Telecommunications Privatization in Developing Countries: The Real Effects of Exclusivity Periods

Scott J. Wallsten*
579 Serra Mall at Galvez St.
Stanford, CA 94305

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Wallsten@stanford.edu
650-724-4371

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* Stanford University and The World Bank.

1. Introduction

The telecommunication sector around the world has been undergoing dramatic reforms since the 1980s. Developing countries have been privatizing state-owned firms and slowly introducing competition into the telecom sector. We have a good theoretical understanding of the effects of telecom privatization and some empirical work is beginning to emerge, as well. In general, privatization, especially when combined with effective regulatory institutions, improves telecom service. However, we have almost no empirical information on the real effects of the details of the privatization transaction. In particular, many countries grant the privatized telecom firm a multi-year exclusivity period; that is, the government allows the newly-privatized firm to operate as a monopoly for some number of years. The exclusivity period is typically granted to increase the sale price of the firm and thus government revenues. While private investors are almost certainly willing to pay more for firms that can earn monopoly profits, a monopoly is less likely to improve service than is a firm operating in a competitive environment. As a result, the exclusivity period may boost government revenues at the cost of delaying improvements in telecom services to the population. Largely because data is scarce, to date no empirical studies have attempted to systematically estimate the effects of these exclusivity periods.

In this paper I use an original, new dataset to explore the real effects of exclusivity periods. The Infrastructure Privatization Database is jointly sponsored by Stanford University and The World Bank to analyze the impact of regulatory institutions and privatization policies on utility performance. Using this combination of firm- and country-level cross-section and panel data, I estimate the effect of exclusivity periods on firms' sale prices and also on sector performance in terms of network penetration. The results confirm conventional wisdom: exclusivity periods significantly increase the sale price of the firm, but substantially decrease network growth.

2. Background[1]

The recent trend towards competition in telecommunications is best described as a return to competition, rather than as an entirely new phenomenon. Telecom markets around the world in the nineteenth century were highly competitive (Petrazzini, 1996). Nonetheless, telecom soon came to be viewed as a natural monopoly—that it could be provided at the lowest cost by one

[1] See Noll (2000) for a comprehensive examination of telecommunications reforms in developing countries.

firm. Most developing countries nationalized their telecom providers in the 1960s, with disastrous consequences in terms of service. Saunders, et al (1983) note that by 1981 Africa and Latin America averaged only 0.8 and 5.5 telephones per hundred people, respectively, compared to 83.7 in the United States.

In the 1980s, the nationalization trend began to reverse itself. A host of reasons led to this reversal, and of course the circumstances differ by country and region. In large part, though, three factors drove reforms. First, the exceptionally poor performance of state-owned telecom firms generated pressure for reforms. Long waiting periods for telephone connections and the poor quality of those connections generated popular demand, while inefficient operations often requiring large subsidies encouraged governments to divest firms that were draining national treasuries. Second, international lending organizations began pressuring countries to divest. Wellenius (1992) notes that in the 1960s the World Bank funded primarily infrastructure investments, in the 1970s organization and management reforms, but by the 1980s focused on sectoral reforms, including privatization. Using panel data on 167 countries from 1980 through 1998, Li, Qiang, and Xu (2000) find empirical evidence that telecom reforms were brought about both in response to poor sector performance and foreign aid, including the presence of World Bank telecommunications loans. Finally, there was a general worldwide trend towards divestiture, started largely by Britain's Thatcher government in 1979, which coined the term "privatization" (Megginson, 2000).

The pace of telecommunications reforms has accelerated dramatically since the 1980s. By the end of 1999 the International Telecommunications Union reported that more than half of Asian and Latin American countries and one-third of African countries had privatized their telecommunications providers. Another eight African countries have immediate privatization plans (ITU, 1999).[2]

Substantial evidence reveals that privatization can lead to performance improvements. Megginson, et al (1994) compare pre- and post-privatization financial and operating performance of 61 companies (in 32 industries, including telecommunications) from 18 countries. They find increased sales, profits, investments, and employment following privatization. The existing literature on telecom reforms in particular contains primarily two types of analyses: case studies and empirical work that compares average performance indicators across firms or countries

[2] The ITU also notes that no Arab states have privatized their telecommunications providers.

before and after reforms took effect. Not surprisingly, given the region's relatively early start in reforms, most of this evidence is from Latin America. In general, these studies find positive effects of reforms (e.g., Wellenius, et al 1992; Kikeri, Nellis, and Shirley, 1992).

Nonetheless, a monopoly provider, whether state-owned or private, faces fewer incentives to improve service and lower prices than do firms operating in a competitive environment. As Ambrose, et al (1990) note, "simply moving a monopoly from the public to the private sphere will not result in competitive behavior." And, indeed, countries are increasingly moving towards competition, though it is still much more prevalent in mobile and other value-added services, such as paging. More than 70 percent of all countries still maintain a monopoly in basic services, while more than half allow competition in mobile service (ITU, 1999).

There is broad agreement overall that competition is likely to be the most effective method of promoting improvements in the telecom sector. Petrazzini and Clark (1996) study the effects of competition in Latin America and Asia. Using the existence of cellular firms as evidence of competition, they compare the performance of competitive and noncompetitive markets. They find that cellular and mainline penetration in competitive markets is higher than in noncompetitive markets. Ros (1999) uses a fixed-effects model to explore the effects of privatization and competition on telecom firms around the world. He finds increases in the number of telephone mainlines per capita in countries that privatize relative to countries that do not. He also finds competition correlated with efficiency improvements in terms of employees per mainline. Wallsten (2000) undertakes a similar study of telecom reforms in Africa and Latin America. He finds that competition (measured as the number of mobile operators not owned by the incumbent) is associated with network improvements, and that while privatization by itself does not yield improvements, privatization combined with an independent regulator does.

Conflicting objectives

It is an understatement to say that telecom reforms are simple. State-owned enterprises must confront inconsistent objectives and competing constituencies (World Bank, 1995), and the privatization process itself is not insulated from those problems. Wellenius (1997) notes that

> The primary purpose of reform is to get consumers more, better, new, and less costly services. Pressures from interest groups—incumbents who want ongoing protection, new entrants seeking special deals, treasury officials expecting to use sales revenues to reduce budget deficits, financial advisers earning success fees tied to transaction prices—can steer reform off

> track. In particular, sales strategies that drive up prices paid for existing companies or new licenses can hold down growth, reduce the funding available to invest in those companies, or result in high tariffs. (p.1)

One important conflict arises between the government's desires to maximize revenues and to improve telecom service.[3] The problem is that especially in the case of the telecom sector, where most nations have a monopoly provider, the easiest—and certainly the most common—method of increasing the firm's value to private investors is to give the incumbent firm monopoly rights. Unfortunately, as discussed above, precluding competition is likely to retard improvements in the telecom sector.

The government may face substantial pressure to maximize revenues. The first metric by which the success of the sale is likely to be judged is the sale price. Privatizations tend to be controversial, and the government may be wary of being accused of giving away the crown jewels if the sale price is "too low." This pressure may create an incentive to generate a high sales price, even at the expense of delaying future improvements in the network.

While maximizing sales prices is the primary reason for granting exclusivity periods, some advance other rationale. First, an unfortunately prevalent view among those implementing telecom privatizations is that the incumbent must be given an exclusivity period in order to stimulate investment. One privatization consultant writes that

> The effectiveness of restrictions on competition during the exclusivity period assures the economic viability of that period. The privatized company relies upon an exclusivity period during which the competitive boundaries are strong enough to control competitive entry so that the operator may direct and concentrate its capital and human and technical resources on expanding and modernizing the network. Successful infrastructure expansion and modernization to ensure broad coverage of service mutually benefits the operator and the customer base. (Barbour, 1997)

This argument, however, simply does not make sense. While such advice is certain to boost the treasury's revenues and the underwriter's fee, restricting competition is not likely to stimulate investment. As Noll (2000) notes, firms operating in a competitive environment and monopolists both face the same cost of capital, and neither will invest unless the expected revenues make the investment worthwhile. The monopolist's market power makes it less, not more, likely to undertake a given investment, since monopoly profits are typically obtained by

[3] Though Megginson (2000) notes that there is progress towards both goals. Privatizations (across the globe for all privatized industries, not just telecommunications) have raised over $1 trillion through 1999, while substantial evidence suggests that privatized firms exhibit improved operating and financial performance.

providing lower quantities of the good or service at higher prices. A firm with a guaranteed monopoly is also less likely to invest since it does not have to worry about more efficient competitors stealing market share.

Second, while decidedly an increasingly less-accepted view, some still believe that local telecom service is a natural monopoly, providing ammunition for those who wish to give exclusive concessions. But this belief contradicts our current understanding of telecommunications. The notion that telecom was a natural monopoly began to appear less tenable as early as 1959, when the U.S. Federal Communications Commission decided to allow large firms to use microwave transmission to bypass the telephone network (Crandall and Waverman, 1995). Continuous improvements in technology make it increasingly unlikely that telecom is a natural monopoly (Spiller and Cardilli, 1997; Noll, 2000). Advances in wireless technology alone allow competing firms to roll out telecommunications services with relatively low sunk costs—an attractive option in many developing countries.

Ultimately, the real effect of these exclusivity periods is an empirical question. To my knowledge, only one paper has taken any empirical look at the effect of exclusivity periods. Megginson and D'Souza (1999) find exclusivity periods correlated with capital expenditures in a cross-sectional sample of ten firms. While the paper is the first to begin to explore transaction details, the analysis does not control for important factors such as national income or population. Such controls are especially important given that their small sample includes both very wealthy and very poor countries.[4] In addition, Wellenius (1997) noted that Chile, which did not grant an exclusivity period, saw faster network growth than Argentina, Mexico, or Venezuela, which did grant exclusivity periods to newly-privatized firms. While this observation adds support to the hypothesis that exclusivity periods come with costs, it also does not control for other factors that may affect network growth and contains only one observation that did not grant an exclusivity period.

In this paper I attempt to quantify econometrically the effects of exclusivity periods by measuring their effects of the firms' sale prices and on sector performance in countries that privatized their telecom providers. In a sense, I conduct a cost-benefit analysis in that I attempt

[4] For example, Boubraki and Cosset (1998), in a study of 79 firms (in several industries) in 21 developing countries find significant productivity improvements after privatization. But they also note that privatization appears most successful in wealthier countries. This observation highlights the need for controlling for important factors such as income. While it may be the case that privatization is most successful in wealthier countries, it may also be the case

to quantify the tradeoff between sale price and network performance. In the following sections I discuss the data, methods, and results.

3. Data

Much of the data I use is part of the Infrastructure Privatization Database, sponsored jointly by Stanford University and The World Bank. This ambitious project aims to fill the large empirical holes in our understanding of telecommunications and electricity reforms in developing countries. In particular, the project is compiling and quantifying detailed regulatory, firm, and transaction information from many sources. Regulatory data is derived from reform legislation and documents published by regulatory agencies. Firm-level financial and operating performance information comes from the firms' annual reports and prospectuses. Details on the privatization transaction come from annual reports, investor prospectuses, and detailed case studies of privatizations. Although this database is still a work-in-progress, enough information has been collected to begin to allow some new analyses. In addition to information from this database, I add country-level data from the International Telecommunications Union and macroeconomic data from the World Bank Development Indicators.

This paper explores the effects of exclusivity periods on firm sales price and sector performance. The sample includes twenty telecom firms in fifteen countries. The sample is small and nonrandom, with selection based largely on the existence of data. In addition, because I am interested in the effects of the details of the transaction itself, I include only firms that were privatized. The analysis, therefore, does not tell us anything about the effects of privatization, per se, compared to firms that were not privatized, but instead allows us to compare firms that were privatized under different conditions. Table 1 lists the firms, the year they were privatized, the length of the exclusivity period, share sold, price, number of mainlines, and country data including population and GDP per capita.

The first firm in this group to be privatized was the Jamaican Telephone Company, in 1987, while the most recent privatizations—in El Salvador and Brazil—took place in 1998. The table shows a great deal of variation in transaction details. First, exclusivity periods range from 36 years for local, fixed service granted to Telmex in Mexico,[5] to none in Chile, Bolivia, El Salvador, Guatemala, and Brazil. The share of the firm sold to private investors differs a great

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that firms in general in wealthier countries experienced improved productivity during the few years studied.

[5] Telmex received only five years monopoly for international long distance service.

deal, as well. The Brazilian government sold its entire stake in its telecom firms, while the Mexican government sold only 20.4 percent. Pakistan stands out by simply selling shares of Pakistan Telephone and Telegraph to the public (twelve percent of the company) and not offering concessions to private firms. Brazil and Argentina are noteworthy in having split their telecom firms into several separate companies before selling them. Argentina created two firms—one to operate in the north (Telecom), and another to operate in the south (Telefonica). They share ownership of the long distance provider. Brazil split its telecommunications provider geographically into three companies plus an international long distance provider.

I derive the value of the firm from the share of the firm sold and the price investors paid for that share. Because privatizations occur over the course of more than a decade, deflating those values is important for any cross-sectional comparison. Choosing the proper deflator is never an easy task, and it becomes more difficult in this cross-country sample. I chose to use the United States capital expenditures deflator since purchasing a telecom firm is essentially a capital investment. As it turns out, the choice of deflator affects only the magnitude of the empirical results but not the conclusions.[6]

4. Empirical Method

The analysis contains two primary components. First, to explore the effects of exclusivity on the sale price of the firm I estimate a cross-sectional specification in which an observation is a firm in the year it was privatized. Equation (1) details the specification I use:

(1) $$ln(\text{implied firm value}) = b_0 + b_1*(\text{exclusivity}) + b_2*ln(\text{population}) + b_3*ln(\text{gdp per capita}) + b_4*(\text{privatized before 1992}) + b_5*ln(\text{risk of expropriation}) + e$$

Implied firm value is the market value of the firm derived from the share of the firm sold and the price paid for that share. *Exclusivity* is a dummy variable that equals one if the firm was granted an exclusivity period. Ideally, I would include the exclusivity period as a continuous variable to measure the effect of different lengths of exclusivity. However, because many firms were granted no exclusivity period, it is impossible to take the log of this variable.[7] Using a dummy variable makes the results easier to interpret and should not affect the results dramatically. Investors will base their willingness to pay for a telecom firm on the present

[6] Indeed, the empirical results are robust to any deflator choice, including no deflator.

[7] I also estimated the specification using *log(exclusivity length + 1)*. The results are qualitatively identical to using the dummy variable. However, because adding one to small numbers makes a bigger difference when taking logs

discounted value of the future stream of income from the firm, meaning that each additional promised year of monopoly is less valuable to the investor.

I estimate the equation twice, each time using a different definition of "exclusivity." Firms may be given exclusivity periods for different services. They may be given a monopoly in the provision of fixed local service but not for providing international long distance service, vice versa, or both. These exclusivity periods may have different effects. *Exclusivity* is therefore first a dummy variable indicating whether the firm received an exclusivity period in local fixed telephone service, and second indicating whether the firm received an exclusivity period in international long-distance communication.[8] Because a monopoly is likely to be more profitable than a firm operating in a competitive environment, we would expect the coefficient on *exclusivity* to be positive.

I include *population* and *gdp per capita* to control for the size and potential profitability of the market. The larger the population and per capita income, the more an investor may be willing to pay to own the telecom firm. I also control for whether the firm was *privatized before 1992*, since early privatizations may be different in many ways from later privatizations. The early movers—both countries and investors—may have been more cautious and unsure of the consequences of privatizations. Investors may have bid less, while governments may have been less willing to give up active control of their telecom sectors. It is also possible that the first firms to be privatized were those that sustained especially large losses, both making governments anxious to sell and lowering investors' willingness to pay.[9] The *risk of expropriation* comes from the International Country Risk Guide, and measures the perceived risk of government expropriation on a scale of 1 to 10 (10 being the lowest risk).

I have excluded some other variables that might seem important. Most significantly, the number of mainlines is excluded. At first glance, this would seem an obvious variable to include, since it proxies for the assets the investor is purchasing. It is also well-known that there is a very strong correlation between network penetration and income. The implication of this correlation is that population, GDP per capita, and number of mainlines are almost collinear, at

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than does adding one to larger numbers, it became impossible to accurately interpret the coefficient on this variable.

[8] Theoretically, I should be able to include both variables together in the estimation. Practically, though, there is too much collinearity between the variables to do so.

[9] One regulator noted that the low price its government received for its telecom provider was in part related to the investor's greater knowledge of telecom markets relative to the government, and in part because of the government's desire to quickly sell a firm that had become a significant drain on the national treasury.

least with such a small sample size. Including the number of mainlines (either the absolute number or per capita) in the estimation does not affect the coefficient on *exclusivity* (which is the variable of interest), but makes the coefficients on population and gdp per capita insignificant and difficult to interpret.

The second part of the analysis explores the effect of exclusivity on growth of the telecom network in the country. This analysis differs from that described above in two important respects. First, the dataset becomes a country-level panel dataset, in which the first year a country appears in the panel is the year its telecom provider was privatized. Second, I restrict the sample to only those countries where the local provider was privatized.[10] I do this because I use mainlines as the measure of network growth. It would not make much sense to look for an effect of an exclusivity period in international long distance service on the number of fixed mainlines, especially when the international provider often is not the firm providing the fixed local service.

To explore the effect of exclusivity periods on growth of the network, I first estimate equation (2):

(2) $$ln(\text{number mainlines}_{it}) = b_0 + b_1*(\text{exclusivity}_{it}) + b_2*ln(\text{population}_{it}) + b_3*ln(\text{gdp per capita}_{it}) + b_4*ln(\#\ \text{mainlines}_{i0}) + b_5*ln(\text{mobile competitors}_{it}) + b_6*ln(\text{risk of expropriation}) + \mathbf{b_7}*(\text{Year fixed effects}) + e_{it}$$

As mentioned above, the dependent variable is the number of mainlines in country *i* in year *t*, where year zero is the year the firm was privatized. I use the total number of mainlines rather than mainlines per capita because it is a more accurate indicator of investment. Changes in mainlines per capita are, obviously, affected by population growth as much as by investment in the telecom network. The point of this exercise is to look for the effect of exclusivity on the firm's investment, so it is appropriate to use this measure rather than the ratio.[11]

I estimate the equation twice, using two different sources of data on mainlines. The first estimation uses the number of lines reported in the firms' annual reports for each year. Unfortunately, the dataset is not complete—data are missing for some years for some firms. To check the robustness of the results, I also estimate the equation using the number of mainlines in the country-year reported by the ITU. *Population* and *GDP per capita* are included for the

[10] In practice this means that I excluded Bolivia from the panel analysis, since it sold only its long-distance and international communications provider.

[11] Nonetheless, I also estimate the equation using lines per capita, and the result using this ratio as the dependent variable is identical to the result using the level.

reasons described above. I also include the log of the number of mainlines in year zero (the year of privatization) to control for initial country conditions at the time of privatization. This variable is time-invariant.

I also include a dummy variable indicating the presence of mobile competitors not owned by the incumbent telecom firm. While this variable controls in some sense for the country's openness to competition, it is not clear what sign to expect on the coefficient. On one hand, mobile service may substitute for local service, especially in countries with very long waiting periods for fixed line service. In this case, mobile competition could spur the incumbent to invest in its local wireline network. On the other hand, the incumbent may decide to roll out its own mobile service to compete with the new mobile firm.[12] In this case, mobile competition could cause the incumbent to divert investment from wireline to mobile service.

As above, I include the ICRG variable measuring risk of expropriation. We would expect that the smaller the risk of expropriation, the greater the investment in the country. However, this variable does not exhibit much variation across time or even across countries in this sample.[13] Finally, I include year fixed effects to control for general trends and economic conditions affecting all countries each year.

The exclusivity variable

Introducing the *exclusivity* variable into the equation is complicated, and each approach has its own problems. I deal with the problem by using several definitions of *exclusivity* to determine how robust any conclusions are to the specification. Below I explain each approach, its problems, and its advantages.

I first define *exclusivity* as I do above—a dummy variable that takes the value one if the firm was granted a monopoly concession for fixed, local telephone service. A serious problem with this variable is that only Chile and Argentina appear in this panel data with any years of zero exclusivity.[14] To deal with this issue, I redefine the dummy variable to take the value of one if more than three years of exclusivity remain in the concession.[15] This makes sense because a

[12] Indeed, many incumbents already offered their own mobile service at the time of privatization.

[13] Another problem is that I have data only through 1997. Because it varies so little over time, I use the 1997 value for 1998.

[14] El Salvador, Guatemala, and Brazil did not grant any exclusivity period, but all privatized in 1998, so those countries are excluded from the panel.

[15] It turns out not to matter substantially if the variable is defined as equal to one if the exclusivity period is more than one, two, three, four, five, six, or seven years. I chose four or more years because that allowed the greatest variation across the panel.

firm with only a short time remaining as a protected monopoly may begin to behave as if it were operating in a competitive environment as the imminent threat of entry becomes more real. In other words, a firm with a very short protected monopoly may behave differently from a firm with a guaranteed monopoly for the foreseeable future.

The latter definition raises another question: what is the effect of the different lengths of the exclusivity periods? Rather than defining *exclusivity* as a dummy variable, it can be instructive to treat it as a continuous variable. Taking the log of this variable is both appropriate and problematic. It is appropriate because the marginal effect of moving from two to three years of guaranteed monopoly may be much bigger than the effect of moving from 29 to 30 years of guaranteed monopoly. Taking the log of this variable is problematic, of course, because it is not possible to take the log of zero. I therefore define the variable first as the log of the exclusivity period plus one, and to check its robustness, as the log of the exclusivity period plus 0.1.

Finally, I re-estimate the entire equation using percent changes. Equation (3) presents the new specification.

(3) $$D(\text{number mainlines}_{it}) = b_0 + b_1*(\text{exclusivity}_{it}) + b_2* D(\text{population}_{it}) + b_3* D(\text{gdp per capita}_{it}) + b_4* (\text{pre-privatization mainline growth rate}) + b_5*(\text{mobile competitors}_{it}) + b_6*(\text{risk of expropriation}) + \boldsymbol{b_7}*(\text{Year fixed effects}) + e_{it}$$

In this estimation *exclusivity* is defined as simply the number of remaining years of guaranteed monopoly.

None of these approaches is perfect—the paucity of data still constrains the possible rigor of the analysis. Nonetheless, implementing all of these approaches should give us a sense of the robustness of the results and to the range of the magnitude of the effects.

5. Results

Table 2 shows the results of estimating equation (1), which evaluates the effect of an exclusivity period of the firm's sale price. Higher population and per capita income both increase the sales price of the telecom firm, which was expected given that each variable means a larger market. The dummy variable indicating whether the privatization took place prior to 1992 is negatively correlated with sale price, though it is not significantly different from zero when

using the local, rather than international, exclusivity dummy. The risk variable is also not significant.

The estimation reveals that granting a monopoly concession substantially affects the firm's value to investors. Granting a monopoly in fixed local service is associated with more than *doubling* the price investors pay for the firm, *ceteris peribus*. Granting an international long distance service monopoly appears to be relatively even more valuable than a local monopoly. It is clear why an exclusivity period is so appealing to governments looking to raise revenue and to the deal's underwriters, whose compensation may depend on the sale price.

But viewing the privatization solely as a means of increasing government revenues is seriously incomplete, as discussed above. Table 3 details the results of estimating equation (2), which evaluates the real effects of the exclusivity period on the telecom sector using the dummy variables as the *exclusivity* indicator. Population, per capita income, and the pre-privatization number of mainlines are all positively associated with the number of mainlines in the years following privatization. Neither the presence of mobile competitors nor the risk variable are significantly different from zero.

The first two columns of Table 3 show the results when *exclusivity* is equal to one when any exclusivity period remains in the concession. The coefficient on *exclusivity* is negative and significant. The results suggest that an exclusivity period can reduce network growth by 20 to 40 percent, using the ITU and firm data, respectively. The second two columns of Table 3 show the results of the estimation when the *exclusivity* equals one when more than three years of exclusivity remain. The results are similar, though the magnitude of the effect is smaller. Here we find that the exclusivity period reduces network growth by thirteen to thirty percent using ITU and firm data, respectively.

Table 4 reveals the results of estimating equation (2) when *exclusivity* is a continuous variable as discussed above. All four estimations (two using firm data and the log of the variable plus one, and two using ITU data and the log of the variable plus 0.1) yield a negative coefficient, and three of the four are statistically significant. The statistically significant results suggest that a one percent increase in the length of the exclusivity period is associated with a 0.05 to 0.08 percent decrease in network growth. Doubling the exclusivity period would reduce network growth by five to eight percent. Of course, the coefficients are difficult to interpret because of the manipulations necessary to include the zero values.

Table 5 shows the results of estimating equation (3), which better includes years of exclusivity as a continuous variable. Again, the results are largely identical to those discussed above. Here we find that each year of exclusivity reduces the network growth rate by 0.3 to 0.4 percentage points. A seven-year exclusivity period, then would reduce the growth rate by 2.1 to 2.8 percentage points, not insignificant given that the mean growth rate in the three years prior to privatization was only 6.7 percent.

None of the approaches I take above are perfect—more time must elapse and more data collected before the analysis can become much more rigorous. Nonetheless, the general result is remarkably robust to the empirical specification. Granting a monopoly in local service provision seriously retards investment in the local network, thereby undermining one of the main goals of privatization.

Together, the results of the two estimations confirm empirically what standard economic theory holds should be true. A monopoly is more valuable to its owners than is a firm operating in a competitive environment. In this case the government may even double the sale proceeds of the telecom firm by guaranteeing its monopoly status. However, this increased revenue to the treasury comes with a real cost to total welfare. Granting a monopoly concession may reduce growth in the telecom network by up to forty percent.

6. Discussion

Empirical studies of telecom reform often suffer from endogeneity problems. Telecom reforms can cause or result from changes in the condition of the national telecom infrastructure, for example. To some degree, this paper faces the same issue—granting an exclusivity period may be endogenous to network penetration. In other words, countries that give exclusivity periods may do so because they have an especially poor telecom infrastructure and believe that monopoly concessions are needed to attract investors. If this were true, we would find exclusivity periods negatively correlated with network expansion because poor networks cause exclusivity periods, not vice versa.

Two factors, however, suggest that reverse causality is not the case here. First, the equations control for the state of the network at the time of privatization, using either the pre-privatization number of mainlines or the average growth rate in the three years prior to

privatization. These variables account for a great deal of variation in the price and growth of the telecom network. Second, and more importantly, the data do not bear out this particular endogeneity hypothesis. Table 6 presents simple correlations between the relevant variables. The table shows that, in this sample, exclusivity periods are positively correlated with number of mainlines. The implication is that the data does not support the hypothesis advanced above—countries with larger networks tended to give longer exclusivity periods.

While endogeneity may not be a problem of the same magnitude as in other empirical telecom studies, this paper is not without problems. In particular, the dataset is still far from ideal. First, its small, nonrandom, sample makes it difficult to generalize the results. Second, it does not address the greatly varied regulatory environments across countries, which can significantly impact both the privatization transactions and network performance. Finally, it does not adequately capture the many important details of the privatization transactions. The solution to these problems is, of course, to gather more data. This data-collection process is time-consuming and expensive, since it involves acquiring annual reports, prospectuses, and legislative and regulatory documents from a host of sources in each country. Nonetheless, the provocative results in this paper only scratch the surface of what these data can tell us about a host of topics. The Infrastructure Privatization Database, when complete, promises to yield valuable new insights on a host of privatization topics crucial to developing countries.

The Database will also ultimately help us answer many other questions about the privatization process. What are the long-term effects of foreign ownership restrictions? What are the effects of employee-ownership or of voucher privatization schemes? How do regulatory institutions affect the development of the telecom sector? These are especially important questions as countries continue to privatize telecom and other sectors and work on building nascent regulatory agencies.

7. Conclusions

The growth of telecommunications reforms around the world shows no signs of slowing. These reforms hold out the possibility of vastly improved telecom service for literally millions of people. Research to date has largely demonstrated that privatization under the right institutional environment can lead to substantial performance improvements. The empirical literature,

however, has almost completely ignored the details of the privatization process. These details can make an enormous difference. In particular, governments tend to give the newly privatized firm a monopoly concession on telecom service. While some contend that an exclusivity period is necessary to encourage investment, the only reasonable explanation is to increase the government's revenues from the sale.

The government may face intense pressure to maximize the sale price. But turning a public monopoly into a private monopoly may not necessarily generate the improvements reformers envision. Guaranteeing the newly-privatized firm a monopoly can increase the government's windfall from the sale, but may seriously reduce investment in the telecom network, and potentially the country's net welfare. The point of this paper is to quantify the implications of that choice. I find evidence that exclusivity periods can double the firm's sale price, but at the cost of substantially reducing investment: exclusivity periods are associated with up to a 40 percent reduction in growth in the number of telephone mainlines.

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Table 1
Privatization Summary Statistics

country	firm	year privatized	Years exclusivity Local fixed	Years exclusivity International LD	Share sold to firms (percent)	Price ($ millions)	Price (millions of 1999 US dollars)	Implied value (millions of 1999 US dollars)
Jamaica	Jamaica Telephone Company (JTC)	1987	25	25	79[1]	155.8	192.6	243.826
Chile	CTC	1988	0	0	36.66	99.5	120.2	327.928
Trinidad & Tobago	Trinidad & Tobago Telephone Company (TELCO)	1989	20	20	49	85	98.8	201.651
Argentina	Telecom (north)	1990	7	7	60	2408	2,977.1	4,961.874
Argentina	Telefonica (south)	1990	7	7	60	2834	3,503.8	5,839.681
Venezuela	CANTV	1991	9	9	40	1885	2,054.6	5,136.513
Mexico	TELMEX	1991	36	5	20.4	1757.6	1,915.7	9,390.894
Hungary	MATAV	1993	8 [2]	8	30.92	875	919.6	2,974.177
Peru	Telefonica de peru	1994	5	5	35	2002	2,061.7	5,890.619
Hungary	MATAV	1995	6	6	37	852	860.7	2,326.286
Bolivia	ENTEL	1995	0	6	50	610	616.2	1,232.495
Czech Republic	SPT Telecom	1995	5	5	27	1450	1,751.9	6,488.610
Pakistan	Pakistan telefone & telegraph (PTC), later PTCL	1995	7	7	0 [3]	-	-	8,327.303
Ghana	GT	1996	6 [4]	6	30	38	37.9	126.483
El Salvador	CTE	1998	0	0	51	275	277.8	544.738
Guatemala	Telecomunicaciones de Guatemala (TELGUA)	1998	0	0	95	700	707.2	744.388
Brazil [5]	AG Telecom (Region 1)	1998	0	0	100	3434	3,469.2	3,469.169
Brazil	Solpart (Tele Centro Sul, Rgn 2)	1998	0	0	100	2070	2,091.2	2,091.200
Brazil	Telefonica (Region 3, Sao Paulo)	1998	0	0	100	5783	5,842.2	5,842.226
Brazil	EMBRATEL	1998	0	0	100	2650	2,677.1	2,677.140

[1] Sold only 17 percent in 1987; increased to 79 percent by 1990.

[2] The exclusivity period covered 2/3 of the country.

[3] Twelve percent sold to the public.

[4] A second network operator (SNO) was authorized and both given a 6-year monopoly. In practice, though, the SNO still is not operational.

[5] In Brazil the telecom operator was divided into four firms, each sold separately: three regional local monopolies and one international and long distance provider

Table 1
Privatization Summary Statistics
(continued)

country	firm	year privatized	Number of mainlines		Macroeconomic country data		
			firm data	ITU data	population	GDP (millions 1999 USD)	GDP/capita
Jamaica	Jamaica Telephone Company (JTC)	1987	81,700	81,713	2,341,980	3,750	1,601
Chile	CTC	1988	592,000	625,466	14,824,000	29,183	1,969
Trinidad & Tobago	Trinidad & Tobago Telephone Company (TELCO)	1989	165,000	158,208	1,170,880	5,025	4,292
Argentina	Telecom (north)	1990	1,391,460	1,364,431	14,661,704	78,774	5,373
Argentina	Telefonica (south)	1990	1,695,504	1,662,569	17,865,392	95,987	5,373
Venezuela	CANTV	1991	1,567,169	1,598,947	19,790,000	58,272	2,945
Mexico	TELMEX	1991	6,024,814	6,024,800	87,840,000	342,512	3,899
Hungary	MATAV	1993	1,466,946	1,497,577	10,310,000	40,565	3,934
Peru	Telefonica de peru	1994	772,390	772,390	23,331,000	51,802	2,220
Hungary	MATAV	1995	1,860,182	2,157,202	10,246,000	44,707	4,363
Bolivia	ENTEL	1995	.	294,639	7,410,000	6,784	916
Czech Republic	SPT Telecom	1995	2,398,238	2,444,156	10,336,000	62,874	6,083
Pakistan	Pakistan telefone & telegraph (PTC), later PTCL	1995	2,127,344	2,127,344	130,250,000	71,984	553
Ghana	GT	1996	77,886	77,886	17,832,000	6,334	355
El Salvador	CTE	1998	482,600	482,566	6,032,000	12,090	2,004
Guatemala	Telecomunicaciones de Guatemala (TELGUA)	1998	429,712	517,000	10,801,000	19,136	1,772
Brazil	AG Telecom (Region 1)	1998	7,797,876	8,690,922	72,118,382	340,613	4,723
Brazil	Solpart (Tele Centro Sul), Telecom Italia (Rgn 2)	1998	3,757,261	4,187,558	34,748,896	164,118	4,723
Brazil	Telefonica (Region 3, Sao Paulo)	1998	6,377,677	7,108,076	58,983,722	278,578	4,723
Brazil	EMBRATEL	1998	17,932,814	19,986,556	165,851,000	783,308	4,723

Table 2
Exclusivity and sale price

Dependent variable: ln (implied value of privatized firm) Mean of dependent variable: 7.42		
Constant	-11.07 (2.57)	-13.82 (4.01)
Local exclusivity?	**1.14** **(2.54)**	
International exclusivity?		**1.55** **(5.72)**
log population	0.76 (3.78)	0.86 (5.17)
log gdp/capita	0.84 (1.89)	1.02 (2.81)
before 1992?	-0.83 (1.48)	-1.11 (2.40)
ICRG risk	-0.13 (0.69)	-0.20 (1.32)
R-squared	0.73	0.81
Number observations	20	20
Heteroskedastic-consistent standard errors		

Table 3
Exclusivity and performance
(exclusivity dummy variable)

Dependent variable	ln(# mainlines)			
	firm data	ITU data	firm data	ITU data
Mean	13.9	14.1	13.9	14.1
Constant	-0.66	-5.92	-0.61	-6.08
	(0.53)	(5.40)	(0.45)	(5.14)
Exclusivity?	**-0.40**	**-0.20**		
	(4.74)	**(3.42)**		
Exclusivity four or more years?			**-0.32**	**-0.13**
			(4.02)	**(1.71)**
log population	0.16	0.64	0.16	0.46
	(3.10)	(11.07)	(2.85)	(8.95)
log gdp/capita	0.07	0.46	0.04	0.64
	(0.82)	(8.63)	(0.47)	(10.11)
log (number mainlines pre-privatization)	0.80	0.44	0.79	0.42
	(10.55)	(9.22)	(10.06)	(8.56)
mobile competition?	-0.14	-0.10	-0.15	-0.09
	(0.66)	(0.76)	(0.77)	(0.66)
log (ICRG risk)	0.29	0.64	0.43	0.85
	(0.60)	(1.33)	(0.79)	(1.49)
R-squared	0.97	0.98	0.96	0.97
Number observations	83	84	83	84
Heteroskedastic-consistent standard errors				

Year fixed effects included in estimation, but not shown.

Table 4
Exclusivity and performance
(log-levels and continuous exclusivity variable)

Dependent variable	ln(# mainlines)			
	firm data	ITU data	firm data	ITU data
Mean	13.9	14.1	13.9	14.1
Constant	-1.55	-6.25	-1.16	-6.13
	(1.19)	(5.68)	(0.90)	(5.55)
log (number years exclusive + 1)	**-0.09**	**-0.07**		
	(1.13)	**(1.96)**		
log (number years exclusive + 0.1)			**-0.08**	**-0.05**
			(2.22)	**(2.73)**
log population	0.18	0.47	0.17	0.47
	(3.59)	(9.34)	(3.40)	(8.81)
log gdp/capita	0.08	0.62	0.04	0.61
	(0.58)	(8.22)	(0.35)	(9.45)
log (number mainlines pre-privatization)	0.78	0.45	0.81	0.46
	(5.87)	(6.97)	(6.99)	(8.03)
mobile competition?	-0.19	-0.20	-0.26	-0.19
	(0.47)	(1.10)	(0.78)	(1.27)
log (ICRG risk)	0.70	0.84	0.45	0.76
	(1.31)	(1.55)	(0.84)	(1.37)
R-squared	0.96	0.98	0.96	0.98
Number observations	83	84	83	84
Heteroskedastic-consistent standard errors				

Year fixed effects included in estimation, but not shown.

Table 5
Exclusivity and performance
(percent changes and continuous exclusivity variable)

Dependent variable	% change in # mainlines	
	firm data	ITU data
Mean	0.12	0.12
Constant	-0.06	-0.12
	(0.29)	(0.58)
Number of years exclusivity	**-0.004**	**-0.003**
	(2.59)	**(2.56)**
population growth	1.00	1.13
	(0.45)	(0.76)
gpd/capita growth	0.13	-0.01
	(1.06)	-(0.11)
average growth in mainlines over the	0.91	0.71
three years before privatization	(2.49)	(3.01)
number of mobile competitors	-0.04	-0.02
	(1.45)	(1.14)
ICRG risk	0.01	0.02
	(0.35)	(0.84)
R-squared	0.34	0.35
Number observations	72	73
Heteroskedastic-consistent standard errors		

Year fixed effects included in estimation, but not shown.

Table 6
Correlation matrix

	Exclusivity period (years)	Number mainlines (ITU data)	Number mainlines (firm data)
Exclusivity period (years)	1		
Number mainlines (ITU)	0.20	1	
Number mainlines (firm data)	0.39	0.92	1