



Fondazione Eni Enrico Mattei

**Sources of Performance
Improvement in Privatised Firms:
A Clinical Study of the Global
Telecommunications Industry**

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**SOURCES OF PERFORMANCE IMPROVEMENT IN PRIVATIZED FIRMS:
A CLINICAL STUDY OF THE GLOBAL TELECOMMUNICATIONS INDUSTRY**

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SOURCES OF PERFORMANCE IMPROVEMENT IN PRIVATIZED FIRMS: A CLINICAL STUDY OF THE GLOBAL TELECOMMUNICATIONS INDUSTRY

Abstract

This paper examines the financial and operating performance of 31 national telecommunication companies in 25 countries that were fully or partially privatized through public share offering between October 1981 and November 1998. Using conventional pre- versus post-privatization comparisons, we find that profitability, output, operating efficiency and capital investment spending increase significantly after privatization, while employment and leverage decline significantly. However, these univariate comparisons do not account for separate regulatory and ownership effects (retained government stake), and almost all telecoms are subjected to material new regulatory regimes around the time they are privatized. We examine these separate effects using both random and fixed-effect panel data estimation techniques for a seven-year period around privatization. We verify that privatization is significantly related to higher profitability, output and efficiency, and with significant declines in leverage. However, we also find numerous separable effects for variables measuring regulation, competition, retained government ownership and foreign listing (on U.S. and U.K. exchanges). Competition significantly reduces profitability, employment and, surprisingly, efficiency after privatization, 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. Major efficiency gains result from better incentives and productivity, rather than from wholesale firing of employees and profitability increases appear to be caused by significant reductions in costs—rather than price increases. On balance, we conclude that the financial and operating performance of telecommunications companies improves significantly after privatization, but that a sizable fraction of the observed improvement results from regulatory changes—alone or in combination with ownership changes—rather than from privatization alone.

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1. Introduction

It is by now well established that the privatization of state-owned enterprises (SOEs), especially those privatizations effected through public share offerings, generally leads to improvements in the financial and operating performance of divested firms in both developed and developing countries.¹ It is far less clear *why* privatization improves performance, and academic research has thus far made little progress in disentangling the separate effects of competition, regulation, and ownership structure on the performance of privatized companies. We attempt to provide answers to these questions by examining the most economically significant and politically sensitive industry being privatized in the world today--the national telecommunications monopolies.

National telecommunications companies, or “telecoms,” have been in state hands since the dawn of the electronics era in most rich countries (with the important exception of the United States), as well as in virtually all the developing nations. Therefore, as discussed in Wallsten (2000a) and Noll (2000), telecom privatization represents a truly epochal shift in the balance of state power within every economy where denationalization is attempted. Additionally, citizens have a direct economic stake in the cost and quality of telecom services being provided, so their privatization is always controversial. The financial impact of telecom sales is also immense, since telecom share issue privatizations (SIPs) are almost always the largest share offerings in a nation’s history. Furthermore, telecoms usually become the “bellweather” stocks on national exchanges, often accounting for 30 percent or more of total capitalization and an even greater share of total trading volume (Boutchkova and Megginson (2000)). Additionally, telecom SIPs often involve sizeable fractions of the population becoming shareholders for the first time. As examples, almost four million (of 65 million total) French citizens purchased shares in the initial public offering of France Telecom, and by the time Telefonica of Spain was fully divested its shares were owned by more than one in eight Spanish households (Jones, et al. (1999)). Finally, it has become painfully obvious to policy-makers that an efficient communications sector is vital to a well-functioning modern economy, and that constructing such a system requires capital investment spending on a scale that few governments can either achieve or effectively manage. For all these reasons, telecom privatizations are always perceived as high-stakes gambles, and selling governments typically approach divestment with great anxiety.

Given the economic importance of national telecommunications industries, and the rich variety of

¹ In addition to the papers summarized in section 2 below, Megginson and Netter (2001) summarize the results of 61 studies that examine privatization’s impact on the subsequent performance of divested firms.

regulatory and financial issues their privatizations inevitably bring to the fore, it is not surprising that many academic researchers have examined telecom divestments empirically. We discuss twelve of these studies more fully in section 2. One of these is a survey article, six are essentially case studies examining either firm-level or economy-wide changes in one or a small number of countries, and the remaining five are empirical studies. Four of the empirical studies—Ros (1999), Wallsten (2000a,b) and Boylaud and Nicoletti (2000)—are multi-country studies employing panel data methodology and country-level observations to examine the effect of privatization and regulation on teledensity (number of lines per 100 population) and service levels. On balance, these studies generally indicate that deregulation and liberalization of telecom services are associated with significant growth in teledensity and operating efficiency, and with significant improvements in the quality and price of telecom services. The impact of privatization, per se, is somewhat less clear-cut, but most studies agree that the combination of privatization and deregulation/liberalization is associated with significant telecommunications improvements. This is certainly the result predicted by Noll (2000) in his survey article examining the political economy of telecom reform in developing countries.

While our study follows in the spirit of earlier telecom privatization studies, we make two important new empirical contributions. First, we present the first multi-national examination of privatization-related performance changes for telecoms using the Megginson, Nash and van Randenborgh [MNR] (1994) methodology for comparing mean (univariate) performance measures in the pre- versus post-privatization periods. Since this has emerged as the most commonly employed methodology for examining privatization's impact on the performance of divested firms, using this technique allows us to directly compare the results of telecom privatizations to those documented for other firms. Second, we perform the first panel data estimation of the effects of telecom privatization and regulation using *firm-level* data, rather than just country-level information. Employing observations for individual companies allows us to examine the firm-specific sources of any performance changes documented. In particular, we can study how ownership and regulatory changes impact the output, profitability, efficiency, investment, employment and leverage levels of privatized telecoms.

We examine the financial and operating performance of 31 national telecommunications companies fully or partially divested via public share offering over the period November 1981 to November 1998. The study is restricted to share issue privatizations (SIPs) for reasons of data availability—since only these generate comparable, publicly available pre and post-privatization financial information. We first build a dataset using balance sheet data for a seven-year period around the privatization dates including various measures for profitability, output, efficiency, employment, capital expenditure and leverage. This dataset also incorporates national measures of telecom service levels, such as number of lines in service, and controls for making cross-country comparisons possible (GDP per capita). We perform univariate comparisons of the pre- versus post-privatization performance levels of these firms using the standard MNR univariate testing procedure. We then

run panel data estimations to explain performance over time in terms of ownership changes and structural changes due to regulatory reforms occurring during the study period.

Beginning with conventional pre versus post-privatization comparisons, we find that profitability, output, operating efficiency and capital investment spending increase significantly after privatization, while employment and leverage decline significantly. However, these univariate comparisons do not account for separate regulatory and ownership effects (retained government stake), and almost all telecoms are subjected to material new regulatory regimes around the time they are privatized. We examine these separate effects using both random and fixed-effect panel data estimation techniques for a seven-year period around privatization. We verify that privatization is significantly related to higher profitability, output and efficiency, and with significant declines in leverage. However, we also find numerous separable effects for regulatory, competition, retained government ownership and foreign listing (on U.S. and U.K. exchanges) variables. Competition significantly reduces profitability, employment and efficiency after privatization 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. Major efficiency gains result from better incentives and productivity, rather than from wholesale firing of employees and profitability increases are caused by significant reductions in costs—rather than price increases. On balance, we conclude that the financial and operating performance of telecommunications companies improves significantly after privatization, but that a significant fraction of the observed improvement results from regulatory changes—alone or in combination with ownership changes—rather than from privatization alone.

This paper is presented as follows: Section 2 discusses the principal methods commonly used to privatize telecoms, and then discusses the three forms of regulation that are commonly imposed on these firms after divestment. Section 3 briefly summarizes the most important general privatization research, then focuses specifically on studies of telecom privatization and regulation. Our sample is described in section 4, while section 5 presents the results of the MNR analyses of performance changes. Section 6 describes the panel data estimation techniques we employ to examine the separate effects of ownership and regulation on telecom performance, and then presents the results of these estimations. Finally, section 7 concludes the paper.

2. Methods of privatization and forms of telecom regulation

Virtually all telecom privatizations take one of three basic forms. In developing countries that lack the managerial and financial resources to implement major technological and service upgrades domestically, the standard method of divestment has been to “import” the needed capital and expertise. In non-transition

countries, this typically involves selling a controlling stake in the national telecom to a western operating company, usually in exchange for a large up-front payment plus binding promises to aggressively update and expand service levels after gaining control. The selling government frequently then sells some or all of its residual holdings in a SIP, thereby helping to jump-start development of the national stock market and to spread ownership of the firm's equity as broadly as possible throughout the citizenry. A second divestment strategy, often called "mass privatization," has been followed by governments in some of the transition economies of central and eastern Europe. This also involves the initial sale of a controlling stake to a western telecom company, but differs in that the government then divests its remaining shares via a distribution of vouchers to the citizenry, at a nominal price, rather than via a public share offering for cash. The third divestment strategy, which is followed in its pure form only in economically advanced countries, is for the government to simply divest all or part of its ownership stake through a public share offering. In effect, this leaves the telecom's existing management team in place and relies primarily on domestic suppliers of capital and technology for all needed system upgrades and expansion. This study examines telecoms that are privatized using either the first or third method, since we require that the divested firm must publish operating and financial performance data after privatization—and this effectively mandates that the firms have publicly traded shares.

Regardless of the method of privatization adopted, virtually every government that has divested its national telecommunications company has deemed it necessary to simultaneously impose a new regulatory system on the privatized firm, which invariably retains a dominant share of the local market. Since many state-owned telecoms were actually government ministries prior to divestment, a near universal prerequisite to formal privatization is to "corporatize" the enterprises—that is to establish the firm as a limited liability company legally distinct from the government itself. The next step involves sale of some or (very rarely) all of government's shares to the public and/or to a foreign operating company. As we document below, the vast majority of these share offerings are pure secondary issues—where the sale proceeds flow directly to the government—rather than capital-raising, primary offerings.

The specific regulatory regime that is then adopted for the privatized telecoms encompasses one or more of three forms of regulation.² The first is establishment of an independent regulatory agency to oversee the privatized telecom and ensure that competitors are allowed to enter the market without being subject to predation by the dominant incumbent. Sometimes this agency is merely the "rump" left over from the telecommunications ministry after the operating assets are sold to the public; sometimes the agency is created

² The discussion in this section draws on several sources. Smith and Wellenius (1999) and Wellenius (2000) present normative analyses of telecom regulation in developing countries, while Wasserfallen and Müller (1998) discuss the privatization and deregulation of western Europe's telecom industry. Many of the telecom papers discussed in section 2.3 also discuss regulatory issues in developing and/or industrialized countries, especially Ros

from scratch. In either case, every government must face the difficult challenge of staffing this new agency with technically competent people and then giving them the authority (and budget) needed to effectively supervise the newly privatized telecom behemoth.

The second form of regulation, which is also designed to ensure the emergence of effective competition, is mandating the rules governing third party access to the incumbent's network. This is an extremely important mandate, for several reasons. First, since it is almost never economically rational to duplicate an incumbent's existing network after privatization, new entrants must be granted access to this network (controlled by the incumbent) at a "fair" price. But determining the appropriate price is extraordinarily difficult. If an incumbent (or an excessively solicitous regulator) is allowed to set access charges at a very high level, price competition will be stifled. On the other hand, if third party access charges are set too low, the incumbent will be unable to cover the full costs of operating the network and the entry of new competitors will be effectively subsidized by the incumbent's reduced profits. However, the most pernicious impact of setting "incorrect" third party access charges is likely to be the effect this has on the incumbent's incentive to invest in network expansion and service improvement. If high charges deter competition, the incumbent will remain a monopolist, and both economic theory and Wallsten's (2000b) findings on the effect of granting exclusivity periods to telecom operators point to the investment-suppressing effects of monopolized telephony markets. Setting access charges too low will effectively de-capitalize the incumbent and rob it of the internal cash flow needed to fund network expansion.

The third form of regulation involves establishing pricing rules for the divested telecom and/or setting up an agency to monitor the incumbent's compliance with pricing guidelines agreed upon at the time of privatization. As described in Megginson, Nash and van Randenborgh (1994), the RPI-X pricing model set up for British Telecom prior to its initial SIP in 1984 has since been widely copied by divesting governments around the world. This involves allowing the privatized company to raise prices on the basket of services it provides to customers by a percentage equal to the increase in the retail price index (RPI) *minus* X percentage points. By the mid-1990s, "X" had risen to seven percent for British Telecom, so it was effectively forced to reduce prices by about four percent every year. Most other newly created regulatory bodies have adopted a more generous standard for privatized telecoms, particularly if these are obviously in need of significant catch-up investment, but the basic price regulation model has proven remarkably effective.

3. Literature review

Since this study examines the privatization of an economically significant industry, where the regulatory environment will likely have first-order effects on performance, we must necessarily draw upon

(1999) and Boylaud and Nicoletti (2000).

several important streams of literature to motivate our analysis and inform our predictions. Section 2.1 surveys the empirical research testing for privatization-related performance changes using the simple pre- versus post-privatization comparison technique first presented by Megginson, Nash and van Randenborgh (1994). Section 2.2 summarizes the empirical studies examining privatization's impact on a single firm or industry, emphasizing studies of regulated firms. Section 2.3 concludes by surveying a dozen recent studies that examine the impact of privatization and/or regulatory changes on the performance of formerly state-owned telecom companies.

3.1. Multi-national and multi-industry research on the performance of privatized firms

The simplest method of examining the effect of privatization on the performance of former SOEs is to compile a large sample of companies privatized through public share offerings and examine whether the mean and median firms improve financial and operating performance, measured various ways, after being divested. The first published study to do this is Megginson, Nash and Van Randenborgh (1994), and since then at least eight studies have employed the MNR methodology in various settings. These studies are surveyed in Megginson and Netter (2001), so this section will only discuss the four that are most directly relevant for our analyses. In spite of obvious drawbacks—principally relating to possible selection bias (governments may only privatize their “best” SOEs via share offerings) and the need to rely on simple, universally-available accounting data—studies employing the MNR methodology have two key advantages. First, they are the only studies that can examine and directly compare large samples of economically significant firms, from different industries, privatized in different countries, over different time periods. Since each firm is compared to itself (a few years earlier) using simple, inflation-adjusted sales and income data (that produce results in simple percentages), this methodology allows one to efficiently aggregate multi-national, multi-industry results. Second, while focusing on SIPs yields a selection bias, it also yields samples that encompass the largest and most politically influential privatizations; SIPs account for more than two-thirds of the \$1 trillion of total revenues raised by governments since 1977.

The original MNR (1994) study examines the pre versus post-privatization financial and operating performance of 61 companies from 18 countries and 32 industries that are fully or partially privatized through public share offerings during the period 1961 to 1990. The authors present strong evidence that, following privatization, their sample firms become more profitable and efficient, and also increases real sales and capital expenditures. Furthermore, these companies significantly lower their debt levels and increase dividend payments. In addition, MNR find no evidence that employment levels decline after privatization. Instead they find an increase in employment levels for a significant 64 percent of the sample companies.

Boubakri and Cosset (1998) examine the financial and operating performance of 79 firms in 21 developing countries that are privatized over the period 1980 to 1992. These authors also report significant

increases in profitability, operating efficiency, capital expenditures, real sales, total employment and dividends. Dewenter and Malatesta (2000), on the other hand, study 63 firms privatized during the years 1981 to 1993, and find that profitability computed using return on sales as a proxy increases significantly after privatization, while profitability measured as earnings before interest and taxes divided by sales declines insignificantly. Further, they show that productivity increases significantly. Perhaps most importantly, they document that privately owned firms (including privatized companies) are significantly more efficient and profitable than are state-owned firms.

Finally, D'Souza and Megginson (1999) examine the pre versus post-privatization financial and operating performance of 85 companies from 28 countries for the period 1990 to 1996. They document significant increases in the mean levels of profitability, real sales and operating investment, significant decreases in leverage ratios, and insignificant changes in employment and capital spending. Interestingly, they find that a much larger fraction of the firms in their sample are from regulated industries (primarily telecoms and electric utilities) than was true for MNR. Taken as a whole, this body of evidence clearly indicates that privatization increases the financial and operating performance of divested firms, and does so in a way that does not necessarily result in wide-spread employment losses.

3.2. *Case study and industry-specific privatization research*

A second major stream of privatization research examines econometrically how privatization impacts the performance of a single firm or a small number of firms in a single industry. Once again, a full survey of these papers is presented in Megginson and Netter (2001), so we focus here only on those studies that examine regulated industries or transport industries that are significantly impacted by regulation. The first study, by Galal, Jones, Tandon, and Vogelsang (1992), has proven to be remarkably influential, both because of the rigor of its methodology and the fact that it is sponsored by the World Bank. These authors compare the actual post-privatization performance of 12 large firms--mostly airlines and regulated utilities--in Britain, Chile, Malaysia, and Mexico to the predicted performance of these firms had they not been divested. Using this counter-factual approach, the authors document net welfare gains in 11 of the 12 cases considered which equal, on average, 26 percent of the firm's pre-divestiture sales. They find no case where workers are made significantly worse off, and three where workers significantly benefit.

Newberry and Pollitt (1997) perform a similar counter-factual analysis of the 1990 restructuring and privatization of the U.K.'s Central Electricity Generating Board (CEGB), and document significant post-privatization performance improvements. However, they find that the producers and their shareholders capture all of the financial rewards of this improvement and more, whereas the government and consumers lose out. The authors conclude that CEGB's restructuring and privatization was in fact "worth it," but could have been implemented more efficiently and with greater concern for the public's welfare. Three other studies—Vickers

and Yarrow (1991), Bishop and Thompson (1992) and Beesley and Littlechild (1989)--also examine the privatization and liberalization of the British electricity industry and describe the regulatory regime adopted for early British utility privatizations. None of these works showers the Thatcher government with praise for its policy decisions, though Beesley and Littlechild do find the RPI-X price regulation system adopted in the U.K. is superior to the U.S. rate of return regulatory regime. Wolfram (1998) and Cragg and Dyck (1999) document the increased compensation for top managers of these privatized utilities, as well as the political furor these “unjustified” raises caused.

The research focus on electric utility privatizations has also extended beyond the U.K. In fact, one of the seminal studies in the field of regulatory economics, Peltzman (1971), examines the pricing behavior of private versus publicly owned electric utilities in the U.S. More recently, Newberry (1997) presents a theoretical analysis of the efficiency and distributional issues that arise when network utilities are privatized and/or liberalized, while Pollitt (1997) and Steiner (2000) analyze the impact of liberalization on the performance of the international electric supply industry. Pollitt also surveys the long list of empirical studies examining whether privately owned utilities out-perform publicly owned ones, and concludes that the evidence does favor private ownership.³ Finally, Bortolotti, Fantini and Siniscalco (1999) document that effective regulation is a crucial institutional variable in electric utility privatization. Establishing such a regulatory regime allows governments to increase the pace of privatization, sell higher stakes, and maximize offering proceeds.

Four recent empirical studies examine the impact of privatization—or, more generally, increasing levels of private ownership—on the performance of transportation companies or industries. Ehrlich, Gallais-Hamonno, Liu, and Lutter (1994) examine productivity differences between state-owned and privately owned firms using a sample of 23 comparable international airlines of different (and in some cases changing) ownership categories over the period 1973-83. Their point estimates indicate that the change from complete state ownership to private ownership in the long run would increase productivity growth by 1.6 to 2 percent a year and would reduce costs by 1.7 to 1.9 percent annually. Their findings also suggest that a partial change from state ownership to private ownership has little effect on long-run productivity growth -- the benefits are based on complete privatization of the firm. Eckel, Eckel, and Singal (1997) examine the effect of British Airways’ 1987 privatization on *competitors’* stock prices and on fares charged in those routes where BA competes directly with foreign airlines. They find that the stock prices of U.S. competitors fall, as do airfares in markets served by BA; both findings suggest that stock traders anticipated a much more competitive BA

³ More emphatic support for the general proposition that privately-owned firms out-perform publicly-owned companies is provided in recent multi-industry studies such as Boardman and Vining (1989), Vining and Boardman (1992), Majumdar (1996) and Dewenter and Malatesta (2000), among others.

would result from the divestiture. Laurin and Bozec (1999) compare the productivity and profitability of two large Canadian rail carriers (one state-owned and one private-sector), both before and after the 1995 privatization of Canadian National. They find that CN's relatively poor performance during the "fully state-owned period" (1981-1991) rapidly converges on Canadian Pacific's performance levels during the pre-privatization, but post-announcement period (1992-1995), and surpasses it thereafter. Finally, Ramamurti (1997), examines the 1990 restructuring and privatization of Ferrocarrilla Argentino, the Argentine national freight and passenger railway system. The author documents a nearly incredible 370 percent improvement in labor productivity and an equally striking (and not unrelated) 78.7 percent decline in employment--from 92,000 to 18,682 workers. Operating subsidies declined almost to zero, and consumers benefited from expanded (and better quality) service and lower costs. Ramamurti concludes that these performance improvements could not have been achieved without privatization.

3.3. *Empirical research on telecom privatization and regulation*

Twelve recent studies examining telecom privatization and regulation are summarized in Table 1. As mentioned earlier, six of these are essentially case studies of individual company divestments, one is a survey article, and the remaining five are multi-national empirical studies. The survey article, Noll (2000), analyzes the political economics of telecom liberalization and privatization in developing countries. The first case study, the aforementioned Galal, Jones, Tandon and Vogelsang (1992) paper, is also cited here because it examines three privatized telecoms—British Telecom, Telefonos de Mexico (Telmex) and Chile's CTC. The authors document significant operating and financial performance improvements in all three cases. Parker's (1994) analysis of British Telecom's 1984 privatization also finds performance improvements using most measures. In particular, prices fell by 11% in real terms after this partial divestment, while service levels and profitability improved. On the other hand, BT's employment fell by a full one-third over the ten years after 1984. Tandon (1995) finds that Telmex's total factor productivity rose by 15% during the three years after its 1990 privatization, and the number of lines in service grew rapidly. Using a somewhat longer post-privatization event horizon, Rogozinski (1997) documents an even more dramatic increase in Telemex's performance, as measured by increases in lines in service, teledensity (lines per 100 population), capital spending and use of fiber optic technology. Boles be Boer and Evans (1996) document significant declines in the price of phone services after Telecom New Zealand's 1990 privatization, that is due mostly to rapid productivity growth and significant service level improvements. Finally, Ramamurti (1996) provides a summary of empirical studies examining four telecom privatizations in Latin America, and concludes that all were judged to be political and economic success stories.

****** Insert Table 1 about here ******

Unfortunately, the multi-national and multi-company empirical studies tell somewhat conflicting

stories, probably due in part to differences in methodology and in the nations covered. In terms of methodology, Ros (1999), Wallsten (2000a,b), and Boylaud and Nicoletti (2000) employ panel data estimation procedures, whereas Petrazini and Clark (1996) use simpler methods of classification and analysis. Regarding coverage, Petrazini and Clark, Ros and Wallsten examine developing countries, either exclusively or as separate subsamples, whereas Boylaud and Nicoletti focus on OECD countries and Ros examines both developing and industrialized nations.

Petrazzini and Clark find that deregulation and privatization are both associated with significant improvements in teledensity in 26 developing countries, but have no impact on service quality. Ros examines the telecom markets of 110 countries (developing and developed) over the period 1986-95, and finds that countries with at least 50% private ownership in the main telecom firm have significantly higher teledensity levels and growth rates. Though both privatization and competition increase efficiency, only privatization is positively associated with network expansion. Wallsten (2000a) econometrically analyses the effects of telecommunications reforms on a panel dataset of 30 African and Latin American countries from 1984 to 1997, and finds that competition is significantly associated with increases in per capita access and decreases in cost. Privatization alone is not helpful, unless coupled with effective and independent regulation; however, privatization coupled with regulation is the single best reform. The final developing-country study, Wallsten (2000b), examines the effect of granting exclusivity periods to 20 privatized telecoms in 15 countries. He finds that exclusivity periods significantly reduce the growth rate in number of main lines due to reduced investment incentives. On the other hand, these concessions roughly double the sale prices of the telecoms to the selling governments.

The one study focussing exclusively on telecom privatizations in OECD countries is Boylaud and Nicoletti (2000), who use factor analysis to investigate whether liberalization and privatization lead to lower prices and improved productivity and service levels in 23 countries during 1991-97. They provide a highly nuanced answer. Boylaud and Nicoletti find that both prospective and actual competition bring about lower prices and higher quality telecom services, but privatization itself has little clear effect. On balance, the telecom studies cited above generally indicate that deregulation and liberalization of telecom services are associated with significant growth in teledensity and operating efficiency, and significant improvements in the quality and price of services. The impact of privatization, per se, is somewhat less clear-cut, but most studies agree that the combination of privatization and deregulation/liberalization is associated with significant telecommunications improvements.

4. Description of sample and regulatory environment

This study is based on a sample of 31 telecommunications firms from 25 countries (14 industrialized

and 11 non-industrialized) that are fully or partially privatized via a public share offering between October 1981 and November 1998. Our principal sources of information are prospectuses and annual reports obtained through direct solicitation from the firms being privatized. We supplement this data using information taken from *Privatisation International*, *WorldScope Disclosure*, *Laser Disclosure*, *Moody's International Manual*, *Datastream*, the International Telecommunications Union (ITU), the IMF's *International Financial Statistics*, and the appendix to Megginson and Netter (2001). Details of the share issues (that involve lowering state ownership) made by the sample firms are presented in Table 2.

**** Insert Table 2 about here ****

The telecom offerings detailed in Table 2 reveal several important regularities. First, as described in most other studies examining SIPs, these share offerings tend to be immense. Twenty of these issues raised over \$1 billion and four raised more than \$10 billion, making these the four largest initial public offerings in financial history. All but four of the offerings occurred after September 1990, though the earliest (Cable and Wireless) occurred in October 1981. Most of the issues (19 of the 24 cases where a definitive classification is possible) are pure secondary offerings where the sale proceeds flow directly to the government, rather than to the telecom itself. This is important because it implies that any changes that occur in these firms' performance after divestment must be due to ownership or regulatory effects, rather than to an infusion of new equity capital from the IPO. Finally, the last two columns show that most (23) telecoms were 100% government owned prior to the IPO, and in only three cases (Telecom Argentina, Manitoba Telecom Services and New Zealand Telecom) did the government sell its entire stake at the IPO. The average stake sold is 34.2% of the firm's total equity, or about one-third of the typical government's initial holding.

4.1. *The regulatory environment of privatized telecoms*

As discussed in section 2, the telecommunication industry has witnessed a wave of regulatory changes in the past two decades, and these changes are frequently adopted at the time a nation's telecom is privatized. We describe the regulatory and competitive environment into which our sample firms are privatized in Tables 3 and 4. By necessity, these are highly summarized measures, and we should stress that the real intensity of competition and regulation varies greatly in a cross-country comparison, according to the extent of liberalization and regulatory reform implemented by different countries. Finding quantitative measures for competition and regulation for a cross-section of telecommunication markets is clearly a difficult exercise. As to competition, the telecommunication industry delivers services, such as domestic and international long distance telephony, mobile telephony, but also data transmission and Internet access. Long distance telephony has been largely liberalized, so that entry conditions in these segments have been substantially relaxed, especially in OECD economies (see Boylaud and Nicoletti 2000). However, information about how potential competition translates into new entry in these markets is very hard to obtain.

The development of wireless telephony in the last decade has been particularly dramatic, both in terms of innovation and marketing of new products and services and due to the emergence of new operators. These new entrants have challenged horizontally integrated incumbents everywhere, but their impact has been greatest in advanced economies. The proxy we use in section 6 for product market competition in the 25 national markets involved is the *number of licensed operators in the mobile (analogue and digital) telephony market*. We are particularly interested in measuring the competitive pressure faced by the privatized companies, so we refer only to operators not owned by the incumbents. Obviously, this measure is far from perfect, as it does not capture the intensity of competition in other segments of the industry. However, as Wallsten (2000a) notes, mobile operators offer benchmark comparisons, and represent a potential threat to incumbents. The variable COMP is drawn from the information provided in Table 3, presenting the timing of entry of new operators not owned by the incumbents in the mobile (analogue and digital) telephony markets of our sample countries. An operator is considered an entrant starting from the date when a competitor is issued a license to manage a portion of spectrum, and COMP is simply given by the sum of these operators over time. Clearly, privatizing governments are effective in promoting competition, at least in some form, as all 25 countries see new competitors enter the mobile telephony market around the time of telecom divestment.

****** Insert Table 3 about here ******

Finding objective measures for regulation is also a difficult task. Several aspects of the operation of fixed telephony services are regulated, including condition of entry in the market, interconnection, safety standards, and prices to final consumers. Furthermore, regulation is enforced by different institutions: independent agencies, agencies controlled by ministries, or by the ministries themselves.⁴ Independent agencies--institutions engaged in arm-length relationships with the government and endowed with executive powers of setting tariffs, and enforcing entry--are a crucial ingredient of reform and liberalization. They are established to enforce rules transparently, and to foster a government's commitment credibility. To track the main regulatory changes that occur in the national telecommunication markets in the relevant periods, we construct three measures, presented in Table 4. AGENCY is a dummy 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. TPA is a dummy variable taking the value one starting from the date when third party access and interconnection rules are imposed by law on the owner of the fixed network. PRICE is a dummy variable taking the value one starting from the date when price regulation (RPI-X, or rate of return regulation) on services to final users is established by law. With the exception of Japan, every

⁴ The material in this section is drawn primarily from ITU publications, which classify independent agencies, and describe the main legal forms of regulation. These data are supplemented by Lewington, et al. (1997) and by materials provided directly by national regulatory institutions. In addition to the material presented here, we have constructed several other appendices detailing the regulatory and competitive environments of our sample telecoms.

country adopted at least one of the three main forms of regulation around the date of their telecom's privatization, and five countries adopted all three forms.

**** Insert Table 4 about here ****

5. Testing for performance changes using pre- versus post-privatization univariate analyses

In our univariate tests of performance changes, we use the same matched pairs (pre vs post-privatization) methodology used by Megginson, Nash and Van Randenborgh (1994), Boubakri and Cosset (1998), and D'Souza and Megginson (1999), hereafter MNR, BC, and DM, respectively. Empirical proxies for each variable and each company are computed for a period of up to seven years encompassing three years before through three years after privatization—or as long after divestment as possible. Thus we develop a performance "time-line" that reflects operating results, from the last three years of public ownership through the first years as a privatized entity. The mean and median of each variable for each firm over the pre- and post-privatization windows (pre-privatization: years -3 to -1 and post-privatization: years +1 to +3) is then calculated. For all firms, the year of privatization (year 0) includes both the public and private ownership phases of the enterprise. Year 0 is therefore excluded from the calculations, though the variable values for year 0 are frequently used to normalize other annual realizations (year-0 value = 1.00).

Having computed pre- and post-privatization means and medians, we use the Wilcoxon signed-rank test to check for significant changes in each of the variables. This procedure tests whether the mean difference in variable values between the pre and post-privatization samples is zero. We then draw conclusions based on the standardized test statistic Z , which for samples of at least ten follows approximately a standard normal distribution. In addition to the Wilcoxon test, a proportion test is also used to determine whether the proportion (p) of firms experiencing changes in a given direction is greater than would be expected by chance (typically testing whether $p = 0.5$). Panel data estimation techniques are later employed to account for both regulatory and ownership effects on firm performance.

We divide our univariate test results into three sections: those examining (1) profitability, output, and efficiency changes, (2) employment changes, and (3) changes in capital investment spending and financing after privatization. These results, plus a description of the empirical proxies used, are detailed in Table 5. In the sections below, we first state for each variable the predicted effect of privatization, and then present and interpret the empirical findings.

**** Insert Table 5 about here ****

5.1. Profitability, output, and efficiency

One particular concern that governments of all political stripes share is the burden that loss-making

These appendices are available upon request.

state owned enterprises (SOEs) place on public budgets, particularly in developing countries. As mentioned by Kikeri, Nellis and Shirley (1992), SOE losses as a percentage of gross domestic product (GDP) reached 9 percent in Argentina and Poland in 1989. Further, LaPorta and López-de-Silanes (1999) report that Mexican SOEs were receiving subsidies equal to 12.7 percent of GDP prior to the launching of that country's privatization program in 1988. Through the 1980s about half of Tanzania's 350 SOEs persistently ran losses that had to be covered from public funds and the annual outflow from the Ghanaian government to fourteen core SOEs averaged 2 percent of GDP between 1985 and 1989. Finally, about 30 percent of Chinese SOEs were suffering losses in 1991. These losses have important consequences. Mexico's minister of finance has noted that a fraction of the \$10 billion in losses incurred by the state-owned steel complex would have been enough to bring potable water, sewerage, hospitals, and educational facilities to an entire region of the country.

MNR, BC and DM all show that profitability, output and sales efficiency increase after privatization, while Dewenter and Malatesta (2000) show that return on sales increases. Based on these results, we predict that profitability, output and efficiency will also increase after privatization for our sample of privatized telecoms.

5.1.1. Profitability

We measure profitability using four ratios: operating income to sales (OISALES), return on sales (ROS), return on assets (ROA) and return on equity (ROE). The results in Table 5 show that return on sales and operating income to sales increases significantly, according to the proportion tests, while return on assets and return on equity change insignificantly according to both tests. Although the change in ROE is insignificant, the mean levels of OISALES and ROS do increase significantly, at the 1% level, and the increase in the mean level of ROA is significant at the 10% level. Over two-thirds of all firms experience increases in OISALES (74.1%), ROS (70.4%) and ROA (66.7%), and these values are significant at the 1, 5 and 10% levels, respectively. Though 59.3% of firms increase ROE, this is not significant.

To determine the reasons for the rise in operating profit margin and return on sales after privatization, we analyze three cost ratios: cost of goods sold to sales (CGS), interest expense to operating income (INTOI) and interest expense to total debt (INTTD). The Wilcoxon test statistics show that the mean levels of both CGS and INTTD change insignificantly, though a significant (10% level) 68.0% of firms see the cost of goods sold fall after privatization. On the other hand, INTOI declines significantly and dramatically. The mean (median) level of interest expense relative to operating income falls by 22.7 (26.6) percentage points, from 45.8% (47.6%) before privatization to 23.1% (20.9%) afterwards, and fully 79.2% of all firms experience declines in INTOI. The Wilcoxon and proportion test statistics for these declines are both significant at the one percent level. Taken together, these results suggest that both sales and cost of goods sold increase after privatization, but CGS increases much less rapidly, causing operating profit margins (OISALES) to increase significantly.

Furthermore, net profit margins (ROS) increase significantly due to a decline in the relative burden of interest payments. We examine the separate regulatory influences on profitability changes after privatization in section 6.

5.1.2. *Output*

We use real sales (in local currency) and number of access line in service (physical units) as proxies for privatization-related output changes. Although MNR, BC and DM all show that the monetary value of sales increases significantly after privatization, we also directly examine changes in the quantity of output after privatization. Each year's observation is normalized by dividing its value by real sales in year zero to yield a ratio less than, greater than or equal to year 0 sales levels. We test for changes in real sales by computing the average inflation-adjusted sales level for the period -3 to -1 (the pre-privatization period) and comparing it to the three-year average level for the post-privatization period, years +1 to +3. A similar procedure is used to examine changes in the number of access lines. Both the Wilcoxon and proportion tests show that real sales and the number of access lines in service increase significantly, at the one percent level, after privatization. Normalized real sales (NRSALES) rises from an average (median) 80 % (67 %) of the year 0 value during the -3 to -1 year pre-privatization period to 172 % (155 %) of year 0 output in the post-privatization period. The normalized average (median) number of access lines in service, NLINES, increases from an average (median) 90 % (91 %) of the year 0 value during the -3 to -1 year pre-privatization period to 111% (105%) of year 0 in the post-privatization period. The price regulation data presented in Table 4, coupled with unreported information we have collected, suggest that regulatory bodies restrict post-privatization price increases for the telecom services of almost all the companies in our sample. Our results thus suggest that the economically and statistically significant increases in real sales we document are mainly due to increases in quantity rather than in price.

5.1.3. *Efficiency*

We test for changes in efficiency by analyzing two ratios: (i) normalized real sales per employee (NRSPE) and (ii) normalized average number of access lines in service per employee (NAVLINEMP). As with output, MNR, BC and DM all show that the monetary value of real sales per employee increases significantly after privatization, but this is the first study to examine if (physical) quantity of output per employee changes significantly after privatization. The Wilcoxon and proportion tests both find significant increases (at the one percent level) in real sales per employee (in terms of value and physical units). The real sales per employee increases from an average (median) 73% (68%) of the year 0 value during the -3 to -1 year pre-privatization period to 168% (149%) of year 0 output in the post-privatization period. The normalized average number of access lines in service per employee increases from 91% (88%) of year 0 levels before privatization to 108% (108%) of year 0 values afterwards. To determine the reason for the increase in productivity, we test if

normalized real average salary per employee (NRSPE) increases dramatically and significantly after privatization. Amongst other things, higher salary could mean higher employee motivation, hence higher output. The Wilcoxon and proportion test statistics both show that the real average salary per employee increases significantly at the one percent level.

5.2. *Employment*

In general, governments expect large declines in employment levels following privatization, but the results in MNR and BC document significant employment increases. On the other hand, DM and most other researchers find that employment typically declines after privatization, often dramatically. Layoffs certainly do not necessarily accompany privatization, particularly in a potentially high-growth industry like telecoms, but if a SOE is obviously over-staffed privatization will not preclude the necessity of cutting employment. If staffing levels must be cut, there are two schools of thought regarding which party (government or buyer) should be responsible. The first, early school of thought holds that where large-scale labor shedding is required, it is best handled by the state (Nellis and Kikeri (1989)). Private investors may demand protection and subsidies in exchange for taking on excess labor, reducing the efficiency gains from privatization. Further, because of the sensitivities in shedding employees, large-scale layoffs are best handled by the state prior to sale. This strategy may be particularly applicable to large and visible firms such as telecoms. Therefore, according to this school of thought, any change in employment should occur prior to, rather than after privatization.

According to the second school of thought (Kikeri, Nellis and Shirley (1992)), the decision to retain or dismiss labor should be left to the new private investors. They, presumably, will be in a better position to judge what kinds of skills the firm needs, and they have the incentive to minimize severance costs. The empirical evidence in López-de-Silanes (1997) strongly supports this view, which implies that employment should fall after privatization, rather than before. Some governments have sold large firms with their labor forces intact, in the interest of speed. This strategy has sometimes worked well, particularly in high-growth industries that are able to absorb the existing excess labor. Given that the sample of firms we are using is from the large, visible, high growth telecommunications industry, which may be in a position to absorb the excess labor, we therefore predict no significant changes in employment after privatization.

We measure employment changes using two variables. The first, the absolute change in the number of employees (EMPL), is the same used in previous studies. The second variable, NEMPL, is the normalized level of employees, where year 0's level is defined as 1.0. The mean decline in the number of employees is a marginally (10% level) significant 3,661 workers after divestment, from 67,090 to 63,429 workers. Even though 61 percent of the telecoms show declining employment levels after privatization, this fraction is not significant according to the binomial test. The normalized employment measures all show insignificant

declines. In other words, employment tends to decline after privatization, but only modestly.

5.3. *Financial and capital spending variables*

5.3.1. *Capital expenditures*

We compute three ratios to determine changes in capital investment spending after privatization. These are: (i) normalized real capital expenditures (NRCE), (ii) capital expenditures to sales (CAPXSAL), and (iii) capital spending to total assets (CAPXASST). MNR and BC document significant increases in capital investment spending using most or all of the ratios they test, while DM find that the absolute level of investment spending increases—but capital expenditures as a fraction of sales does not, since sales increase even more rapidly than capital expenditures. Galal, Jones, Tandon and Vogelsang (1992) also show that capital investment increases significantly after privatization for the three firms from the telecommunication industry they analyze. Given these findings, and that our sample of firms is from the rapidly growing and capital intensive telecommunication industry, we predict that capital investment should increase after privatization. Not only is the technology in this industry changing very rapidly, but many countries were moving from mechanical switches to digital switches during the study period. Both factors suggest the need for large-scale investment, which the government cannot provide. In fact, this is one of the principal reasons why governments privatize telecommunications firms in the first place.

Our Wilcoxon and proportion tests both show that normalized real capital expenditures increase significantly (at the one percent level) and dramatically. The Wilcoxon and the proportion test statistics are significant at the one percent level. Normalized real capital expenditure goes from an average (median) 98% (77%) of the year 0 value during the -3 to -1 year pre-privatization period to a remarkable 223% (177%) of year 0 output in the post-privatization period. The changes in CAPXSAL are modest and insignificant, but the ratio of capital spending to total assets *declines* significantly. Most dramatically, the median level of capital expenditures declines insignificantly from 15.2% of assets before privatization to 13.1% afterwards, and 65.4% of all firms experience declines in CAPXASST—which is significant at the 10% level. The declines in CAPXSAL are of similar magnitude, but are less statistically significant. The reason for this relative decline in capital spending is that sales, assets and capital expenditures all increase after privatization, but investment increases less rapidly than do assets.

5.3.2. *Leverage*

SOEs, particularly in developing countries, are typically encumbered by large debts, causing many to have negative net worth. Private buyers often make it clear that they do not want to take on these debts, even when the sale price is discounted by the amount of the debt. They seek an immediate positive cash flow to reduce their risk and help finance new investment. Debt write-downs are thus not uncommon practices for divesting governments the world over. The governments of Argentina and Venezuela assumed debts of \$930 million and \$471 million respectively, prior to sale of their telephone companies. In Ghana, the government

assumed \$6.3 million in debts and unpaid taxes before divestiture. Finally, the German government assumed, in November 1991, 70 percent of the debts of the approximately 4,500 companies sold in the former German Democratic Republic.⁵

MNR, BC, and DM all show that leverage decreases significantly after privatization, a result that is partly due to debt write-downs and partly due to infusions of equity capital into those firms executing primary offerings, but mostly a result of higher (retained) profitability. Given this literature, we predict that leverage--measured as total debt to total assets (TDTA) and long-term debt to total assets (LTDA)--will decrease after privatization, and the results partially support this prediction. We find the average (median) level of total debt declines from 34.3% (29.8%) of total assets prior to divestiture to 24.5% (27.7%) percent afterwards, and that 66.7% of all firms experience declines in TDTA. The Wilcoxon test for this decline is significant at the one percent level, while the proportion test is significant at the 10% level. As in the earlier studies, this decline in leverage seems to be related to higher rates of retained profitability, cash infusions in the small number of primary offerings, and perhaps some debt forgiveness--though we find no specific examples of forgiveness occurring in our sample of telecoms. On the other hand, there is no significant change in long-term debt to total assets. Finally, to test for liquidity changes we measure the current ratio, current assets divided by current liabilities (CURRENT), before and after privatization. No significant changes are observed.

5.3.3. *Financing*

Our univariate analyses show that output and capital expenditure increase significantly, which begs the question: How does the privatized firm finance this growth in capital expenditure? Do they continue financing through their operating activities, do they finance asset growth by selling investments (i.e., subsidiaries or equity stakes in unrelated firms), or do they finance growth externally--by selling debt and/or equity? We examine the mix of internal versus external financing sources using three variables: cash flow from operations divided by total assets (CFTASS), cash flow from operations divided by total sources of funding (CFSOURCS), and funds from financing divided by total sources of funding (FINSOURC). Rather surprisingly, we find no significant change in any of these three measures after divestment, according to either the Wilcoxon or the proportion tests. It seems that privatized telecoms do not materially change the way they finance their operations after divestment, even though the scale of the firm's revenues, assets and investments

⁵ Highly leveraged telecom sales can also be risky for the selling government, if they are extending credit to the buyers of a strategic stake. In Chile, for example, the failure of privatized firms between 1974 and 1984 was partly due to the large debts owed to the government. The initial terms were attractive. Buyers were to pay 10 to 20% down, with one year's grace period. After that, however, they faced a short (five to seven years) repayment period at a real interest rate of 8 to 12%. The firms had a very thin equity cushion when recession hit in the early 1980s. Seven of every ten privatized Chilean companies went into bankruptcy and reverted back to state hands when their controlling banks were nationalized (Yotopoulos (1989)).

increases dramatically. These firms rely primarily on internally generated funds for expansion both before and after privatization, and the constancy of financing patterns in the two periods may suggest that the increased profitability induced by privatization in part *allows* the firm to grow faster after divestment than it did under state ownership.⁶

Taken together, the univariate results presented in this section strongly support the proposition that telecom performance improves significantly after they are fully or partially privatized. However, we also know that significant regulatory changes occur simultaneously with privatization, and simple univariate pre- versus post-divestment comparisons will not be capable of disentangling ownership and regulatory influences on telecom performance. To attempt this, we now turn to panel data estimation techniques.

6. Panel data estimations

The principal aim of our panel data analysis is to test how changes in the ownership structure and in the domestic competitive and regulatory environment affect the financial and operating performance of privatized companies over time. To do this, we reuse many of the same variables constructed earlier for the univariate analyses, but we must also develop additional variables to measure ownership and regulation. State ownership is simply measured by the size of *government's residual stake* after divestment, which we label STAKE. We obtain the initial post-privatization stake from company prospectuses (as in table 1), and then update it when seasoned offers or issues of new capital take place later in the post-privatization period. To test the effects of cross listing of privatized stock, we also construct two indicators. The dummy US takes the value one starting from the year when the company shares are listed on the New York Stock Exchange, NASDAQ, or Portal (the upstairs market for securities issued under Rule 144a). The dummy UK takes the value one starting from the year when the company shares were listed on the London Stock Exchange. Apart from these ownership measures, we employ the competition and regulatory dummy variables discussed in section 4: COMP for the presence of competition in the mobile telephone market, TPA for third party access regulation, and AGENCY for the creation of an independent regulatory agency. We also include other balance sheet variables to control for company specific effects, as well as a trend variable counting the years from the first

⁶ Though overall financing patterns do not change, secondary sources indicate that telecoms dramatically increase their use of at least one form of debt financing during the 1990s. The Loanware database, produced by CapitalDATA Ltd, details the total number and value of syndicated loans raised by non-U.S. telecom companies over the January 1980 to April 2000 period. This compilation indicates that syndicated loans to international telecoms surged throughout this period, rising from an average of fewer than 25 per year during the 1980s to over 100 per year during the late-1990s. The value raised also increased dramatically, rising from less than \$2 billion per year during the 1980s to over \$30 billion during the late-1990s, and an extraordinary \$119 billion in 1999.

privatization reported in the *Privatization International* dataset (British Petroleum, in 1977), which allows us to also proxy for technological progress. We test for the separate effects of privatization using a dummy taking the value one from the privatization year onward (POSTPRIV).

6.1. Methodology

Panel data estimation is certainly the most suitable method of capturing the variation over time of our performance indicators, since it is able to control for individual, firm-specific heterogeneity, as well as for temporal changes in the firms' operating environment. The general model we refer to can be written as follows:

$$y_{it} = \alpha + x_{it} \beta + v_i + \varepsilon_{it} \quad (1)$$

where v_i is the unobservable cross-sectional unit specific residual that accounts for individual effects not included in the regression and ε_{it} is the usual error term.

As is customary in panel data analysis (see Baltagi (1995)), we estimate both a fixed effect and a random effect model. The fixed effect specification assumes that company-specific effects are fixed parameters to be estimated, whereas the random effect model assumes that companies constitute a random sample. The fixed-effect estimator (also known as the within estimator) is obtained by estimating the following equation by ordinary least squares:

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i) \beta + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (2)$$

The assumptions of such a model are that the error terms, ε_{it} , are uncorrelated with the independent variables and that the v_i are fixed. The fixed effect model entails a large loss of degrees of freedom, which could be reduced if the v_i were assumed to be random variables. The random effects models assumes that $v_i \sim IID(0, \sigma_v^2)$ and $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$, v_i to be independent from the ε_{it} , and the independent variables X_{it} to be uncorrelated both to the v_i and the ε_{it} for all i and t .

Formally, the random-effect model has the form:

$$(y_{it} - \theta \bar{y}_i) = (1 - \theta) \alpha + (x_{it} - \theta \bar{x}_i) \beta + [(1 - \theta) v_i + (\varepsilon_{it} - \theta \bar{\varepsilon}_i)] \quad (3)$$

where θ is a function of σ_v^2 and σ_ε^2 . Thus the random-effect estimator is a weighted average of the within and the between estimators. The between estimator is the estimator used to estimate β coefficients in a regression

where both the dependent and the independent variables are the mean of the corresponding variable for each particular unit, and it usually provides more efficient estimates.⁷

Our strategy is to test first whether individual effects exist and, if so, to identify which is the best model to estimate them. We use the Breusch-Pagan test to identify the existence of individual effects. If we reject the null hypothesis of homogeneous effects across units and over time, then a model capturing individual heterogeneity is more appropriate. We can allow for specific effects by using either the fixed or the random effects model. The Hausman test measures whether the random effects are correlated with the explanatory variables, which in turn implies that coefficients estimated by the fixed-effect estimator and those estimated by the random effect estimator do not statistically differ.

In the following sections, we test for privatization-related changes in profitability, output, efficiency, employment, investment and leverage. Since we do not document significant changes in financing patterns, we will not re-examine these variables in the panel data estimations. In all of these separate tests, we estimate four different regressions. First, we perform both fixed effect and random effect estimations using only the post-privatization dummy variable (POSTPRIV), a constant term, and the measure real GDP per capita (GDP), which we use to control for differences in the overall productivity levels of different countries. We then perform fixed and random effect estimations with the full complement of ownership, regulatory and cross listing variables. We allow the Hausman test to inform us regarding which model to stress; if the Hausman test is significant we focus on the fixed effect model, whereas we stress the random effect model if the Hausman test is insignificant.

6.2. Panel data results

6.2.1. Profitability

We measure profitability using three of the ratios employed in the univariate analyses: operating income to sales (OISALES), return on sales (ROS) and return on assets (ROA). The results for OISALES are presented in Table 6, while the results for ROS and ROA are presented in Table 7. All three sets of estimations confirm the results of our previous empirical analyses; privatization is associated with enhanced profitability. The coefficient on the dummy for the post privatization period (POSTPRIV) is always positive and almost always highly significant for all three measures. The same results emerge both in the fixed and random effect models. According to the insignificant value of the Hausman test, the latter model appears particularly suitable for estimating OISALES and ROS, while the fixed effect model is more appropriate for ROA, since the Hausman test is significant there.

⁷ The between estimator is obtained by estimating by OLS the following model: $\bar{y}_i = \alpha + \bar{x}_i\beta + v_i + \bar{\varepsilon}_i$ where $\bar{y}_i = \sum_t y_{it} / T_i$, $\bar{x}_i = \sum_t x_{it} / T_i$ and $\bar{\varepsilon}_i = \sum_t \varepsilon_{it} / T_i$.

****** Insert Tables 6 and 7 about here ******

Apart from the mere fact of privatization itself, several other factors significantly influence post-divestment profitability. In particular, competition, price regulation, cost reductions, and the cross-listing of stock warrant attention. Competition significantly reduces operating income relative to sales and return on sales. Therefore a substantial fraction of profitability gained in the post privatization period is due to the limited competition operators face on the product markets. Indeed, national operators – especially in less developed economies - were often granted exclusivity period to foster profitability and attract investors. The interpretation of the significantly *positive* coefficient on the PRICE variable in the ROS estimation is not straightforward, since subjecting a telecom to price regulation should curb profit margins on sales. However, one should consider that the impossibility of raising prices may have spurred restructuring so that higher profit margins are due to costs reductions. Indeed, the negative coefficients on INTTD and CGS document that increased profitability is at least partly due to reductions in interest payments and in cost of goods sold, just as the univariate tests indicated.

A US listing is significantly positively associated with increased OISALES and ROA. Without richer data, we cannot examine whether the significant US dummy variable is cause or effect—does listing in the U.S. yield superior monitoring and thus higher profits, or do more profitable telecoms choose to list on U.S. exchanges? It is also unclear why listing on the London Stock Exchange should be associated with *reduced* profitability, though that is what the significant negative coefficient on UK in the ROA estimation indicates is the case. Finally, the negative coefficient on TIME suggests that the overall profitability of the telecom industry is declining slightly (though significantly) every year, probably due to the industry’s increasing competitiveness.

6.2.2. *Output*

We use the normalized value of inflation-adjusted sales (NRSALES), in constant US\$, as the proxy for output. The estimation results are presented in Table 8. Since the Hausman test is insignificant, we focus on the random effect model. As was true for the univariate tests, the significantly positive coefficient on our POSTPRIV dummy indicates that real sales increase significantly after privatization. The only other significant variable is AGENCY. The positive coefficient on this variable indicates that setting up an independent regulatory agency causes privatized telecoms to increase their output. The most logical explanation for this finding is that such an agency discourages the privatized telecom from acting like a price-discriminating monopolist. The agency could accomplish this deterrence either through direct regulation or by posing a credible threat to curb the incumbent’s power if the incumbent restricts output in order to push up prices.

****** Insert Table 8 about here ******

6.2.3. *Efficiency*

We employ normalized real sales per employee (NRSPE), in thousands of real US dollars, to test for changes in efficiency after privatization, and we again control for differing levels of economic development using GDP per capita. The results of these estimations are presented in Table 9. Since the Hausman test is significant, we focus on the two fixed effect regressions. Although the POSTPRIV dummy is highly significant in the “short” regression--which includes only this dummy, the GDP control variable and the constant—it is insignificant in the full model that also includes the ownership, regulatory and cross listing variables. In this model, the variables GDP, RASE, AVLINEMP and TIME are all significantly positively related to NRSPE, while the coefficient on COMP is negative and significant. Rather than privatization itself, three factors appear to be positively related to efficiency: higher levels of national development, higher salaries, and higher labor productivity. The positive coefficient on GDP indicates that output per worker increases more after privatization for telecom employees in economically advanced countries than it does for telecom workers in less developed nations. Given the likely productivity-enhancing effect of incorporating new technology, it stands to reason that workers in richer countries will be able to employ this new technology more rapidly and effectively than will their counterparts in poorer countries.

Real average salary per employee (RASE) and average lines per employees (AVLINEMP) are both significant at the one percent level in the fixed effect model. Higher salary seems to induce higher employee motivation, hence higher labor productivity (above that of the nation’s other workers), which in turn is reflected in sales. The AVLINEMP result is harder to interpret, though the most logical explanation is that this variable is capturing another effect of technological sophistication. This is because it implies that worker output increases more for telecom employees who are already relatively productive (in terms of lines per employee) before privatization than it does for workers in the less capital intensive telecom firms characteristic of poorer countries. The significantly positive coefficient on TIME also supports a technological explanation for post-divestment productivity increases, since it indicates an ongoing, secular rise in real output per worker. Finally, the significant negative coefficient on COMP indicates that competition actually reduces the productivity of the incumbent telecom’s workforce. A partial explanation for this result—that competition also lowers an incumbent’s capital spending--is provided by the capital investment estimations, which are presented in section 6.2.5 below.

****** Insert Table 9 about here ******

6.2.4. *Employment*

Our panel data estimations of privatization-related employment changes, measured by normalized number of employees (NEMPL), are presented in Table 10. We focus on the random effect model since the Hausman test is insignificant. We do not observe any systematic change in employment associated with the

post-privatization period. The relevant variables are not the mere fact of having the company privatized, but the *extent* of privatization and the competitive and regulatory environment that emerges after divestment. Quite surprisingly, the variable measuring the government residual stake (STAKE) is *negatively* and significantly related to employment levels. However, the economic significance of this result is debatable, since an additional percentage point of retained government ownership is associated with only 0.1 percent lower employment. In any case, this inverse relationship between employment and STAKE can be interpreted using the logic of Biais and Perotti (2000). A “committed” (to privatization and economic reform) government willing to retain a large fraction of ownership might also be willing to engage in restructuring and labor shedding around the time of privatization, possibly to make the company more attractive to investors. Alternatively, higher government ownership might proxy for a less entrepreneurial post-privatization company, and the lower employment may thus simply be a result of an inert management failing to grasp employment-generating business expansion opportunities that companies with more private ownership would grasp. Without additional data, we cannot distinguish between these two possible explanations.

****** Insert Table 10 about here ******

Increased competitive pressure on the product market – proxied by the number of operators in the nation’s mobile telephony market (COMP) – is strongly and significantly associated with lower employment levels. On average, the emergence of competition is associated with a 4.4 percentage point reduction in employment after privatization. The interpretation of this result is straightforward: managers of privatized companies are forced to cut labor costs and reduce slack to maintain profitability in more competitive environments. Somewhat surprisingly, the significantly positive coefficient on TPA indicates that mandating third party access is associated with significantly higher employment levels after privatization. Finally, it is also quite interesting to note higher employment levels to be associated with a listing in London, which is an empirical result that we leave unexplained.

6.2.5. *Capital expenditures*

We estimate capital investment spending using normalized real capital expenditures (NRCE), in thousands of 1996 US dollars. The panel data estimation results, presented in Table 11, are quite disappointing, since the POSTPPRIV variable is never significant and the two fixed effect models explain an insignificant fraction of the variation in investment spending. However, there is one result that is worth noting. The coefficient on the regulatory indicator TPA is negative and significant at the ten percent level, indicating that regulation may strongly affect the strategic investment decisions of firms. TPA legislation typically forces the incumbent national operators to grant access to the fixed network at regulated interconnection prices to entrants or potential competitors. This element of regulation is strongly pro-competitive, as it gives access to an essential facility. However, regulators should be aware that a more competitive environment may crowd

out investment by the incumbents, as they will have to share some of the benefits from these investments with their competitors. This argument seems supported by our data, as capital spending decreases when TPA legislation is enacted. This result also helps reconcile our earlier finding that competition reduces per worker efficiency. By reducing investment, competition also reduces the amount of new technology added per worker.

**** **Insert Table 11 about here** ****

6.2.6. *Leverage*

Our univariate results show that leverage decreases significantly after privatization, a result that may be partly due to debt write-downs, partly to cash infusions from primary share offerings, and partly due to higher (retained) profitability. The panel data leverage results are presented in Table 12 and, since the Hausman test is insignificant, we focus on the random effect models. We predict that leverage -- measured as total debt to total assets (TDTA) -- will decrease after privatization, but our results offer only limited support for this hypothesis. The coefficient of the post-privatization dummy is negative, but is only significant in the regression including just the GDP per capita control and the post-privatization dummy variable. However, the coefficient on the government residual stake (STAKE) is positive and statistically significant in the full model, but its economic significance is again marginal. A one percentage point increase in retained government ownership is associated with only a 0.09 percentage point increase in leverage. Regardless of its economic significance, the positive relationship between STAKE and may be either cause or effect. Higher retained stake may cause higher leverage because it restricts the firm's access to equity markets after divestment. On the other hand, higher stakes may signal an implicit promise of financial protection by a divesting government, thus allowing the firm to get by with a higher debt level than would otherwise be feasible. We do not have enough observations to disentangle these two possible effects; instead we can only show that STAKE and TDTA are significantly positively related.

**** **Insert Table 12 about here** ****

Somewhat embarrassingly, we also cannot satisfactorily explain the other significant result: leverage is significantly (at the one percent level) positively related to a stock listing on a UK exchange. A British listing is associated with an 11.1 percentage point increase in TDTA, while a US listing is associated with an insignificantly lower leverage level. We leave to the reader's imagination an explanation of why UK-listed telecoms are more highly leveraged than are otherwise similar firms listed elsewhere.

7. **Summary and conclusions**

This paper examines the financial and operating performance of 31 national telecommunication companies in 25 countries that were fully or partially privatized through public share offering between October 1981 and November 1998. Using conventional pre- versus post-privatization comparisons, we find that

profitability, output, operating efficiency and capital investment spending increase significantly after privatization, while employment and leverage decline significantly. However, these univariate comparisons do not account for separate regulatory and ownership effects, and almost all telecoms are subjected to material new regulatory regimes around the time they are privatized. We examine these separate regulatory and ownership effects using both random and fixed-effect panel data estimation techniques for a seven-year period around privatization. We verify that privatization is significantly related to higher profitability, output and efficiency, and with significant declines in leverage. However, we also find numerous separable effects for regulatory, competition, retained government and foreign listing (on U.S. and U.K. exchanges) variables. Competition significantly reduces profitability, employment and, surprisingly, efficiency after privatization 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. Major efficiency gains result from better incentives and productivity, rather than from wholesale firing of employees and profitability increases are caused by significant reductions in costs—rather than price increases. On balance, we conclude that the financial and operating performance of telecommunications companies improves significantly after privatization, but that a significant fraction of the observed improvement results from regulatory changes—alone or in combination with ownership changes—rather than from privatization alone.

Our study represents but a first pass at examining how significant ownership and regulatory changes impact the evolution of one of the key industries of the modern global economy. Much more remains to be done in terms of explaining the technological evolution the telecommunications industry, as in Klepper and Simons (2000). Researchers should also examine more specifically how regulatory changes impact governance structures of privatized telecoms, as Kole and Lehn (1999) do for the U.S. airline industry after its deregulation in 1978. As more data becomes available—and several telecoms are being privatized each year—an in-depth analysis of the determinants of changes in investment spending patterns by privatized should provide valuable insights. Recent studies by Cleary (1999), Minton and Schrand (1999) and Himmelberg, Hubbard and Inessa (2000) offer testable predictions regarding how privatization should impact investment spending. Cleary and Minton and Schrand suggest that if privatization leads to a financially riskier environment and/or higher cash flow volatility for telecoms capital spending should decline. Himmelberg, et al. predict that investment spending should be significantly related to the degree of investor protection offered by a divesting government, as well as to insider ownership in divested telecoms. Perhaps the most exciting research opportunities offered by telecom privatizations, however, involve capital structure changes after divestment, since recent studies offer at least three contrasting predictions. Smith and Watts (1992) predict that the more entrepreneurial

environment offered by privatization should cause divested telcoms to decrease their leverage, while Garvey and Hanka (1999) predict that the removal of the government's implicit protection after divestment should cause leverage to increase. Shyam-Sunder and Myers (1999) predict that the evolution of an individual telecom's debt ratio after privatization should be primarily an artifact of its profitability after divestment and its beginning leverage level. We will continue to collect new data in hopes of contributing to this ongoing research agenda.

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Table 1: Summary of empirical studies and survey articles examining telecom privatizations

This table summarizes the sample selection criteria, methodologies, and empirical findings of recent academic studies examining the privatization of state-owned telecommunications firms. Both empirical studies and survey articles are described.

Study	Sample description, study period, and methodology	Summary of empirical findings and conclusions
Galal, Jones, Tandon, and Vogelsang (1992)	Compare actual post-privatization performance of 12 large firms in Britain, Chile, Malaysia, and Mexico to predicted performance of these firms had they remained SOEs. Three are telcos: British Telecom, Telmex and Chile's CTC.	Document net welfare gains in 11 of the 12 cases which equal, on average, 26% of the firms' pre-divestiture sales. Find no case where workers were made worse off, and 3 where workers were made significantly better off.
Parker (1994)	Performs case study analysis of the effects of the 1984 privatization of British Telecom on the firm's service level, profitability, efficiency, factor productivity and investment spending. Also describes regulatory changes and restructuring of BT coincident with and subsequent to divestment.	Finds significant improvements in BT's performance based on most measures, though expenditures on R&D and investment fell as a share of income. After privatization, prices fell by 11% in real terms while service levels and profitability improved. Employment fell by roughly one-third in ten years.
Tandon (1995)	Examines the welfare effects of privatizing three large Mexican SOEs, including Telmex. Also describes the regulatory changes surrounding Telmex's privatization, the capital investment program that preceded it, and the terms of the sale.	Total factor productivity rose by more than 15% during the three years after privatization and the number of lines in service grew rapidly. Prices rose, but so did service quality. Net benefits hard to assess due to simultaneous regulatory changes and introduction of competition.
Ramamurti (1996)	Surveys studies of 4 telecom, two airline, and one toll-road privatization programs in Latin America during period 1987-1991. Also discusses political economic issues, methods used to overcome bureaucratic, ideological opposition to divestiture.	Concludes privatization very positive for telecoms, partly due to scope for technology, capital investment, and attractiveness of offer terms. Much less scope for productivity improvements for airlines and roads, and little improvement observed.
Boles de Boer and Evans (1996)	Estimates the impact of the 1987 deregulation, and 1990 privatization, of Telecom New Zealand on the price and quality of telephone services. Also examine whether investors benefited.	Document significant declines in price of phone services, due mostly to productivity growth that cut costs at a 5.6% annual rate, and significant improvement in service levels. Shareholders also benefited significantly.
Petrazzini and Clark (1996)	Using International Telecommunications Union (ITU) data through 1994, test whether deregulation and privatization impact the level and growth in teledensity (main lines per 100 people), prices, service quality, and employment by telecoms in 26 developing countries.	Deregulation and privatization both are associated with significant improvements in level and growth in teledensity, but have no consistent impact on service quality. Deregulation associated with lower prices and increases employment; privatization has the opposite effect.
Rogozinski (1997) [in Sheshinski & Lopez-Calva (99)]	Examine how 1990 privatization of Telmex impacted firm's service levels, investment, teledensity, and investment spending over the following four years.	Document massive increases in number of lines in service, number of towns with telephone access, teledensity, capital spending and use of fiber optic technology.
Ros (1999)	Uses ITU data and panel data regression methodology to examine the effects of privatization and competition on network expansion and efficiency in 110 countries over the period 1986-1995.	Finds that countries with at least 50% private ownership of main telecom firm have significantly higher teledensity levels and growth rates. Both privatization and competition increase efficiency, but only privatization is positively associated with network expansion.

Noll (2000)	Analyzes the political and economic factors underlying the growth in state ownership of telecom firms during the postwar era and the subsequent reform programs that have been launched since 1980.	Concludes that most reform programs pay insufficient attention to constructing adequate regulatory structures and institutions, and place too much emphasis on maximizing sales revenue for the government.
D'Souza and Megginson (2000)	Examine pre- versus post-privatization performance changes for 17 national telecommunications companies privatized through share offerings during 1981-94.	Finds that profitability, output, operating efficiency, capital spending, number of access lines, and average salary per employee all increase significantly after privatization. Leverage declines significantly; employment declines insignificantly.
Wallsten (2000a)	Performs an econometric analysis of the effects of telecommunications reforms in developing countries. Using a panel dataset of 30 African and Latin American countries from 1984 to 1997, explores the effects of privatization, competition and regulation on telecommunications performance.	Competition is significantly associated with increases in per capita access and decreases in cost. Privatization alone is not helpful, unless coupled with effective, independent regulation. Increasing competition the single best reform, competition with privatization is best, but privatizing a monopoly without regulatory reforms should be avoided.
Wallsten (2000b)	Employs a sample of 20 privatizations from 15 developing countries to examine the real effects of granting exclusivity periods to privatized telecom companies.	Exclusivity periods reduce the growth in number of main lines by a highly significant 40% due to reduced investment incentives. However, these agreements also double the sale price of the telecom.
Boylaud and Nicoletti (2000)	Uses factor analysis and a database on market structure and regulation to investigate the effects of liberalization and privatization on productivity, prices and quality of long-distance and cellular telephony services in 23 OECD countries over the 1991-97 period.	Prospective and actual competition both bring about productivity and quality improvements—and lower prices—in telecom services, but no clear effect could be found for privatization.

Table 2: Characteristics of our telecommunications privatization sample

This table provides issue information for our sample of telecommunication firms that were fully or partially privatized via public share offering during the period 1981-1998. All issue dates are for the first public share offering, though many of these companies were also involved in seasoned offerings at a later date.

Number	Country	Company Name	Issue Date mm-yy	Issue Size US\$ million	Fraction Secondary	Government Shareholdings	
						Before Issue	After Issue
1	Argentina	Telecom Argentina Stet France ¹	Mar-92	1,227	100%	30%	0%
2	Argentina	Telefonica De Argentina ¹	Dec-91	849	100	40 ³	10
3	Australia	Telstra	Nov-97	10,018	100	100	66.6
4	Belgium	Belgacom	Dec-94	2,450		100	50.1
5	Canada	Telus	Oct-90	835	100	100	40
6	Canada	Manitoba Telecom Services	Dec-96	910		100	0
7	Czech Republic	SPT Telecom	Jul-95	1,320		100	51
8	Denmark	TeleDanmark	May-94	2,894	0	89.9 ⁴	51
9	Finland	Telecom Finland (Sonera)	Nov-98	1,388	100	100	77.8
10	France	France Telecom	Oct-97	7,892	100	100	75
11	Germany	Deutsche Telekom	Nov-96	12,937	0	100	74
12	Greece	Hellenic Telecommunication (OTE)	Mar-96	464	100	100	94
13	Hungary	Matav	Nov-97	1,013	100	25.5	6.47
14	Indonesia	Indosat ²	Oct-94	1,060	0	100	68
15	Indonesia	PT Telekom	Nov-95	1,680	100	100	80
16	Italy	Stet-Societa Finanziaria Telefonica	Nov-85	103	100	88.53 ⁵	83.8
17	Italy	Telecom Italia	Oct-97	10,697	100	44.7	2.77
18	Japan	Nippon Telegraph And Telephone	Nov-86	18,670	100	100	87.5
19	Korea	Dacom Corporation	May-94	5		--	--
20	Korea	Korea Telecom	Nov-93	100		100	71.2
21	Malaysia	Telekom Malaysia	Oct-90	872	0	100	76.1
22	Mexico	Telefonos de Mexico	May-91	2,170	100	30.6 ⁶	15
23	Netherlands	Koninklijke PTT Nederland N.V.	Jun-94	3,868	100	100	68.75
24	New Zealand	Telecom Corporation Of New Zealand	Jul-91	819	100	100 ⁷	0
25	Poland	Telekomunikacja Polska S.A. (TPSA)	Nov-98	1,020	100%	100%	70%
26	Portugal	Portugal Telecom	Jun-95	984	100	100	72.7
27	Singapore	Singapore Telecommunications Ltd	Oct-93	1,950		100	92.8

Number	Country	Company Name	Issue Date mm-yy	Issue Size US\$ millions	Fraction Secondary	Government Shareholdings	
						Before Issue	After Issue
28	South Africa	Telekom SA	Mar-97	1,261		100	70
29	Switzerland	Swisscom	Oct-98	4,831	100	100	70
30	UK	British Telecom	Nov-84	4,763	100	100	49.8
31	UK	Cable & Wireless ²	Oct-81	466	47.5	100	50

Notes on Table 2

1. Telecom Argentina Stet France and Telefonica de Argentina: Prior to privatization of the two firms, there existed only one telecommunication market. At the time of privatization, the market was divided into two (a) North market (b) South market. Telefonica de Argentina was granted the Southern market and Telecom Argentina Stet France was granted the Northern market.

2. Indosat and Cable & Wireless: Indosat provides only international telecommunication services, and Cable & Wireless provides telecommunication services overseas on a franchise basis. All other firms have domestic and international telecommunication service as their primary business.

3. Telefonica de Argentina: Prior to offering, on October 1, 1990, the government sold 60% of its ownership to the consortium named "Cointel." This 60% ownership was held by Citicorp Venture Capital (20% of 60% or 12% of 100% share capital), Telefonica International Holding B.V. (10.13% of 60% or 6% of 100% share capital), Inversora Catalinas S.A. (8.31% of 60% or 5% of 100% share capital), other small investors (61.56% of 60% or 37% of 100% share capital). After the privatization, Telefonica de Argentina's 10% ownership will most likely be transferred, by decree, to certain former employees of ENTel.

4. Tele Danmark: Prior to the offering, unaffiliated third parties owned 10.1% of the share capital.

5. Stet: Prior to the offering, 4.6% of the share capital was owned by different banks and firms and 6.87% was owned by other small investors.

6. Telefonos de Mexico: Prior to offering, in 1953, a group of Mexican investors acquired the company. In 1972, the government acquired 20.4% of the capital stock (51% of the voting rights) and the Mexican investors owned 19.6% of the capital stock (49% of the voting rights). The remaining 60% of the capital stock consists of nonvoting shares, 29.4% of which are held by Mexican investors and 30.6% by the government. On December 20, 1990, the Mexican government sold its 20.4% of the share capital (but 51% of the voting rights) to "Controlling Shareholders." The Controlling Shares were held as follows: (i) 51% of 20.4% (or 10.4% of the 100% share capital) by a group of Mexican investors (ii) 25.3% of 20.4% (or 5.16% of the 100% share capital) is held by Grupo Carso and 2.9% of 20.4% (or 0.59% of the 100% share capital) is held by Seguros de Mexico, both of which are controlled by Mr. Carlos Slim Helo), (ii) 24.5% of 20.4% (or 5% of the 100% share capital) by Southwestern Bell International Holding (iii) 24.5% of 20.4% (or 5% of the 100% share capital) by France Cables, a subsidiary of France Telecom. The 30.6% of the shares that are a part of the current offering are basically the non-voting shares held by the government. After the offering, therefore, 51% of the voting rights (20.4% of capital stock) will be held by the Controlling Shareholders and 49% of the voting rights (19.6% of capital stock) will be held by the Mexican Investors. Furthermore, 45% of the capital stock (no voting rights) will be held by Mexican and foreign investors, and 15% of the capital stock (no voting rights) will be held by the government.

7. Telecom Corporation of New Zealand: Prior to offering, on September 12, 1990, 99% of the company was sold to Ameritech and Bell Atlantic in equal proportions for NZ\$ 4.25 billion (US\$ 2.46 billion). 18% of their share is offered to the public, of which, 5% is allocated to employees, 28% to the New Zealand public and 67% in international offering. After the offering 81% is owned by Ameritech and Bell Atlantic, 0.5% by Carla Group in New Zealand, 1% by employees, 6% by New Zealand public, 11% by foreign investors.

Table 3. Competition in mobile telephony for our sample companies

This table presents the name of the mobile operator owned by the incumbent in the fixed-telephony, if any, the names of the entrants not owned by the incumbent and the timing of entry of new operators not owned by the incumbents in the mobile (analogue and digital) telephony in 25 countries under observation. An operator is considered an entrant starting from the date when a license to manage a portion of spectrum is issued.

Country	Incumbent operator	Entrant	Date license issued	Country	Incumbent Operator	Entrant	Date license issued
Australia	Telstra	Oprus	1997	Indonesia	PT Telkom, Indosat	Omnitel	1994
		Vodafone	1997	Italy	TIM	Wind	30/8/1998
		AAPT	1997			Blu Spa	4/8/1999
		PanAm Sat	1998			2 NCCs	1988
		Hutchinson	1998	Japan	NTT	2 NCCs	1989
		Ozitel	1999				
		Onetel	1999	Korea	SK Telekom	Binariang	3/1993
Argentina	Minifon	CTI	1994	Malaysia	Telekom Malaysia	Time Telekom	6/1994
		Movicom	1989			Celcom	5/1994
Belgium	Belgacom Mobile	Mobistar	27/8/1996			Mutiara	1/1995
		KPN-Orange Belgium	1999			Consortium	1990
Canada		Rogers Cantel	21/3/1991	Mexico	TelCel	Vodafone	1993
		Bell Mobility Cell	29/1/1986	New Zealand	Telecom New Zealand	Polska Telefonía Cyfrowa	1996
Czech Repub.	Eurotel Praha	Radiomobil	1996	Poland	TPSA	Polkmtel	1996
		Cesky Mobil A.S.	1999			Telecel	1991
Denmark	Tele Danmark Mobil	Sonofon	1991	Portugal	TMN	Mainroad	1997
		Mobilix	12/6/1997			Mobile One	1997
		Telia	12/6/1997	Singapore	Singtel Mobile	Starhub	2000
Finland	Sonera	Radiolinja	1990			MTN	1996
		Telia Mobile	1995	South Africa	Telkom SA	DiAx	1998
		Finnish 2G	2000	Switzerland	Swisscom	Orange	1998
France	France Telecom	SFR	21/4/1988			Libertel	1995
		Bouygues Telecom	4/1/1995	The Netherlands	KPN Telecom NV	Dutchtone	1998
		Iridium Italia	10/11/1998			Telfort	1998
Germany	Deutsche Tel MobilNet	E-PLUS Mobilfunk	4/5/1993			BEN	1998
		Mannesmann Mobilfunk	15/2/1990			Orange	4/1994
		Viag Interkom	15/5/1997	UK	BT-Cellnet	One2One	9/1993
Greece	OTE	Panafon	30/9/1992			Vodafone	1/1985
		Telestet	8/1992				
Hungary	Matav	Pannon	4/1994				
		Vodafone	1999				

Table 4. Timing of regulatory reform in the telecommunication industry

This table reports the year when an independent agency – one not under direct control of a ministry and endowed with powers to enforce regulation – is established by law, when third party access and interconnection rules (TPA) are imposed by law on the owner of the fixed network, and when price regulation on services to final users (RPI-X, or rate of return regulation) is established by law. Sources are ITU, and Lewington (1997).

Country	Date of first telecom privatization	Date independent Agency established	Date Third Party Access established	Date Price regulation established
Argentina	1992			1991
Australia	1997	1997	1997	1998
Belgium	1994		1991	1991
Canada	1990	1993	1992	1992
Czech Republic	1995		2000	1997
Denmark	1994		1996	1996
Finland	1998	1988	1996	
France	1997	1997	1996	1996
Germany	1996		1997	1997
Greece	1996			1994
Hungary	1997			1992
Indonesia	1994			1996
Italy	1985	1997	1998	1997
Japan	1986			
Korea	1994			1983
Malaysia	1990		1991	1991
Mexico	1991		1996	1990
Netherlands	1994		1989	1989
New Zealand	1991		1990	1990
Poland	1998			1998
Portugal	1995		1998	
Singapore	1993	1992		1992
South Africa	1997	1997	1996	1996
Switzerland	1998	1997		1992
UK	1981		1984	1984

Table 5. Summary of financial and operating performance changes following privatization of telecommunications firms

This table presents empirical results for our full sample of privatized firms in the telecommunication industry. The table presents, for each empirical proxy the number of useable observations, the mean and median values of the proxy for the three-year periods prior and subsequent to privatization, the mean and median change in the proxy's value after versus before privatization, and a test of significance of the median change. We employ the Wilcoxon signed rank test (with its z-statistic) as our test for significance for the change in mean values. The final two columns detail the percentage of firms whose proxy values change as predicted, as well as a test of significance of this change. Normalized variables are computed by dividing the variable's value in year t by the value for that firm and that variable in year 0 (the year of privatization). ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Variable	Variable Name	No. Obs	Average (median) before	Average (median) after	Average (median) change	z-statistic for difference in means	Fraction of firms that increase after privatization	z-statistic for significance of proportion change
Operating income ÷ sales, %	OISALES	27	22.89 (21.76)	27.41 (25.29)	4.51 (3.54)	2.76***	74.07%	2.85***
Return on sales (net income ÷ sales), %	ROS	27	11.63 (8.96)	15.79 (13.12)	4.16 (4.16)	2.67***	70.37%	2.32**
Return on assets (net income ÷ assets), %	ROA	27	6.31 (4.58)	7.42 (6.30)	1.12 (1.72)	1.66*	66.67%	1.84*
Return on equity (net income ÷ equity), %	ROE	27	13.43 (12.89)	14.92 (14.57)	1.49 (1.68)	0.77	59.26%	0.98
Cost of goods sold ÷ sales, %	CGS	25	50.54 (52.04)	47.62 (48.41)	-2.92 (-3.63)	-1.33	32.00%	-1.93*
Interest expense ÷ operating income, %	INTOI	24	45.81 (47.56)	23.10 (20.92)	-22.71 (-26.64)	-3.14***	20.83%	-3.52***
Interest expense ÷ total debt, %	INTTD	24	10.00 (9.00)	9.39 (9.09)	-0.61 (0.09)	-1.2	45.83%	-0.41
Real sales [normalized]	NRSALES	25	0.80 (0.67)	1.72 (1.55)	0.92 (0.88)	3.27***	92.00%	7.74***
No. of access lines in service [normalized]	NLINES	18	0.90 (0.91)	1.11 (1.05)	0.21 (0.14)	3.46***	94.44%	8.23***
Real sales per employee [normalized]	NRSPE	24	0.73 (0.68)	1.68 (1.49)	0.95 (0.81)	3.86***	95.83%	11.24***
Average no. lines per employee [normalized]	NAVLINEMP	17	0.91 (0.88)	1.08 (1.08)	0.16 (0.20)	2.15**	88.23%	4.89***
Real avg salary per employee [normalized]	NRASE	15	0.83 (0.62)	1.75 (1.36)	0.93 (0.74)	2.67***	93.33%	6.73***
Total number of employees	EMPL	28	67090 (25619)	63429 (25905)	-3661 (285.67)	-1.72*	39.28%	-1.16

Normalized Employment	NEMPL	24	1.01 (1.02)	1.04 (0.98)	0.03 (-0.04)	-1.09	41.67%	-0.83
Real capital expenditure [normalized]	NRCE	22	0.98 (0.77)	2.23 (1.77)	1.25 (1.00)	3.10***	90.90%	6.67***
Capital expenditures ÷ sales, %	CAPXSAL	26	30.01 (28.72)	30.75 (26.46)	0.73 (-2.26)	-0.39	38.46%	-1.21
Capital expenditures ÷ total assets, %	CAPXASST	26	14.67 (15.21)	14.06 (13.11)	-0.61 (-2.10)	-0.83	34.62%	-1.65*
Long-term debt ÷ total assets, %	LTD	26	79.56 (84.53)	75.01 (81.31)	-4.55 (-3.23)	-1.28	38.46%	-1.21
Total debt ÷ total assets, %	TDTA	27	34.28 (29.75)	24.47 (27.66)	-9.81 (-2.09)	-2.81***	33.33%	-1.84*
Current asset ÷ current liabilities, %	CURRENT	27	1.12 (0.95)	1.30 (0.96)	0.18 (0.01)	1.37	55.55%	0.58
Cash flow from operations ÷ total assets, %	CFTASS	25	16.91 (16.64)	16.88 (17.16)	-0.03 (0.51)	0.42	60.00%	1.02
Cash flow from operations ÷ total sources %	CFSOURCS	23	62.91 (66.23)	58.87 (62.24)	-4.04 (-3.99)	-0.64	39.13%	-1.07
Funds from financing ÷ total sources, %	FINSOURC	23	-6.84 (-3.94)	-2.02 (-5.25)	4.82 (-1.32)	0.79	52.17	0.21

Table 6. Results of panel data estimations: Profitability I

This table reports the estimates of panel data estimations for operating income to sales of the 31 privatized TLC operators in the pre and post-privatization period (years -3; years + 3). GDP is gross domestic product per capita in US\$ 1996. POSTPRIV is a dummy taking the value one in the post-privatization period. CGS is cost of goods sold. TIME is the number of years from the first privatization reported in the *Privatisation International* database (BP, 1977). COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. Standard errors are in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Operating income to sales			
	Fixed effects	Random effects	Fixed effects	Random effects
Constant	0.175*** (0.040)	0.235*** (0.022)	0.225 (0.142)	0.234*** (0.060)
GDP	3.76e-06 (2.83e-06)	-8.10e-07 (1.21e-06)	3.56e-06 (3.74e-06)	-1.18e-06 (1.26e-06)
POSTPRIV	0.034*** (0.012)	0.039*** (0.011)	0.030 (0.023)	0.038** (0.018)
CGS			-0.057 (0.091)	-0.066 (0.058)
TIME			-0.002 (0.009)	0.0024 (0.003)
COMP			-0.019 (0.015)	-0.026** (0.012)
STAKE			0.0002 (0.0004)	0.0003 (0.0003)
AGENCY			0.006 (0.029)	0.026 (0.024)
TPA			-0.005 (0.0312)	-0.028 (0.023)
PRICE			0.005 (0.027)	0.0077 (0.021)
US			0.057** (0.022)	0.049** (0.019)
UK			0.001 (0.027)	-0.005 (0.023)
Nobs	164	164	135	135
Tests				
F	7.44***		1.91**	
Wald		12.72***		28.84***
Hausman		8.86**		6.14
Breusch-Pagan		135.96***		31.92***

Table 7. Results of panel data estimations: Profitability II

This table reports the estimates of panel data estimations for return on sales and return on assets of the 31 privatized TLC operators in the pre and post-privatization period (years -3; years + 3). GDP is gross domestic product per capita in US\$ 1996. POSTPRIV is a dummy taking the value one in the post-privatization period. CGS is cost of goods sold. IENP is interest expense to net profit. INTTD is interest expense to total debt. INTOI is interest expense to operating income. TIME is the number of years from the first privatization reported in the *Privatisation International* database (BP, 1977). COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. Standard errors are in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Return on sales				Return on assets			
	Fixed effects	Random effects	Fixed effects	Random effects	Fixed effects	Random effects	Fixed effects	Random effects
Constant	0.158*** (0.034)	0.143*** (0.023)	0.468*** (0.141)	0.271*** (0.081)	0.066*** (0.019)	0.061*** (0.011)	0.249*** (0.078)	0.124*** (0.036)
GDP	-3.05e-06 (2.40e-06)	-2.21e-06* (1.23e-06)	-1.20e-06 (3.40e-06)	-1.53e-06 (1.59e-06)	-6.90e-07 (1.34e-06)	-4.13e-07 (5.94e-07)	1.06e-06 (1.92e-06)	-1.14e-07 (6.71e-07)
POSTPRIV	0.041*** (0.011)	0.039*** (0.010)	0.0533** (0.022)	0.043** (0.018)	0.017*** (0.006)	0.016*** (0.006)	0.026** (0.012)	0.019** (0.009)
IENP			0.061 (0.099)	0.049 (0.091)				
INTTD			-0.230 (0.204)	-0.202 (0.185)			-0.214* (0.108)	-0.125 (0.092)
INTOI							-0.001 (0.013)	-0.012 (0.012)
CGS			-0.212** (0.093)	-0.099 (0.068)			-0.121** (0.052)	-0.053* (0.032)
TIME			-0.011 (0.009)	-0.003 (0.004)			-0.008* (0.005)	-0.003 (0.002)
COMP			-0.023* (0.013)	-0.021* (0.012)			-0.004 (0.007)	-0.004 (0.006)
STAKE			-0.0004 (0.0004)	-0.00005 (0.0003)			-0.00005 (0.0002)	0.0002 (0.0001)
AGENCY			-0.020 (0.027)	-0.013 (0.024)			-0.004 (0.015)	0.007 (0.013)
TPA			0.021 (0.029)	0.005 (0.024)			-0.009 (0.016)	-0.011 (0.012)
PRICE			-0.007 (0.026)	0.0009** (0.022)			0.017 (0.014)	0.019* (0.011)
US			0.032 (0.021)	0.029 (0.019)			0.025** (0.012)	0.017 (0.010)
UK			-0.043 (0.030)	-0.028 (0.026)			-0.028* (0.016)	-0.014 (0.014)
Nobs	167	167	121	121	159	159	121	121
Tests								
F	6.98**		1.57		3.74**		1.74*	
Wald		15.74***		18.57		7.38**		22.67**
Hausman		0.44		11.27		0.62		34.78***
Breusch-Pagan		207.44***		61.17***		133.92***		26.12***

Table 8. Results of panel data estimations: Output

This table reports the estimates of panel data estimations for the output of the 31 privatized TLC operators observed in the pre and post-privatization period (years -3; years + 3). Sales is normalized real sales. GDP is gross domestic product per capita in in US\$ 1996. POSTPRIV is a dummy taking the value one in the post-privatization period. LINES is the normalized number of lines of fixed telephony in operation. TIME is the number of years from the first privatization reported in *the Privatisation International* (BP, 1977). COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. Standard errors in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Normalized sales			
	Fixed effects	Random effects	Fixed Effects	Random effects
Constant	1.570 (3.007)	2.304 (1.507)	-1.960 (2.385)	1.199 (0.975)
GDP	-0.00003 (0.0002)	-0.00007 (0.00008)	0.00009 (0.00006)	1.34e-06 (0.00001)
POSTPRIV	2.018** (0.954)	2.375*** (0.880)	0.470 (0.384)	0.776*** (0.266)
LINES			-0.0162 (1.008)	0.488 (0.747)
TIME			0.065 (0.175)	-0.053 (0.043)
COMP			-0.049 (0.348)	0.079 (0.162)
STAKE			0.002 (0.006)	-0.002 (0.003)
AGENCY			0.361 (0.505)	0.547* (0.289)
TPA			0.836 (0.784)	0.324 (0.289)
PRICE			-0.360 (0.641)	-0.197 (0.295)
US			-0.083 (0.388)	-0.151 (0.303)
UK			0.482 (0.460)	0.359 (0.345)
Nobs	167	167	97	97
Tests				
F	2.50*		2.08**	
Wald		7.65**		31.15***
Hausman		8.42**		6.81
Breusch-Pagan		9.29***		6.21**

Table 9. Results of panel data estimations: Efficiency

This table reports the estimates of panel data estimations for normalized real sales per employee as a measure of efficiency in the 31 privatized TLC operators observed in the pre and post-privatization period (years -3; years + 3). GDP is gross domestic product per capita in US\$ 1996. POSTPRIV is a dummy taking the value one in the post-privatization period. RASE is normalized salary per employee in 1996 US\$. AVLINEMP is the normalized number of lines per employee. TIME is the number of years from the first privatization reported in the *Privatisation International* (BP, 1977). COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. Standard errors in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Normalized real sales per employee			
	Fixed effects	Random effects	Fixed effects	Random effects
Constant	0.351*** (0.115)	0.873*** (0.038)	-0.427** (0.176)	-0.219** (0.096)
GDP	0.00004*** (7.92e-06)	3.46e-06* (1.93e-06)	0.00001* (5.45e-06)	3.00e-06* (1.58e-06)
POSTPRIV	0.184*** (0.036)	0.266*** (0.035)	0.030 (0.027)	0.075*** (0.022)
RASE			0.587*** 0.051	0.575*** (0.039)
AVLINEMP			0.236*** (0.055)	0.284*** (0.049)
TIME			0.030** (0.013)	0.021*** (0.005)
COMP			-0.064** (0.028)	-0.053*** (0.019)
STAKE			-0.0002 (0.0004)	-0.00004 (0.0003)
AGENCY			-0.0004 (0.044)	0.013 (0.033)
TPA			-0.023 (0.057)	-0.035 (0.036)
PRICE			0.037 (0.051)	0.015 (0.035)
US			-0.026 (0.025)	-0.028 (0.025)
UK			-0.032 (0.030)	-0.035 (0.029)
Nobs	150	150	79	79
Tests				
F	38.68***		58.51***	
Wald		58.99***		619.24***
Hausman		89.95***		153.32***
Breusch-Pagan		0.22		0.45

Table 10. Results of panel data estimations: Employment

This table reports the estimates of panel data estimations for the employment measure by the normalized number of employees in the 31 privatized TLC operators observed in the pre and post-privatization period (years -3; years + 3). GDP is gross domestic product per capita in US\$ 1996. TIME is the number of years from the first privatization reported in the *Privatisation International* (BP, 1977). POSTPRIV is a dummy taking the value one in the post-privatization period. COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. Standard errors in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Number of employees			
	Fixed Effects	Random effects	Fixed Effects	Random effects
Constant	1.101*** (0.100)	1.007*** (0.028)	1.058*** (0.358)	1.035*** (0.068)
GDP	-6.55e-06 (6.88e-06)	1.84e-08 (1.42e-06)	-7.66e-06 (8.59e-06)	1.45e-06 (1.54e-06)
POSTPRIV	0.018 (0.032)	0.007 (0.028)	-0.009 (0.057)	-0.008 (0.038)
TIME			0.012 (0.024)	0.004 (0.004)
COMP			-0.017 (0.029)	-0.044** (0.019)
STAKE			-0.001 (0.001)	-0.001* (0.0005)
AGENCY			-0.078 (0.069)	-0.064 (0.046)
TPA			0.015 (0.077)	0.110*** (0.039)
PRICE			-0.020 (0.067)	-0.012 (0.038)
US			-0.069 (0.054)	-0.076* (0.039)
UK			0.009 (0.065)	0.039 (0.049)
Nobs	152	152	141	141
Tests				
F	0.49		0.69	
Wald		0.06		17.69*
Hausman		0.96		5.08
Breusch-Pagan		0.93		0.87

Table 11. Results of panel data estimations: Investment

This table reports the estimates of panel data estimations for investment measured by normalized real capital expenditure by the 31 privatized TLC operators observed in the pre and post-privatization period (years -3; years + 3). GDP is gross domestic product per capita in US\$ 1996. POSTPRIV is a dummy taking the value one in the post-privatization period. TIME is the number of years from the first privatization reported in the *Privatisation International* (BP, 1977). COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. Standard errors in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Normalized real capital expenditure			
	Fixed effects	Random effects	Fixed effects	Random effects
Constant	1.115 (8.459)	5.107 (4.222)	-36.146 (25.874)	-1.444 (11.464)
GDP	0.00007 (0.0006)	-0.0001 (0.0002)	-0.0004 (0.0007)	-0.0003 (0.0003)
POSTPRIV	3.387 (2.287)	4.290* (2.187)	1.859 (4.365)	4.004 (3.522)
TIME			2.446 (1.773)	0.274 (0.749)
COMP			1.714 (2.733)	2.482 (2.383)
STAKE			0.131* (0.073)	0.043 (0.056)
AGENCY			-3.614 (5.019)	-3.562 (4.546)
TPA			-3.809 (5.762)	-7.883* (4.716)
PRICE			-2.258 (5.229)	3.352 (4.429)
US			5.867 (4.207)	5.808 (3.817)
UK			-4.780 (5.171)	-5.745 (4.850)
Nobs	137	137	125	125
Tests				
F	1.26		1.11	
Wald		4.29		11.32
Hausman		19.73***		6.45
Breusch-Pagan				10.52***

Table 12. Results of panel data estimations: Debt

This table reports the estimates of panel data estimations for leverage measured by the ratio of total debt to total assets of the 31 privatized TLC operators observed in the pre and post-privatization period (years -3; years + 3). GDP is gross domestic product per capita in US\$ 1996. POSTPRIV is a dummy taking the value one in the post-privatization period. TIME is the number of years from the first privatization reported in the *Privatisation International* (BP, 1977). COMP is the number of operators not owned by the incumbent in the mobile telephony operating in a given country in each year. STAKE is the residual percentage of capital owned by the State. AGENCY is a dummy taking the value one starting from the year when an independent regulatory agency was established. TPA is a dummy taking the value one starting from the year when third-party access (common carrier) regulation was enacted. PRICE is a dummy taking the value one starting from the year when a regulation of prices to final consumers in fixed telephony was enacted. US is a dummy taking the value one starting from the year when the company was cross-listed on NYSE, NASDAQ, or Portal. UK is a dummy taking the value one starting from the year when the company was cross-listed on LSE. . Standard errors in brackets. ***, **, * denote significance at the 1, 5, or 10 per cent level, respectively.

Independent variables	Total debt to total assets			
	Fixed effects	Random effects	Fixed effects	Random effects
Constant	0.307*** (0.074)	0.259*** (0.043)	0.209 (0.227)	0.227* (0.123)
GDP	1.17e-06 (5.14e-06)	4.47e-06* (2.31e-06)	1.71e-06 (6.20e-06)	3.67e-06 (3.02e-06)
POSTPRIV	-0.091*** (0.021)	-0.095*** (0.019)	-0.037 (0.038)	-0.445 (0.031)
TIME			-0.002 (0.015)	-0.004 (0.008)
COMP			0.009 (0.024)	0.016 (0.021)
STAKE			0.001* (0.0007)	0.0009* (0.0005)
AGENCY			0.075 (0.047)	0.066 (0.043)
TPA			0.041 (0.051)	0.039 (0.043)
PRICE			-0.029 (0.045)	-0.033 (0.039)
US			-0.055 (0.035)	-0.052 (0.033)
UK			0.119*** (0.042)	0.114*** (0.039)
Nobs	153	153	135	135
Tests				
F	10.40***		2.90***	
Wald			24.92***	32.69***
Hausman			1.04	1.75
Breusch-Pagan			101.39***	75.63***