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Effective subsidies to the demand for fixed broadband with an increase in penetration and an undistorted competition landscape - The Colombian case

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Abstract

This article reviews the effectiveness of Colombia's social telecommunications policy in terms of promoting fixed broadband. With a trajectory of almost a decade with subsidies for residential fixed voice, the government changed its policy in the late 1990s moving towards community access for voice and Internet. In 2010, the social telecommunications plan raised the possibility of granting subsidies to fixed broadband to lower income homes throughout the country. Academic research, carried out mainly for the case of the United States, concluded that domiciliary subsidies were not effective and inefficiencies appeared when applied through incumbent operators. The only academic study available for Colombia pointed in the same direction.

This work presents an overview of the situation of subsidies for local voice and its evolution towards subsidies for fixed broadband in Colombia. Using a simple econometric exercise, this paper tries to prove that despite the existing evidence against subsidies to the demand, results have been positive in Colombia. This analysis has two main limitations: i) available information is on a quarterly basis; and ii) additional refinements to the econometric model should be introduced to verify the impact of variables such as years of education and degree of urbanization of the population. Facing these constraints, results indicate that subsidies to the demand for fixed broadband applied in Colombia have positively contributed to increase broadband penetration and have not introduced competitive distortions.

Keywords: subsidies, fixed broadband, telecommunications, policy

1. Introduction.

For eighteen years, social telecommunications policy in Colombia was limited to cross subsidies between long distance and local telephone services in an environment of near monopoly. Following the opening of the sector in 1994, a classical tariff rebalancing process began in order to promote a competitive market for all services. In addition, subsidies for local fixed voice were applied from the higher to the lower income segments of the population. With the entry of foreign investors to the market and without achieving full privatization of the sector, the design of a new social telecommunications policy faced a challenge fifteen years later: to increase penetration of *basic services* through incentives, while promoting competition among agents.

In 2009, the tariff rebalancing was completed and competition was consolidating with positive results in terms of fixed broadband penetration. Nevertheless, the government aimed to develop policies that drove the development of information and communications technologies as a key factor to poverty reduction. Thus, a sectorial discussion on the use of public funds available for the information and communications technology (ICT) sector was initiated and subsidies to the demand for fixed broadband were first considered.

With few international experiences on subsidies for domiciliary services and academic research indicating that they were ineffective, government and operators in Colombia designed a scheme that defined the service to be subsidized, least-cost alternatives for the provision of that service, the target population, the amount of subsidy, and some mechanisms for preventing potential negative effects on the market.

This work analyses the main elements considered in the discussion and compares the results obtained against academic recommendations available at that time. Results from a simple econometric model allow to conclude that the policy defined by the Colombian government has been positive for the sector and suggests reviewing the main academic recommendations on subsidies to the demand. However, additional refinements should be used in further studies since this work does not include strong statistical models, mainly because few data is available. It is also desirable that parameters such as years of education and degree of urbanization of the

population be included in future analyses. These and similar variables have been used to measure the degree of contribution of broadband to gross domestic product (GDP) growth, as in Katz (2012).

2. Literature Review.

Telecommunication subsidies have been widely used in many countries to promote access and use of telecommunication services, but nonetheless several authors have concluded that such subsidies distort competition and can even decrease consumer welfare.

Hausman and Shelanski (1999) criticize the *e-rate* subsidy in the United States, which established an additional charge to interstate long-distance calls in order to provide Internet access at low cost to schools and libraries. The author concludes that the scheme imposes high social costs when compared with other mechanisms.

Ward (2007), when reviewing subsidies to rural voice services also in the US, concludes that this scheme has not been appropriate and has motivated cream skimming of most profitable segments. The author concludes that although these subsidies were intended to help low-income consumers, generally located in areas where the costs for provision of services are higher, they create an incentive for operators to maintain high operating costs in rural areas. This can distort consumers' decisions by forcing them to choose a *high cost* option and not cheaper alternatives such as wireless services.

Chiang, Hauge and Jamison (2007) analyze the system of subsidies among US regions and verify a conceptual concern: offered subsidies distort competition. Despite being designed to be competitively neutral, the authors found evidence that this system promoted cream skimming by participants in low-cost areas and discouraged entry of new operators into high cost areas, where it was more likely that established operators received subsidies.

The 1996 Law stated that incumbent and alternative operators should contribute to a Universal Service Fund (USF) on an equitable and nondiscriminatory basis. Telecommunication regulators considered that allocation of USF funds to all eligible companies that operated in high-cost areas could promote an efficient competition: the system should not distort competition

when treating incumbents and entrants in the same way. However, while established operators were automatically classified, new operators were required to demonstrate eligibility. During the time period studied few participants were qualified to receive high-cost support. Focusing on the program known as High Cost Fund, the authors identified at least two potential negative effects on competition. First, entrants were negatively affected by payments to the Universal Service Fund because they usually operated in areas in which they were not subject to subsidies and therefore qualified less often than incumbents.

Second, efficient entry is discouraged by the system: while contributions to USF affect the profitability of all operators, the financing system provides entrants one possible advantage on incumbents when the latter are net contributors. An incumbent is required to serve low and high cost regions whereas an entrant is not, so the former is less able to compete effectively in low-cost areas. Additionally, in states with many high-cost areas new operators are less interested in providing services simply because of costs. Therefore, being a net recipient of USF subsidies does not encourage entry to the market and could discourage efficient competition when entrants faces difficulties to be entitled to subsidies.

More recently, Hazlett and Wallsten (2013) analyze the performance of the universal service scheme in the United States in the 1998-2012 period. The authors indicate that positive results are imperceptible, since any impact the scheme would have had was surpassed by high costs imposed on fixed and mobile calls. Hazlett and Wallsten conclude that the slant of subsidies to achieve incremental coverage of telephone services in the United States is obsolete:

Administrative failure, market competition, and technological evolution have rendered the USF system obsolete. Multiple communications networks now offer voice and broadband services all across the U.S., even in very remote regions. A strategy of subsidizing incremental government funding, is no longer even a plausible textbook exercise. (Hazzlett and Wallsten, 2013, page 52).

There are few similar analyses for Latin American countries. Gomez-Lobo and Melendez (2006) presented an evaluation of the social telecommunications policy in Colombia. In their analysis, the authors state that promoting the expansion of services in order to reach the domiciles of low-income population is something typical in developed countries, whereas schemes of

community access to telecommunications services are more efficient for developing countries, such as Colombia.

They review the result of the subsidies and contributions policy for local fixed telephony in Colombia, where users from higher socioeconomic strata (5, 6 and commercial) paid a surcharge calculated from the reference value (stratum 4), so that strata 1, 2 and 3 users could pay a lower price. Gomez-Lobo and Melendez conclude that although this scheme allowed the country to reach a fixed voice penetration higher than its peers, it is better to migrate to a community scheme. The authors found that the subsidies and contribution system is deficient and that households receiving such subsidies often do not require them.

3. Elements of the program of subsidies for fixed broadband

3.1. Background

Since the issuance of Law 142 of 1994, Colombia started a reform of liberalization of public utilities, including telecommunications. Some of the main objectives of this reform were universal service, economic efficiency and competition.

In order to reach a universal provision of fixed telephony services, government developed social telephony community programs, in addition to the subsidies and contributions scheme already described. These community programs were financed by a fund that was especially created for this purpose, called *Communications Fund*. This fund received payments made by telecommunication operators for: i) the right to provide networks and services; ii) the issuance of licenses for spectrum utilization; iii) fines and penalties concerning non-compliance with the telecommunications regime; and, iv) earnings yields from such resources.

Until 2009 each telecommunication operator providing services in Colombia must paid 5% of its revenues from mobile cellular telephony and, 3% for those of national and international long-distance calls and Internet access. There were no contributions to the fund derived from local fixed telephony since this service was subject to a special regime of subsidies and contributions. This scheme consisted on a surcharge (contribution) paid by higher strata users (5, 6 and commercial), which was distributed as a discount (subsidy) to the lower strata users (1, 2

and 3). The stratum 4 was used as reference. The scheme was designed to be neutral and self-sustained, therefore it should not generate any financial burden for operators of the fund.

Table 1. Telecommunications services revenue in Colombia in 2002-2010. Source: Ministry of Information Technologies and Communications (MINTIC) of Colombia, 2010 (2) and 2011

USD million	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mobile telephony	\$ 1,585	\$ 2,178	\$ 3,493	\$ 5,298	\$ 6,756	\$ 7,729	\$ 7,941	\$ 8,261	\$ 8,863
Local fixed telephony	\$ 3,802	\$ 3,560	\$ 3,848	\$ 3,953	\$ 4,668	\$ 4,965	\$ 3,258	\$ 3,924	\$ 3,988
Long Distance	\$ 1,519	\$ 1,409	\$ 1,233	\$ 1,007	\$ 1,243	\$ 1,168	\$ 3,054	\$ 2,685	\$ 2,880
Added Value	\$ 415	\$ 629	\$ 788	\$ 835	\$ 1,153	\$ 2,095	\$ 4,683	\$ 4,956	\$ 5,539
Others	\$ 2,088	\$ 2,213	\$ 2,451	\$ 2,826	\$ 3,059	\$ 2,925	\$ 1,425	\$ 826	\$ 886
Total	\$9,409	\$9,989	\$11,813	\$13,919	\$16,879	\$18,882	\$20,361	\$20,652	\$22,156

With the enactment of Law 1341 of 2009, the contributions of the operators to this fund were unified in 2.2% of their revenue for all service provided, including fixed local telephony. This Law also ordered the dismantling of subsidies and contributions for fixed local telephony in order to migrate the subsidy scheme to the Internet access. In March 2014, an additional payment to the fund, of 0.7% of gross revenue, was established to mobile operators as part of the fee for renewing their licenses for the 850MHz band.

Gomez-Lobo and Melendez acknowledged that the scheme of subsidies and contributions for fixed telephony has contributed to a higher penetration of this service in Colombia, when compared to others with the same level of economic development. However, important shortcomings of the scheme began to be detected in 2009. As it is shown in Table 1, local fixed voice had declined its importance compared to mobile services. The number of customers of socioeconomic strata 5 and 6, who contributed to the system, was decreasing and therefore, the resources available to the respective subsidies also had decreased. As it is shown in Figure 1, the schema of subsidies and contributions to fixed telephony was financially unviable and presented a cumulative deficit of nearly USD 266 million between 1998 and 2008.

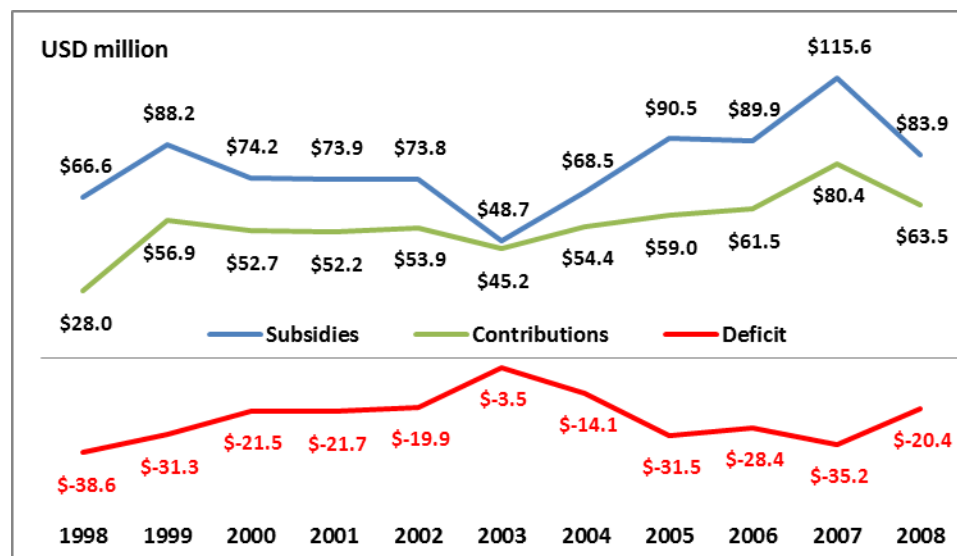


Figure 1. Subsidies and contributions to local fixed telephony and its net deficit. Source: Ministry of ICT of Colombia, 2009.

The aforementioned work of Gomez-Lobo and Melendez found that the subsidies and contributions scheme for fixed was not well targeted and was not sustainable over time. The authors observed that 60% of households in the 5 highest deciles, i.e. 50% richer, received subsidies and because of that 20% of households subscribed to the service in the first four deciles (of the poorest households) did not receive any support. The document however found that these problems were less severe than those of other public utilities such as electricity or water supply.

In December 2011 Colombia had a universal service scheme limited to local fixed voice which was not sustainable and the penetration of fixed broadband only reached 3 million with a penetration of 7.2% of households. Although the numbers showed a growth of 87% compared to the previous year, the installed base was relatively low and a significant decrease in the number of new customers was observed each quarter.

The operator with larger market share at a national level was UNE Empresas Públicas de Medellin (UNE EPM) with 29%, followed by Telmex (Teléfonos de México) with 26%, Telefónica with 19%, and ETB (Empresa de Telecomunicaciones de Bogotá) - with 18%. The remaining 7% was shared among 32 other companies, according to sectorial reports of the Ministry of ICT.

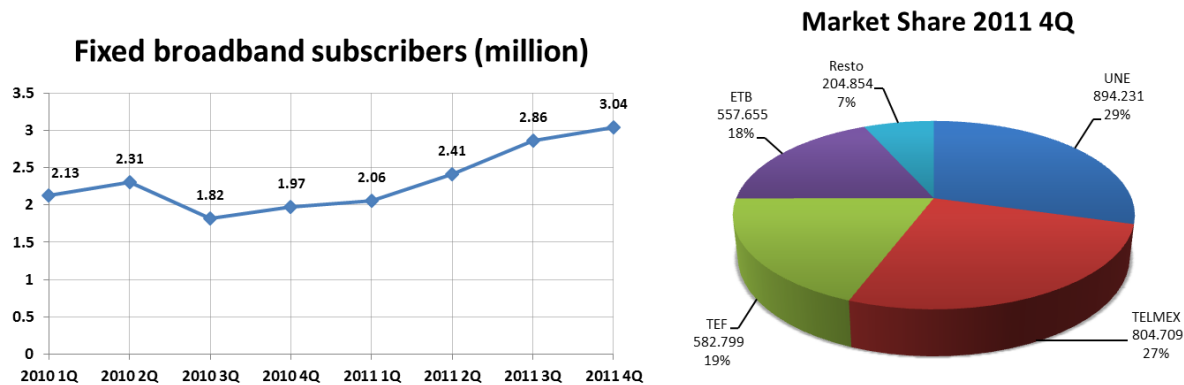


Figure 2. Evolution of fixed broadband subscribers (million) and market shares; Source: Ministry of ICT of Colombia.

With this framework, the Ministry of ICT in its drafts for the government plan collected contributions of different empirical studies such as United Nations Conference on Trade and Development (UNCTAD) (2010) and that of Katz (2010). These documents promoted the development of Internet services to reduce poverty and the strength of ICT ecosystem to generate direct and indirect employment. They provided the basis for the government and the operators in Colombia to start discussing on how to increase deployment of broadband, especially to the base of the social pyramid, and on how to find the best cost-effective way of allocating the resources of the fund.

3.2. *Layout.* The importance of information technology and communication productivity and competitiveness were evident in Colombia's 2010 government plan for telecommunications, Plan Vive Digital Plan. The Ministry of ICT gave priority to Internet universal service, and gradually eliminated the subsidy scheme for local fixed voice considering its low penetration. During the discussion of the social telecommunications policy in 2011, it was identified an opportunity to foster broadband adoption among population of strata 1 and 2: 29 million inhabitants, 66% of the total households (based on data from the National Bureau of Statistics), and a fixed broadband penetration of 6%. This low penetration was mainly due the barriers such as the high relative weight of the of fixed broadband service monthly bill for the household, absence of computers and, deficiencies in the knowledge to use computers and the Internet.

Considering this problem, the initiative of substituting subsidies for fixed telephony to subsidies for Internet access in lower strata was defined.

3.3. *Goals.* An ambitious goal of multiplying by 4 the number of fixed broadband subscribers was set and the government committed resources for USD 200 million for the promotion of fixed broadband in strata 1 and 2 for the period 2010 until 2014.

3.4. *Terms of subsidy scheme for fixed broadband.*

3.4.1. *Type of subsidy.* It was proposed to provide subsidies to the investment, considering that by constitutional mandate it was not possible to subsidize operating and maintenance costs.

3.4.2. *Mechanisms.* The government explored different options including the distribution of redeemable bonds for customers to buy equipment and services of their choice - as described by IDC for the case in Malaysia (2013)-, or provide bonuses to customers in order to support monthly payment for their services. For ease of auditing, provision and prevention of possible fraud, it was chosen to deliver a direct subsidy to each client, via the operators.

3.4.3. *Funding sources.* In order to bring the plan forward, the government chose to reuse the resources that were formerly intended for local fixed voice and to add some budget from other resources.

3.4.4. *Amount of subsidies and requirements.* The government proposed a reference subsidy for any new and existing fixed broadband customer in strata 1 and 2 of USD 83,1 for the period 2012 to 2014. To grant subsidies to operators, the Ministry of ICT set two goals to each operator participating in the project: increasing the installed base between 15% and 80% and to reduce average prices between 10% and 38% by December 2014. It also decided that subsidies should be adjusted for remote areas with high costs of service provision and low-income levels. In major cities with higher levels of penetration, lower costs and higher income, such as Bogota and Medellin, the subsidy would be adjusted by a factor of 0.6. In less dense and poorer regions, the subsidy would be multiplied by 2.4.

The companies argued for eliminating the price reduction obligation. As the elasticity of customers before price reductions is not static and depends on multiple conditions such as changing customer habits and market saturation, it was very

difficult to predict far in advance whether the market were to respond as required by the Ministry of ICT.

In June 2012, the Ministry of ICT defined the subsidies for fixed broadband subscribers in strata 1 and 2 as a discount in the monthly bill that would apply for existing and new customers. The obligation to increase the installed base between 15% and 80% remained and the rate reduction obligation was excluded. The standard reference amount was USD 83.4, adjusted with weighting factors defined by geographic area. Every month, each operator was recognized with an amount calculated by multiplying the unit subsidy per area times the total number of users, with a value per customer that now has a range between USD 2.2 and USD 6.8.

4. Results.

A trend change is not perceived when reviewing the evolution of total fixed broadband connections in Colombia. On the opposite, a higher growth is observed during the period prior to the subsidies than during the next phase. The total market increased from 2.40 to 3.09 million subscribers between June 2011 and March 2012, i.e. 1.28 times growth. June 2011 is taken as a starting point because it is the date from which the statistics per stratum are obtained. From March 2012 to January 2014, the total market grew 1.5 times, reaching 4.63 million. However, the quarterly compound growth rate was 9% in the first period and 5% in the second.

However, when discriminating the available information per socioeconomic strata different results are observed. In stratum 1, total fixed broadband subscribers augmented from 107 thousand to 184 thousand in the first period. This is an increment of 77 thousand or 72%. In the second period, subscribers grew by 206 thousand (112%) reaching 390 thousand. Even more important, is that during the period in which subsidies were provided, neither slowdown nor a negative growth was observed in any quarter.

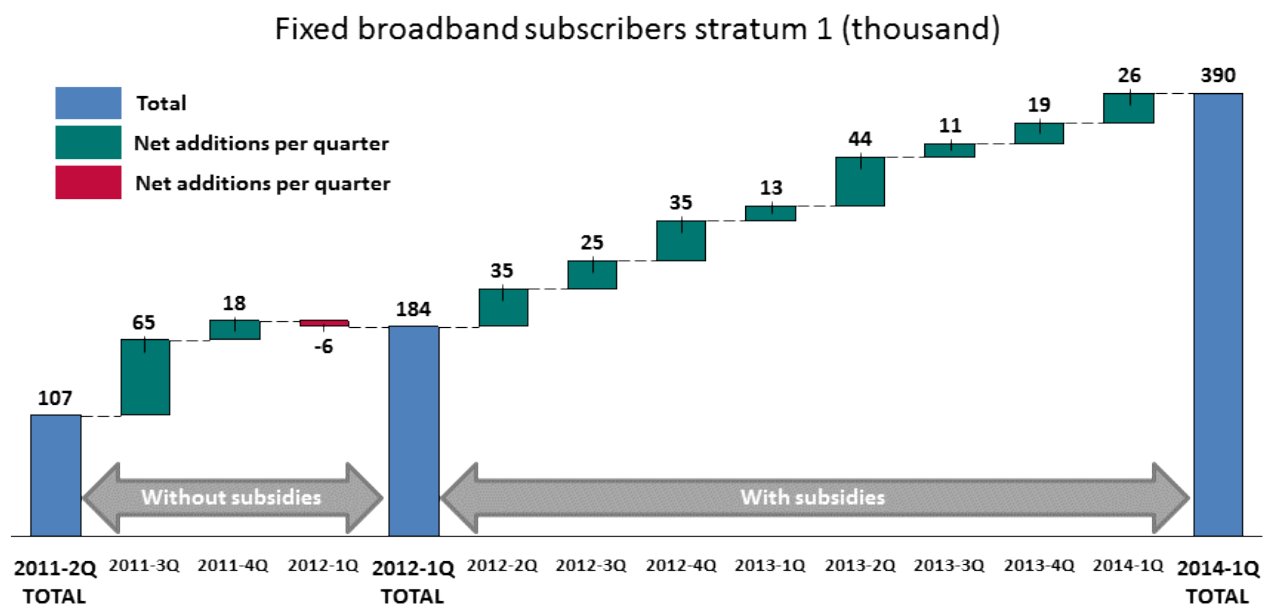


Figure 3. Total fixed broadband subscribers and net additions per quarter for stratum I (thousand); Source: Ministry of ICT of Colombia.

The behavior is similar in stratum 2: total subscribers grew in 251,142 (41%), moving from 610,606 to 861,748 during period 1. In period 2, subscribers reached 1.6 million having increased in 746,029 or 87%. It is also observed how, in the period before the grant of subsidies, there was a high slowdown and the number of new subscribers decreased from 199 thousand in the third quarter of 2010 to only 66 thousand in the fourth quarter of that year, and even decreased by 14 thousand in the next quarter.

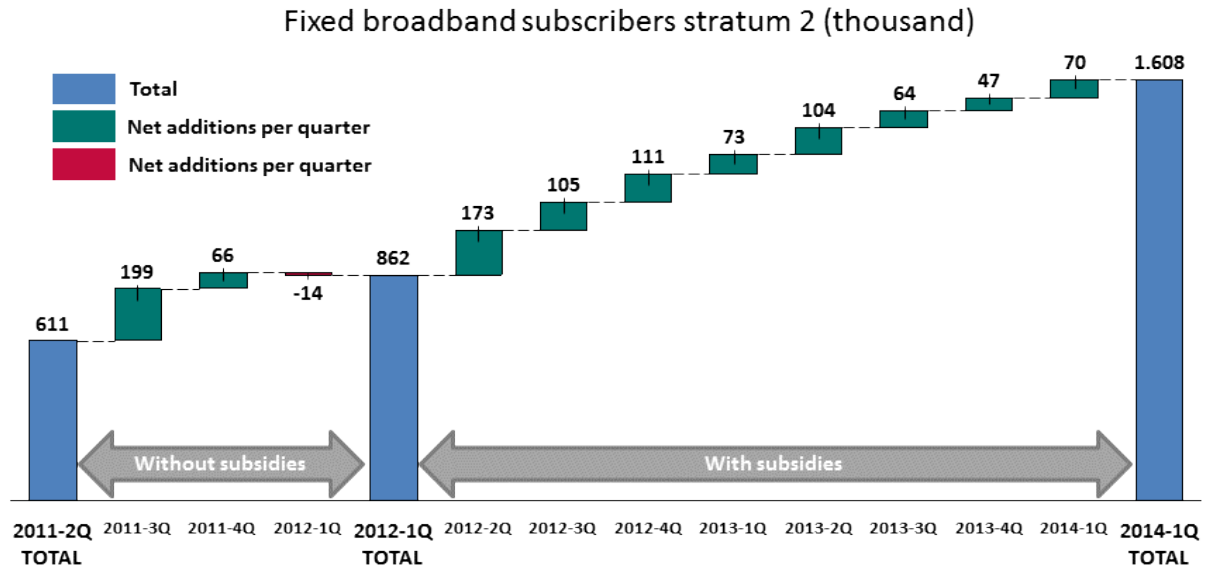


Figure 4. Total fixed broadband subscribers and net additions per quarter for stratum II; Source: Ministry of ICT of Colombia.

A statistical analysis tool was used to verify the effect of the subsidy system. Unfortunately, official data series only covers twelve quarters, four before applying the subsidy scheme and eight since it's beginning. These are very few observations to have a good conclusion, since time series analysis requires long series to attempt to characterize any behavior. If the Ministry of ICT had monthly information and not quarterly, a Chow test could be applied in order to determine if there is stability in the total series or if, by contrast, the inclusion of subsidies changes the trend.

With these limitations, a linear estimate with a dichotomous variable (*dummy*) was made, checking whether the subsidy program has had a positive influence on the increase in broadband subscribers in strata 1 and 2 in Colombia. The following model was used:

$$Y_i = \alpha x_1 + \beta x_2 + u_i$$

Where

Y = number of broadband subscribers per stratum 1 reported by the Ministry of ICT for each quarter

x1= period corresponding to the quarters since 2Q of 2011 until 1Q 2014

x2= artificial variable (dummy) that takes the zero value for the periods without the application of the subsidy and 1 from the start of the program.

Table 2 shows the values of the variables described for the stratum 1:

Table 2. Values of variables for stratum 1

	x1	x2	y (stratum 1)
2011-2Q	1	0	107.220
2011-3Q	2	0	172.324
2011-4Q	3	0	189.928
2012-1Q	4	0	184.147
2012-2Q	5	1	218.707
2012-3Q	6	1	243.453
2012-4Q	7	1	278.511
2013-1Q	8	1	291.034
2013-2Q	9	1	334.725
2013-3Q	10	1	345.638
2013-4Q	11	1	364.144
2014-1Q	12	1	390.070

The results of the linear regression including the dichotomous variable are listed in Table 3:

Table 3. Regression Results

Coefficient for x1	24430.3511
Coefficient for x2	-1701.6064
Coefficient for the constant (b)	102328.8723
Standard error for x1 (Se1)	1964.9741
Standard error for x2 (Se2)	14389.3269
Standard error for the constant (b)	8336.6790
Standard error for the calculation and	13471.1836
R2	0.9809
F	231.5109
Df (degrees of freedom)	9
Sum of squares regression	84025867910
Residual sum of squares	1633255082

As a result, the coefficient of determination (R^2) indicates a close relationship between the independent variables and the number of subscribers. In order to rule out whether these results were random, the F test is made.

Df and F values of the above table were used to determine the probability of random occurrence of a higher F value. This result can be compared with the critical values of F distribution tables published in textbooks on statistics. A standard F distribution has degrees of freedom v_1 and v_2 for the numerator and denominator respectively.

With n as the number of data, then v_1 is equal to $n - Df - 1$ and v_2 is equal to Df . As α is the significance level, or the probability of rejecting the true hypothesis, and taking this value to 0.05, then $v_1 = 12 - 9 - 1 = 2$, and $v_2 = 9$. Thus, the degrees of freedom for the numerator are $12 - 9 - 1 = 2$ and the degrees of freedom for the denominator are 9. Assuming an α value of 0.05 and verifying in the table of higher percentage points, a critical value of 5.12 is found. As the regression value $F_{231.51}$ is much higher than 5.12, a random result is extremely unlikely.

Then, the confidence interval for the regression coefficient of the dummy variable (x_2) was found for the case of stratum 1. When $\alpha = 5\%$, i.e., with a confidence coefficient of 95%, the t-distribution table shows 10 degrees of freedom ($n-2$, or $12 - 2 = 10$ for this case) and the critical $t_{\alpha/2}$ equals $t_{0.025} = 2.228$. The confidence interval can be written as $x_1 \text{ estimated} \pm t_{\alpha/2} Se_1$.

Upon replacement of the values of Table 3 into the previous equation, the interval is equal to $24430,3511 \pm 2.228 * 1964,9741$. In 95 out of 100 cases, intervals as (20,052; 28,808) will contain the true coefficient value. The coefficient value (24,430) is within the interval. Similarly, the exercise for the subscribers of stratum 2 was carried out, using the same type as described before, where this time the variable Y represents the number of broadband subscribers in stratum 2, x_1 is the period of each quarter since 1Q of 2011 to 2Q of 2014 and x_2 is the dummy variable which takes the zero value for the periods without the application of the subsidy and 1 from the beginning of the program. The values of the variables for the Stratum 2 can be seen in the following table:

Table 4. Values of variables for Stratum 2

	x1	x2	y (stratum 2)
2011-2Q	1	0	610.606
2011-3Q	2	0	809.355
2011-4Q	3	0	875.690
2012-1Q	4	0	861.748
2012-2Q	5	1	1.034.388
2012-3Q	6	1	1.139.340
2012-4Q	7	1	1.250.474
2013-1Q	8	1	1.323.920
2013-2Q	9	1	1.427.802
2013-3Q	10	1	1.491.459
2013-4Q	11	1	1.538.212
2014-1Q	12	1	1.607.777

The results of the linear regression including the dichotomous variable are shown in Table 5:

Table 5. Regression Results

Coefficient for x1	81432.7766
Coefficient for x2	73725.0904
Coefficient for the constant (b)	585767.8085
Standard error for x1 (Se1)	6123.8340
Standard error for x2 (Se2)	44844.2809
Standard error for the constant (b)	25981.2274
Standard error for the calculation and	41982.8909
R2	0.9865
F	327.6156
Df (degrees of freedom)	9
Sum of squares regression	1.155E+12
Residual sum of squares	15863068152

Once again, the R2 indicates a close relationship between the independent variables and the number of accesses. In the F test, the degrees of freedom for the numerator are $12 - 9 - 1 = 2$, and the degrees of freedom for the denominator are 9, whereby the higher percentage point table, assuming an alpha value of 0.05, shows a critical value of 5.12. The F value obtained in the regression was 327.6 which is much higher than 5.12, therefore random results are ruled out.

Then, the exercise of the confidence interval for the regression coefficient of the dummy variable (x_2) in the case of stratum 2 was performed. With $\alpha = 5\%$ and a confidence coefficient of 95%, the t-distribution table shows 10 degrees of freedom ($N-2$, or $12-2=10$ for this case), the critical $t_{\alpha/2}$ is equal to $t_{0.025} = 2.228$. The confidence interval can be written as x_2 estimated $\pm t_{\alpha/2} Se_2$.

Upon replacement of the values of Table 5 into the previous equation, the interval is equal to 81432, 7766 $\pm 2.228 * 6123,8340$. In 95 out of 100 cases, intervals as (67,788; 95,076) will contain the true coefficient value. Once again, the coefficient value (81.432) is within the interval.

Finally, it should be noted that in the time span analyzed the number of firms in the market increased from 32 to 49. Similarly, the intensity of competition increased as the leader became a different company with a much smaller market. The list of the top five companies varied their composition, and other companies show an increase in market share. As of March 2010, the leading company was ETB at the country level with 50.2% of accesses, followed by UNE with 22%, Telefónica with 20.2%, Telmex with 2.5%, Metrotel (Empresa Metropolitana de Telecomunicaciones) with 2.1%, and the remaining companies adding 3%. In March 2014, Telmex took the first place with a share of 32.3%, followed by UNE (27%), Telefónica (19%), ETB (11.4%) and Edatel (Empresa Departamental de Telecomunicaciones de Antioquia) with 2.7%, while the remaining companies added 7.5%.

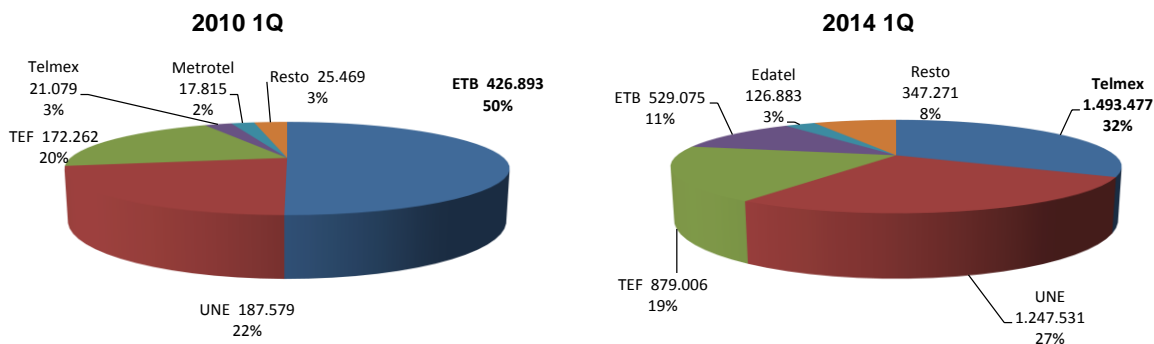


Figure 4. Market share for fixed broadband, total country; Source: Ministry of ICT of Colombia.

5. Conclusion

From 1994 until 2009 cross-subsidization models between profitable and less profitable services and segments of the population characterized the public policy for social telecommunications in Colombia. Within this policy, the scheme of subsidies and contributions from local telephony seems to have allowed the country to achieve higher penetration than that of its peers. In addition, telephony programs and community internet access complemented the scheme and helped to promote universal access.

In 2011, the government and the industry discussed on the best way to close the digital gap in Colombia, and concluded that, despite recommendations to the contrary, a model of demand subsidies through incumbent operators could contribute significantly to increasing the penetration of fixed broadband. Colombian legal framework imposed some restrictions on the subsidy, which was granted to assist operators to make the necessary investments in expanding the geographical coverage of fixed broadband. Such assistance was transferred to monthly discounts of the monthly bill that low-income users should pay for the service.

This work uses a simple econometric exercise with public available information to analyze the effect of that policy in the penetration of fixed broadband in low-income socioeconomic segments.

Based on the limited information described above, the results of the econometrical exercise show a significant increase in the number of fixed broadband subscribers in strata I and II from the moment subsidies were applied. Perhaps more important, the results show a trend change when comparing the data to the period prior to the granting of assistance. The econometric verification that could be carried out indicates a close relationship between the independent variables and the number of subscribers, and an extremely low probability that growth has occurred by chance.

It is necessary to make sturdier analyses that include other variables that can impact positively on the adoption of fixed broadband in Colombia. It is also desirable to include in the analysis complementary measures that were launched at the same time such as the national plan for optical fiber, the supply of handsets to low-income students, and the promotion of contents and applications of the Colombian National Broadband Plan – Vive Digital.

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ANNEX I - Representative market exchange rate (TRM, in Spanish)

Year	Exchange rate (average)
2002	2.506,55
2003	2.875,91
2004	2.628,47
2005	2.321,49
2006	2.358,96
2007	2.076,24
2008	1.967,11
2009	2.153,30
2010	1.898,68
2011	1.846,97
2012	1.797,79
2013	1.869,10
2014*	1.937,99

* Average exchange rate from January to August 2014

Source: Financial Superintendence of Colombia (www.superfinanciera.gov.co)