

The effect of institutional constraints on the success of universal service policies

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Abstract

Beginning in the late 1980s and early 1990s governments began to privatize state operators and open markets to competition. The introduction of liberalization to telecommunication markets has well known positive effects in the sector. In reconciling the dramatic changes wrought by the liberalization process with social goals of universality of service, many countries considered revising their universal service programs. However, despite the strong support of these programs, there are critics. Some scholars argue that these programs have not led to significant increase in telephone penetration. The purpose of this paper is to determine how effective in terms of network expansion have been these programs. Using data from 189 countries we conducted a regression analysis to help elucidate this debate. The statistical results indicate that universal service funds have not led to increases in the number of fixed telephone lines but they show a positive relation with the number of public phones. Consistent with previous studies, the analysis indicates that per capita income, population size and, the size of the manufacturing and service sector positively contribute to the telecommunications infrastructure. Of the institutional variables that were included the presence of the regulator shows positive effects on the payphone infrastructure as well as the number of employees in these agencies. Overall the research suggest that these programs have positive effects for universal access and governments are encouraged to continue them.

Introduction

Beginning in the late 1980s and early 1990s governments began to privatize state operators and open markets to competition. The introduction of liberalization to telecommunication markets had well known positive effects in a sector where state-owned companies typically undersupplied services and generally exhibited network and service quality deficiencies.¹ (Wellenius & Stern, 1994) For example, Ramamurti (1996) found that in the four years that followed privatization in Argentina, Jamaica, Mexico, and Venezuela, these countries experienced a rapid expansion in their networks, averaging 15% growth per year.

However, the positive effect of the process of liberalization on expansion and quality of these communication networks is not a complete story. Some scholars have argued that this may simply be a natural outcome from better private administration compared to the years of state neglect. Regarding this, the Lead Economist at the World Bank's Development Research Group, Ioannis Kessides stated that "[f]ew—if any—sustainable improvements in utility performance can be achieved simply by replacing a state-owned monopoly with a private one," and concluded that policies should be designed to "strike a balance between economic efficiency and social

¹ This was not a problem unique to telecommunications. State enterprises were often poorly managed and thereby harmed their country's economy.

equity...and [find] new ways to increase poor people's access to services." (Kessides, 2003, p. II)

In reconciling the dramatic changes wrought by the liberalization process with social goals of universality of service, many countries considered revising their universal service programs. Notably, competition in the sector together with policy makers' desire to foster entry led to the creation of interconnection schemes based on costs. This approach, in combination with stringent regulatory oversight, made the traditional cross subsidization practices to finance less profitable sectors and regions difficult to continue.

The liberalization process thus required other mechanisms to fund access to telecommunications services for low income or isolated communities. The most widely used alternative was the use of explicit subsidies that are normally allocated based on competitive reverse auctions, where the carrier that bids for the lowest subsidy wins the government contract. These relatively new programs have had strong backing from various governments, such as those of Peru and Chile, and the International Telecommunications Union. (Intven & McCarthy Tétrault, 2000) However, despite the general support of these programs, there are critics. Some scholars argue that these programs have not led to significant increase in telephone penetration. (Rosston & Wimmer, 2000) Similarly, policy makers in the United States have criticized the FCC for the Universal Service program, which they argue has led to increases in prices for consumers as a result of access fees thereby driving them from the network. Furthermore, in developing countries, governments have also faced other challenges such as the lack of bids for these projects. (Gruenwald, 1998)

While determining the most optimal funding mechanisms is still in dispute, institutional constraints can also affect the success of these programs and of investment in telecommunications in general. Several scholars have indicated that a poor institutional environment can hamper investment. Nonetheless, these studies have focus primarily on the macro institutional factors such as the constitution (Cherry & Wildman, 1999), the political party system (Henisz & Zelner, 2001), and the legislature (Pargal, 2003; Spiller, 1996), among others. However, there has been little attention given to the characteristics of the political institutions affecting the sector, such as the independence of the regulator. The aim of this study is thus to determine the effectiveness of universal service programs and the effect that institutions have on their success.

Research Questions

Our study involves an empirical statistical investigation of the factors that determine the effectiveness of universal service programs. Because universal service objectives include both expansion of the network and affordability, the dependent variables for this project are the total number of telephone lines in the country, including both wired and wireless, as well as the monthly subscription price for the service. The independent variables include: local telephone rates; the presence of sector competition, privatization, universal service fund programs; autonomy and appointment process of the regulator, transparency of the regulator's decision making process, and the presence of executive branch constraint; population, GDP/PPP per capita, and size of the service, manufacturing and agricultural sectors. All of these variables have been identified in previous studies of telecommunications investment.

The following research questions will guide this research project:

Q1: How effective in terms of network expansion are Universal Service Funds in providing increasing levels of telecommunication services?

Q2: How do economic reform factors such as privatization and competition affect the success and failure of these programs?

Q3: What impact do the institutions governing the sector, such as the existence of a regulator, transparency of its decision making process, and degree of autonomy from political influence have on the effectiveness of these programs?

Theoretical Background

With dramatic changes toward liberalization of telecommunications services away from national monopolies over the past quarter century, the literature surrounding the importance of institutions and economic reforms in facilitating the expansion of infrastructure has grown steadily.

Institutional Characteristics

North's contribution to the field of Institutional Economics [citations] has generated increasing interest in the role of institutions as a factor that affects economic development. Institutions are defined as the formal and informal rules of behavior that govern economic transactions. Formal rules refers to laws and regulations enforced by the government and informal institutions refers to rules of behavior enforced by peers. In general, societies are governed by both. However, in many cases informal rules are more important because they represent the actual implementation of formal rules.

Understanding the impact of these different institutional arrangements on the economy has generally been undertaken at two levels of analysis. At a higher level, rules correspond to those that govern the country as a whole. Here formal rules refer to Constitutions, the rules and procedures governing the executive, the legislature, and the courts. At another lower level, scholars investigate the specific rules governing a sector of the economy, for instance the telecommunications industry.

National institutional constraints

Scholars have paid considerable attention to the issue of credible commitments, which refers to the government's ability to keep its part of the contract regarding policies that affect the private sector in spite of the potential political benefits that it could obtain from violating it. One of the negative consequences associated with a lack of credible commitments is the uncertainty that it creates in the market. For example, Barro (1997) finds that political instability regarding such as popular protests, coup d'etat attempts and political assassinations significantly affected economic growth. Similarly Borner, Brunetti and Weder (1995) found that the policy and regulatory uncertainty in economic issues was an important determinant of investment and economic growth.

In undertaking the development of infrastructure the greatest fear is expropriation. The private sector is unable to make long term plans because of government uncertainties, and thus discouraged from investing. This is particularly true in the telecommunications sector where investment experiences large sunk costs in an asset specific infrastructure that cannot be redeployed without significant loss of value. Regarding this, Henisz and Zelner (2001, p. 127) state that in the absence of credible commitment by political actors not to expropriate capital assets increases the risk associated with investment. In their work they measure political stability by the “checks and balances on executive discretion created by variation in political structures and party systems.” (p. 123) Similarly, Begara, Henisz & Spiller (1998) find that where veto power is held by multiple actors within an institution, there is a reduction in infrastructure investment risk.

Industry level institutions

At the industry level, studies about the effect of institutions has generally been associated with the regulatory body responsible for supervising the industry. In 1994, Levy & Spiller (1994) conducted a study where they found evidence of the need for institutional constraints to ensure the credible commitment of regulators to increased infrastructure investment. Henisz (2002) empirically confirmed these findings for the electricity and telecommunications sector. His empirical analysis of over a 100 countries demonstrated that institutional constraints on political actors which limited the potential for arbitrary policy change were positively related to increases in infrastructure growth rates, even when accounting for unobserved country-level heterogeneity. In the case of Latin America, many have questioned if most countries have indeed committed to creating and ensuring credible regulatory regimes (Noam, 1998). However, more recent evidence suggests that the provisioning of a “check and balance” in the Brazilian privatization program, by means of an independent judiciary, provided investors with safeguards against arbitrary expropriation by the government. This provided them with assurances to enter the market and invest confidently. (Mueller, 2001)

While the findings above corroborate earlier work on the importance of institutional constraints such as autonomy and ability to be overridden by veto, it is important to note that these factors are often moderated by extenuating circumstances such as agenda-setting power or appointment processes; experience of firms in the political or regulatory process; and the reduction of hold-up problems due to technological advances.² (Henisz & Zelner, 2001, p. 144) In particular, the appointment process of regulators can exhibit negative effects as Galperin (2000) recalls in looking at Argentine reforms, where the executive nominated a favorable judiciary thereby maintaining centralized control over communication policy.

In addition to the need for credible commitments, scholars have analyzed other factors such as the degree of autonomy and transparency in the decision making process of regulators. Evidence suggests that the presence of an independent regulator impacts infrastructure expansion positively. Gutierrez & Berg’s (2000) study of 19 Latin American countries found that the existence of an independent regulator, as measured by their ability to enforce decisions and their

² This final factor is of particular note given the prevalence and rapid uptake of alternative infrastructures in Latin America, where mobile cellular technology penetration has exceeded initial projections. (Noam, 1998, p. xxvii)

neutrality, positively affected teledensity. Similarly, Pargal (2003) found that government action, specifically legislation establishing independent regulatory bodies was the main determinant of private investment levels in telecommunications for nine Latin American countries. Additionally, when taken in conjunction with the effects of privatization and competition reforms, the presence of a separate and independent regulatory agency resulted in the greatest impact on teledensity in developing countries. (Fink, Mattoo, & Rathindran, 2002).

The need for an independent regulator stems from the need to isolate these agencies from the influence of policy makers and private interest groups. The need for independence and transparency are particularly important in the administration of a universal service fund. This is because most of them use reverse auctions for the allocation of subsidies. Because these are generally large infrastructure contracts, allocations of subsidies based on influence could have serious negative consequences to the project.

The independence of the regulator does not necessarily mean isolation from all potential sources of influence. As pointed out by a current FCC commissioner, federal agencies must recognize that they cannot possibly have all the resources and information that they need to make decision. (Abernathy, 2002) Given this, it is important for agencies to “reach out to consumer groups, industry, trade associations, and state regulators to maximize the information available in the decision-making process.” (p. 223) The International Telecommunication Union has recently concurred with this sentiment, suggesting in their 2003 report the active use of consultation and hearings open to all affected parties in order to facilitate good decision-making. (Intven & McCarthy Tétrault, 2000)

The use of consultation mechanisms in conjunction with transparent procedures is likely to have positive effects on these agencies efforts to implement a Universal Service Fund. Transparency in this context has generally referred to the publication and access by the public of their decisions. Given the benefits that scholars have found regarding transparent processes countries have moved in that direction (Dokeniya, 1999). In Brazil, under reforms implemented in the 1990s, the pay-TV (i.e., cable, DBS, MMDS) regulatory regime became increasingly transparent with requirements for the publication of administrative procedures and public hearings prior to implementation of rules. (Galperin, 2000) Similarly, many regulators around the world have set up websites where decisions are posted.

Economic Factors

Privatization of state-owned service providers and the promotion of competition in the telecommunications industry are increasing globally. (Ramamurti, 1996; Wellenius & Stern, 1994) While each reform can play unique and instrumental roles in the development of telecommunications infrastructure, they are often viewed as interacting complements where privatization leads to increased teledensity under competitive conditions which limit the incumbent(s) provider’s market power. (Kay & Thompson, 1986; Vickers & Yarrow, 1998; Yarrow, 1986 both cited in Li & Xu, forthcoming) Furthermore, the exact sequence of privatization and competition reforms can impact outcomes, along with additional country-specific factors which often moderate the impact of reforms.

Privatization

In general, privatization reforms have been associated with increased deployment of telecommunications infrastructure. Ramamurti's (1996) study of four Latin American countries, including Jamaica, Mexico, Argentina and Venezuela, notes the "striking and consistent" impact of privatization reforms in achieving network growth rates in excess of 10% per annum only three to four years after being implemented. (p. 26) Similarly, Ros and Banerjee (2000) found privatization reforms in 23 Latin America countries between 1985 and 1996 to significantly and positively affect network expansion. While not looking specifically at privatization reform, Wallsten (2001b) uncovered in another era of dramatic network provider competition (i.e., the early 20th century) a negative relationship between the provisioning levels of mainline telephones and the presence of state-owned monopolies. However, improved performance from privatization does come with caveats. While finding that countries in which the majority of the dominant telecommunications provider is privately held achieve statistically significant higher teledensity levels and teledensity growth rates, Ros (1999, p. 88) identified that the growth effect of privatization only held true for middle and high GDP per capita countries.³

Competition

Similarly, improvements in telecommunications performance indicators are often positively associated with competition reform. In Sri Lanka, the creation of a competitive telecommunications market environment was the most important factor leading to increased investment, lower prices and higher levels of connectivity. Additionally, organizational reform of the incumbent was reinforced, and the consolidation and legitimation of regulation occurred as a result of the introduction of competition. (Samarajiva, 2000) In a study of 30 Latin American and African countries from 1984 to 1997, Wallsten (2001a) determined that a competitive market, as indicated by the presence of mobile sector firms unassociated with the incumbent carrier, was positively linked to increases in teledensity, connection capacity and a decrease in local call prices. In addition, when moderated by the presence of an independent regulator, privatization reforms were also positively correlated with all the aforementioned telecom indicators.

Interaction between and the sequence in which privatization and competition reforms occur is important. Fink, et al. (2002, p. 15) found that in addition to positive independent effects, the benefit (i.e., higher teledensity) of competition "primarily occurs through its interaction with privatization." In 86 developing countries, teledensity was found to be significantly higher in years following the simultaneous introduction of privatization and competition versus the introduction of privatization prior to competition reforms. Wallsten (2002) found that the establishment of a regulatory authority to manage competition policy prior to the privatization reform led to increased levels of investment, and fixed and mobile teledensity.

Methods and Data

This section consists of two parts. First, summary data is presented and we elucidate on some of the relationships of interest in this research. This is followed by the statistical analysis.

³ That is, for countries with GDP per capita exceeding \$10,000.

Data collected for this paper comes from the *World Bank Development Indicators* database, and the *World Telecommunication Indicators* and the *Country Regulatory Profiles* databases, both published by the ITU. Some of the regulatory data that was missing was collected by contacting the regulators of the Latin American region directly. Table 1 (below) includes the names of the variables used for the statistical analysis as well as the transformation that were done.

The statistical analysis consists of heteroskedastic robust standard errors given that tests show the presence of non-homogeneous residuals. Additionally, the model was modified to eliminate multicollinearity problems. The original models, for example, included the privatization, monopoly and a interaction variable composed of these two resulting in multicollinearity. Because of this we decided to keep the composite variable. Other similar modifications to the model were made to prevent that problem.

Finally, even though we collected a considerable amount of data from several datasets and from the Latin American regulators, there was still a high number of missing variables. To alleviate the problem of missing data I used a multiple imputation technique where missing data is generated simultaneously from all the available variables for all the observations and years. The mathematical algorithms that are necessary for multiple imputation are now easier to use thanks to advances in computing. In this project I used the Amelia program developed by Honecker, et al. (Honaker, Joseph, King, Scheve, & Singh, 2001) “[M]ethodologists and statisticians agree that "multiple imputation" is a superior approach to the problem of missing data scattered through one's explanatory and dependent variables than the methods currently used in applied data analysis”. (King, Honaker, Joseph, & Scheve, 2001, p. 49)

Table 1: Variable Descriptions

SOURCE	VARIABLE DESCRIPTION	VARIABLE OPERATIONALIZATION	TRANSFORMATION
("ITU World Telecommunication Indicators," 2004)	Number of fixed telephone lines		Natural log
	Cellular mobile telephone subscribers		Natural log
	Residential monthly telephone subscription	USD	Natural log
	Cellular monthly subscription	USD	Natural log
	Cost of a local 3 minute call	USD	Square root
	Public pay phones		Natural log
("ITU Country Regulatory Profiles," 2002)	Existence of Universal Service Fund program	Dummy	
	Is operator(s) privatized	Dummy	
	Is operator monopoly	Dummy	
	Does regulator exist	Dummy	
	Is regulator autonomous	Dummy	
	Which branch of government appoints regulator	President, Minister, Legislator	
	Are regulator hearings public	Dummy	
	Are regulator decisions published	Dummy	

<i>(Transparency International Corruption Perceptions Index, 2002)</i> (Beck, Clarke, Groff, Keefe, & Walsh, 2001)	Number of regulatory staff	Dummy	
	Is regulator understaffed	Dummy	
	Level of government transparency and corruption	Composite index, with values ranging from 0 (corrupt) to 10 (non-corrupt)	
("World Bank Development Indicators," 2003)	Correcting treatment of parties in presidential system and whether they are closer ideologically to opposition or to presidential parties	Open-ended scale, incremented by one for factors increasing institutional constraint	Natural log
	GDP per capita, purchasing power parity	GDP per capita converted to international dollars using purchasing power parity rates	Natural log
	Mainlines per employee	Fixed telephone lines/labor force	Natural log
	Industry, value added	1995 USD	Natural log
	Agriculture, value added	1995 USD	Natural log
	Services, etc., value added	1995 USD	Natural log
	Population		Natural log
	Percent urban population		
Percent rural population			

We identified two types of data, that which pertained to the economic relationships and can affect the deployment of infrastructure, and institutional variables that can affect the implementation of universal service policies. More specifically, this data included the level of institutional transparency and the ability of affected parties to participate in the policymaking process.

Descriptive Statistics

This section presents summary statistics from two economic variables, privatization and level of competition, and also institutional variables including the ability of affected parties to participate in the hearings process and to review regulatory decisions. We also look at the general measure of transparency in governmental institutions and its relationship to the mean levels of payphone, fixed telephone line and cellular line infrastructure for both Latin America and the world.

As expected, the global data shows in Table 2 (below) indicates that countries that have privatized their carriers experience higher levels of infrastructure development than those that still maintain a monopoly. However, while cellular teledensity in Latin America is higher for countries that have privatized the dominant carrier, the average number of fixed telephone lines are surprisingly greater with a monopoly operator.

Table 2: Infrastructure Levels and Privatization Status

World		Latin America	
Privatized	State owned	Privatized	Monopoly

Payphones	0.196 (0.204)	0.173 (0.287)	0.211 (0.251)	
Fixed teledensity	20.322 (19.960)	14.816 (19.618)	13.958 (7.733)	27.481 (0.962)
Cellular teledensity	32.274 (31.674)	20.034 (30.823)	22.277 (14.818)	16.447 (3.978)

The effects of competition on infrastructure development show similar results in Table 3 (below). Globally, we see expected results of higher levels of infrastructure development occurring with the introduction of competition. However, the Latin American region again shows to be somewhat of an anomaly. While the number of public payphones is consistent with global conditions, both fixed and wireless teledensity means are apparently higher under conditions of monopoly.

Table 3: Infrastructure Levels and Competition Status

	World		Latin America	
	Monopoly	Competition	Monopoly	Competition
Payphones	0.179 (0.250)	0.212 (0.237)	0.169 (0.233)	0.281 (0.281)
Fixed teledensity	16.652 (16.715)	23.269 (22.645)	16.576 (10.387)	14.195 (6.727)
Cellular teledensity	22.701 (25.597)	37.537 (34.829)	21.688 (16.935)	20.556 (10.050)

The ability of affected parties to review regulatory decisions has mixed results when looking at infrastructure development. For every type of infrastructure within Latin America and globally, we see higher average levels of infrastructure when regulatory hearings are public and affected parties can participate. To the contrary, we see both globally and within Latin America in Table 4 (below) that published decisions are not indicative of higher levels of infrastructure with the exception of public payphone levels.

Table 4: Infrastructure Levels and Consultation Activity

	Published decisions	No published decisions	Public hearings	No public hearings
World				
Payphones	0.245 (0.214)	0.222 (0.145)	0.229 (0.205)	0.181 0.225
Fixed teledensity	21.157 (19.830)	26.333 (20.750)	25.223 (21.718)	14.833 (16.933)
Cellular teledensity	33.584 (31.190)	34.667 (29.112)	37.838 (33.443)	26.277 (28.733)
Latin America				
Payphones	0.310 (0.318)	0.225 (0.285)	0.269 (0.309)	0.131 (0.199)
Fixed teledensity	14.296 (8.371)	16.978 (9.215)	15.478 (8.793)	12.399 (7.669)
Cellular teledensity	20.744 (16.403)	23.866 (11.254)	22.702 (16.850)	17.618 (9.798)

Finally, in Table 5 (below) we see the expected relationship when looking at the level of institutional transparency and its effect on infrastructure levels. The measure of transparency is a composite index, drawing on 17 surveys conducted by 13 independent institutions, with values ranging from 0 (low transparency) to 10 (high-transparency). As one would expect, higher levels of infrastructure development worldwide and within Latin America are seen with greater levels of institutional transparency. Although the increase in infrastructure seems to be more gradual for Latin America when compared to global levels, highlighting a need for further investigation.

Table 5: Infrastructure Levels and Institutional Transparency

	Less than 3	Between 3 and 6	Greater than 6
World			
Payphones	0.095 (0.163)	0.393 (0.293)	0.490
Fixed teledensity	8.325 (6.007)	16.809 (7.321)	22.511
Cellular teledensity	15.363 (9.939)	20.385 (11.149)	41.850
Latin America			
Payphones	7.959 (1.040)	10.248 (1.304)	11.231
Fixed teledensity	12.156 (0.464)	13.985 (0.513)	15.059
Cellular teledensity	12.401 (0.565)	13.985 (0.562)	15.679

Statistical Analysis

This section presents the results of the statistical models constructed for this study. We present regression result for both the world and Latin America. Two regression models were fitted for each. One measures the impact of the institutional and economic factors on the fixed telecommunications infrastructure of the country and the other on the payphone infrastructure. Our reasoning for this is that in more developed countries universal service obligations include telephone service to the home. However, in poorer regions where there are numerous isolated rural communities, the universal service program normally consists of community phones also known as public pay phones.

Table 6: Descriptive Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
telfix (Thousands)	137	6,995.86	28,100.00	4.46	263,000
telwls (Thousands)	149	8,198.19	27,800.00	0.00	269,000
payphones (Thousands)	115	165,429.90	950,709.70	10.00	9,855,000
numstaff	82	46.341	80.687	1	448
checks	152	2.737	1.686	1	15
populati (Thousands)	186	32,500	124,000	30	1,270,000
gdpcapp (USD)	162	8,580	9,263	470	53,780
indva95 (USD Millions)	129	37,100	106,000	10.30	748,000
agrva95 (USD Millions)	131	7,610	20,200	11.00	175,000
srvva95 (USD Millions)	129	66,900	209,000	26.50	1,670,000

The results between the world and Latin America show important differences. With respect to the number of fixed lines for the world, the significant economic factors include income as measured by GDP/PPP, the size of the population, and the size of the service sector – all of which have a positive effect on infrastructure. The agriculture sector that is represented by the constant term is also significant and negative. This result suggests that an agriculturally based society relies less on telecommunications. These results are consistent to what other researchers have found. When looking at the institutional variables, only the variable *checks* is significant. *Checks* represents the level of opposition that exists in the legislature. The variable is positive which suggests that the existence of greater ideological opposition to the executive, and hence greater constraint on potentially arbitrary decision-making, leads to more infrastructure.

The results for Latin America are similar although there are a few more significant institutional variables. The factors that show a positive effect on the fixed telephone infrastructure are income, the size of the population and the service sector. In Latin America the size of the agricultural sector also shows a negative relationship with the fixed infrastructure. Again, significant institutional variables include *checks*, as well as variables *understa* (“understaffed”), and *publishd* (“published decisions”). Both have positive signs. While it was expected that openness in the policy-making process will lead to greater investment in infrastructure, it is unclear why having an understaffed regulator will be related to greater infrastructure levels. It is possible that a smaller regulator is unable to monitor the industry and thus companies may feel freer to carry out their plans including infrastructure deployment. Further investigation into this variable will be necessary to determine the reason.

With respect to the public phones infrastructure, the significant variables for the world are once again the size of both the manufacturing and the service sector all of which show positive relationship. The size of the agricultural sector is also significant and shows similarly a negative relationship with the public phone infrastructure. Additionally, the variable *pricom*, which is a composite variable that represents the interaction between privatization and competition, is also significant and positive. This means that nations with both a competitive market and where the incumbent carrier has been privatized will experience higher levels of public phones than those that do not have these conditions.

Of the institutional variables only the existence of a Universal Service Program is significant with a positive sign. This means that this type of initiatives show a positive relationship with the pay phone infrastructure.

The results for Latin America show some differences with those of the world. The economic variables that show significant results are similar to those of the world. Both the manufacturing and service sector show as positive. In Latin America the presence of both a privatized incumbent carriers as well as a competitive market appear to have a negative relationship with the public phone infrastructure. This is an unexpected result that will require further investigation. The institutional variables that show significant results are the existence of a regulator, and whether or not it is understaffed. Having a regulator shows a positive relationship with the public phone infrastructure, and once again being understaffed also shows a positive relationship. The variable of interest for this study, which is the impact of a Universal Service Program on infrastructure, is significant and positive. This thus means that these programs have had positive effects and governments are thus encouraged to pursue this policies to further enhance access to communications services for the population.

Table 7: Regression results for fixed and payphone infrastructure

	World		Latin America	
	ltelfix	lpayphon	ltelfix	lpayphon
uspfund	-0.008	1.089***	0.163	1.259*
	-0.127	-0.298	-0.122	-0.714
lgdpcapp	1.035***	0.152	0.723***	-0.581
	-0.132	-0.192	-0.111	-0.616
lpopulat	0.789***	0.378***	0.583***	-1.168***
	-0.077	-0.14	-0.052	-0.403
lindv95	0.017	0.365***	-0.018	2.347***
	-0.05	-0.133	-0.045	-0.676
lsrvv95	0.149**	0.268**	0.260***	-0.855
	-0.061	-0.117	-0.062	-0.6
regexist	-0.17	0.48	0.122	2.944***
	-0.168	-0.366	-0.122	-0.926
understa	-0.044	0.074	0.344***	2.289**
	-0.146	-0.281	-0.112	-0.858
publiche	0.193	0.246	-0.145	-0.577
	-0.129	-0.34	-0.107	-0.73
publishd	-0.151	0.122	0.256**	0.18

	-0.161	-0.447	-0.095	-0.884
lchecks	0.286**	-0.108	0.226**	0.779
	-0.138	-0.256	-0.105	-1.074
pricom	0.182	0.723**	-0.256	-1.318*
	-0.158	-0.308	-0.173	-0.678
Constant	-11.837***	-13.933***	-7.863***	-4.718
	-1.197	-2.146	-1.432	-7.575
Observations	188	188	34	34
R-squared	0.87	0.57	0.98	0.66

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Conclusion

The purpose of this research was to determine the effectiveness of Universal Service Programs in expanding the telecommunications infrastructure. While there have been studies documenting positive effects, there have also been critics of these types of programs. Critics claim that these programs are expensive and difficult to administer. In this paper we attempt to contribute to the debate by analyzing statistically the economic and institutional factors that have contribute to the expansion of the fixed line infrastructure as well as payphones. These two were selected because there are some countries, where universal service is defined as providing access to telecommunications services to each home. In less developed nations that experience higher levels of poverty and isolation of rural communities, universality is generally defined as a phone for the community.

Our investigation into the institutional and economic factors surrounding Universal Service Funds reveals initial evidence that these programs can lead to improved levels of infrastructure, at least when looking at one alternative definition of universality (i.e., public payphones). The results do not support positive effects of universal service programs when defined as a phone line per household.

The main difference between the results for the world and those from Latin America is that the Latin American region shows that having a separate regulator positive affects infrastructure. Further investigation is necessary to determine why an understand regulator also shows positive effects.

The positive effects that universal service programs experience at least regarding the public phone infrastructure suggest that government should be encourage by these results and should thus continue to promote them.

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