

UNIVERSIDAD DE OVIEDO

DEPARTAMENTO DE ECONOMÍA

PERMANENT SEMINAR ON EFFICIENCY AND PRODUCTIVITY

**WHAT DOES “PRIVATIZATION” DO FOR EFFICIENCY?
EVIDENCE FROM ARGENTINA AND BRAZIL’S RAILWAYS**

Antonio Estache[§], Marianela González[^] and Lourdes Trujillo[^]

Efficiency Series Paper 2002/10

Abstract

Railway restructuring and privatization has now become a mainstream policy option in many developing countries. This paper provides the first analysis of the efficiency payoffs of railway reform for a couple of developing countries, Argentina and Brazil. We track down the evolution of the performance of the private operators in both countries since reform, compare with the pre-reform performance when possible, distinguishing between the output and input sources of efficiency changes. This is done by computing the total factor productivity (TFP) of each business unit since the regulators started collecting enough data.

Keywords: privatization, regulation, efficiency, railway, Argentina, Brazil.

* World Bank Institute (Washington DC), and ECARES, Université Libre de Bruxelles,

^ Departamento de Análisis Económico Aplicado, Universidad de Las Palmas de Gran Canaria.

^ Departamento de Análisis Económico Aplicado, Universidad de Las Palmas de Gran Canaria.

E-mails: aestache@worldbank.org, marianela@empresariales.ulpgc.es, lourdes@empresariales.ulpgc.es.

1. Introduction

Railway restructuring and privatization has now become a mainstream policy option in many developing countries that are reforming their transport sectors. In most countries, the main goal is to obtain private financing for much-needed rehabilitation while promoting competition in the sector and relying on a management that is subject to little political interference. The specific restructuring form varies from country to country¹. Most bundle track maintenance, rehabilitation and service provision into one service to be provided by the same operator. Very few follow the UK in separating tracks from rolling stock operations. To avoid a simple switch from a public monopoly to a private monopoly the restructuring often leads to a division of railways services into several freight and passenger business units which essentially enjoy local or regional monopolies. Generally, whatever the specific form of restructuring, reformers rely on auctions for the markets to introduce at least ex-ante competition where ex-post competition is often limited to inter-modal competition from buses or trucks. When there is some residual monopoly power, to minimize the risk of abuse of specific goods and services, maximum prices, subject to occasional revisions to reflect changes in cost and efficiency, are usually set by the regulatory regime. An independent regulatory agency or a specific supervision unit within the Ministry of Transport is created to monitor the compliance of the operators with their contractual obligations and to enforce the regulatory regime.

Latin America may have been the most enthusiastic supporter for this re-organization since almost all countries with large railways systems in the region have already concessioned their railway services. Argentina and Brazil are arguably two of the three main players in the region (the third is Mexico) and have been the first to implement the reforms. At the end of the 1980s when reforms were initially considered, both national railways companies were facing the same concerns: an unsustainable financial situation requiring implicit or explicit subsidies to cover only operating expenses, an excess of

¹ For recent reviews of the international experience in transport privatization, see for instance, Gomez-Ibañez and Meyer (1993) or Estache (2001). For the most recent and more general review of privatization experiences, see Megginson and Netter (2001) and all the references cited in that paper.

employment, outdated operating practices, little maintenance and no new investments. The reforms were profound, relatively quick in Argentina and quite progressive in Brazil.²

While these reform experiences in developed countries have been widely covered by transport analysts and studied quite rigorously, there is no analytically robust analysis of the efficiency effects of these reforms in developing countries.³ This paper provides the first analysis of the efficiency payoffs of railway reform for a couple of developing countries. We track down the evolution of the performance of the private operators in both countries since reform and distinguish between the output and input sources of efficiency changes.⁴ This is done by computing the total factor productivity (TFP) of each business unit since the regulators started collecting enough data in the case of Argentina and since the early 1990s in the case of Brazil, where the gradual approach to reform allowed a more systematic data driven monitoring of policymaking in transport.⁵

The data has some limitations, which are discussed later, but it is sufficient to allow us to answer three questions that are increasingly commonly asked in policy debates on infrastructure privatization. *First*, thanks to the data available on Brazil, we give some evidence for one of the most commonly debated questions on infrastructure privatization: does it do any good? *Second*, we compare the difference in progress of passenger and freight services in Argentina since reform as an answer to the question of whether all public services are likely to be operated equally successfully by private firms. *Third*, we track down the evolution over time of TFP under private management to check whether indeed private operators tend to concentrate their efficiency gains early on, as suggested by the incentive theory underlying the adoption of a price cap type of regime. In the process, we isolate the input effects from the output effects to test whether, as sometimes argued by opponents to the reforms, the gains were mostly achieved through reductions in

² For earlier discussions of the Argentine experience, see Ramamurti (1997).

³ For developed countries, see the recent book by Van de Velde (2000), for a wider coverage, see Thompson (2001).

⁴ For a recent survey of the use of efficiency measures in assessing railways performance, see Oum, Waters II, and Yu (1999).

⁵ The computation is done with the program TFPIP version 1.0 developed by Tim Coelli and available on the website of New England University in Australia; the specific methodology is discussed in Coelli *et al.* (2002).

inputs (mainly labor) or through a combination of improvements in input use and output side as well.

The paper is structured as follows. Section 2 provides a brief overview of the organization of the two systems since reform. Section 3 describes the methodology used to assess the performance of the private management of the each concession. Section 4 compares the before and after privatization performance of the Brazilian freight railway system. Section 5 compares passenger and freight rail in Argentina. Section 6 provides a comparison of the performance for freight trains in Argentina and Brazil. Section 7 concludes.

2. The restructuring of Argentina's and Brazil's railroads

This section provides some of the context, explains the purposes of reform and summarizes key institutional and economic aspects in both countries. The focus is on the information relevant to interpreting the performance assessments presented in the second part of the paper.⁶

(a) Argentina

The main catalyst for the restructuring and concessioning of state-owned railways in Argentina was fiscal. The financial pressure on the national treasury imposed by public enterprises led to the 1989 *State Reform and Public Enterprise Restructuring Law*, whose objective was to revitalize the economy by encouraging the private sector operation of public services. For railways, the government decided that private participation was to be implemented by concessioning the freight and commuter networks that were originally owned as an integrated network by the public enterprise, Ferrocarriles Argentinos (FA).

The freight network was partitioned into six sub-networks. Between 1990 and 1993, each of the sub-networks was then concessioned for a 30-year period with an optional 10-year extension to private consortia through an auction. Concessions remained vertically

⁶ For details on the restructuring in each country: for Argentina, see Estache *et al.* (1996), Thompson (2000) and Campos and Estache (2001); for Brazil, see Campos (2001), Estache *et al.* (2001); for a wider comparisons of railways reforms, see Campos and Cantos (2000).

integrated and each operator had to undertake all of the activities involved in railroad operations, from the improvement and maintenance of fixed facilities such as stations and tracks to the dispatching and movement of trains as well as marketing and financial control. Concessionaires were free to introduce new working practices but were expected to deliver on the investment commitments made in the bids. They were also expected to hire FA employees, but only those considered necessary. Labor redundancies were financed by the government (with the help of the World Bank). Private operators were to pay the federal government a fee for the use of the rail infrastructure as well as a lease for the use of the rolling stock, which remained in the ownership of the state. Overall, the annual payment commitments to the government added up to US\$140 million. The final main element of the reform was that although freight tariffs were deregulated, operators would still need to file maximum rates for each commodity for approval by the Secretary of Transport.

The winning bid was selected based on a complex set of weighted criteria. The largest weight was assigned to the basic investment plan submitted by each bidder, followed by the projected quality of operations and the number of FA staff to be hired by the private concessionaire in its new operation. The points awarded for employment of FA personnel reflected a political compromise and the limited amount of money available for redundancy payments. On average, 82 percent of FA's former employees were retained. Total investment commitments added up to US\$1.2 billion over 15 years. Table 1 summarizes the winning bids in each freight sub-network. All concessions were won by consortia headed by Argentine investors that included – mostly nominally – rail operators with foreign experience and committed investments of US\$1.2 billion over 15 years.

For passenger services, the restructuring was separated into inter-city and the suburban traffic around Buenos Aires. Since most of the inter-city traffic was not commercially attractive to the private sector, the federal government decided in 1992 to let the provinces decide if they wanted to continue the services at their own expense. The only provinces that agreed to the transfer were Buenos Aires, La Pampa, Tucumán, Córdoba, Salta, Río Negro and Chubut. The transfers were done with concession agreements between the state and the provinces whereby the state transferred the rolling stock and complementary equipment necessary to run the services. The provinces agreed to subsidize these

operations and run the services over the network concessioned to the freight and metropolitan private operators, and to pay a fee to these operators. Most of this traffic has in fact been abandoned now.

Table 1. The new players in Argentina's railway freight concessions

Line	Length (kms)	Concessionaire	No. of bidders	Takeover date	Payment to government (US\$ mill.)	Employees transferred (% hired from FA)	Proposed investments (US\$ mill in first 15 years)
San Martín	5,493	Buenos Aires al Pacífico (BAP) Ferrocarril	2	Aug. 1993	36.4	2,271 (83%)	369
Urquiza	2,751	Mesopotámico (MES)	1	Oct. 1993	2.8	1,255 (76%)	64
Rosario-Bahía Blanca	5,163	Ferropreso Pampeano (FEP)	2	Nov. 1991	48.4	1,500 (85%)	234
Roca	4,791	Ferrosur Roca (FER)	1	Mar. 1993	18.0	1,133 (86%)	173
Mitre	4,520	Nuevo Central Argentino (NCA)	2	Dec. 1992	33.5	2,322 (78%)	386
TOTAL	22,781	–	–	–	139.1	6,912 (82%)	1,226

Source: Estache et al. (1996).

The Buenos Aires commuter services were separated in 1991 into seven vertically integrated units which were actually transferred after an auction to private operators between 1994 and 1995. The concessions corresponded to the seven different lines and networks that had existed prior to the creation of FA in the 1950s: *Mitre*, *Sarmiento*, *Urquiza*, *Roca*, *San Martín*, *Belgrano Norte* and *Belgrano Sur*. The subway, consisting of five underground lines and a surface light rail line, was placed in a bidding package together with the Urquiza line which shared the same track gauge and was physically connected to the subway. As in the case of freight, the government maintained ownership of the assets, and concessionaires were expected to operate, maintain, comply with the service obligation spelled out in the contracts and carry out the investment commitments made in the bids. The government set maximum fares subject to automatic increases according to service quality and increases in the US Consumer Price Index. Non-achievement of quality of service levels resulted in financial penalties. The main differences with the freight concessions were that there were no restrictions on reemployment or labor practices, that investments were to be financed by the government

and that the contracts were shorter (10 years with an optional 10 year extension, except for the subway and the Urquiza line where the contract is for 20 years). Also, some of the concessions involved subsidies to be paid by the government.

Following an international competitive bidding process, concessionaires were selected on the basis of a single parameter: the lowest subsidy requested by the concessionaire to operate the line and undertake the specified investment and rehabilitation program. Lowest subsidies were measured as the first ten-year present value of the annual subsidy flow required to operate the line and undertake the investments, net of the annual flow of the fee (or “canon”) offered to be paid for the use of fixed assets such as track and stations. The characteristics of the successful bids for each railway concession package are summarized in Table 2.

Table 2. The new players in Argentina’s commuter railway concessions

Line	Length (kms)	Concessionaire	No. of bidders	Takeover date	Operating subsidy or (fee) (US\$ mill.)	Proposed investments (US\$ mill.)	
						Annual average	Year 1
Belgrano Norte	51.9	Ferrovias (FEV)	2	Apr. 1994	196.7	18.1	58.7
Belgrano Sur	58.4	Metropolitano (TMB)	3	May 1994	166.1	13.5	43.8
Roca	252.4	Metropolitano (TMR)	4	Jan. 1995	(70.0)	120.2	136.0
San Martín	55.4	Metropolitano (TMS)	4	Apr 1994	(44.7)	54.9	62.7
Mitre	182.1	Trenes de Buenos Aires (TBA)	3	May 1995	84.1	57.7	221.2
Sarmiento	166.6	Trenes de Buenos Aires (TBA)	3	May 1995	(177.9)	93.6	193.2
Urquiza	25.6	Metrovías	3	Apr. 1994	101.7	24.8	37.8
Subway	44.1	Metrovías	3	Apr. 1994	(438.4)	151.5	399.2
TOTAL	836.5	–	–	–	(182)	534.4	1,152.6

Source: Estache et al. (1996).

The combined total government payment requested by the consortia to operate and rehabilitate the systems over the duration of the concessions was about US\$1 billion in nominal terms, or US\$630 million in present value (in 1992 US\$). Most of this amount – which was below the cost of running the system by FA – was intended for capital investment (about US\$550 million), as opposed to government subsidies which mostly financed operational deficits before privatization. The reduction of the operational costs was also based on a sensible staff reduction. In 1991 there were 17,000 employees in the commuter rail services. The concessionaires, altogether, for all the groups of suburban services, only requested 8,500 agents.

As for the regulatory regime, it was driven by a cost plus model for both passengers and freight. There are some trigger rules which drive incentives. The trigger rule is based on an agreed upon structure of cost. The changes in cost over time are compensated through tariff increases or through equivalent subsidies by the government. The main issue with the rule is that the incentives to minimize costs are not very strong in this type of environment.

Within three years of the first contract, as early as 1995, the government started to face a growing dilemma about whether it should renegotiate the railway concession contracts or enforce them as written. Minor problems had arisen. Some consortia bidding for the freight concessions had promised to hire large numbers of FA employees, since that was one of the criteria for the final award. Once the consortia were awarded their concessions, however, some argued that they could not meet their commitments because most FA employees were not qualified for the new jobs. Similarly, immediately after the award of the urban commuter concessions, some of the winners argued that there were ambiguities in the contracts that had to be resolved before they could take over the lines. The main outstanding issue since then with the freight railways was that if the government strictly enforced the contracts, it would force at least three of the five concessions into bankruptcy. For the commuter railways, the main issue was excess demand for the improved service and its impact on quality, and hence, on prospective riders. The renegotiation process that started with the concessionaires in 1997 was partly concluded in 1999 just before the change of the administration. After the government change, the renegotiation issue was reopened and had not been concluded yet by the end of 2001.

Overall, at the end of year 2001, in spite of the on-going renegotiation process, many would argue that the reforms have been at least a qualified success on the basis of a comparison of the perceived quality and level of service before and after the reform. Fiscal costs have dropped—although they are becoming higher than expected because of the return of subsidies—and output and quality have clearly improved. Commuter rail services duplicated their output figures above expectations in just three years of private operation. Rail freight shipments have more than doubled FA levels—although the macroeconomic crisis of the last two years has slowed the growth rate and outputs remain below the projections in the contract. Service quality has seen major improvements as well. For

shippers, savings on rail freight charges can reasonably be estimated to be over US\$70 million annually, to a large extent reflecting improvements in labor productivity – from 0.1 to two million tons per worker – and in locomotive availability – from 50% to 80%. Commuter services enjoy greater frequency, fewer delays and cancellations, and improving levels of comfort and customer attention.

There are some concerns that for the rail system as a whole, the number of accidents has increased in absolute terms since 1995. The main issue arising at this stage of the reform, however, is the renegotiation of all contracts. With freight concessions, weak contractual compliance reflects an incentive to over-optimize, which was built into the design of the auction and resulted in unrealistic formal investment promises—quite different from those built into the actual business plans of each bidder. Only one operator (NCA) achieved 50% of its physical investment commitments, with the rest ranging between 10% and 39%. The operators have been subject to about US\$10 million in penalties, most of which are being disputed in court and remain unpaid. Also, several of the freight and passenger concessionaires have also defaulted on their canons. For passenger contracts, the investments to be carried out by the government have been updated and reduced and tariff increases (by 60% over a six-year horizon) have been secured to raise funds to compensate for the debt of the government to the operators and to finance investment (managed through a trust fund). Changes in TBA tariffs have been contested by the users, but renegotiation with other concessionaires continues.

(b) Brazil⁷

The restructuring and concessioning of freight railways in Brazil was implemented in 1997 and involved four groups of players. The restructured company, *Rede Ferroviária Federal, Sociedade Anônima* or RFFSA, was a government-owned rail corporation structured around six regional divisions spread out over the country since 1957. A second public operator *Ferrovias Paulistas, Sociedade Anônima* (FEPASA), created by the state of São Paulo in 1974, was later included in the reform package as well. These two public operators provided rail transport services to about 95% of the country's freight shippers, whereas the third important operator (and the largest in terms of output) at the beginning

⁷ The reform of passenger services in Brazil is mostly a subnational responsibility and followed a similar but slower track. For more details, see Rebelo (1999).

of the 1990s was the *Companhia Vale de Rio Doce* (CVRD). CVRD was a huge, government-owned industrial holding that managed two different, specialized railroads, EFVM (*Estrada de Ferro Vitória a Minas*) and EFC (*Estrada de Ferro Carajás*), running from mining sites to the ports in the north and center of the country. This company mostly attended its own traffic, which largely consisted of high volumes of iron ore for export.

These companies were generally not doing well just before the beginning of the privatization process. RFFSA and FEPASA were overstaffed and lack of investments had made important parts of their infrastructure and rolling stock obsolete. Particularly in the case of RFFSA, poor revenue/cost ratios demanded a continual support from public funds, which amounted on average to more than US\$250 million a year. It had a cost structure with a wage component of almost 75% of operating expenditures and where the debt burden rapidly rocketed out of control to US\$3 billion. Employment levels had been cut from about 125,000 in the mid-80s to about 42,000 just before the privatization process started.

In view of the geographic characteristics of the country, the size and state of conservation of the federal railway network, as well as the significant cross-regional differences in RFFSA traffic, the government decided to reorganize the network and divide it into six vertically integrated regional monopolies, to be joined later by FEPASA as a seventh region. The rail services would be concessioned for 30 years by the Ministry of Transport. The first six concessions – *Nordeste*, *Centro-Leste*, *Sudeste*, *Sul*, *Teresa Cristina* and *Oeste* – were awarded between 1996 and 1997. The *Malha Paulista* (former FEPASA), was included in the privatization program of RFFSA and its concession was carried out in November 1998, thereby concluding the privatization process of former government-owned rail operators. When CVRD was privatized in June 1997 its two railroads (EFVM and EFC) were sold with it, but not concessioned in the same way as the RFFSA network. The two railroads essentially now operate as internal departments of CVRD, specializing in iron ore traffic, although they are obligated to carry traffic for other shippers as well. The auction outcomes are summarized in Table 3.

Table 3. The new players in Brazil's railway freight concessions

Line	Length (km)	Concessionaire	No. of bidders	Takeover date	Payment to government	Employees transferred (% of before transfer)	Investment commitments	
							Years 1-6	Years 7-30
Centro-Leste	7,080	Ferr. Centro Atlántica (FCA)	2	Sept. 1996	316.9	7,900 (72%)	327.4	982.4
Nordeste	4,534	Co. Ferr. Nordeste (CFN)	4	Jan. 1998	15.7	1,600 (50%)	18.4	49.2
Sudeste	1,674	MRS Logística (MRS)	3	Dec. 1996	888.9	6,600 (70%)	227.0	1,408.0
Sul	6,586	Ferrovía Sul Atlántico (FSA)	4	Mar. 1997	216.6	6,900 (72%)	276.0	1,083.0
Oeste	1,621	Ferr. Novoeste (FNV)	n.a.	July 1996	62.4	1,800 (74%)	89.0	270.0
Tereza Cristina	164	Ferr. Tereza Cristina (FTC)	1	Feb. 1997	18.5	250 (73%)	9.4	19.3
Paulista	4,236	Ferroban (FBN)	2	Jan. 1999	245.0	6,380 (46%)	304.8	588.2
TOTAL	25,895	-	-	-	1,764.0	31,430	1,252.0	4,400.1

Source: Author's computation based on data available on RFFSA's website.

Except in the case of CVRD, and with several minor amendments in the case of FEPASA, the concessioning process of RFFSA consisted of a public competitive bidding process for the operation and maintenance of each of the regional networks for a period of 30 years (renewable for another 30 years at most, according to the Brazilian law) with the simultaneous leasing of operational assets by RFFSA and the sale of some small, non-operational assets. Each auction was won by the bidding consortium offering the highest price over the minimum price set by the government—to be paid as a down payment of 10-30% of the minimum price and quarterly installments for the rest. The government had to receive a total of about R\$1,700 million for the seven concessions, although only about R\$400 million was paid in the first installments with the rest due (after a one-three year grace period, depending on the concession) in 108-112 (depending on the concession) quarterly payments over the remaining life of the concessions. The number of workers transferred to the concessionaire was also specified in the bidding documents (the average reduction was 25%) and the remaining ones retired, were laid off or still work for RFFSA in non-operating activities.

The main innovation of the Brazilian contracts is that they spell out two specific targets about output and safety, in terms of minimum net ton-kilometers carried each year and

maximum number of accidents per train-kilometer during the first five years. They were set based on what the Brazilian Transport Ministry thought to be reasonable based on international best practice and already reflected in the minimum value assessed for the bids by the privatization agency. These targets will be reviewed during the third concession year, establishing the new goals for the next five-year period. The regulation sets product specific maximum prices to be charged for transport services in the contracts. Ceilings varied according to the length of the haul, type of product and the geographic region served. These maximum prices are to be revised periodically to correct them according to inflation. Rail's share of the transport market increased by 4.5 percent in 1997 and 13 percent in 1998, and is expected to continue increasing at a greater rate following the concessioning of Malha Paulista in late 1998. The former RFFSA concessions' performance during 1996-99 is summarized below.

Overall, the performance of the sector appears to have improved significantly since reform. Savings to the Federal Treasury arising from reduced operating subsidies and concession contracts proceeds can be estimated at more than US\$300 million a year. Reductions in labor and financial costs enabled five out of the six former RFFSA companies to cover their operating expenses as of 1999. Quality and level of services have improved and explain why freight revenue started to increase since 1999 in spite of strong competition from trucks and waterways. There are, however, significant issues. Safety targets have been a problem for CFN and Novoeste in particular. The main issue may be that the operators are not meeting their investment commitments. A tariff revision is about to start which will provide an opportunity to settle the matter.

3. The analytical approach⁸

While the partial performance indicators briefly reviewed above are effective in highlighting some of the toughest issues, they are not as useful in generating a full picture of the evolution of the sector since reform. They are particularly limited in terms of generating a synthetic performance indicator which can be used to make comparisons across operators

⁸ For a longer discussion of this approach, see Coelli *et al.* (1998) or Coelli *et al.* (2002).

and across countries. To generate an indicator that accounts for the joint effects of improvements in output and input management, we rely on a TFP index.⁹ This index measures the changes in total output relative to changes in total inputs. In growth rates, it can be expressed as follows.

$$\ln TFP_{st} = \ln \frac{\text{Index for product}_{st}}{\text{Index for input}_{st}} \quad (1)$$

where the indices s and t refer to the beginning and end time period, respectively, and where the product is measured in tons-km and the inputs are measured as employment and energy consumption.

The indexes are estimated as *Tornqvist* which in log takes the following form:

$$\ln \text{Index for product}_{st} = \frac{1}{2} \sum_{i=1}^N (w_{is} + w_{it}) (\ln y_{it} - \ln y_{is}) \quad (2)$$

$$\ln \text{Index for input}_{st} = \frac{1}{2} \sum_{j=1}^K (v_{js} + v_{jt}) (\ln x_{jt} - \ln x_{js}) \quad (3)$$

where:

y_i represents the quantity of the i -th product,

x_j represents the quantity of the j -th input,

w_i is the share of the value of the i -th product, and

w_j is the share of the value of the j -th input.

The main challenge is to identify from among the indicators typically produced by operators the variables that are reliable and relevant enough to get an approximation of the variable components of the TFP measure. With respect to the measurement of output, the practice is as follows. Even if many studies recognize that the services provided by railway companies are multi-product in nature, most actually focus on a couple of measures of output, principally because of the lack of data available in the sector. One

⁹ While the approach is not as rich as the one proposed by Galal *et al.* (1994), it has the advantage of being much more consistent with standard regulatory practice in the context of ordinary or extraordinary tariff revisions when regulators are asked to assess the size of the gains over of certain period with a view to pass them through to users to tariff reductions.

option is to focus on capacity or its use. An alternative is to rely on a standard measure in the sector reflecting the combination of volume and distance: tons-km for freight railways and passenger-km for passenger railways.

For outputs, since we consider an aggregate single output (passenger or freight), we do not need to compute the value shares. For inputs, we follow the standard practice. Whenever possible, most studies rely on three inputs: capital, labor and energy consumption. For Argentina, reliable data was available on all counts.¹⁰ For Brazil, the data available on capital inputs, particularly its pricing, proved to fail most reasonable tests of reliability and consistency across firms. The labor input is the number of workers employed by each concessionaire or the corresponding regional operator before the privatization in the case of Brazil. The energy input is approximated by the diesel consumption expressed in liters, since it is the main source of fuel for these operators and is used by all of the operators covered by the sample. Since the price of diesel was quite consistent across operators, whenever physical consumption was not available, we generated the figure by dividing fuel expenditures by the average price of the relevant year in the country. Note that passenger rail also uses electricity, but as a residual source of energy (except for metro) but this was ignored due to lack of consistent information across operators. There are two reasons why there is no capital input. The most obvious is that since we did not have good data for Brazil, we could not have had comparable input series for both countries. The second and more conceptual one is that the main capital input is the railtrack, which is essentially fully amortized in both countries and therefore unlikely to influence allocative decisions in any major way.¹¹

The price of inputs were computed as follows. The price of labor is obtained by dividing labor expenditures by the number of workers. The price of energy is obtained by dividing

¹⁰ While the raw data was indeed there, it took quite a bit of processing of this raw information to get the data used here. For a longer discussion of regulatory accounting in Argentina, see Campos *et al.* (2001).

¹¹ Ideally, we should have included data on rolling stocks but since we were not able to cross-check on its quality as we were for the rest of the data we used, we decided not to use it. In Argentina, the rolling stock has been underused in freight and there is an excess demand in passenger concessions. The quality indicators routinely issued by the regulators suggest that maintenance has been done appropriately. Similarly, in Brazil, the quality indicators on the state of the rolling-stock, combined with the fact that most accidents have been blamed on track maintenance rather than on trains suggests that maintenance is not an issue either.

the energy expenditure by the number of liters consumed wherever the two observations were available.

A final important observation is the fact that the data was obtained from balance sheets and reports to the regulators. Unfortunately, for the case of Argentina, the accounts across firms are not strictly comparable without some major adjustments. Indeed, in that country, the start of the business year is defined by the date of creation of the company. This implies that we had to work from monthly data to reconstruct comparable balance sheets across firms. Whenever the relevant data was not available, we ended up relying on annual fixed proportions to come up with an assessment of the missing monthly data from available data.

4. Did privatization improve the overall performance of railway services?

The first question that comes to the mind of most casual observers of “privatization” processes, whatever the sector, is: “did it do any good?”. The suggested computation of TFP is useful to address this question as long as there is information available for before and after the privatization. The necessary details are only available for Brazil’s freight railways since the monitoring authority enjoys a time series of observation covering the 1992-99 period and privatizations started after 1996. This data allowed us to compute for each concession area (as defined after the privatization) a TFP based on labor and energy inputs, and hence assess the effect of “privatization”.

The results are summarized in Table 4. Overall, TFP has clearly improved since the private operators took over the sector. The average TFP growth has been 8.4% since all systems were operated privately, up from 5.5% before the change. However, the table provides additional insights, particularly with respect to the diverse performance effects of the reforms and the sources of changes in TFP, as seen in the disaggregation between changes in output and input performance.

**Table 4. Average annual rate of change in Brazil's freight railways:
before and after "privatization"**

Freight concession	Date of concession	TFP		Output		Input	
		Before ^a	After ^b	Before ^a	After ^b	Before ^a	After ^b
FCA	Sept. 1996	16.7	23.2	-2.2	18.6	-16.2	-3.8
CFN	Jan. 1998	4.7	46.7	-9.0	41.4	-13.1	-3.6
MRS	Dec. 1996	12.4	7.7	-2.0	3.0	-12.8	-4.3
FSA	Mar. 1997	9.4	25.4	-2.6	16.9	-11.0	-6.8
FNV	July 1996	2.8	9.5	-5.7	4.3	-8.3	-4.8
FTC	Feb. 1997	14.6	13.8	-0.8	5.9	-13.5	-7.0
Total freight railways^c	92-95	5.5		-0.6		-5.8	
	98-99		8.4		6.0		-2.2

^a "Before" covers 92-96, except for NOV (92-95) and CFN (92-97).

^b "After" covers 97-99, except for NOV (96-99) and CFN (98-99).

^c "Before" covers 92-95. "After" covers the period 98-99. Also we did not have the relevant data for the Paulista network.

The diversity of performance can be seen from a glimpse at the performance across operators. Four have improved quite dramatically, including CFN and FSA. Two have a much lower TFP growth rate: TEC's modest rate and MRS's much more dramatic one. As for the sources of changes, they are as expected. The private operators managed to obtain significant improvement in output growth rates with an average growth rate of 6% for the system as a whole, including some dramatic turnaround for FCA, CFN and FSA. These very large efficiency gains in outputs largely offset the somewhat modest performance with respect to inputs.

As for the emerging story on the sources of changes, it is quite interesting. The efficiency gains achieved before the reform were on the input side, while after the reform, they focused on the output side. The main reason is that the before figures reflect the fact that the reform started with a progressive reduction in employment from 150,000 workers in 1985 to 42,000 just before the reforms in 1996. The last stage of the reform cut another 25,000 workers and the operators themselves eventually cut 14,000, but most of the improvements in labor efficiency had already been achieved. As a result, inputs are cut throughout the period, but even more so before than under the private sector operation.

5. Is there a difference between passenger and freight operators?

The second question that can be answered from the data available is whether efficiency gains achieved in passenger and railways services are comparable as a way of checking whether in an equivalent environment all public services are likely to be influenced similarly by restructuring and privatization. The standard partial indicators reviewed in section 2 for Argentina already suggest that, generally, output, prices and quality have improved for both types of railway services but with varying degrees. The data, after some rearrangement of the raw material to obtain a consistent time series across operators, allows us to track down a five-year period during the private operation of freight services in Argentina and for four years for the passengers (excluding subway). Table 5 shows TFP growth and its sources for each freight and passenger operator.

Table 5. Average annual rate of change in Argentina's railways since privatization

Freight (1994-1999)	TFP	Output	Input
BAP	3.9	4.0	0.1
MES	0.9	-6.8	-7.6
FEP^a	-1.6	0.5	2.2
FER	11.0	9.2	-1.6
NCA^a	10.3	17.1	6.2
<i>Overall freight</i>	5.3	5.9	0.6
Passengers (1995-1998)	TFP	Output	Input
FEV^b	14.5	13.7	-0.7
TMB	21.5	9.7	-9.8
TMR	9.2	7.5	-1.6
TMS	19.1	13.6	-4.7
TBA^b	3.2	20.9	17.1
<i>Overall passenger</i>	9.8	16.9	6.5

^a FEP and NCA covers the period 1993-1999.

^b FEV and TBA covers the period 1995-1999.

A few interesting points emerge from Table 5. The first is that, in Argentina, the passenger concessions must have been a much better deal than the freight concessions. The potential operators knew this, since the average number of bidders for passengers was three, while it was 1.5 for freight concessions. The 9.8% efficiency gains achieved in

passenger concessions are almost twice the 5.3% achieved for freight. Moreover, all passenger concessions have managed to have a positive TFP, while the outcomes are not as positive on the freight side where FEP saw its TFP growth deteriorate and MES did not achieve much growth.

A second comment stems from comparing Table 5 with the information on the value of the bids for each concession provided in Table 1. It seems that the payment levels committed by the winning bidders to the governments are not well-correlated with the ex-post performance revealed by the TFP analysis. Worse yet, in freight railways, the highest payment was for FEP, which it turns out is one of the only operators with a negative TFP growth.

A third noticeable observation is that in addition to major differences in the performance levels, there are differences in the factors driving TFP. All passenger operators, except TBA, have improved both their output and input performance (i.e. reduced their use of inputs for a given level of output) but the output gains have been larger than input cuts. This result allows the questioning of one of the strongest criticisms of privatization, which argues that efficiency gains are only due to input reductions. TBA's experience reinforces this questioning. Indeed, TBA has increased its input uses so much that for the passenger system as a whole, it offset the input efficiency gains achieved by the other operators. In spite of this, TBA is still better off under private operation since its increased output levels sufficiently to achieve an overall increase in TFP.

For freight operators, the situation is not as clear cut. First, BAP and NCA's performance suggests that there is scope for win-win situations in terms of input use and output delivery. Both managed to increase output and input uses (most importantly jobs), a result very similar to the one observed for TBA. Second, the case of MES reveals a private operator achieving an improvement in TFP with a larger reduction in input use than in output. The main reasons for the deterioration on the output side are a major deterioration in aggregate demand combined with a particularly strong competition from the trucking industry in its service region, and probably most importantly, major flood problems which tend to inundate the tracks and stop service for several days in a row. Third, one of the operators has clearly not benefited from the privatization since it has a negative TFP.

Indeed, the FEP performance is similar to the one characterizing many public operations and justifying the shift away from public operations. The positive output growth is more than offset by the increase in input use. Over time, of course, it may simply reflect the fact that the private operator is making the input adjustment to promote longer term growth in outputs.

Overall, the TFP results for Argentina's freight railways seem to confirm Brazil's result. Indeed, in both cases, since privatization, the main source of change in TFP is due to changes in the output performance.

6. How are the efficiency changes distributed over time?

The final question we want to focus on is the distribution over time of the changes in TFP in freight railways. It is generally argued that any regulatory regime, such as price caps, that protects the rent created by an operator will give an incentive to that operator to maximize rent as soon as possible since at the time of tariff revision, the regulator is likely to try to redistribute at least part of the rent to the users. If this assumption is correct, we would expect to observe major efficiency improvements at the beginning of the period for each operator and perhaps some convergence toward the end of the period. Figures 1 and 2 provide a "naïve" test of that assumption for the information we have on freight and passenger rail.

Figure 1 reproduces the evolution of the annual TFP growth rate for the information we have since privatization on each concession. The year zero in the graph corresponds to the first year of operation of the private operator. Unfortunately, once more, we only have partial information on this. For a period of up to six years after the beginning of the private operation of the freight concessions in both Argentina and Brazil (in some cases it is less since for some concessions, the services were transferred only two years before the end of the period for which we have comparable data. With the exception of MES and NCA in Argentina, the major gains in efficiency were achieved in the first year of operation. This tends to confirm the expectations derived from the use of price cap regimes with regular tariff revisions. It is as interesting to note that toward the end of the period covered

in all cases, efficiency drops. It turns out that in both countries, after the second year of operations, formal or informal contract renegotiations started. This suggests that, in addition to the demand shocks and the pressure from competition, there may have been some strategic gaming by the operators since the overwhelming coincide of events is hard to explain otherwise.¹²

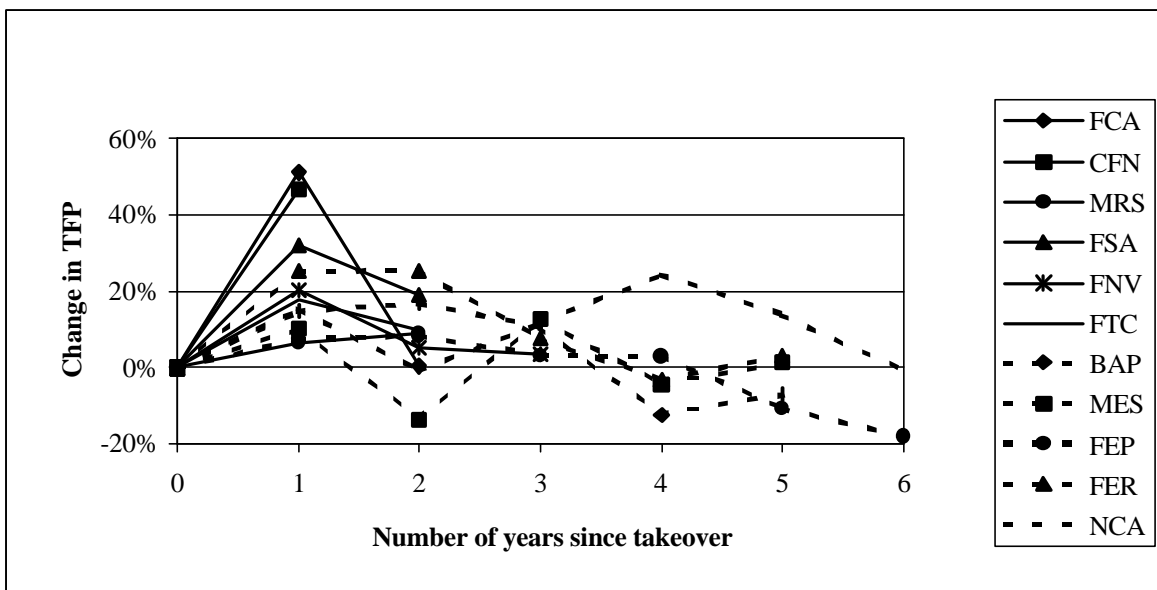


Figure 1. Annual TFP growth since private operators took over freight railways in Argentina and Brazil

The overall impressions are similar for passenger railways, although the largest annual growth rates were achieved during the second year after the concession started being operated by the private companies. This reflects the fact that it took about a year for the operators to achieve the major efficiency gains in outputs after improving service quality and input uses during the first year. The main point from the viewpoint of a regulator however is that as soon as renegotiations start, it seems that efficiency starts to decline, just as in the case of freight railways. In this case however, as mentioned earlier, it may reflect a problem of excess demand for much-improved services, which resulted in an insufficient production scale.

¹² For a longer discussion on how to handle strategic games and how to use these measures in the context of renegotiations, see respectively, Trujillo *et al.* (2002) and Campos *et al.* (2001).

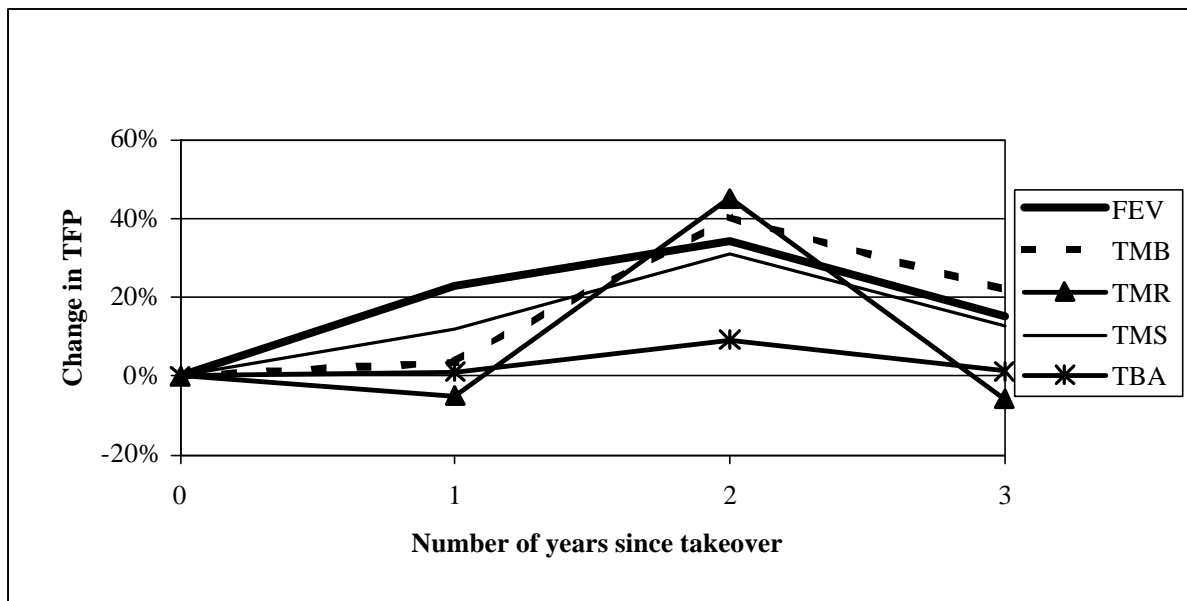


Figure 2. Annual TFP growth since private operators took over passenger railways in Argentina

7. Conclusions

The obvious answer to the title question of the paper is that restructuring and privatization have indeed had a major impact on efficiency in these sectors. It influenced both the level and the sources of efficiency gains. It probably also influences the timing of efficiency efforts.

The freight and passenger railways are more efficient after than they were before privatization, but there is a more subtle answer to the question which is likely to fuel the continuously heated debate between the partisans and the opponents to privatization. In favor of the views of the opponents, Brazil's slow and gradual approach shows that significant improvements in input management can be achieved by the public sector as well. In favor of the privatization partisans, Argentina's freight experience shows that privatization is not necessarily associated with fewer inputs. Jobs were created by the private operators, in contrast to a common perception that productivity gains associated with privatization are only due to reductions in employment. While it is true that some of

the recruitment by private operators resulted from excessive labor reductions built into the restructuring, output levels have increased in the sector in spite of strong predatory competition from the trucking industry. In fact, the results show that for both Argentina and Brazil, the post-privatization period is characterized by a situation in which improvements in TFP are mostly due to improvement in outputs rather than to improvement in input uses. Ultimately, the results suggest that for both Argentina and Brazil, the post-privatization period is characterized by the fact that growth of TFP is generally much more due to an improvement in output than to a reduction in input use.

The most innovative contribution of the paper however may be the discovery that the efficiency gains achieved since privatization seem to provide a weak empirical test confirming the assumption underlying the use of price caps or similar incentive-driven regulatory regimes regarding the timing of the efforts of operators to improve their efficiency effects. It turns out that for most operators, the efforts to improve efficiency are concentrated at the beginning of the period. A related puzzling fact is that in preparation for tariff revision renegotiations, the efficiency performance seemed to deteriorate. Additional work needs to be done on this very specific point. Among other things, a better testing of the causality between renegotiation and the timing of efficiency changes is needed before considering these results to be a strong test of the effects of incentive driven theory.

In sum, the quantitative analysis of the effects of privatization still has a long way to go before policymakers will be able to rely on robust evaluations of many of the pro and cons of privatization. The gains are generally strong, but the opportunities for strategic behavior by the operators in various settings cannot be discarded and the costs balanced against those of not reforming.

References

- Campos, J. (2001), "Lessons from Railways Reform in Brazil and Mexico", *Transport Policy*, Vol. 8 (2), 85-95.
- Campos, J. and P. Cantos (2000), Rail Transport Regulation. In Estache, A. and G. de Rus (Eds.), *Privatization and Regulation of Transport Infrastructures* (171-234). Washington: World Bank Institute Studies in Development.
- Campos, J. and A. Estache, (2001), *Re-assessing Argentina's Rail Concessions after 10 Years Experience*. Washington: World Bank Institute (mimeo).
- Campos, J., A. Estache and Trujillo, L. (2001), "Processes, Information and Accounting Gaps in the Regulation of Argentina's Private Railways". Policy Research Working Paper, No. 2636. Washington, World Bank.
- Coelli, T., D.S.P. Rao and G.E. Battese (1998), *An Introduction to Efficiency and Productivity Analysis*. Massachusetts, Kluwer Academic Publishers.
- Coelli, T., Estache, A., S. Perelman and L. Trujillo (2002), *A Primer on Efficiency Measurement for Utilities and Transport Regulators*. Washington, World Bank Institute Studies in Development (forthcoming).
- Estache, A, J. Carbajo, J.A. Gomez-Ibañez and J. Meyers (1996), *Argentina: Transport Privatization and Regulation: The next Wave of Challenges*. Washington, World Bank Report No. 14469-AR .
- Estache, A., A. Goldstein and R. Pittman (2001), "Railways Reform in Brazil", *The Journal of Industry, Competition and Trade*, Vol. 1 (2), 203-235.
- Estache, A. (2001), "Privatization and Regulation of Transport Infrastructure in the 1990s", Washington, *World Bank Research Observer*, Vol. 16 (1), 85-108.
- Galal, A., L. Jones, P. Tandon and I. Vogelang (1994), *Welfare Consequences of Selling Public Enterprises: an Empirical Analysis*. Washington, The World Bank.
- Gomez-Ibañez, J.A. and J.R. Meyer (1993), *Going Private: The International Experience with Transport Privatization*. Washington, The Brookings Institution.
- Meggison, W.L. and J.M. Netter (2001), "From State to Market: A Survey of Empirical Studies on Privatization", *Journal of Economic Literature*, 39, No. 2, 321-89.
- Oum, T.H., W.G. Waters II and C. Yu (1999), "A Survey of Productivity and Efficiency Measurement in Rail Transport", *Journal of Transport Economics and Policy*, 33 (1), 9-42.
- Ramamurti, R. (1997), "Testing the Limits of Privatization: Argentine Railroads", *World Development*, Vol. 25, December, 1793-93.
- Rebelo, J. (1999), "Reforming the Urban Transport Sector in the Rio de Janeiro Metropolitan Region: a Case Study in Concessions", Policy Research Working Paper, No. 2096. Washington, World Bank.
- Thompson, L. (2000), "Argentine Freight Concessioning: Achievements and Challenges", Washington, World Bank (mimeo).
- Thompson, L. (2001). Private Investment in Railways: Experience from South and North America, Africa and New Zealand. Washington, World Bank (mimeo).
- Trujillo, L., E. Quinet and A. Estache (2002), Dealing with Demand Forecasting Games in Transport Privatization, *Transport Policy* (forthcoming).
- Van de Velde, D., (ed) (2000). *Changing Trains: Railways Reform and the Role of Competition: The Experience of Six Countries*, Oxford Studies in Transport Series.