

The Impact of the Regulatory Process and Price Cap Regulation in Latin American Telecommunications Markets

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Abstract

I empirically examine the impact of the liberalization and regulatory process on the Latin American telecommunications sector during the period 1990-1998. I find that privatisation and the existence of an independent regulator are positively associated with teledensity and operating efficiency while competition and price cap regulation are strongly positively associated with teledensity. This study confirms results in previous research that identify the importance of an independent regulator, competition and privatisation. Moreover, this study provides an initial examination of the positive impact that price cap regulation has had on telecommunications market in Latin America.

1 Introduction

The transfer of state-owned telecommunications assets to the private sector has been the linchpin of telecommunications reform in many developing economies during the 1990s (Noll, 2000). Coupled with a more liberalized and competitive telecommunications market structure, privatisation has generated economic benefits in developing and developed economies – Bortolotti et. al. (2001), Megginson (2001), Ros and Banerjee (2000) and Ros (1999). Some of these benefits include: increased network expansion, reduced waiting time for network access, increased capital investment and improved operating efficiency. The benefits to the overall economy from a more developed and efficient telecommunications sector are considerable – Röller and Waverman (2001) and Saunders, Warford and Wellenius (1994).

While policymakers actively pursued privatisation and liberalization in many countries, an area that has received less attention is the setting up of independent regulatory agencies. Only recently have countries embarked down this path. With the exception of a few studies discussed below, our understanding of the impact that regulation has on telecommunications markets in developing economies is minimal. The significance of the regulatory process on sector performance is likely to be large. A recent study by Wallsten

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(2001) indicates that not only is an independent regulator associated with improved sector performance but, unlike previous studies, privatisation is beneficial only when coupled with an independent regulator.

The purpose of this paper is to investigate the impact that the regulatory process has had on telecommunications development in Latin America. Specifically, in addition to controlling for privatisation and liberalization, I analyze the impact that an “independent” regulator has had on the performance of the sector and build on the work of Gutierrez (2003), Wallsten (2001), Bortolotti et. al. (2001) and Gutierrez and Berg (1999). In addition, I go beyond these studies and examine the impact that a certain type of regulation, price cap regulation, has on sector performance in Latin America.

2 Background

There have been several recent studies examining the impact of privatisation on telecommunications performance. Megginson and Netter (2001) present a comprehensive review of the literature dealing with privatisation in several different industries including telecommunications. They highlight five empirical studies on the impact of privatisation and liberalization on the telecommunications sector: Petrazini and Clark (1996), Ros (1999), Wallsten (2001), Boylaud and Nicoletti (2000) and Boles de Boer and Evans (1996). Megginson states that on balance, these studies generally indicate that deregulation and liberalization are associated with significant growth in teledensity and operating efficiency, and significant improvements in the quality and price of telecom services.¹ While the impact of privatisation by itself is less clear, Megginson and Netter state that the combination of privatisation and deregulation/liberalization is associated with significant improvements in telecommunications performance.²

An important element missing in these papers – with the exception of Wallsten (2001) – is the impact that the type of regulation has on industry performance. This gap in the literature has begun to be bridged in Gutierrez (2003), Wallsten (2001), Bortolotti et. al. (2001) and Gutierrez and Berg (2000). Gutierrez (2003) examines the effect of reform on telecom performance using a second-generation regulatory framework and panel data techniques to test how regulatory governance affected sector performance in 22 Latin American countries during the 1980-1997 time period. He found that sound regulatory governance, openness of markets to competition and divestment of former state-owned telecommunications operators contributed positively to sector performance.

Wallsten (2001) examines countries in Latin America and Africa from 1984 through 1997 and finds that privatisation, by itself, is not a driver of improved telecommunications performance but when it is combined with an independent regulator, the country experiences increased connection capacity and payphones per capita. Wallsten’s measure of an independent regulator comes from the ITU and characterizes a country as having an independent regulator if there is a separate telecommunications regulatory agency not directly under control of a ministry. As he states, his results suggest that reformers are correct to emphasize regulatory reforms along with privatisation, since privatisation without attention to regulation may be costly to consumers. Wallsten concludes his study with a call to obtaining more information on the type of regulation practiced in a country –

¹Megginson and Netter (2001) at 351.

²*Ibid.*

e.g., price cap regulation – and explicitly incorporate it in the econometric analysis, which this present paper undertakes.

Gutierrez and Berg (2000) also investigate the impact that regulation has on sector performance but their focus is exclusively on Latin America from 1985 through 1995. They develop a dichotomous variable measuring the degree to which the regulatory framework in telecommunications affords: (1) enforcement power to regulators and (2) neutrality/independence. They stress that the independent regulatory variable should not be interpreted as whether there is increased or decreased regulation but rather whether the regulator is independent. Their study shows that an independent regulator has significant positive impacts on telephone lines per capita. Like Wallsten, because of data constraints Gutierrez and Berg were unable to examine the impact that different types of regulation – e.g., price caps – have and suggest this as an avenue for further research.

Finally, Bortolotti, et al. (2001) examine 31 telecommunications firms from 25 countries – 14 industrialized and 11 non-industrialized – that were fully or partially privatized via a public share offering between October 1981 and November 1998. Their measure of regulation is similar to the measure used by Wallsten (2001). It is a dichotomous variable taking the value one starting from the date when an independent agency – one not under direct control of a ministry and endowed with powers to enforce regulation – is established by law.

Unlike the previous papers, the authors also explicitly model the impact of the existence of price cap regulation. The authors' conclusions are as follows: Competition significantly reduces profitability, employment and, surprisingly, efficiency after privatisation, while creation of an independent regulatory agency significantly increases output. Mandating third party access to an incumbent's network is associated with a significant decrease in the incumbent's investment and an increase in employment. Retained government ownership is associated with a significant increase in leverage and a significant decrease in employment, while price regulation significantly increases profitability. On balance, they conclude that the financial and operating performance of telecommunications companies improves significantly after privatisation, but that a sizable fraction of the observed improvement results from regulatory changes – alone or in combination with ownership changes – rather than from privatisation alone.

All four studies indicate that an independent regulator has positive and significant impacts on telecommunications sector performance by itself or when coupled with privatisation. As discussed below, this general result is confirmed in this present study. As stressed by Gutierrez and Berg, an independent regulator need not be equated with more or less regulation. Rather, an independent regulator attempts to measure the degree to which decision-making occurs in a manner that is transparent, non-arbitrary, free – as much as possible – from day to day political interference and representative of a regulator's ability to maintain credible commitment.³ These results are, by in large, consistent with predictions arising from the new institutional economic (NIE) school of thought (Levy and Spiller, 1996). Using a NIE approach to examine the problems of utilities regulation, issues such as commitment, expropriation and manipulation of utilities are hypothesized to have an important impact on sector performance.

³ Ai and Sappington (1998) and Donald and Sappington (1995, 1997) investigate a somewhat similar issue when they examining whether price caps is more or less likely to be adopted in states that elect regulators as opposed to states where regulators are appointed by the governor.

In this study, I examine the determinants of telecommunications sector performance in 20 Latin American countries from 1990 to 1998. My study is similar to the studies described above but differs in some important respects. In particular, I examine the impact of price cap regulation as well as privatisation, competition and existence of an independent regulator. While Bortolotti et. al., also examined the impact of price cap regulation, their sample consisted of developed and developing economies while the present study focuses solely on developing economies in Latin America. Given the very recent trend of using price cap regulation in Latin American countries, this study provides one of the first analyses of the impact that this type of regulation is having on industry performance in Latin America.

The positive impact of price cap regulation on telecommunications network investment and efficiency has been documented extensively in the literature where many studies have focused on telecommunications operators in the United States.⁴ These studies have demonstrated that compared to rate of return regulation, price cap regulation leads to more investment and efficient operations.

A potential issue that arises in the present study is that rate of return regulation for telecommunications operators in Latin America has been rare. The dummy variable used for price cap regulation in this study takes a value of one if the country has a price cap plan in place and zero otherwise. In the United States and some other countries, a zero generally indicates that the company is regulated under a rate-of-return methodology and it is generally assumed that the move to price cap regulation is somewhat of a “loosening” of the regulatory binds.⁵ The same cannot be said for the price cap variable in the present study because it is not clear how a country regulated telecommunications prices *prior* to the establishment of a price cap plan. In some instances, the type of regulation practiced prior to implementation of price cap may have been weak or non-existent, while in other instances it may have been more onerous than price cap regulation; it is difficult to know for certain without more in depth analyses.⁶

In general, it seems unlikely that the latter holds true; that is, it seems less likely that the move to price cap represents a loosening of regulation. Given the manner in which concession contracts were written initially – i.e., with the goal of maximizing the sale price of the newly privatised firm – a plausible hypothesis is that the move to price cap regulation is a tightening not a loosening of the regulatory constraints facing the firm. The impact that a tightening of the regulatory constraints has on telecommunications performance is not clear. More onerous regulation would not likely be consistent with improvements in telecommunications performance in emerging competitive markets where alternative forms of competing technologies – i.e., wireless, satellite and cable and the Internet – are proliferating. Onerous regulation on telecommunications firms in the presence of competitive alternatives may tend to reduce sector outcomes.

On the other hand, when predicting the impact that price cap regulation is likely to have in Latin America there is another plausible interpretation. Namely, price caps in Latin

⁴ See, for example, Greenstein, McMaster and Spiller (1995), Donald and Sappington (1995, 1997), Greenstein and Spiller (1995) and Berg and Foreman (1995). For an extensive review of the literature see Kridel, Sappington, and Weisman (1996) and Sappington (2002).

⁵ That is, regulation of the firm's profits is less strict and the company obtains the flexibility to price services within the price cap basket in a manner that is more reflective of market conditions.

⁶ The problem is further exacerbated by a lack of transparency in decision making in some of the countries used in this study.

America may reduce the uncertainty concerning the time-path of prices as opposed to a previous price regime that was somewhat more arbitrary.⁷ And we would expect to see that reducing uncertainty – as with the case of having an independent regulator – results in efficiency gains.

3 Data analysis

3.1 Data description

In this study, I examine the determinants of telecommunications sector performance in 20 Latin American countries from 1990 to 1998. Table 1 below presents the list of countries and the important regulatory variables used in this study. There are a few important findings that stand out from Table 1. Eleven countries – more than half of the Latin American countries sampled – have private telecommunications operators during the 1990-2000 time period.⁸ In the present study, a country is said to have privatized if at least 50% of the assets of the main operator are owned by the private sector. While liberalization of the fixed sector seems to have occurred later than privatisation – due primarily to exclusivity guarantees in concession contracts – as of 2000 almost half of the countries (9) permit competition in either local or long distance services.⁹

Another important finding from Table 1 is related to the regulatory variable. According to the table, 18 of the 20 countries surveyed have established new regulatory agencies during this time period. These agencies either specialize in telecommunications – such as Comision Federal de Telecomunicaciones (COFETEL) in Mexico – or regulate public utilities in general – such as Superintendencia General de Electricidad y Telecom in El Salvador.¹⁰ However, the mere existence of a separate regulatory agency does not necessarily equate with the existence of an independent regulator. According to the ITU, only 8 out of the 20 countries surveyed have independent regulators.¹¹

Another interesting finding is related to whether a country has a price cap regime and the X-factor in place.¹² As can be seen, by the end of 2000 half of the countries surveyed had put in place some type of price cap regime for regulating certain telecommunications services, usually network access, local and long distance usage. As described in Table 9 in the Appendix, the X-factors used by the sample countries during this time period averaged 1.24%. However, this masks the trend that X-factors are initiated at low levels immediately

⁷ I thank Dennis Weisman for directing me to this interpretation of the price cap variable in Latin America.

⁸ ITU (2000)

⁹ Wallsten (2001) correctly observes that a competition variable that only considers whether countries permit competition in certain services can miss important factors such as the effectiveness of competition. Data on the degree of competition in different telecommunications markets are scarce, especially for early periods of study. As countries gain more experience with competition, researchers should have available better quality data that will enable superior measures of competition.

¹⁰ ITU April 2000.

¹¹ ITU-BD Telecommunication Regulatory Database, www.itu.int/treg/profiles2/Regulatory_Trends/Sepreg_AM_E.

¹² Various sources were used to construct variables: ITU (2000), Meitzen *et. al.* (2001), OSIPTEL (2001). In addition, the author has worked on price cap plans in Mexico and Peru.

Country	Privatisation	Competition fixed	Separate regulator	Regulator independent	Price cap	X-factor
Argentina	Y (91)	Y (99)	Y (1990, 1996)	N	Y	91-92 0%; 93-97 2%; 98-99 4%; after 99 5.5%
Belize	Y (88)	N	Y	N	N	
Bolivia	Y (95)	N	Y	Y	Y	99-01 5.25%
Brazil	Y (98)	Y (duop.)	Y	Y	Y	Local 98- 00 0%; LD domestic 2%; LD Int 5%
Chile	Y (87)	Y (87)	N		Y	Na
Colombia	N	Y (97)	Y	Y	Y	97 0%; 98- 00 2%
Costa Rica	N	N	Y	Y	N	
Dominican Rep.	Y	Y (92)	Y	Y	N	No retail price regulation
Ecuador	N	N	Y	Y	N	
El Salvador	Y (98)	Y (98)	Y	N	Y	As of 98, 0%
Guatemala	Y (98)	Y (96)	Y	N		
Honduras	N	N	Y			
Jamaica	Y (87)	N	Y	N	N	
Mexico	Y (90)	Y (97)	Y	N	Y	91-96 0%; 97-98 3%; 99-02 4.5%
Nicaragua	N	N	Y	N		
Panama	N	N	Y	Y	Y	As of 97 0%
Paraguay	N	N	Y	N		
Peru	Y (94)	Y (98)	Y	Y	Y	94-01 0%
Uruguay	N	N	N			
Venezuela	Y (91)	N	Y	N	Y	91-96 0%; 96-00 3%

Table 1: Regulatory characteristics of Latin American telecommunications markets

Source: Author's construct, see text for individual sources.

following privatisation and are ratcheted upward over time.¹³ Table 2 below shows the average value of X for different time periods and presents evidence of this ratcheting up effect.

Year	X-factor (%)
1995-2000	1.69
1996-2000	1.84
1997-2000	1.96
1998-2000	2.17
1999-2000	2.25

Table 2: Average X-factor in Latin America during different time periods

Source: Author's construct.

In addition to the variables discussed above, Table 3 below presents a list of other important telecommunications variables, many of which are used in the econometric analysis described below. Tables 7 through 9 in the Appendix present the descriptive statistics.

Variable	Description
ML	Telephone main lines in operation
ML100	Telephone main lines in operation per 100 inhabitants
ML100g	Growth in telephone main line operation per 100 inhabitants
MLEmp	Telephone main lines in operation per employee
%dig	Percent of digital main lines
%res	Percent of residential main lines
Wait	Waiting list for main lines
Anninv	Annual investment in telecommunication in 1995 \$
Pvt	Privatisation (1=privately owned, 0=government owned)
Compf	Competition permitted in either local or long distance (1=comp, 0=no comp)
Indreg	Separate Regulator is independent (1=yes, 0=no)
Pc	Price cap regulation used (1=yes, 0=no)
Xfac	X-factor utilized
Gdp	Gross domestic product in 1995 \$
Gdpcap	Gross domestic product per capita in 1995 \$
Pop	Population
Popden	Population density, inhabitants per sq. km.

Table 3: Description of variables

¹³ Low X-factors (including even X-factors of 0) set out in the concession contracts increases the purchase price of the assets and increases government revenue brought in from the sale of the telecommunications network.

3.2 Model

The dependent variables used in this study are main lines per 100 inhabitants (ML100) – a measure of teledensity – growth in main lines per 100 inhabitants (ML100g) and main lines per employee (MLemp) – a measure of operating efficiency. The regulatory explanatory variables are privatisation, competition, existence of an independent regulator, and whether the country has a price cap regime in place.¹⁴ Control variables consist of GDPcap, Popden, %dig and %res.

Table 4 presents the hypothesized impact of the regulatory variables. Privatisation, competition and independent regulator are hypothesized to have a positive impact on MLemp, while privatisation and an independent regulator are hypothesized to have a positive impact on network penetration.¹⁵ Under the theory that price cap regulation represents a tightening of the regulatory regime, price cap regulation is expected to increase operating efficiency – higher hurdle to overcome – but negatively impact investment – more onerous regulation requires the company to adjust in other areas of operations such as investments. Alternatively, under the theory that price cap regulation represents reduced uncertainty and less discretion on the part of the regulator, it is expected to have a positive impact on general telecommunications performance such as ML100.

Variable	ML100	ML100G	MLemp
Privatisation	+	+	+
Competition			+
Independent regulator	+	+	+
Price cap regulation			+

Table 4: Predicted impact of regulatory variables

Additional explanatory variables include: real \$1995 gross domestic product per capita (GDPcap), population density (Popden), real \$1995 annual investment in telecommunications assets (Anninv), percent of network with digital lines (%dig) and percent of network that consists of residential lines (%res). We expect GDPcap, Anninv, and Popden to have a positive role on our dependent variables. Popden is a proxy for the costs of deploying telecommunications assets because a main cost driver of loop plant is distance from the central switching office. Since residential customers are more likely to be located at greater distances from the central switching office than business customers, we expect %res to have a negative impact on our variables. %dig is a proxy for increased technology and is hypothesized to have a positive impact on our dependent variables.

The data for this study consist of cross-sectional/time series (panel) data. I use the following functional form to estimate the values for the parameters through use of either fixed-effects or random effects models¹⁶:

¹⁴ Models were estimated which included the actual X-factor used in the price cap plan but inclusion of the X-factor generally neither improved the model estimation nor resulted in a significant X-factor coefficient.

¹⁵ Competition's impact on main lines is unclear because if there are significant economies of scale in the provision of access lines, additional competitors may simply increase overall total network unit costs, see Ros (1999) for a discussion.

¹⁶ Hausman and Breusch Pagan tests used as the basis for use of either fixed or random effects model.

$$(1) \quad y_{it} = \alpha_i + \beta_k' X_{it} + \delta_j' d_{it} + v_i + \varepsilon_{it}$$

where y_{it} is either logML100, ML100g or MLemp, β_k' is a $1 \times K$ vector of coefficients, where K is the number of control variables for each regression estimate, X_{it} is K exogenous variables, δ_j' is a 1×4 vector of dummy coefficients, d_{it} are four dummy variables corresponding to the effects of privatisation, competition, independent regulator and price cap regulation, α_i is a 1×1 scalar constant representing the effects of those variables peculiar to the i th country in more less the same fashion over time, v_i is the unit-specific residual that differs between units but remains constant for any particular unit, while ε_{it} is the “usual” iid residual.

The decision to privatize, permit competition, establish an independent regulator and implement price cap regulation may be endogenous and, therefore, not suitable for inclusion as a set of independent variables without some additional estimation technique.¹⁷ That is, the decision and timing to engage in the regulatory decisions and the manner in which it is undertaken may be conditioned on the pre-regulation market performance. For example, it may be the case that certain pre-regulation market characteristics – such as network penetration – helps explain a countries’ decision to privatize or set up an independent regulatory structure. From a statistical perspective, it is important to test for whether the regulatory regressors are endogenous in the estimated models because failure to do so leads to inconsistent estimators. From a qualitative perspective, it is also interesting to attempt to identify the source of endogeneity; that is, the factors that distinguish the time and type of regulatory changes among the countries.

In order to test for the possibility that the regulatory dummy variables are endogenous in the models, I follow the testing methodology popularized by Hausman (1978). Specifically, under the assumption of endogeneity, an Instrumental Variable (IV) estimator is consistent while the OLS estimator is not. Under the assumption of exogeneity, the OLS and Instrumental Variable estimators are both consistent. This means that if the regressors are truly exogenous, both estimators (the OLS and the IV) should produce similar results.¹⁸

In order to obtain the IV estimators, I follow the approach recommended by Heckman (1978), Bowden and Turkington (1984) and Duncan and Leigh (1985) and employ an instrumental variable technique to estimate new dummy coefficients.¹⁹ Specifically, following Donald and Sappington (1997), I first model the decision to privatize, permit competition, have an independent regulator and employ price caps as a means to regulate telecommunications prices as a discrete choice using a logit model. The regressors in the logit model are some of the exogenous variables in the system of equations (such as GDPcap and Anninv) plus some of the performance variables such as ML100, MLemp and wait.²⁰ The predicted probabilities are then interacted with the observed dummy variables

¹⁷ This would violate the assumption that the observations on the independent variables can be considered fixed in repeated samples and imply contemporaneous correlation between the regressors and the error term.

¹⁸ See Kennedy (1992) at 135.

¹⁹ This approach was also utilized by Ros (1999).

²⁰ Naturally, ML100, MLemp and wait are endogenous variables. They were included in the logit model because it is likely that the “quality” of the network has an impact on the decisions to privatise, permit competition, regulate and implement price cap regulation. In general, my results are not sensitive to the inclusion of these variables in the logit models.

and used as instruments in the second stage estimation process. Specifically, I use the following approach:

$$(2) \quad d_{it} = \beta_k' X_{it} + u_i$$

$$(3) \quad \text{Pr ob}(d_{it} = 1) = \text{Pr ob}(u_i > -\beta' X_{it}) = 1 - F(-\beta' X_{it})$$

using a logistic model we have:

$$(4) \quad 1 - F(-\beta' X_{it}) = \frac{\exp(\hat{\beta}' X_{it})}{1 + \exp(\hat{\beta}' X_{it})} = \hat{p}$$

where the X_{it} in (4) consist of GDPcap, Anninv, ML100, MLemp and wait. Substituting (4) into (1) we obtain:

$$(5) \quad y_{it} = \alpha_i + \beta_k' X_{it} + \delta_j' d_{it}(\hat{p}) + v_i + \varepsilon_{it}$$

Results from estimating equation (4) do not provide convincing evidence regarding the source of the potential endogeneity in the regulatory variables. That is, the regressors in the logit models were generally not significant predictors for whether a country privatized, permitted competition, established an independent regulator or implemented price cap regulation.²¹

3.3 Results

Testing the regulatory variables for endogeneity, the OLS and IV estimators were significantly different, thus providing evidence that the decision to privatize, permit competition, create an independent regulator and implement price cap regulation should be considered as endogenous and, for econometric analysis, estimated through an IV approach. To do otherwise would lead to inconsistent coefficient estimates.

Table 5 below presents the results of equation (5). Equation A in Table 5 below models logML100 and the results indicate that price cap regulation is significantly associated with greater ML100. Those countries that have a price cap regime in place experience, on average, 22% greater ML100 than those countries that do not have a price cap regime in place. In addition, privatisation and competition are both highly significant and positively related to ML100. Specifically, privatisation and competition are, on average, associated with approximately 18% and 200% more ML100, respectively, and both are significant at the 1% level. Having an independent regulator also results in significantly greater ML100

²¹ In fact, all the models estimated were generally unsatisfactory in terms of significantly explaining differences in why countries embarked on regulatory changes.

(7.5%), although the significance is at the 10% level as compared to the 1% level for price cap, privatisation and competition. Other variables that are significant include GDPcap, Popden and %digital. The model explains 92% of the variation in the dependent variable and passes the joint test for significance.

Independent Variables	Dependent Variables		
	Equation (A) logML100 2-Stage estimation (fixed effects)	Equation (B) ML100g 2-Stage estimation (random effects)	Equation (C) MLEmp 2-Stage estimation (fixed effects)
%dig	.0035**** (.0008)	.0004 (.0004)	1.01**** (.196)
%res	.0016 (.0035)	.0035 (.0022)	-.248 (0.881)
Popden	.0332**** (.0042)	.0006**** (.0002)	-0.128 (1.080)
Anniv	2.47e-11 (1.75e-11)	1.02e-11 (7.36e-12)	3.38e-09* (4.46e-09)
Gdpcap	.0001**** (.00004)	-5.07e-06 (7.97e-06)	.029**** (.0105)
Pvt	.1724**** (.0407)	-.0111 (.0296)	63.27**** (10.38)
Compf	3.11**** (.8726)	.7113 (.7003)	-361.72 (222.48)
Indreg	.0971* (.0536)	.0268 (.0386)	51.47**** (11.91)
Pc	.2078**** (.0627)	.0319 (.0261)	21.87 (15.99)
Cons	-.3669 (.2989)	-.2263 (.1637)	-249.15**** (73.11)
R ²	.93		.51
N	82	74	82
F-stat	F(9,59) = 83.06		F(9,59) = 47.50
Wald Test		Chi2 (9) = 26.51	

Table 5: Regression results (standard errors in parenthesis)

Note: * Significant at the 10% level; ** significant at the 5% level; *** significant at the 2. 5% level; **** significant at the 1% level.

Equation (B) presents the results when growth in ML100 is the dependent variable. None of the regulatory variables were significant in explaining the growth in ML100. The only variable that explains the growth in ML100 is population density, which has a significant and positive impact on the growth in ML100. As population density is a proxy for costs, not surprisingly those countries where it is relatively less costly to deploy lines

have, on average, higher growth in ML100. These countries also had, on average, higher ML100.

Equation (C) models MLemp and the results indicate that an independent regulator and privatisation are positively and significantly related to MLemp. Having an independent regulator results, on average, to an increase of approximately 51% in MLemp while privatisation leads to, on average, a 63% increase in MLemp. Other variables that are significant include, %digital, and GDPcap. The independent variables explain approximately 51% of the variation in the dependent variables and the F-test is significant at the 1% level.

Table 6 below summarizes the impact that the variables of interest have on the different models. How do these results compare to previous research and prior expectation? The existence of an independent regulator is associated with improvements in general measures of telecommunications performance such as ML100 and MLemp. This is consistent with prior findings and is consistent with the theory that an independent regulator – acting as a proxy for the ability to maintain credible commitment, reduce uncertainty and remove discretionary actions on the part of the regulator – should play an important positive role in sector performance. These results support the position that those countries that do not have independent regulatory mechanisms and institutions in place are at a disadvantage.

Independent variable	Equation (A) LogML100	Equation (C) Mlemp
Privatisation	+(19%) ****	+ (63%) ****
Competition (fixed)	+(200)	NS
Independent Reg.	+(10%) *	+ (51%) ****
Price Cap	+(23%) ****	NS

Table 6: Summary of results for the regulatory variables

Note: NS = not significant; NA = not applicable; *significant at the 10% level; ****significant at the 1% level.

Privatisation is positively associated with ML100 and MLemp while competition is strongly positively associated with ML100. The positive impact of privatisation on network expansion and growth in network expansion is consistent with some prior research and inconsistent with other research that found that privatisation, by itself may result in efficiency losses and only when coupled with an independent regulator does privatisation improve performance. In this study, privatisation was found to improve performance irrespective of whether it was coupled with an independent regulator.

Competition is strongly associated with network expansion. This finding is consistent with prior research, which found significant impacts of competition; these findings reject the existence of strong economies of scale in the telecommunications industry in Latin America. Competition in telecommunications markets in Latin America seems to be having a positive impact on sector performance and from a policy perspective, it is correct for policymakers to continue to open these markets to competition.

The newer findings in this study pertain to the impact of price cap regulation. According to the data, price cap regulation is strongly associated with ML100. As discussed in the text, it is difficult to interpret the price cap variable because in Latin America it is not clear whether the move to a price cap regime represents a weakening or tightening of the regulatory constraints. One hypothesis in this paper is that the move to price cap regulation generally represents a tightening of the regulatory constraints facing the firm because the initial regulatory conditions after privatisation were likely to be lax with respect to near-term regulatory constraints. An alternative hypothesis is that the imposition of price cap regulation can be viewed as reducing the uncertainty of operating in the market by giving more certainty and predictability to the time-path of prices. In the present study, the finding that price cap regulation leads to increases in ML100 implies that the latter hypothesis – that prices caps reduce uncertainty in the industry – overcomes any negative impact that may arise from tightening of the regulatory regime.

Finally, contrary to our expectation, no evidence was found that price cap regulation leads to higher levels of Mlemp (efficiency). While the coefficient did have the expected sign, it was not statistically significant.

4 Conclusions

In this paper, I empirically examined the impact that the regulatory process and price cap regulation has had on the Latin American telecommunications sector during the 1990-1998 time period. Consistent with prior findings, I find that the existence of an independent regulator is associated with improvements in general telecommunications performance. This is consistent with the school of thought that predicts that an independent regulator – acting as a proxy for the ability to maintain credible commitment and reduce discretionary action on the part of the regulator – plays an important positive role in the industry. The results support the position that those countries that do not have independent regulatory mechanisms in place to credibly commit, are at a disadvantage. The existence of an independent regulator does not necessarily imply a tightening or a loosening of regulation imposed on carriers. Rather, the existence of an independent regulator can be interpreted as reducing discretionary actions on the part of regulators, which reduces uncertainty. This, in turn, reduces obstacles to sector investment and lessens the regulatory risks associated with the supply of telecommunications services.

Privatisation is found to be positively and significantly associated with network expansion and efficiency. This is consistent with some prior research while inconsistent with others, which found that privatisation by itself, may lead to decreases in sector performance. Specifically, some prior research has found that only when coupled with an independent regulatory regime does privatisation result in gains in efficiency. The policy implication of this particular debate, however, may be less relevant because there seems to be a trend emerging among policymakers on the importance of having an independent regulatory regime, as this paper and other papers have found to be the case.

A newer finding of this paper is the impact that a form of regulation – price cap regulation – is having on the industry in Latin America. In this study I found that price cap regulation is strongly associated with network penetration. In many countries, prior to price cap regulation the setting of telecommunications prices had significant discretionary components which increased uncertainty and risk to market participants. Price cap

regulation – by setting a predicable time-path for the regulated services – can reduce uncertainty and helps explain the positive impact on network expansion, irrespective of the fact that the move toward price caps in Latin America in some instances may represent a tightening of the regulatory regime.

Finally, competition was found to be strongly and positively associated with network penetration in Latin America. Those countries that permit competition in telecommunications experience greater network penetration. From a policy perspective, it is correct for policymakers to continue to open these markets and put in place policies that are pro-competition.

5 Appendix – Descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
MI	215	2,263,919	4,196,825	17320	30,090,000
MI100	215	9.24	5.81	1.26	27.84
MI100g	196	.089	.112	-1	.423
Mlemp	206	109	70.14	13.24	405.64
%dig	194	69.5	25.66	1	100
%res	172	72.8	6.54	48	92
Wait	144	263,612	354,405	303	2,400,000
Anninv (000)	159	685,000	1,320,000	459,524	8,300,000

Table 7: Telecommunications industry variables

Variable	Obs	Mean	Std. Dev	Min	Max
Gdp (000)	180	84,300,000	165,000,000	481,000	748,000,000
Gdpcap	180	2655	1699	424	8475
Pop	220	2,260,000	3,720,000	189000	170,000,000
Popden	180	59.63	72.35	6	292

Table 8: Macroeconomic variables

Variable	Obs	Mean	Std. Dev	Min	Max
Pvt	220	.44	.50	0	1
Compf	220	.20	.40	0	1
Indreg	198	.22	.42	0	1
Pc	165	.4	.49	0	1
Xfac	54	1.24	1.74	0	5.5

Table 9: Telecommunications regulatory variables

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