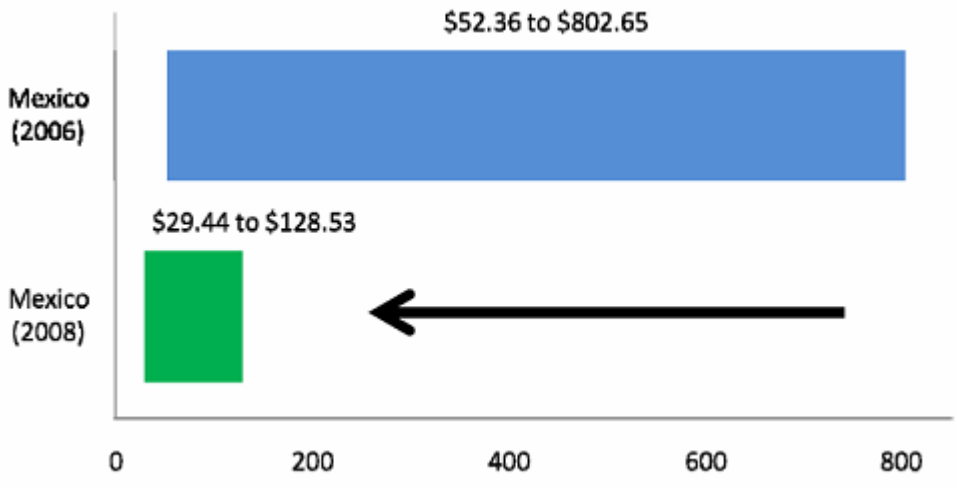
Figure 11: Latin America: Comparison of broadband prices among incumbents and cable TV operators 2009 (USD)

Country	Company	Minimum Speed		Medium Speed		Maximum Speed	
		Download Speed	Price USD	Download Speed	Price USD	Download Speed	Price USD
Mexico	Telmex	1Mb	22.40	2 Mb	44.87	4 Mb	89.74
	Megacable	1Mb	14.91	2Mb	22.40	10 Mb	59.85
Chile	Telefonica	1 Mb	29.91	4 Mb	39.55	8 Mb	53.00
	VTR	2Mb	41.15	4 Mb	45.90	15 Mb	56.97
Brazil	Telefonica	1 Mb	25.66	4Mb	42.02	8 Mb	93.43
	Net Servicios	3 Mb	49.03	6 Mb	65.39	12 Mb	112.12
Argentina	Arnet	1 Mb	19.46	5 Mb	36.58	20 Mb	118.82
	Fibertel	1 Mb	19.26	5 Mb	64.93	10 Mb	108.22

Source: Companies websites

Furthermore, the price of broadband services is a perfect example of the positive impact of competition. Pricing of broadband has remained relatively high in Mexico until cable TV operators were allowed to enter the market. Only after the cable companies were allowed to provide "triple play", the prices from broadband services have fell drastically. (See figure 12).

Figure 12. Mexico: Span of observed monthly subscription prices for broadband (USD PPP)



Source: OECD Communication Developments: Mexico (2009)

The resulting pricing in broadband indicates an alignment of prices (see figure 13)

Figure 13. Mexico: Comparable Broadband Services and Prices

Company	Minimum Speed		Medium Speed		Maximum Speed	
	Download Speed	Price USD	Download Speed	Price USD	Download Speed	Price USD
Telmex	1Mb	22.4	2 Mb	44.87	4 Mb	89.74
Megacable	1Mb	14.91	2Mb	22.4	10 Mb	59.85
Cablevision	450 Kbps	23.09	1.5 Mb	31.01		
Axtel	1Mb	29.29				
Cablecast	1.5 Mb	25.39	2 Mb	33.41	3 Mb	50.19

Source: Signals Telecom Consulting (2009)

While the reduction of prices in broadband services has been the result of competition in the market, it is important to mention that this competition could be affected if Telmex is allowed to enter the pay-tv market using its IPTV ready network.

4. Venezuela:

The evolution of the Venezuelan telecommunications industry has been consistently influenced by the political environment and macro-economic difficulties that have affected the country for the last three decades. During this period, the sector has undergone three important reforms, the privatization of the Venezuelan National Telephone Company (CANTV) and its mobile affiliate Movilnet, the liberalization of the local telephony market and the re-nationalization of CANTV and Movilnet.

The concession contract attached to the privatization stipulated that CANTV was granted the exclusivity right to provide local telephony service and local and international calls for 9 years (1992-2000). All other telecommunications services were to be offered in competition after 1990.

In June 2000 an Organic Telecommunications Law came into force, replacing the 1940 law. The new regulatory framework included rules to ensure universal access to telecommunications services and encouraging competition. Particular emphasis was given to interconnection, requiring it to be charged based on real costs plus a reasonable profit margin. The end of the exclusivity period meant that other providers would be allowed to compete in the provision of the local basic service and the first measure taken by the government was the auction of spectrum for the provision of Wireless Local Loop (WLL). The government awarded four WLL licenses, one to Telefonica and the remaining three to regional providers, which later merged in a single company (Digitel).

In 2006, President Chavez threatened CANTV with nationalization if the company did not pay the retirees. In February 2007, the president orders the nationalization of the operator and after a period of negotiations in May of that year the state buys out Verizon7. The resulting structure of the Venezuelan telecommunications sector following the nationalization comprises a mix of state-owned and private suppliers. All markets, fixed wireline included, exhibit a fair amount of competitive activity, although the state-owned company remains dominant throughout the market (see figure 14).

[7] The US company had assumed ownership of CANTV following their acquisition of GTE, primary shareholder of VenWorld, acquirer of the carrier at the time of privatization. GTE had also bought ATT and Telefonica's shares.

Figure 14. Venezuela: State-owned versus private sector shares (YE 2008)

	State-owned	Private Sector	
		Total share	Share of Top player
Fixed Line	78.5 %	21.5 %	19.6 % (Telefónica)
Wireless subscribers	42.9 %	57.1 %	37.9 % (Telefónica)
Wireless revenues	37.7 %	62.3 %	50.8 % (Telefónica)
Broadband	70 %	30 %	~12% (Telefónica)
Pay TV	0 %	100 %	38 % (Direct TV)

Sources: BMI (2009); Merrill Lynch (2009)

The fixed line market is split between CANTV (78.5 % share), Movistar (19.6 % share through a WLL offer), Digitel (1.5% with a WLL offer restricted to areas with lower than 5,000 population) and cable TV operators (NetUno, Intercable) (0.4%)8. The mobile market is served by Movilnet, a subsidiary of CANTV (42.9 % share), Movistar, owned by Telefónica9 (37.9 %) and Telvenco/Digitel10, owned by the Cisneros Group (19.2 %). Finally, the broadband market is split between CANTV.net (70%), cable TV operators (NetUno, InterCable) and wireless providers.

In 2007, the Ministry of the Popular Power for Telecommunications and Informatics presented the "The Telecommunications, Informatics and Postal Service National Plan", which established that all of the citizens should be granted access to the services offered by the sector. This effort comprises the introduction of low-cost ICT offerings as well as the deployment of ICT infrastructure in order to cover the entire national territory. To promote universal service and adoption of telecommunications services among low-income segments, the government has been actively intervening in the market through CANTV, its mobile subsidiary, and a newly launched telecommunications satellite.

In October 2008, CANTV's "Tarifa Solidaria", a special tariff for low-income customers, was launched for residential subscribers. The country was divided in regions, which were defined by a series of defined parameters to have four options available for the solidarity tariff. The Limited and Classic plans are postpaid services, while two prepaid services, Basic and Free Minutes, are also available. Pre-paid broadband services were also launched in May 2008 under the ABA brand, offering 100MB of downloads with a download speed of 256 Kbps for US$9.34 with each additional 1MB used costing US$ 0.07.

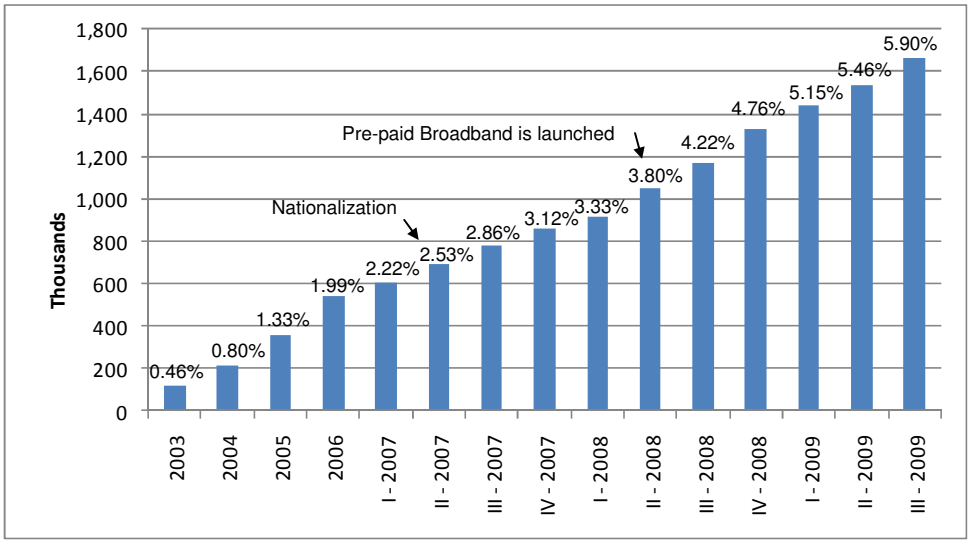
A similar effect can be seen in the broadband arena, where CANTV controls more than 70% of the market. Even though only aggregate information is available, a relatively important effect was detected after the implementation of broadband pre-paid plans (see figure 15).

[8] The cable companies started including a VoIP offer in 4Q08.

[9] Telefónica acquired Telcel, which was the first mobile carrier, from BellSouth in October 2004. Since April 2005, the company operates under the Movistar brand.

[10] Digitel launched as a wireless provider in August 1999 serving the central region of Venezuela. In October 2000, Telecom Italia Mobile acquired a controlling share, which it sold later to a local private equity group, Televenco, owned by the Cisneros Group. Televenco acquired two other local operators: Digicel and Infonet.

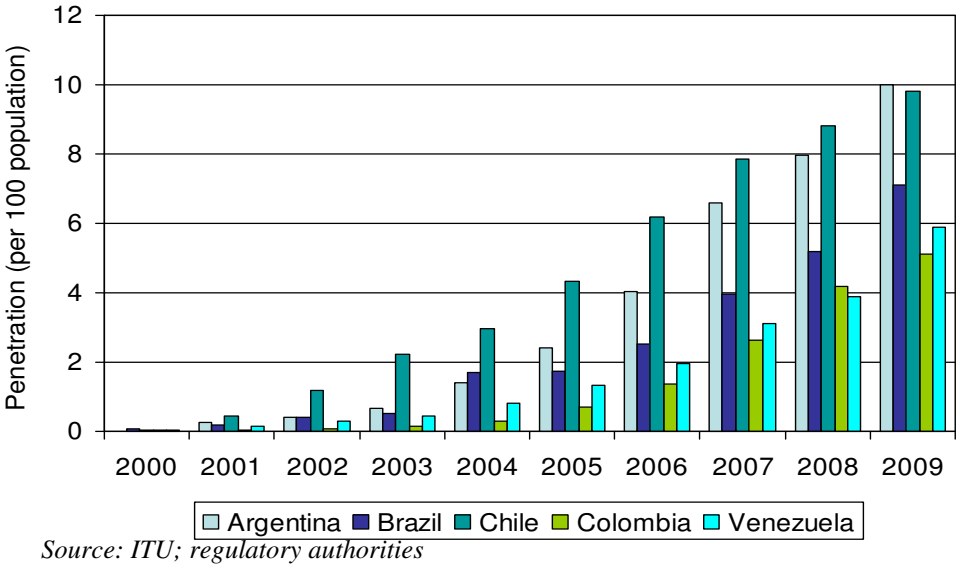
Figure 15. Venezuela: Broadband Penetration



Source: Company reports; analysis by the authors

When prepaid broadband is launched, penetration starts to grow faster. Nevertheless, this effect is not sufficient. Venezuela is still lagging in the development of broadband (see figure 16).

Figure 16. Latin America: Comparative penetration of broadband

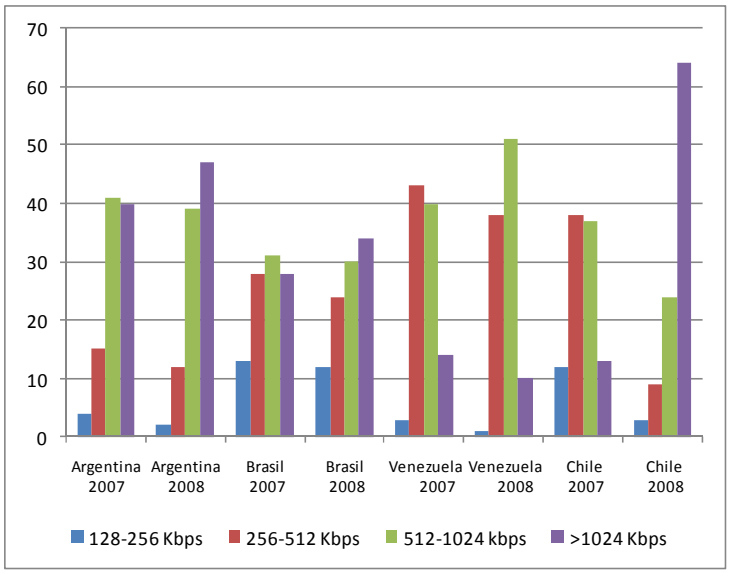


Source: ITU; regulatory authorities

As shown in Figure 16, Venezuela's broadband penetration in 2009 is 5.90 %, the second lowest among peers in the Latin American region. This could substantiate a hypothesis that the process of state intervention is having positive benefits in the diffusion of basic telecommunications services while having a negative impact on the rate of innovation.

The limited competition in fixed broadband services has had also an impact on the rate of service innovation, when measured by the introduction of faster download speeds. When comparing the 2007-2008 evolution of the distribution of broadband connections by download speed, it can be seen that Venezuela has not kept up with the pace of other Latin American countries (see figure 17).

Figure 17. Latin America: Comparative Broadband Download Speeds



Source: Cisco/IDC

As figure 17 indicates, the increase in access lines by download speeds has occurred within the slower categories (128-256 kbps), yielding a decrease in the absolute proportion of faster access lines (>12024 Kbps). This effect is a direct consequence of the lack of interest on the part of the incumbent to increase service quality11.

5. An explanatory framework

The case studies will allow to test which are the conditions under which broadband achieves the highest level of development, thereby having an impact on the economy

[11] For example, in Chile the main fixed line operators offer minimum speeds of 1 Mb and maximum speeds of 15 Mb. In Argentina, even though there are offers with speeds below 1 Mb, the maximum speed offered is 20 Mb.

Clusters	Policies	Alternatives	Chile	Mexico	Venezuela
Institutional Framework	Regulatory independence	• The regulatory authority is independent in terms of finance, structure and decision making from the operator(s) and the Ministry of Communications • The regulatory authority is autonomous in decision making	• No • No	• No • Yes	• No • No
	Privatization stages	• State-owned company • Up to a 50% of the company is owned by private shareholders • More than 51% of the company is owned by private shareholders, but the government still holds shares • The privatization is complete	• Privatized	Privatized	• State-owned
	Industrial and/or development plan	• Is there a digital plan? Is it revised periodically? • Is there a comprehensive ICT strategic plan? Is it revised periodically? • Are there demand-side incentives and an ICT oriented industrial policy?	• Yes • Yes • Yes	• No • No • No	• Yes, but not revised • Yes • Yes, government partnerships
Regulatory Framework	Level of competition	• Services (fixed, wireless, broadband, VAS, etc.) under partial, managed or full competition	• Full competition	• Managed	• Managed
	Universal Service Obligations	• Does universal services/service policy exist? • Which services are covered by USO (wireline, broadband)? • Which operators are under USO (incumbent, all)?	• Yes, for voice	• Yes, for voice	• Yes, for voice, dial-up, telecenters
	VoIP regulation	• Is VoIP service allowed? • Is there a VoIP regulation in place?	• Yes • Yes	• Yes • No	• No • No
Non-sector specific variables	Wireless, AS, ISP ownership restrictions	• Are foreigners prohibited from holding shares in an operator? • Are foreigners allowed to own up to 49% of an operator? • Are foreigners allowed to own more than 49% of a company, but a national partner is required? • There are no restrictions on foreign ownership	• No restrictions	• No restrictions	• No restrictions
	Fixed line ownership restrictions	• Are foreigners prohibited from holding shares in an operator? • Are foreigners allowed to own up to 49% of an operator? • Are foreigners allowed to own more than 49% of a company, but a national partner is required? • There are no restrictions on foreign ownership	• No restrictions	• Up to 49% of shares	• No restrictions

In the three case studies, one can determine that an overarching government vision determines the policies to be followed, which can ultimately have an impact on the development of broadband. Furthermore, it is not the independence of the regulator but rather the overall strength of the institutional framework the variable that influences the development of broadband, and ultimately, the telecommunications sector.

In the Chilean case, the overall vision of the government has been to stimulate the development of sustainable competition as a key driver of industry development. This vision has been carried through by government entities such as the regulator (Superintendencia de Telecomunicaciones) or the competition commission (Tribunal de la Libre Competencia). A paradigmatic decision of the competition commission was the authorization of the merger between VTR and Metropolis, two cable TV operators, whose combined market share was 90%. The policy objective at the time was to create a strong telecommunications facilities-based competitor, capable o stimulating the development of the broadband market. This validated the policy of stimulating platform-based competition. The policy commitment is supported by the existence of a government policy and plan oriented toward achieving broadband development.

In the Mexican case, the policy aimed at supporting the development of a dominant carrier and defining the right incentives for investment and development of broadband. The results have been very slow to come. In fact, the acceleration of broadband development occurred only at the time that the government started to favor the development of cable TV as a competitive alternative to the incumbent. Still at this time, the Mexican government is facing two obstacles. First, foreign investment in wireline telephony is restricted in Mexico. This forced the government to rely on nationally owned cable TV companies, with lesser investment capacity. To deal with this situation, the government might be allowing a partnership of Movistar (foreign-owned), Televisa (the strongest media company) and Cablemas (a cable TV operator) to purchase a government-owned fiber backbone for auction. Chile, who does not have a foreign investment restriction never had to deal with this issue. In fact, the largest investor in VTR is Liberty Media, a foreign capital media company.

The second obstacle resides in the weakness of the Mexican institutional framework. Once the government reorients its policy toward developing platform-based competition, it took significant time to recognize the dominant market power of the incumbent and impose asymmetric regulation. The existence of judicial recourse ("amparo") results in the ability of the incumbent to delay the enactment of asymmetric regulation.

Finally, contrary to the other cases, Mexico lacks a government plan oriented toward fulfilling broadband deployment, as is the case in Chile and, at least in partial fashion, in Venezuela.

The Venezuelan case exhibits some factors similar to the Mexican experience. Notwithstanding, the exogenous factors (devaluation, government intervention for the re-nationalization), the policy objective was to create a dominant player that would receive the incentives to deploy infrastructure. When this did not occur, the government nationalization resulted in the imposition of network deployment targets (among them broadband) in order to reach high penetration. The objective of the government-mandated goal is to reach high levels of massification through pre-paid low quality service. It is unclear, as of yet, whether this government policy allows the development of competition for the high end and the corporate market with higher speed and quality broadband service

In sum, platform-based competition and institutional strength appear to be the most important variables driving broadband development and innovation in the region. The Chilean experience of being the most successful broadband nation supports this; the turnaround in Mexico validates it as well, although the challenge remains the lack of institutional strength. Government mandated policy in Venezuela has been successful in promoting service penetration but still lacking innovation.

CONCLUSION:

The purpose of this paper was to determine the economic impact broadband in the region and establish whether the policy and regulatory variables have an impact on the development of the technology.

In the first place, we were able to generate evidence supporting the economic impact of broadband in the region:

- Broadband is contributing to GDP growth along the following parameters: 1 percentage point in broadband penetration can generate 0.0178 percentage points in GDP growth
- Similarly, broadband contributes to the creation of jobs: 1 percentage point increase in broadband penetration results in an increase of 0.18 points in the occupation rate

The case studies successfully identified policy and regulatory variables that explain the successful development of broadband:

- Platform based competition: in Chile and evolving in Mexico
- Institutional strength: in Chile
- Existence of a government plan: in Chile and Venezuela (oriented toward service massification)
- Freedom of foreign investment: in Chile and partial in the other two countries

In sum, if a country wants to develop high quality, highly deployed broadband services, it needs to stimulate the development of platform-based competition, strengthen the institutional framework to build an adequate set of checks and balances that guarantee sustainable competition, develop a government broadband plan, and allow for total foreign direct investment.

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Appendix A. Data used for estimating impact of broadband on the economy

countrycode	GDP_per_capita	Investment	Growth_GDP	Education	BBpen
ATG		66.2797	8.9403		
ARG	7702.89	20.6923	16.5867	61.1355	107.823
ABW	20502.1			28.2821	387.313
BHS	16506.7	29.3046	4.3506	24	15.5457
BRB	10168	20.1008	5.5318	37.2433	8.1841
BLZ	3329.86	18.6054	5.521	1.93629	194.065
BOL	1009.76	13.5399	14.8069	38.2594	49.0383
BRA	3701.47	16.7093	18.9152	20.1332	222.64
CYM				18.8224	
CHL	4880.05	21.0708	12.0877	41.0088	34.5049
COL	2364.27	23.1895	19.9581	24.0214	94.2288
CRI	4058.86	20.4167	9.9618	18.9653	84.3765
CUB				27.8023	
DMA	3802.05	27.4794	5.0248	10.72	22.9353
DOM	2744.36	17.1358	16.2107	34.0052	144.656
ECU	1295.48	21.5539	11.6646	26	66.1192
SLV	2209.16	16.5201	9.8179	17.4876	49.0833
GRD	4078.75	50.4495	8.4024	4.5791246	
GTM	1717.86	19.3484	10.2256	9.51231	
GUY	942.36	24.7934	8.0225	6.51219	
HTI	448.932	28.3518	13.1886	1	
HND	1146.87	27.2208	9.8352	17.259	
JAM	3479.06		10.1887	19.1449	197.798
MEX	5934.98	20.3829	7.4992	21.7426	144.245
ANT				21.242	
NIC	770.589	27.4293	7.3006	17.8016	12.1392
PAN	3939.22	18.8851	10.2418	42.6653	9.3827
PRY	1322.65	18.666	18.1138	25.9625	498.308
PER	2049.3	20.1453	12.8428	31.9533	139.23
PRI	16003.7				58.0852
KNA	7441.03	44.0985	6.5369	2.1776316	117.188
LCA	4224.21	25.2008	5.4352	12.8799	168.86
VCT	3102.43	32.4618	7.6686	5.665548	14.9604
SUR	1909.75	23.4107	21.8914	12.4278	91.9079
TTO	6269.92	16.7421	14.3111	8.36397	377.199
URY	6914.36	16.2452	19.4821	35	
VEN	4818.71	19.8794	23.2786	37.8436	76.5741

Appendix B. Data used for estimating impact of broadband on employment (Extract of database)

CODE	Quarter	Year	Region	BBPEN	LABOR_FORCE	INACER	TASA_OCUP
4Q2001q4I	4	2001q4	I	0.109725	159.08	#N/A	0.916708574
1Q2002q1I	1	2002q1	I	0.34161	160.99	131.14	0.877818498
2Q2002q2I	2	2002q2	I	0.549319	165.4	138.55	0.874365175
3Q2002q3I	3	2002q3	I	0.83637	163.88	134.7	0.895655358
4Q2002q4I	4	2002q4	I	1.268328	165.98	146.2	0.915712736
1Q2003q1I	1	2003q1	I	1.556236	165.58	132.1	0.896726658
2Q2003q2I	2	2003q2	I	1.996579	168.17	133.2	0.899922697
3Q2003q3I	3	2003q3	I	2.327688	164.95	123	0.90821461
4Q2003q4I	4	2003q4	I	2.717226	171.47	140.1	0.910771564
1Q2004q1I	1	2004q1	I	2.952131	168.94	130.4	0.916242453
2Q2004q2I	2	2004q2	I	3.376514	171.16	154.2	0.906403365
3Q2004q3I	3	2004q3	I	3.611934	170.28	165.3	0.913377966
4Q2004q4I	4	2004q4	I	3.834212	167.51	190.5	0.917497463
1Q2005q1I	1	2005q1	I	4.132534	168.51	134.9	0.908254703
2Q2005q2I	2	2005q2	I	4.586029	175.34	129.1	0.913425345
3Q2005q3I	3	2005q3	I	4.998851	178.66	132.4	0.914530393
4Q2005q4I	4	2005q4	I	5.603378	177.14	159.1	0.916901886
1Q2006q1I	1	2006q1	I	6.290334	177.84	138.6	0.908232119
2Q2006q2I	2	2006q2	I	6.879404	203.082	146.4	0.916610039
3Q2006q3I	3	2006q3	I	7.424782	200.636	153	0.915693096
4Q2006q4I	4	2006q4	I	8.171057	204.463	184.1	0.933058793
1Q2007q1I	1	2007q1	I	8.811035	206.973	146.5	0.917863683
2Q2007q2I	2	2007q2	I	8.796576	208.591	154.1	0.926046665
3Q2007q3I	3	2007q3	I	9.308798	205.135	155.3	0.923313915
4Q2007q4I	4	2007q4	I	9.515995	210.673	210.9	0.92103402
1Q2008q1I	1	2008q1	I	9.46782	129.335	152.2	0.926477752
2Q2008q2I	2	2008q2	I	9.739561	128.992	164.4	0.941073865
3Q2008q3I	3	2008q3	I	10.01384	138.739	160	0.948060747
4Q2008q4I	4	2008q4	I	10.01896	139.811	#N/A	0.944339144
1Q2009q1I	1	2009q1	I	10.2341	138.119	#N/A	0.929647623
2Q2009q2I	2	2009q2	I	10.66338	142.639	#N/A	0.944713578
3Q2009q3I	3	2009q3	I	10.92971	140.016	#N/A	0.949584333