PERGAMON

Telecommunications Policy 26 (2002) 243–268

TELECOMMUNICATIONS POLICY

www.elsevier.com/locate/telpol

Privatization and the sources of performance improvement in the global telecommunications industry

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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. Using conventional pre- versus post-privatization comparisons and panel data estimation techniques, we find 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 major ownership changes—rather than from privatization alone.

Keywords: Privatization; Telecommunications; Regulation

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

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[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.

0308-5961/02/$ - see front matter
PII: S0308-5961(02)00013-7

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% or more of total capitalization and an even greater share of total trading volume (Boutchkova & Megginson, 2000). Additionally, telecom SIPs often involve sizeable fractions of the population becoming shareholders for the first time. As examples, almost 4 million French citizens (16% of the population) purchased shares in the initial public offering of France Telecom, and by the time Telefonica was fully divested its shares were owned by more than one in eight Spanish households (Jones, Megginson, Nash, & Netter, 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 as system requires capital investment spending on a scale that few governments can either achieve or effectively manage (Röller & Waverman, 2001). 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 regulatory and financial issues their privatizations inevitably bring to the fore, it is not surprising that many academic researchers have examined telecom divestments empirically. Four empirical studies are particularly important. Ros (1999), Wallsten (2000a, b) and Boyland 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.

We examine the financial and operating performance of 31 national telecommunications companies fully or partially divested via public share offering over the period November 1981–1998. 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 7-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 Megginson, Nash, and van Randenborgh (1994) 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.

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 et al. [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.

This paper is presented as follows: Section 2 briefly summarizes the most important general privatization research, then focuses specifically on studies of telecom privatization and regulation. Our sample is described in Section 3, while Section 4 presents the methodology and the empirical results presents the results. Finally, Section 5 concludes the paper.

2. Environment of the telecommunications industry and sample description

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. The sample is presented in Table 1. 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 Privatization 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).

The telecom offerings 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

Table 1
Characteristics of our telecommunications privatization sample

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[a]	Mar-92	1227	100%	30%	0%
2	Argentina	Telefonica De Argentina[a]	Dec-91	849	100	40[b]	10
3	Australia	Telstra	Nov-97	10,018	100	100	66.6
4	Belgium	Belgacom	Dec-94	2450		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	1320		100	51
8	Denmark	TeleDanmark	May-94	2894	0	89.9[c]	51
9	Finland	Telecom Finland (Sonera)	Nov-98	1388	100	100	77.8
10	France	France Telecom	Oct-97	7892	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	1013	100	25.5	6.47
14	Indonesia	Indosat[d]	Oct-94	1060	0	100	68
15	Indonesia	PT Telekom	Nov-95	1680	100	100	80
16	Italy	Stet-Societa Finanziaria Telefonica	Nov-85	103	100	88.53[e]	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	2170	100	30.6[f]	15
23	Netherlands	Koninklijke PTT Nederland N.V.	Jun-94	3868	100	100	68.75
24	New Zealand	Telecom Corporation Of New Zealand	Jul-91	819	100	100[g]	0
25	Poland	Telekomunikacja Polska S.A. (TPSA)	Nov-98	1020	100%	100%	70%
26	Portugal	Portugal Telecom	Jun-95	984	100	100	72.7
27	Singapore	Singapore Telecommunications Ltd	Oct-93	1950		100	92.8

Table 1 (*continued*)

Number	Country	Company name	Issue date mm-yy	Issue size US$ million	Fraction secondary	Government shareholdings	
						Before issue	After issue
28	South Africa	Telekom SA	Mar-97	1261		100	70
29	Switzerland	Swisscom	Oct-98	4831	100	100	70
30	UK	British Telecom	Nov-84	4763	100	100	49.8
31	UK	Cable & Wireless[d]	Oct-81	466	47.5	100	50

[a]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.

[b]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 10% ownership will most likely be transferred, by decree, to certain former employees of ENTel.

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

[d]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.

[e]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.

[f]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 non-voting 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), (iii) 24.5% of 20.4% (or 5% of the 100% share capital) by Southwestern Bell International Holding (iv) 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.

[g]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.

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.

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.

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. 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 Boyland & 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 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 about 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.

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. 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.[2] 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

[2] 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 (1997) and by materials provided directly by national regulatory institutions. We have constructed several appendices detailing the regulatory and competitive environments of our sample telecoms. These appendices are available upon request.

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 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.

We also develop additional variables to measure ownership changes. 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.

Several control variables are also included. 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. 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 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).

3. Empirical methodology

We perform two kind statistical analyses on our sample: a traditional univariate test and a panel data estimation. In our univariate tests of performance changes, we use the same matched pairs (pre versus post-privatization) methodology used by Megginson et al. (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 7 years encompassing 3 years before through 3 years after privatization—or as long after divestment as possible. Thus we develop a performance "time-line" that reflects operating results, from the last 3 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 employed to account for both regulatory and ownership effects on firm performance. 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:

$$y_{it} = \alpha + x_{it}\beta + v_i + \varepsilon_{it}, \tag{1}$$

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:

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

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

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

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.[3]

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.

[3] 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 $\bar{\varepsilon}_i = \sum_t \varepsilon_{it}/T_i$.

In the following sections, we test for privatization-related changes in profitability, output, efficiency, employment, investment and leverage. 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 measured 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.

We divide our test results into three sections, presenting both the results of the univariate and of the econometric panel data analysis: those examining (1) profitability, output, and efficiency changes, (2) employment changes, and (3) changes in capital investment spending after privatization.

4. Results

4.1. Profitability, output, and efficiency

Several studies (MNR, BC, DM and Dewenter & Malatesta, 2001) show that profitability, output and sales efficiency increase after privatization present similar results, but find 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. Our univariate results are presented in Table 2.

4.1.1. 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 2 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

Table 2
Summary of financial and operating performance changes following privatization of telecommunications firms

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	NEMPI	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

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 3-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% level.

Table 3
Results of panel data estimations: Profitability I

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***

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 Privatization 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% level.

one percent level. This decline in interest burden may be partly due to write-offs by governments of some existing debts, but we could find no specific instances of this occurring. 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.

The results of the panel data estimation for OISALES are presented in Table 3, while the results for ROS and ROA are presented in Table 4. 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

Table 4
Results of panel data estimations: Profitability II

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***	0.143***	0.468***	0.271***	0.066***	0.061***	0.249***	0.124***
	(0.034)	(0.023)	(0.141)	(0.081)	(0.019)	(0.011)	(0.078)	(0.036)
GDP	−3.05e-06	−2.21e-06*	−1.20e-06	−1.53e-06	−6.90e-07	−4.13e-07	1.06e-06	−1.14e-07
	(2.40e-06)	(1.23e-06)	(3.40e-06)	(1.59e-06)	(1.34e-06)	(5.94e-07)	(1.92e-06)	(6.71e-07)
POSTPRIV	0.041***	0.039***	0.0533**	0.043**	0.017***	0.016***	0.026**	0.019**
	(0.011)	(0.010)	(0.022)	(0.018)	(0.006)	(0.006)	(0.012)	(0.009)
IENP			0.061	0.049				
			(0.099)	(0.091)				
INTTD			−0.230	−0.202			−0.214*	−0.125
			(0.204)	(0.185)			(0.108)	(0.092)
INTOI							−0.001	−0.012
							(0.013)	(0.012)
CGS			−0.212**	−0.099			−0.121**	−0.053*
			(0.093)	(0.068)			(0.052)	(0.032)
TIME			−0.011	−0.003			−0.008*	−0.003
			(0.009)	(0.004)			(0.005)	(0.002)
COMP			−0.023*	−0.021*			−0.004	−0.004
			(0.013)	(0.012)			(0.007)	(0.006)
STAKE			−0.0004	−0.00005			−0.00005	0.0002
			(0.0004)	(0.0003)			(0.0002)	(0.0001)
AGENCY			−0.020	−0.013			−0.004	0.007
			(0.027)	(0.024)			(0.015)	(0.013)
TPA			0.021	0.005			−0.009	−0.011
			(0.029)	(0.024)			(0.016)	(0.012)
PRICE			−0.007	0.0009**			0.017	0.019*
			(0.026)	(0.022)			(0.014)	(0.011)
US			0.032	0.029			0.025**	0.017
			(0.021)	(0.019)			(0.012)	(0.010)
UK			−0.043	−0.028			−0.028*	−0.014
			(0.030)	(0.026)			(0.016)	(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***

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 Privatization 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

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.

Apart from the mere fact of privatization itself, we find that 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 US yield superior monitoring and thus higher profits, or do more profitable telecoms choose to list on US 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.

4.1.2. 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 0 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 3-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

table footnote continued

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% level.

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 (unreported) price regulation data, coupled with information from secondary news sources 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 are mainly due to increases in quantity rather than in price.

In the econometric analysis 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 5. 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 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.

4.1.3. 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.

In the panel data analysis, 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 6. Since the Hausman test is significant, we focus on the two fixed effect regressions. Although the POSTPRIV dummy is highly significant in the "short"

Table 5
Results of panel data estimations: Output

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**

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* Privatization 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% level.

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,[4] 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.

[4]Some caution is needed when interpreting the results on salaries, as they may be affected by simultaneity issues.

Table 6
Results of panel data estimations: Efficiency

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

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 Privatization 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% level.

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 1 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 this section below.

4.2. *Employment, capital spending and leverage*

4.2.1. *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 & 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, & 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 3661 workers after divestment, from 67,090 to 63,429 workers. Even though 61% of the telecoms show declining employment levels after privatization, this fraction is not significant according to the binomial

Table 7
Results of panel data estimations: Employment

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

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 Privatization 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.

test. The normalized employment measures all show insignificant declines. In other words, employment tends to decline after privatization, but only modestly.

Our panel data estimations of privatization-related employment changes, measured by normalized number of employees (NEMPL), are presented in Table 7. 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% lower employment. In any case, this inverse relationship between employment and STAKE can be

interpreted using the logic of Biais and Perotti (2001). 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.

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.

4.2.2 *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

Table 8
Results of panel data estimations: Investment

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***

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 Privatization 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% level.

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.

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 8, 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 10% 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 to reconcile our earlier finding that competition reduces per worker efficiency. By reducing investment, competition also reduces the amount of new technology added per worker.

4.2.3. 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% of the debts of the approximately 4500 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%) afterwards, and that 66.7% of all firms experience declines in TDTA. The Wilcoxon test for this decline is significant at the 1 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] 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 10–20% down, with one year's grace period. After that, however, they faced a short (5–7 years) repayment period at a real interest rate of 8–12%. 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).

Table 9
Results of panel data estimations: Debt

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***

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 Privatization 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% level.

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 9 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.

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.

5. 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 7-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 US and UK 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.

Acknowledgements

We gratefully acknowledge the financial support of the University of Oklahoma's Michael F. Price College of Business and of the University of Georgia Research Foundation in acquiring the data used in this study. We are also grateful for comments received from participants at the 1998 NYSE/Paris Bourse conference on Global Equity Markets, the 1999 Conference on Privatization and the Kuwaiti Economy in the Next Century, the 2000 Financial Management Association and European Financial Management Association meetings, the 2000 Harvard Institute for International Development's (HHID) Privatization Workshop, the 2001 Princeton University/World Bank Privatization Workshop, and seminars at the World Bank, the International Federation of Stock Exchanges (FIBV), the OECD, the City University Business School (London), London Guildhall University, the Swiss Banking Institute and the University of Oklahoma. Finally, we thank Narjess Boubakri, Maria Boutchkova, Jean-Claude Cosset, Michael DeWally, Ranko Jelic, Roger Noll, Han Kim, Kojo Menyah, Rob Nash, Jeff Netter, Enrico Perotti, Augustin Ros, Alessandro Sembenelli, Francesc Trillas, Scott Wallsten, Leonard Waverman and two anonymous referees for their specific comments and recommendations.

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