ESTIMATING BROADBAND DEMAND AND ITS ECONOMIC IMPACT IN LATIN AMERICA

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BIOGRAPHY

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ABSTRACT

This paper estimates the demand for broadband technology in Latin America and quantifies the macroeconomic impact of broadband technology on employment and productivity. While the total number of broadband access lines is 26.8 million and has increased 38% in the last year, the region still needs to grow the number of lines by 41% (adding 11 million lines) to respond to the needs of the economy. If that were to be achieved, it is estimated that the deployment could result in, at least, 378,000 new jobs.

KEYWORDS

Telecommunications, Broadband, Infrastructure, Growth, Employment, Input-Output Analysis, Latin American economics

INTRODUCTION

Latin America lags most regions of the world with regards to broadband penetration. Average broadband density in 2008 reached 5.5 %, while in industrialized countries it exceeded 25%. In the emerging world, China has reached 5.1%, and Malaysia 4.6 %. Among emerging economies, Latin America broadband penetration exceeds only India (0.3%), Philippines (0.5%) and other less developed countries. Furthermore, the current average penetration hides wide disparities between capitals and the rest of the territory.

This paper focuses on assessing the demand for broadband technology in Latin America and provides an estimation of its potential economic impact (job creation, productivity improvement, export promotion, etc.). It tackles the following questions:

- How many more broadband lines should Latin America have to meet the needs of its economy?
- Where broadband lines should be deployed?
- What is the expected economic impact of those lines?

The paper begins by assessing the research literature on economic impact of broadband to determine what has been empirically proven about the causal relationship between broadband, employment, productivity and other network externalities. Having ascertained that causality has been proven with some caveats, we then establish, through simple econometric models, what are the required broadband access lines in the region (without defining what would the most appropriate platform be: fixed DSL, cable modem, or wireless). Another modeling exercise is conducted to establish where deployment should occur if economic impact where to be maximized. Based on that interim conclusion, we will, then, estimate impact in terms of employment generation through regression analyses.

THE RESEARCH LITERATURE ON THE ECONOMIC IMPACT OF BROADBAND

The study of the economic impact of broadband has yielded so far several empirically driven pieces of research. Three types of studies have been conducted so far: a) international cross-sectional studies aimed at identifiying the causality link between economic growth and broadband, b) national cross-sectional research focused on identifying employment and/or output effects on national economies, and c) regional studies oriented to the assessment of broadband economic effects at the regional level. Two methodologies are primarily used in these studies: input-output analysis and multivariate regression modeling (see figure 1).

	Global Economy	National Economies	Regional Economies
Input-Output Analysis		• Crandall et al. (2003) • Katz et al. (2008) • Atkinson et al. (2009) • Katz et al. (2009a) • Katz et al. (2009b) • Libenau et al (2009)	• Strategic Networks Group (2003)
Multivariate Regression Modeling	• Gentzoglanis (2007) • Koutroumpis (2009)	• Lehr et al. (2006) • Crandall et al. (2007) • Thompson et al. (2008) • Katz (2009) • Katz et al (2009b)	• Kelly (2004) • Ford and Koutsky (2005)

Figure 1. Studies of the Employment Impact of Broadband

This section will review the literature regarding first the impact on employment and then, on economic growth.

BROADBAND AND EMPLOYMENT GENERATION

In general, the academic literature has concluded that, while it is difficult to precisely measure causality, broadband technology contributes to the creation of employment. Some studies differentiate two types of employment impact of broadband:

- First impact: Jobs created in order to deploy the infrastructure (e.g. construction), and
- Second impact: Employment generated as a result of network externalities on other sectors of the economy. The results of the research to date in these two areas will be reviewed in turn.

First, it is obvious that network construction will result in some level of job creation, in terms of direct effects. The six national studies that attempted to estimate this amount relied on input-output matrices[1] and assumed a given amount for capital investment. All studies also calculated multipliers, which measure the total employment change throughout the economy resulting from the deployment of a broadband network. Beyond network construction (direct employment effects), broadband construction has an employment impact at two additional levels. Resulting from the sector interrelationships calculated in input-output matrices, network deployment will result in indirect job creation (incremental employment generated by businesses selling to those that are directly involved in network construction) and induced job creation (additional employment induced by household spending based on the income earned from the direct and indirect effects). Figure 2 compiles employment effects estimated for recently announced broadband programs.

Country	Investment program (USD million)	Employment Creation				Multipliers	
		Direct	Indirect	Induced	Total	Type I (*)	Type II (**)
US	$ 6,390	37,300	31,000	59,500	127,800	1.83	3.42
Switzerland	$ 10,000	80,000	30,000	N.A.	110,000	1.38	N.A.
Germany	$ 47,660	281,000	126,000	134,000	541,000	1.45	1.93
UK	$ 7,463	76,452	134,541		211,000		2.78
Australia	$ 31,340				200,000		

(*) (Direct + Indirect)/direct (**) (Direct + Indirect + Induced)/direct

Sources: Katz et al. (2009a); Katz et al. (2008); Katz et al. (2009b); Liebenau et al. (2009); Australian government

Figure 2. Employment Impact of Broadband Network Construction

The interrelationship of these three effects is measured through multipliers, which quantify the total employment change throughout the economy from one unit change on the input side. Type I multipliers measure the direct and indirect effects (direct plus indirect divided by the direct effect), while Type II multipliers measure Type I plus induced effects (direct plus indirect plus induced divided by the direct effect). While multipliers from one economy cannot be applied to another one, it is useful to observe the summary results of multipliers of the seven input-output studies (see figure 3).

[1] From the Bureau of Economic Analysis for the US studies or the national statistics authorities of Switzerland for the Swiss study. In addition, the Strategic Networks Group (2003) also relied on input-output tables, although in this case they were the regional ones created by Canada's statistics agency, Statistics Canada.

	Geography	Type I	Type II
Crandall et al. (2003) (**)	US		2.17
Strategic Networks Group (2003)	Canadian county	2.03	3.42
Katz et al. (2008) (*)	Switzerland	1.40	
Atkinson et al. (2009) (**)	US		3.60
Katz et al. (2009a)	US	1.83	3.43
Libenau et al. (2009) (**)	UK		2.76
Katz et al. (2009b)	Germany	1.45	1.93

(*) This study calculates only direct and indirect effects; induced effects were not calculated

(**) This study does not differentiate indirect from induced effects

Figure 3. Breakdown of Employment Multipliers of Studies relying on Input-Output Analysis

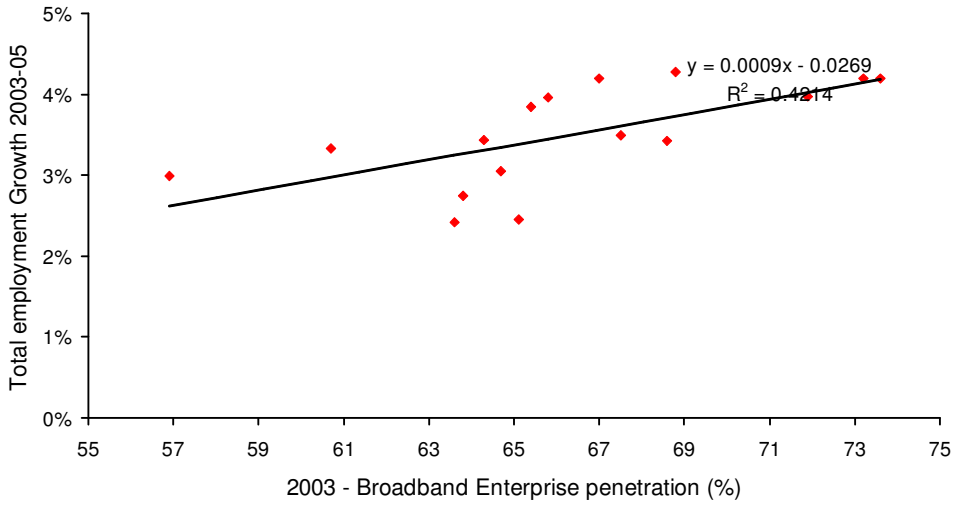
According to the sector interrelationships depicted above, a European economy appears to have lower Type I multipliers than the US economy. Furthermore, the decomposition also indicates that a relatively important job creation effect occurs as a result of household spending based on the income earned from the direct and indirect effects.

Beyond the employment and output impact of network construction, research has also been focusing on a set of network externalities variously categorized as "innovation", or "network effects" (Atkinson et al., 2009). In general, studies based on regression analysis do not differentiate between construction and spill-over effects. However, after examining the conclusions of the regression studies, the evidence regarding externalities appears to be quite conclusive. First, broadband spill-over employment effects are not uniform, they tend to concentrate in service industries (e.g., financial services, health care etc.), although Crandall et al. (2007) identified an effect in manufacturing as well. Second, two studies (e. g. Lehr et al., 2006; Thompson et al., 2008) point to the productivity impact of broadband, which can result in a net reduction in employment resulting from capital-labor substitution.

In another study, Doris Kelly (2004) analyzed the comparative evolution of two adjacent cities in the state of Florida, attempting to assess the impact of fiber optic deployment. According to the study, the city that deploys fiber at an earlier point in time attracts the investment of 140 companies, thereby generating 4,250 incremental jobs, while the second cannot attract more than nine companies to its industrial parks. The fiber optic infrastructure in the more technologically advanced city also serves all educational institutions creating an additional incentive for population to relocate, resulting in an increase at a rate of 5.3% per annum, compared to 3.4% growth in the other urban center. Ford et al (2005) pursued further the comparative analysis across regions depicting different broadband penetration, concluding that fiber optic service to enterprises, public administration, hospitals and educational institutions could result in a net impact on economic growth reaching 28%. Lehr et al (2006) relied on broadband penetration data of 1999 concluding that the technology had an important impact on economic growth in 2002. In particular, Lehr et al. concluded that the broadband economic effects are of two kinds:

- Incremental employment growth of 1.5%
- Employment creation is even more accentuated in the information-intensive sectors of the economy

This author has also conducted a study of the job creation impact of broadband in Spain (Katz, 2008) reaffirming the conclusions of prior studies, albeit with a low level of significance (see figure 4)



Sources: Instituto Nacional de Estadística – IN; Directorio Central de Empresas – DIRCE; analysis by the author

Figure 4. Causal relationship between Broadband deployment and employment growth in Spain

In this study, we specified a simple regression model of broadband penetration in the enterprise segment by Autonomous Communities in 2003 with employment growth in those same communities between 2003 and 2005. According to this model, an increase in broadband penetration in enterprises of 5% will result in an improvement of 0.6% in the capacity to create jobs. Obviously, this relationship masks a number of effects (particularly in terms of employment growth as a result of the expansion of the construction sector). However, we relieve that directionally data indicates a positive direct relationship between broadband penetration and job creation.

Beyond, what can be inferred as "network effects" from the regression studies, two types of approaches have been utilized to isolate this impact: 1) top-down based on "network effect" multipliers, and 2) bottom-up estimates based on extrapolating findings of microeconomic analysis of impact of broadband on efficiency and effectiveness at the firm level.

Within the first group, key studies are Pocsiak (2002) and Atkinson et al. (2009). Both studies relied on an estimated "network effect" multiplier, which is applied to the network construction employment estimates[2]. While the top-down approach allows to rapidly estimating a number, it does not have a strong theoretical support. Network effects are not built on interrelationships between sectors. They refer to the impact of the technology on productivity, employment and innovation by industrial sector.

There is only one bottom-up study of network effects has been identified (Fornefeld et al., 2008). This study identified three types of impact of broadband on employment: first, the acceleration of innovation resulting from the introduction of new applications and services (with the consequent creation of employment); second, the improvement of productivity as a result of the adoption of more efficient business processes enabled by broadband; and third, the possibility of attracting employment from other regions as a result of the ability to process information and provide services remotely. These three

[2] For example, Pocsiak relied on two multiplier estimates (an IT multiplier of 1.5 to 2.0 attributed to a think tank and another multiplier of 6.7, attributed to Microsoft) and calculated an average of 4.1. Similarly, Atkinson et al. (2009) derived a multiplier of 1.17 from Crandall et al. (2003).

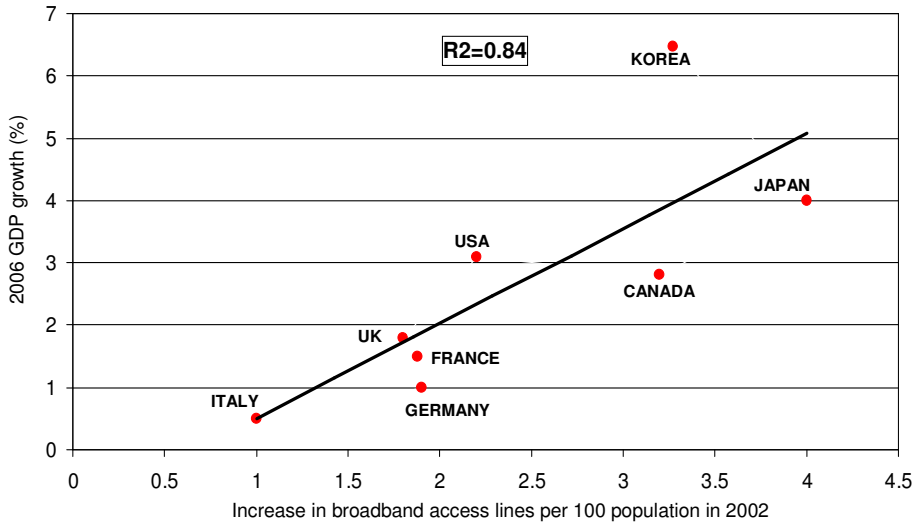
effects act simultaneously, resulting in contradictory impact on employment. The increase in broadband penetration can have a positive impact on productivity, contributing as a consequence to a negative effect on employment[3].

However, this negative effect is compensated by the increase in the rate of innovation and services, thereby resulting in the creation of new jobs. Finally, the third effect may be comprised by two countervailing trends. On the one hand, a region that increases its broadband penetration can attract employment displaced from other regions by leveraging the ability to relocate functions remotely. On the other hand, by increasing broadband penetration, the same region can lose jobs by virtue of the outsourcing effect. While a better understanding of these combined "network effects" is being gained, the research is still at its initial stages of quantifying the combined impact. The study by Fornefeld et al. (2008) is probably the first attempt to build a causality chain applying ratios derived from micro-economic research to estimate the combined impact of all effects.

To sum up, the literature on the employment impact of broadband provides solid grounding on the framework and methodology to estimate the impact on employment and output of network construction. Input-output analysis is analytically rigorous and its application to the issue under consideration has been sufficiently codified. With regard to the externalities estimations, it is necessary to develop a methodology that goes beyond the top-down multipliers and relies on econometric modeling. This approach will require handling relative large time series with a high level of disaggregation in order to establish regional effects and build bottom estimates of impact.

Broadband and economic output

Moving now to impact on economic impact, cross-sectional country analyses have identified the relationship between broadband deployment and level of economic development. For example, Gentzoglanis (2007) showed how among a small sample of countries broadband deployment tends to acellerate the rythm of economic growth four years later (see figure 5).



Sources: Gentzoglanis (2007)

Figure 5. Broadband deployment and economic growth

[3] This effect was alluded to by Lehr et al. (2006) when they said that "broadband might facilitate capital-labor substitution, resulting in slower job growth", and is also alluded to by Thompson et al. (2008) as they mention that "there may be a substitution effect between broadband and employment."

Expanding on these findings, Koutroumpis (2009) analyzes data between 2002 and 2007 for 22 OECD countries. The author found that an increase in broadband adoption and use generates significant aggregate economic output. The magnitude of this effect can be calculated and result into a practical estimate of this positive relationship between broadband and GDP. The point estimate of the elasticity is roughly equal to 0.025 which implies that one percent increase in the penetration rate – described by the variable PEN in this author's model – increases economic growth by an average of 0.025 percent.

In general, the research on single country time series data has also verified the causality between broadband deployment and economic development. For example, Crandall y Jackson (2001), of the Brookings Institute built a model to estimate the prospective impact in GDP growth of broadband deployment in the United States. According to their model, an investment of $ 63.3 billion aimed at achieving universal coverage of broadband World result in an incremental GDP generation of $ 179.7 billion. Katz et al. (2009b) analyzed data at the county level for Germany between 2000 and 2006. The results of the regression analysis for national time series indicated, with high significance levels, a strong impact of increased broadband penetration on GDP growth, although the degree of impact tends to diminish over time. On the other hand, results regarding the impact of broadband penetration on employment creation carried a low level of significance and, therefore, did not allow us to indicate, with certainty the existence of causality.

However, consistent with the results of Lehr et al. (2006) for the US, the economic impact in the German case can be identified once the analysis is disaggregated and models are specified at the county (Landkreise[4]) level (see figure 6). By splitting the national territory into two groups, Landkreise with 2008 average broadband penetration of 31 percent of population and Landkreise with average broadband penetration of 24.8 percent, the analysis determined, with high level of significance for the advanced territories, that the type of network effects of broadband varies by region.

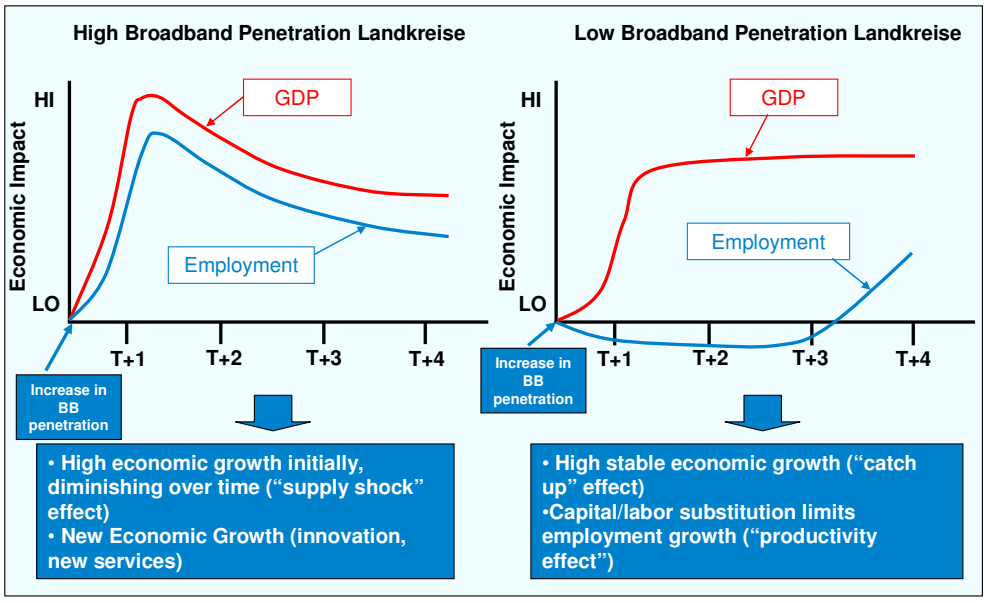


Figure 6. Conceptual view of comparative broadband regional effects[5]

In high broadband penetrated Landkreise, the impact of the technology is very high both on GDP and employment in the short term, but declines over time. This "supply shock" is believed to occur because the economy can immediately utilize the

[4] Landkreise is the administrative unit in Germany corresponding to a county.

[5] Only effects up to t + 3 are estimated.

new deployed technology. Furthermore, the fact that employment and GDP grow in parallel indicate that broadband is having a significant impact on innovation and business growth, thereby overcoming any employment reduction resulting from productivity effects.

In conclusion, academic research to date has generated a substantial empirical base substantiating the economic impact of broadband. The conclusions have been compiled in figure 7.

Impact Area	Benefits
Productivity	• Labor productivity in ICT intensive and ICT non intensive industries • Productivity in supply chain and distribution functions
Firm relocation	• Relocation of firms in search for labor pool (static arbitrage) • Relocation of functions resulting from value chain decomposition • Enhancement of quality of life which attracts educated labor force
Employment	• Enhancement of self-employed workforce enabled by telecommunications infrastructure • Employment created by development of ICT industries • Enhancement of radius of tele-commuting, allowing for tapping into additional labor pools • Creation of new firms/services requiring additional labor force
Economic growth	• Strengthening of industries with high transaction costs (trade, finance, etc.) • Consumer surplus derived from new telecommunications services, saving of transportation time, etc.

Figure 7. Broadband impact on the economy

THE CURRENT SITUATION OF BROADBAND IN LATIN AMERICA

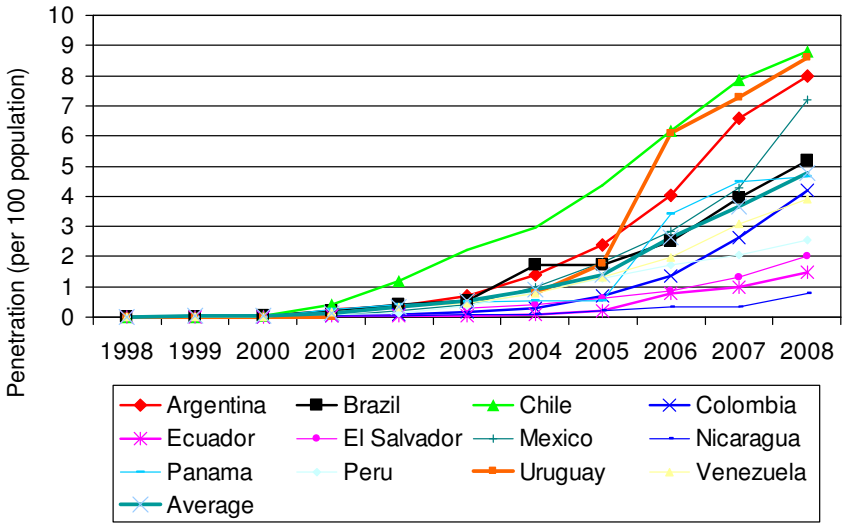
Latin America lags broadband penetration when compared to the industrialized and selected emerging economies (see figure 8).

Country	Broadband Penetration	Region	Regional Penetration
Argentina	7.9	Latin America	5.5 %
Brazil	5.3		
Chile	8.4		
Colombia	4.2		
Ecuador	1.5		
El Salvador	2.0		
Mexico	7.1		
Nicaragua	0.8		
Panama	4.6		
Peru	2.5		
Venezuela	3.9		
Uruguay	8.6		
Canada	29.0	North America	27.8 %
United States	26.7		
Germany	27.4	Europe	24.8 %
Austria	21.6		
Belgium	28.1		
Denmark	37.2		
Spain	20.8		
France	28.0		
Finland	30.7		
Greece	13.5		
Hungary	16.8		
Italy	19.2		
Netherlands	35.8		
Portugal	16.0		
United Kingdom	28.5		
Czeck Republic	17.2		
Sweden	32.0		
Australia	25.4	Asia	14.0 %
China	5.1		
South Korea	32.0		
India	0.3		
Japan	23.6		
Malaysia	4.6		
Philippines	0.5		
Taiwan	20.7		
Morocco	1.5	Africa	1.6 %
South Africa	0.8		

Sources: IDC/Cisco; UBS; ITU; OECD

Figure 8. Broadband penetration by country (end 2008) (Percentage per population)

As shown in Figure 8, Latin America exhibits still an extremely low penetration level of broadband lines. Chile, which is the most advanced country in the region, has a much lower level of development compared to lesser developed European countries such as Greece and Portugal. Having said that, the last figures for selected countries indicate that the region is engaged in a fast diffusion cycle (see figure 9).



Sources: ITU; IDC/Cisco; Regulatory Authorities

Figure 9. Latin America: Broadband Penetration by Country (1998-2008)

Despite its fast development in the recent two years, broadband diffusion lags Internet usage, which results that considerable amount of Internet users gain access to the platform in their place of work or study, public telecenters, or do it through dial-up mode (see figure 10).

Country	Internet users	ISP subscribers	Broadband penetration	Difference with Internet users	Difference with ISP subscribers
Argentina	11.4 %	8.7%	7.9 %	3.5 %	0.8%
Brazil	22.2 %	9.5%	5.3 %	16.9 %	4.2 %
Chile	29.2 %	…	8.4 %	20.8 %	…
Colombia	22.1 %	4.8%	4.2 %	17.9 %	0.6%
Ecuador	7.9 %	2.08%	1.5 %	6.4 %	0.6%
El Salvador	9.55%	…	2.0 %	7.5%	…
Mexico	21.6 %	8.5%	7.1 %	14.5 %	1.4%
Nicaragua	2.46%	…	0.8 %	1.66%	…
Panama	22.3%	…	4.6 %	17.7%	…
Peru	35.7 %	…	2.5 %	33.2 %	…
Venezuela	22.5 %	3.81%	3.9 %	18.6%	0 %
Uruguay	33.6%	10.0%	8.6 %	25.0%	1.4%
Non-weighted average	20.0%	6.53%	5.5%	15.3 %	1.27%

*Sources: IDC/Cisco; www.internetworldstats.com; **Argentina:** CNC; **México:** Cofetel; **Colombia:** CRT; **Perú:** Osiptel; **Chile:** Subtel; **Venezuela:** Conatel; **El Salvador**: SIGET; **Nicaragua:** Telcor; **Uruguay:** Ursec*

Figure 10. Internet usage versus broadband penetration (2008)

On average, internet penetration is 15% higher than broadband penetration which is also an indicator of latent demand fro broadband. Low aggregate penetration is considerable aggravated by the geographic duality, which results in an even lower penetration for the regions beyond the metropolitan areas (see Figure 11).

Country	National Penetration	Penetration >national	Penetration <national
Argentina	7.9 %	Buenos Aires capital: 30.7 %	Santa Fe: 7.52 %
		Buenos Aires provincia: 7.55 %	Córdoba: 7.77 %
			Mendoza: 3.88 %
Brazil	5.3 %	Sao Paulo 9.12%	Nordeste: 1.09 %
		Rio Grande do Sul: 6.6%	Sud este: 6.24 %
			Centro Oeste: 5.49 %
			Norte: 2.96 %
Chile	8.4 %	Región Metropolitana: 12 %	Quinta región: 8.2 %
		Primera región: 14.2 %	Tercera región: 8.1 %
		Segunda región 12.9 %	Cuarta región: 5.3 %
			Octava región: 6.0 %
			Sexta-séptima región: 4.3 %
			Novena región: 5.3 %
			Décima región: 6.2 %
			Undécima región: 5.5 %
			Duodécima región: 3.8 %
Colombia	4.2 %	Bogota: 8.8 %	Medellín: 8.7 %
		Barranquilla: 5.4 %	Cali: 5.2 %

Sources: IDC/Cisco; CNC; CRT

Figure 11. Regional comparative penetration (2008)

As the figure indicates, broadband penetration is higher than the national averages only in capital and first tier cities. Beyond that, adoption declines rapidly.

Another dimension of the seriousness of the problem is the low download speeds that characterize the service (see figure 12).

	<256 kbps	256-512 kbps	512 kbps-1 mbps	>1 mbps
Argentina	1.4 %	12.4 %	39.0 %	47.2 %
Brazil	11.4 %	24.8 %	30.1 %	33.7 %
Chile	2.4%	9.4 %	24.8 %	63.4 %
Colombia	11.4 %	11.4 %	51.0 %	26.2 %
Peru	10.3%	41.7 %	38.3 %	9.7 %

Sources: IDC/Cisco

Figure 12. Broadband download speeds breakdown (2008)

Based on the definitions of what represents minimum download speeds as agreed upon by regulators or international bodies, a large portion of access lines considered to be broadband in the Latin American region would not qualify as such. For example, the ITU defines broadband as "transmission capacity exceeding 1.5 o 2 Mbps"[6]. On the other hand, the OECD considers in its data bases only those lines with speeds equal or more than 256 kbps. This last definition is consistent with

[6] Cited in IDC/Cisco. *Barómetro de la Banda Ancha en Chile*.

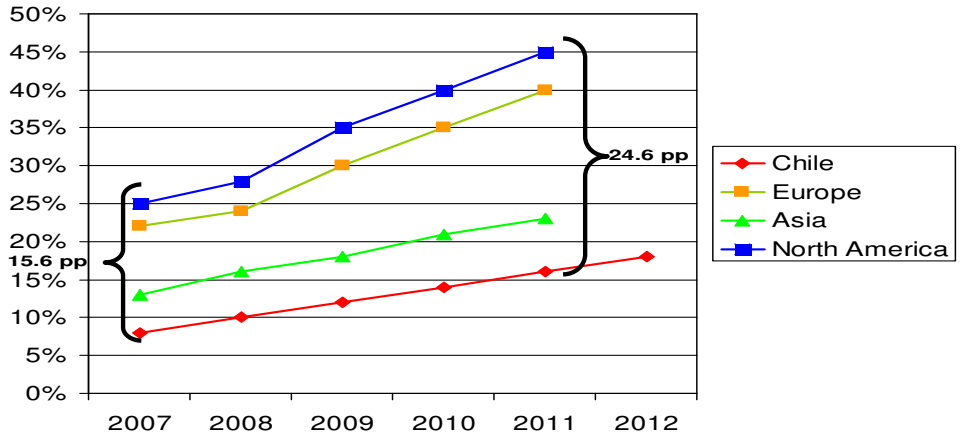
that one of the FCC, although the CRT in Colombia defines minimal broadband speed to be 512 kbps[7] . If we were to use the more restrictive definitions to evaluate the penetration of broadband in the region, the broadband penetration indices would be somewhat lower (see figure 13).

Country	Number of Broadband lines	Penetration	Adjustment according to the ITU definition		Adjustment according to the OECD definition	
			Lines	Penetration	Lines	Penetration
Argentina	3,185,300	7.9 %	1,504,780	3.8%	3,141,365	7.9 %
Brazil	10,098,000	5.3 %	3,403,026	1.8%	8,948,917	4.6 %
Chile	1,426,400	8.4 %	905,026	5.6%	1,391,970	8.2 %
Colombia	1,902,800	4.8 %	498,665	1.1%	1,686,274	3.7 %
Peru	725,600	2.5 %	70,058	0.3%	650,538	2.3 %

Sources: IDC/Cisco; ITU

Figure 13. Adjustment of broadband penetration according to internationally sanctioned download speed norms (2008)

To conclude, the status of broadband deployment in Latin America, particularly in comparison with other telecommunications technologies such as mobile telephony, is embryonic. This should be of concern to policy makers given the economic impact of broadband. This situation is even more serious given the limited understanding on the part of policy makers regarding the importance of broadband for economic development. For example, Chile, the most advanced country in the region has stipulated in its recently developed Digital Plan the need to double the number of broadband accesses in 5 years, which would result in a penetration of 17.6%. The problem with this target is that in five years most of the developed world would have reached a penetration in excess of 40%, thereby perpetuating Chile's technological lag (see figure 14).



Sources: UBS; IDC/Cisco; ITU; analysis by the author

Figure 14. Chile's Targets in the Digital Agenda compared with Developer World forecast

According to this target, the gap that separates Chile from developed countries (which is approximately 15 percentage points) would increase to 24.6 %.

In addition to limited deployment, the price of broadband in Latin America is comparatively more expensive than in many other countries of the world. This limits broadband accessibility for the residential market (see Figure 15).

[7] On the other hand, the regulatory authorities in Argentina, Brazil, Peru and Venezuela have not defined a minimum broadband speed.

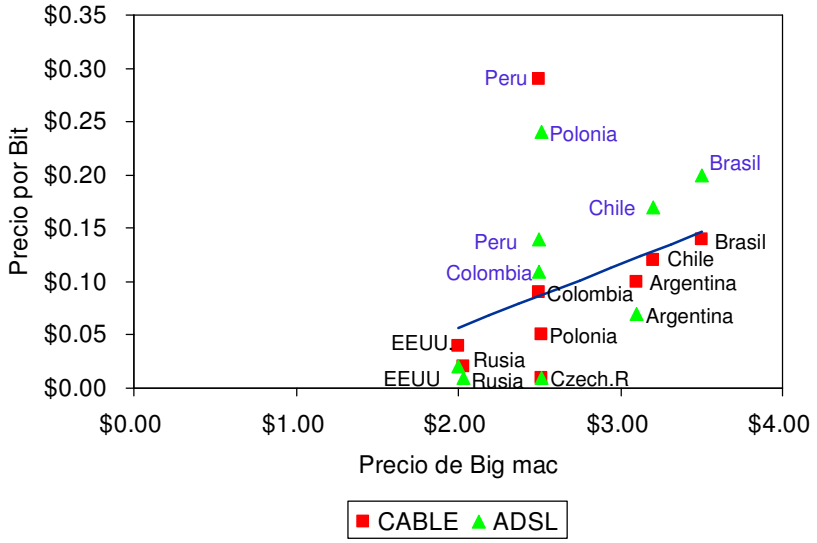
	Download Speed					Upload Speed				
Service	Argentina	Brazil	Chile	Colombia	Peru	Argentina	Brazil	Chile	Colombia	Peru
ADSL										
Minimum Speed	256 Kbps	128 Kbps	200 Kbps	225 Kbps	200 Kbps	$ 18.9	$ 25.9	$ 33.6	$ 23.7	$ 27.0
Maximum Speed	5 Mbps	10 Mbps	4 Mbps	2 Mbps	2 Mbps	$ 46.9	$ 202.8	$ 70.6	$ 100.4	$ 1,032.2
Cable modem										
Minimum Speed	128 Kbps**	200 Kbps	300 Kbps	300 Kbps	128 Kbps	$ 13.0	$ 27.4	$ 35.9	$ 28.3	$ 36.9
Maximum Speed	6 Mbps	8 Mbps	10 Mbps	350 Kbps	2 Mbps	$ 160.7	$ 106.5	$ 63.9	$ 26.5	$ 430.1
Exchange Rate (08.31.2007)						$ 3.2	$ 2.0	$ 524.5	$ 2,192	$ 3.2

* Does not include bundling discounts ** Special 64 kbps plans *** Product for low-income customers

Sources: Rodriguez (2008); IDC

Figure 15. Broadband Price Comparison

As the chart above indicates, prices for broadband access vary substantially. By standardizing the rates on a per bit basis and comparing them with the Purchasing Power Parity index (the cost of a burger at Mc Donald's), we not only conclude that prices for broadband vary substantially in many Latin American countries, but we also realize that broadband prices in the region are very high (see Figure 16).



Sources: IDC; Morgan Stanley; analysis by the author

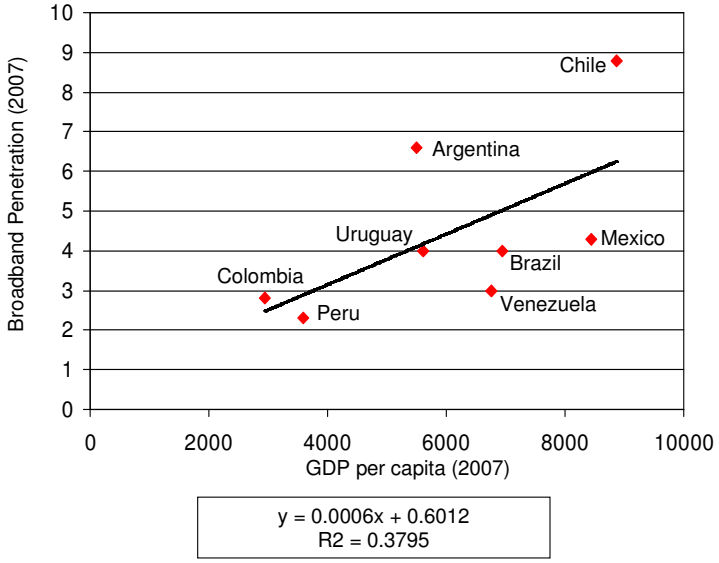
Figure 16. Broadband Access: The Cost of a Big Mac versus the Cost of a Bit (For Minimum Speed)

This analysis allowed us to draw two conclusions. First, in comparative terms, the price of cable access in Peru[8] and ADSL access in Chile, Peru and Colombia is higher than they should be, considering the prediction of parity prices. The second conclusion is that in the countries where there is less market competition the price difference between cable and ADSL is larger (or, in other words, the closer the points of ADSL and cable for each country in Figure 16 the more price competition, this is clearly the case in Argentina). This allows us to say that to encourage lower prices and hence greater accessibility one should create a degree of healthy competition between operators of independent platforms, such as telecom operators and cable companies.

[8] This has recently brought on the dramatic reduction of prices by the broadband cable operator in Peru.

AN ESTIMATION OF THE BROADBAND DEMAND

How much additional broadband capacity is needed in Latin America to close the broadband gap that separates it from the developed world? To estimate the needs of broadband in the region we have developed a simple regression model, similar to the original teledensity models, based on the size of the economy. This model has been estimated for the current levels of broadband penetration in Latin America and the world. Figure 17 represents the regression based on figures from Latin America.



Sources: World Bank; UBS; analysis by the author

Figure 17. Economic Development in Latin America and Broadband Penetration

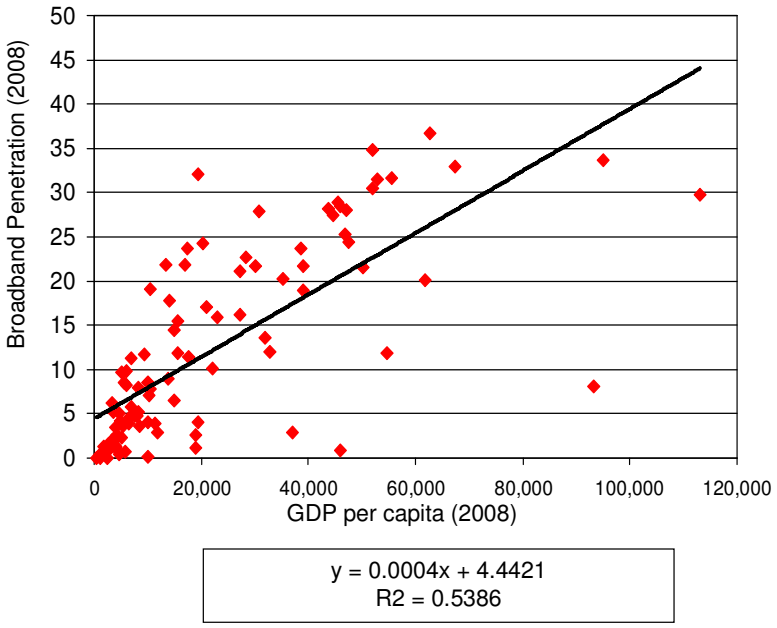
According to this model, Latin America today, at the aggregate level, has a gap of 2,000,000 broadband connections (see Figure 18). This means that considering the direct relationship between economic development and broadband in Latin America, there are regions that already suffer from a deficiency in broadband coverage. The largest share of this gap is concentrated in Venezuela (50%) and Brazil (20%).

Country	Number of Lines (2008)	Demand estimation according to GDP 2008	2008 Gap
Argentina	3,185,300	2,219,250	**No gap**
Brazil	10,098,000	10,580,524	482,524
Chile	1,426,400	1,131,381	**No gap**
Colombia	1,902,800	1,617,675	**No gap**
Ecuador	210,285	401,897	191,612
El Salvador	123,500	178,456	54,956
Mexico	7,604,600	7,251,236	**No gap**
Nicaragua	45,044	69,846	23,902
Panama	157,500	161,357	3,857
Peru	725,600	953,490	227,890
Venezuela	1,096,500	2,112,594	1,016,094
Uruguay	287,700	223,520	**No gap**
Total	26,864,129	26,901,226	2,000,835

Sources: UBS; IDC/Cisco; World Bank; analysis by the author

Figure 18. 2008 Gap Between Supply and Demand of Broadband (Latin American Model)

However, we believe that the estimate of the broadband gap should not be made using the parameters and metrics of Latin America but rather the rest of the world. As expected, if we use the regression model estimated for the global figures, the gap becomes even more important. Figure 19 represents the regression for a worldwide data series.



Sources: World Bank; UBS; analysis by the author

Figure 19. World Economic Development and Broadband Penetration

According to the model based on the penetration of broadband and global economic growth, the size of the broadband gap in Latin America is alarming. If we consider the development of Latin American economies, the region now has a shortfall of 11 million lines (thereby resulting in the need to increase by 41 % the current deployment). The largest portion of this deficit is concentrated in Brazil (43 %), followed by Mexico (14 %) and Venezuela (13 %) (see figure 20).

Country	Number of Lines (2008)	Demand estimation according to GDP 2008	2008 Gap
Argentina	3,185,300	3,101,435	**No Gap**
Brazil	10,098,000	14,800,734	4,702,734
Chile	1,426,400	1,439,173	12,773
Colombia	1,902,800	2,898,369	995,569
Ecuador	210,285	834,481	624,196
El Salvador	123,500	368,036	244,536
Mexico	7,604,600	9,180,576	1,575,976
Nicaragua	45,044	278,656	232,712
Panama	157,500	247,158	89,658
Peru	725,600	1,812,972	1,087,372
Venezuela	1,096,500	2,556,853	1,460,353
Uruguay	287,700	284,841	**No Gap**
Total	26,864,129	37,803,283	11,025,879 (*)

(*) Sum of countries with broadband gap

Sources: World Bank; UBS; IDC/Cisco; analysis by the author

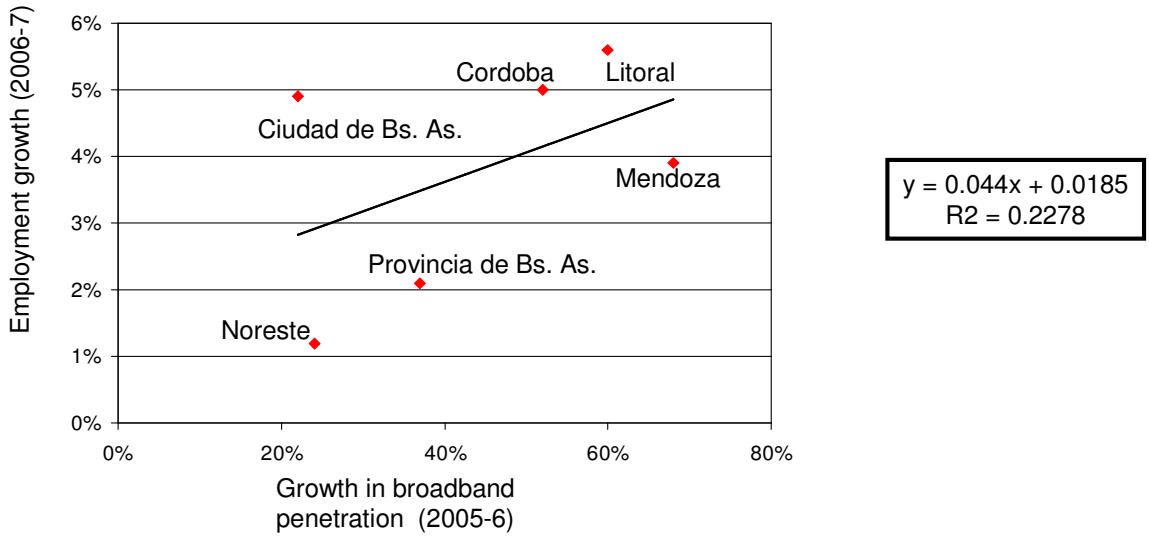
Figure 20. 2008 Gap between Supply and Demand for Broadband (World Model)

While Argentina, Uruguay and Chile do not appear to deviate from the regression mean of broadband and GDP, that does not mean that they do not have challenges of their own. They pertain, however, to tackle digital divide issues in those regions that have significantly below broadband penetration when compared to the national average (see figure 10). In addition to addressing the digital divide, Latin America must also meet the challenge of accessibility in terms of prices.

In conclusion, from a technological point of view, the limited penetration of broadband to the level of economic development presents an important challenge for the region. If one takes the relation defined on the basis of global statistics, Latin America should double its deployment. This challenge becomes even more complex to the extent that the deployment should include a significant increase in access speeds, especially for lines installed in companies. In the following section, we will analyze what the potential economic impact is assuming the region can resolve this challenge, but before we do that, we are going to look at another regional challenge that is dealing with. ICT needs to increase its penetration rate within small and medium sized corporations.

EMPLOYMENT IMPACT OF BROABAND IN LATIN AMERICA: PAST EXPERIENCE AND EXPECTED IMPACT

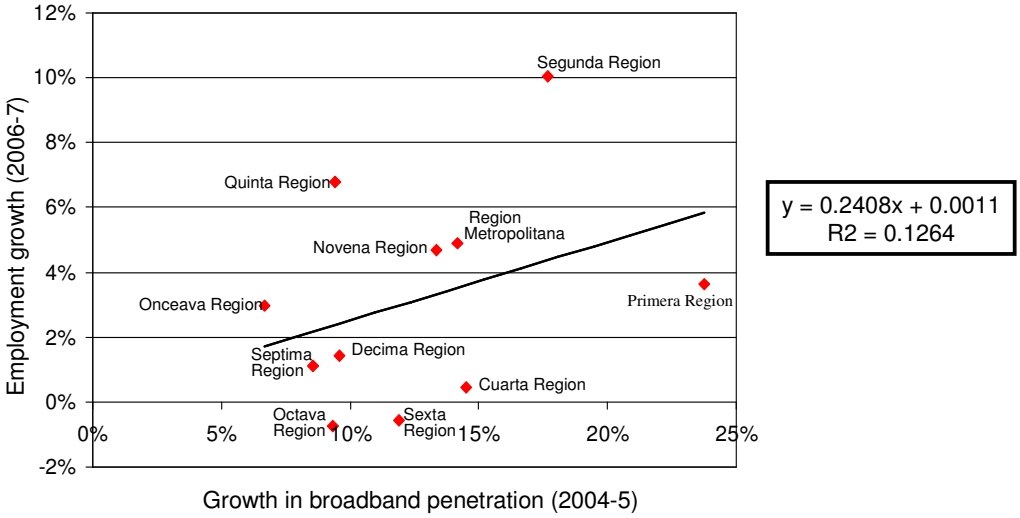
As reviewed in section one there exists a clear cause and effect relationship between the diffusion of broadband and job creation (Lehr et al., 2005, Crandall et al., 2006, Katz, 2008). In the following analyses, we have tried to prove the same relation to Latin American countries in regional samples. First, we have found the relationship to exist for Argentina when regressing data on with a one year lag between broadband penetration and employment growth (see Figure 21)



Sources: Cisco/IDC; CEPAL; analysis by the author

Figure 21. Argentina: Regional Broadband Penetration and Job Creation

According to the regression between both variables one can observe, at least directionally, the binding causation. The same conclusion can be reached in the case of Chile (see figure 22).



Sources: Cisco/IDC; CEPAL; analysis by the author

Figure 22. Chile: Regional Broadband Penetration and Job Creation

In the Chilean case there exists a reasonable relationship between the broadband penetration of 2004/2005 and the job growth of 2006/2007.

Based on the estimates of the Argentine model, we have estimated the impact on job creation if the Latin American nations were to increase the installation of broadband lines according to the goals set out in section III of this paper. According to the model:

Employment Growth in t+1 = 0.044 * (Broadband penetration growth in t) + 0.0185

Relying on our estimations of the broadband gap in 2008 (see Figure 18), we calculated the incremental penetration of broadband and estimated the impact on employment growth (see figure 23).

Country	Number of access lines (2008)	Penetration (2008)	Estimation of Demand According to PBI 2008	Broadband Gap 2008	Incremental Penetration	Impact on employment growth
Argentina	3,185,300	7.9 %	3,101,435	**No Gap**	7.9 %	1.7 %
Brazil	10,098,000	5.3 %	14,800,734	4,702,734	7.7 %	3.9 %
Chile	1,426,400	8.4 %	1,439,173	12,773	8.5 %	1.9 %
Colombia	1,902,800	4.2 %	2,898,369	995,569	6.4 %	4.2 %
Ecuador	210,285	1.5 %	834,481	624,196	6.0 %	14.9 %
El Salvador	123,500	2.0 %	368,036	244,536	6.0 %	10.6 %
Mexico	7,604,600	7.1 %	9,180,576	1,575,976	8.5 %	2.8 %
Nicaragua	45,044	0.8 %	278,656	232,712	4.9 %	24.1 %
Panama	157,500	4.6 %	247,158	89,658	7.2 %	4.4 %
Peru	725,600	2.5 %	1,812,972	1,087,372	6.2 %	8.4 %
Venezuela	1,096,500	3.9 %	2,556,853	1,460,353	9.0 %	7.7 %
Uruguay	287,700	8.6 %	284,841	**No Gap**	8.6 %	1.8 %
Total	26,864,129	5.5 %	37,803,283	11,025,879	9.9 %	3.6 %

Source: analysis by the author

Figure 23. Impact of Growth in the Diffusion of Broadband on Employment in Latin America

With the estimate of impact on employment growth yielded by this calculation, we then examined what the actual employment growth had been for each country between 2005 and 2006 (columns 3 and 4 of figure 24). We then factored the incremental employment growth due to broadband (column 6 of figure 24) to the actual employment growth (column 5) according to the following formula:

$$\text{Incremental employment due to BB (2006)} = (((\text{Delta Actual employment 2005-06}) * (\text{Incremental impact of broadband penetration})) * \text{Employment 2005}) - \text{Employment 2006}$$

Considering the current levels of employment, it is estimated that this quantum leap in broadband access could generate 378,000 additional jobs in the region (see Figure 24).

Country	Impact on employment growth rate	Total Employment (2006)	Total Employment (2005)	Delta Employment 2005-06	Impact of broadband on employment growth	Incremental employment estimate
Argentina	1.7 %	10,045,000	9,638,700	4.22 %	4.29 %	7,046
Brazil	3.9 %	84,596,300	80,163,500	5.53 %	5.75 %	172,840
Chile	1.9 %	6,411,000	5,905,000	8.57 %	8.73 %	9,560
Colombia	4.2 %	17,609,000	18,217,000	-3.34 %	-3.48 %	Not significant
Ecuador	14.9 %	4,031,600	3,891,900	3.59 %	4.12 %	20,830
El Salvador	10.6 %	2,685,900	2,591,100	3.66 %	4.05 %	10,013
Mexico	2.8 %	42,197,800	40,791,800	3.45 %	3.54 %	38,832
Nicaragua	24.1 %	1,631,700				
Panama	4.4 %	1,210,700	1,188,300	1.89 %	1.97 %	975
Peru (*)	8.4 %	3,656,700	3,400,300	7.54 %	8.18 %	21,650
Venezuela	7.7 %	11,224,800	10,035,700	11.85 %	12.76 %	91,680
Uruguay	1.8 %	1,413,500	1,114,500	26.83 %	27.31 %	5,401
Total	3.6 %	186,714,000	176,937,800	5.53 %	5.73 %	378,827

(*) Estimated population of Lima

Sources: ILO; analysis by the author

Figure 24. Jobs Generated From the Increased Adoption of Broadband

We believe this number to understate the total impact because the estimates for Peru include only the employment for Lima y Callao (due to the lack of national statistics for 2005-6), and it was not possible to generate an employment estimate for Nicaragua due to the lack of national employment statistics for 2006. Furthermore, the estimates for Argentina and Uruguay do not address the job creation opportunity resulting from deploying broadband infrastructure in less covered regions of the interior of the country. Therefore, the 378,000 job estimate should be considered a lower bound one.

CONCLUSION

This paper has presented the compelling empirical evidence that has been generated regarding the economic impact of broadband technology, both in terms of job creation and development. In this context, the situation of broadband in Latin America has been examined concluding that, despite the enormous progress in the past two years, the region seriously lags in penetration when considering the needs emerging from the economy. Based on that conclusion, we have, based on simple regression analysis estimated what the level of broadband penetration in the region should be today, thereby determining how big the current gap is. According to our analysis, Latin America currently exhibits a broadband gap equivalent to 11 million lines (an increase of 41% over the current 26 million lines).

After estimating the gap, and based on regression analysis of the capacity of broadband to generate jobs, we have estimated the potential employment impact resulting from addressing the current broadband gap. According to this analysis, if the gap were to be addressed, 378,000 additional jobs could be created. This allows us to conclude emphasizing the counter-cyclical potential that broadband has to fight the current economic crisis. Future research needs to be conducted at the disaggregated national level to validate these top-down estimates. This will require the availability of broadband penetration in addition to employment data by department.

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