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Privatisation, Liberalisation and the Portuguese Telecommunications Sector: a Social Cost-Benefit Analysis[1]

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Abstract:

The Portuguese Telecommunications industry has experienced overwhelming changes in the last two decades. In this paper we summarise the main economic indicators of the Portuguese Telecommunications industry, and report a social cost-benefit analysis of the privatisation and liberalisation of the Portuguese Telecommunications sector between 1993 and 2004. Our results show that all agents benefited from the reforms, in particular the government and consumers from international and mobile segments. International customers may have benefited from price "rebalancing" schemes and mobile consumers were benefiting from increased competition. Net efficiency gains seem to have ranged from 6% (in the strong-pro public scenario) to 32% of annual total PT's wireline and mobile revenues (in the strong pro-privatisation scenario).

Jel Classification: H43**,** L32. L33, L5, L96.
Key words: Telecommunications, Portugal, Privatisation/Liberalisation, Welfare analysis

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1. Introduction

The Portuguese telecommunications sector has undergone dramatic changes during the last two decades. Until the early 1990s, the domestic telecommunications network was small and provided exclusively by two public monopolies - CTT and TLP. Nowadays, after the merger and divestiture of these public enterprises and the increasing liberalisation of the (fixed and mobile) network, the Portuguese telecommunications sector resembles any other in Europe. Multiple new firms now operate in the telecommunications sector, offering expanded telephone and other network services.

Which are the benefits (costs) of these reforms? Did the increased competition and the privatisation generate a rise in the productivity? Were the efficiency gains reflected in call prices? What happened in terms of profitability of the incumbent and new firms? Were there any economic agents that became worse off after the reforms?

The aim of the study was to evaluate the social welfare impact of privatisation and liberalisation of the Portuguese telecommunications sector. In particular, we wanted to infer how the aggregate social gain (cost) is distributed among the different economic groups - consumers, firms and government. Our study is in similar vein to Newberry and Pollitt (1997), who evaluate the restructuring and privatisation of the electricity industry in England and Wales. Hence, for the evaluation of the impacts of the reforms adopted the same methodology - a difference-in-differences approach. The essence of this approach is to construct (simulate) for each variable a counterfactual behaviour correspondent to the hypothetical scenario of no reform in the telecommunications sector. Therefore, the impact of the reform is isolated by the difference between the effective (observed) and simulated values before and after the implementation of the reform. The change in the aggregate welfare is found by the sum of the net changes in the welfare levels of the individual groups.

This study used data from four different sources. We used data available from the International Telecommunications Union for the period 1975-2003, from OECD Communications Outlook 2005, from telecommunications company annual reports for the period 1994-2004 and from ANACOM Statistics Yearbooks.

Until now, there is little evidence addressing the Portuguese telecommunications' reforms economic impact. Therefore, the findings of this study can provide more concrete policy advice than has previously been available.

This paper is structured as follows. Section 2 describes how the Portuguese telecommunications sector evolved since the formation of the public telecommunications group Portugal Telecom (PT here after) in 1994 until 2004. We highlight in particular changes occurred in the regulatory regime and competition environment.

Section 3 describes the methodology to be applied. Section 4 implements and discusses the results of the approach. Section 5 closes the paper by summarising the main lessons of this study.

2. The Portuguese Telecommunications Sector

Although telephone and telegraph services have been provided in Portugal since 1882, the sector was fragmented until 1994. The Portuguese Government formed Portugal Telecom (PT, hereafter) in June 1994 to consolidate the telecommunications services through the merger of three companies wholly-owned by the Portuguese Government – Telefones de Lisboa e Porto, Telecom Portugal, S.A. and Teledifusora de Portugal.[2] Together, these firms were responsible for providing domestic (both local and long distance) and part of the international telecommunications services and for providing the infrastructure for the provision of television broadcasting services. In April 1995, PT acquired Companhia Portuguesa Rádio Marconi which allowed for the full integration of intercontinental telecommunications services.[3]

As a result of this process, PT is the principal multiproduct firm in the Portuguese telecommunications sector. Its main outputs include wireline telephone services (both local, domestic long distance and international telephone services), paging services (TLM and Contactel), data communications (Telepac), leased lines, telex and telegraph services, mobile telecommunications and cable television and direct-to-home satellite television services (TV Cabo). In addition, PT has also own interests, which were significantly expanded after 1998, in a number of telecommunications service operators and providers in Macau, Brazil and Africa.

In the public wireline telephone services, PT used to operate under a monopoly position ("the Concession") since the Portuguese Government granted the exclusive right for a term of 30 years to provide domestic and international public voice telephone services and to install and operate the public telecommunications network infrastructure in Portugal.[4] In the mobile segment, TMN (the PT mobile company operating in the market since 1989) already faced direct competition from Telecel (a firm member of Vodafone group operating in Portugal since 1991). The data communication (data transmission and added services) and

[2] Telefones Lisboa e Porto provided local telephone services in Lisbon and Oporto metropolitan areas; Telecom Portugal S.A**.,** which was organised in December 1992 to assume responsibility for the telecommunications business of CTT (Correios, Telégrafos e Telefones). It provided all of the telecommunications services in Portugal outside the Lisbon and Oporto metropolitan areas, including local and domestic long distance services and international services between Portugal and European countries and Algeria, Tunisia and Morocco. Teledifusora de Portugal operated the infrastructure for the provision of television broadcasting services.

[3] Marconi had provided since 1926 all intercontinental telecommunications services with other than to European countries, including the countries of the former Soviet Union, Algeria, Tunisia and Morocco.

[4] Assets held PT that are part of basic telecommunications network are treated as being within the public domain of the Portuguese Government, to which are required to revert without compensation upon the expiration or termination of the "Concession".

cable television segments were liberalised in 1990 and 1991 respectively, although new firms did not stay for long in the market[5].

PT was privatised over five stages between 1995 and 2000 (Table 1). In each stage, the Portuguese Government offered and sold ordinary shares in domestic and international markets to PT's employees, small subscribers, Portuguese emigrants and retail investors (general public). Beyond this public offering, PT also directly sold ordinary shares to the Company's strategic partners.[6] PT has two classes of stock: ordinary shares and A shares.

Table 1 Privatisation in the Portuguese Telecommunications Sector

Date	Stage	Method	Proceeds (10^6 Euros)		Capital privatized (%)	
01-06-1995	1ª	Public Offer	373.4		14.5	
01-06-1995	1ª	Direct sale	338.9	712.3	12.8	27.3
11-06-1996	2ª	Public Offer	212.8		6.7	
11-06-1996	2ª	Direct sale	517.3	730.1	15.1	21.8
09-09-1997	3ª	Public Offer	626.6		9.1	
10-09-1997	3ª	Direct sale	1184.9	1811.5	16.9	26.0
12-07-1999	4ª	Public Offer	267.1		3.8	
12-07-1999	4ª	Direct sale	680.6	947.7	9.6	13.4
04-12-2000	5ª	Public Offer	379.5		3.6	
04-12-2000	5ª	Direct sale	282.4		2.5	
04-12-2000	5ª	Reference sale	294.9	956.8	2.6	8.7
		Total		5158.4		97.2

Source: Ministry of Finance

Despite this ownership transfer, since the Government holds all of the A Shares, it has the right to veto a number of important actions of PT, including the policy of dividends distribution and capital increases. In

[5] Extracted from the APDC (Associação para o Desenvolvimento das Comunicações) journal's editorial commemorative of the 20th anniversary of this association.

[6] PT entered into strategic alliances with British Telecom (UK since 1997), MCI(since 1997), Telefonica (Spain, since 1997), Atlantic Alliance (Telebras, Brazil, 1997), Alliance Brisa, Alliance Microsoft, consortium composed of International Business Machines (IBM), CGI (a Canadian technology group) and Case (a Portuguese information services) in 1999, Alliance with BES and CGD (2000) These alliances aim to modernize and prepare PT for a fully competitive environment, by improving the quality and portfolio of available services and transferring technology and expertise from operators accustomed to fully liberalized markets.

addition, the Government vote is required to elect the Chairman of the Board of Directors and one or two other Directors. The Government regulates the sector according to the Basic Law of Telecommunications (law 91/97 of August 1, 1997)[7] and other legislation besides regulating the company in accordance with the Concession and licenses granted to PT. The regulation is exercised primarily through the ANACOM created in 2001 (formerly Instituto das Comunicações de Portugal or ICP, a regulatory agency created in 1989) accountable to the Ministry.

In conformity with EU requirements[8], ICP granted a new cellular telephone license in 1997 to Optimus, which began its commercial operations in 1998. In January 1, 2000, PT lost the exclusive right to provide international public switched wireline telephone services or to install and operate the related telecommunications networks in Portugal. As result of the opening/liberalisation of fixed network, there were 14 licensed wireline access providers in 2000 and 21 in 2004 (source: ICP/ANACOM).

Table 2 Maximum nominal change allowed by Price Convention

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Overall weighted average prices for fixed services	2.2%	CPI-2%	CPI-2%	CPI-4%	CPI-4%	CPI-4%	CPI-4%	CPI-3%	CPI-2.75%	CPI-2.75%
. installations charges	7.5%	CPI+6%	CPI+6%	CPI-2%	CPI-2%	CPI-2%	CPI-2%		CPI-2.75%	CPI-2.75%
. each tariff in domestic services	7.5%	CPI+6%	CPI+6%	CPI-2%	CPI-2%	CPI-2%	CPI-2%		CPI-2.75%	CPI-2.75%
. each tariff in international services	7.5%	CPI+6%	CPI+6%	-	-	-	-		-	-
.leased lines		-0.75%	Not subject							

Source: PT annual reports.

The regulatory agency is also engaged in the pricing policy of the sector. PT, ICP/ANACOM and the Autoridade da Concorrência (formerly Direcção Geral para a Comércio e da Concorrência or DGCP) are the parties of three-year Pricing Conventions. Each Price Convention establishes the principles for determining the prices of a certain basket of services - fixed telephones, leased circuits, interconnection between fixed telephone and complementary services and certain other services. These Price Conventions fix what has been known in the UK, as the RPI-X form of price cap regulation. Price cap regulation puts a ceiling on the average price increase for a certain basket of services given by the retail price index minus a factor designated by X. In Portugal, price caps

[7] This law was enacted to implement the European Commission's legal framework for opening the telecommunications sector to full competition, including public switched fixed line telephone services and related infrastructure, as of January 1, 2000.
[8] The EU requires the liberalisation of mobile services telephone (the "Mobile Services Directive") in 1997.

were imposed on a basket and on specific telecommunications segments based on the expected inflation rate (Consumer Price Index or CPI). There was, however, considerable freedom to set prices within the basket. Services not included in the basket are unregulated. Table 2 illustrates the results of the four Price Conventions reached.[9]

We now describe the main developments occurred in the Portuguese telecommunications sector between 1994 and 2004. More specifically, we look at (1) density/penetration indicators of different telecommunications services, (2) output and its structure, (3) prices, (4) revenues, (5) investment and profitability and (6) telecommunications labour force and productivity.

2.1 Density/penetration indicators of telecommunications services

The figures displayed in Table 3 shows that all telecommunications services experienced an increase after the formation of PT in 1994. In the fixed network, the number of main lines rose on average 2.8% per year, between 1993 and 2003. The density of subscribers also increased during the period under analysis. Despite this, the Portuguese density remains still below the EU25 average. The quality of the service has also improved as the number of faults has decreased markedly, stabilising around 11 faults per 100 main lines in 1999.

The most dramatic changes occurred in the cellular mobile sub-sector. The mobile service started operating in Portugal in 1989, but the density of mobile subscribers outnumbers the EU15 averages from 1997 on. It has also overtaken the density of the wireline main lines. TMN also "survived" the market entry of the third operator, Optimus. Indeed, TMN´s market share declined after Optimus entrance, but this slowdown is merely temporary as TMN dominates (obtained its highest market share) the mobile service after that. Besides that, according to the Herfindahl-Hirshman index, the market is still highly concentrated.

The bottom part of Table 3 shows the progress in the introduction of technological innovations in the telecommunications sector. "Multi-purpose" networks such as integrated services digital networks (ISDN), asymmetric digital subscriber lines (ADSL) or cable television replaced specialised networks for signal transport.

[9] The price convention does not permit PT to increase the weighted average nominal prices to leased lines prior to the end 1997. Prices for leased circuits to providers of mobile and data communications are currently much lower than prices for retail subscribers. In the event PT and the providers cannot reach an agreement, ICP can determine the prices, which happened in 1996. In 1997, leased lines are not subject to the New Pricing Convention

Table 3 Density indicators in the Portuguese telecommunications sector, 1993-2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Fixed Main Lines												
Total main lines in 10^3	3,260	3,474	3,643	3,822	4,002	4,117	4,230	4,314	4,383	4,355	4,279	4,238
Main lines per 100 inhabitants	33	35	37	38	40	41	42	43	42	42	41	40
EU 15/25 main lines per 100 inhabitants					53	54	55	52	52	49	50	51
Waiting list for main lines in 10^3	57	17	6	8	9	10	26	…				
Telephone faults per 100 main lines	52	46	52	24	21	15	11	11	12	10	10	
Percent of faults repaired within 24 hrs	90	91	91	92	92	85	89	89	76			
Mobile												
Total subscribers in 10^3	101	174	341	664	1,507	3,075	4,671	6,665	7,978	8,529	9,351	9,959
Subscribers per 100 inhabitants	1.0	1.8	3	7	15	31	47	66	77	83	90	95
TMN market share			50%	50%	51%	46%	45%	44%	49%	52%	52%	51%
HHI			0.50	0.50	0.50	0.42	0.37	0.36	0.41	0.45	0.45	
EU15 Subscribers/100 inhabitants	2	4	6	9	14	23	40	62	73	79	85	91
Other Networks and Services in 10^3												
Leased circuits	30	35	34	36	39	48	57	54	63	61	62	
ISDN channels	0	11	38	82	174	306	471	644	817	861	857	
ISDN subscribers	0	2	8	20	48	90	140	195	251	279	282	
Cable TV subscribers	9	18	58	171	383	596	740	925	1,119	1,262	1,334	1,418
Cable modem TV subscribers						0	0	25	94	207	316	
DSL Internet subscribers								0	3	52	184	
Internet subscribers					89	173	645	2,111	3,459	5,165	7,211	

Source: ITU , OECD Communications Outlook 2005 and PT annual reports, Anacom.

2.2. Output

Table 4 shows the traffic in the fixed and mobile networks between 1993 and 2004. The most remarkable change occurred in the consumption of domestic telephone and mobile services. It seems clear from Table 4, that these two services became almost substitute. Indeed, while the domestic traffic fell significantly from 1998 onwards, coinciding with the entry of the third mobile operator in the market and the liberalisation of the fixed line on the 2000, the mobile traffic grew exponentially in the same period.

Table 4 Traffic in the fixed and mobile networks, 1993-2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Originated in fixed line network, 10^6 minutes												
Domestic	n.a.	n.a.	n.a.	11,167	11,124	10,633	9,972	8,933	7,431	6,480	5,841	5,236
International	n.a.	n.a.	n.a.	308	343	384	410	413	411	402	382	372
Wireline-mobile	n.a.	n.a.	n.a.	285	460	743	1,083	1,290	1,215	1,119	1,023	918
Internet	n.a.	n.a.	n.a.	0	143	1,100	2,800	5,630	6,920	6,581	5,023	3,151
Data and other	n.a.	n.a.	n.a.	63	84	96	114	379	1,319	1,758	2,294	2,673
Total		9,078		11,823	12,154	12,956	14,379	16,645	17,296	16,340	14,563	12,350
Mobile traffic												
10^6 minutes	137	255	436	787	1,550	2,758	4,805	8,126	8,691	12,917	13,673	14,486
10^6 calls	53	177	323	688	1,550	2,707	3,984	5,467	5,712	7,645	7,881	8,191
10^6 SMS (written messages sent)								550	1,529	2,089	2,294	2,841
10^6 MMS (mltimedia messages sent)											3	20

Source: PT annual reports, Anacom

At the same time, the use of the wireline to internet and data communications also increased significantly. But, after 2001, wireline to Internet traffic decreased as a consequence of a decline in consumers' preference for dial-up Internet access services.

2.3. Prices

We now turn to evidence on price trends. Table 5 shows the trend in current prices for the fixed network over the period 1993-2004, while Figure 1 shows them in constant prices. Over the years, we observe that the tariffs were rebalanced, mainly according to distance. In fact, the most distant calls, such as national and international, experienced the most important declines in particular after 1997. At the same time, local and regional prices tend to converge over time. This price adjustment, with the most distant calls declining the most, is in line to what has been observed in British Telecommunications between 1985 and 1990 (BT was privatised in 1984), see Florio (2003), although BT preferred to relatively increase the fixed costs (installation fee and monthly subscription) than local calls.

Table 5 Price (current in Euros) of telecommunications services, 1993-2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Fixed network (retail prices)												
Installation fee	n.a.	n.a.	71.33	73.55	76.34	79.24	71.83	77.69	74.41	71.83	71.83	71.83
Monthly subscription	n.a.	n.a.	8.62	8.89	9.22	9.57	10.47	12.08	12.27	11.85	12.30	12.66
Call prices[a)]												
. Local	0.05	0.05	0.05	0.06	0.06	0.10	0.09	0.13	0.12	0.12	0.12	0.13
. Regional	0.28	0.28	0.33	0.35	0.39	0.34	0.28	0.31	0.24	0.23	0.21	0.16
. National	1.04	1.04	1.09	1.06	0.97	0.77	0.60	0.42	0.35	0.33	0.29	0.20
. International												
EU, Switzerland, Norway and Morocco	0.68	0.68	0.69	0.62	0.56	0.43	0.34	0.29	0.28	0.27	0.27	0.27
US	1.06	0.99	1.02	0.91	0.79	0.53	0.34	0.30	0.29	0.28	0.28	0.28
Brazil	1.63	1.45	1.42	1.31	1.18	0.95	0.63	0.67	0.59	0.57	0.57	0.57
Mobile services[c)]												
Installation fee	44.9	42.4	42.4	42.4	42.4	0						
Monthly subscription	32.4	32.4	29.7	29.7	28.7	24.8	10	10	10	-		
Call prices												
. Peak prices	1.08	1.08	1.01	1.03	0.99	0.78	0.71	0.98	1.08	0.48		
. Off-peak prices	0.56	0.56	0.52	0.52	0.37	0.71	0.57	0.77	1.08	0.48		

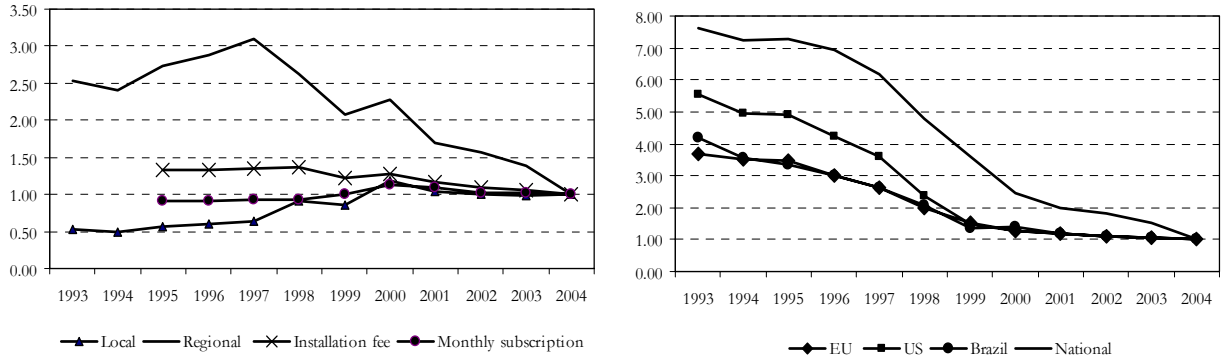
Source: PT annual reports, ITU database.

Notes: a) Peak rate tariffs per 3 minutes call, excluding VAT.

b) Prices are greater in 2000 than in previous periods due to the new per-second pricing.

c) TMN prices

Figure 1 Price trends in the fixed network, 1993-2004



In the mobile sector, price competition has increased appreciably since Optimus entered in the market in September 1998. Both TMN and Telecel have lowered prices in response to price reductions by Optimus. Gagnepain and Pereira (2005) show that the averages prices of TMN and Vodafone are co-integrated and have a

downward break in 1997. As the mobile telephone charges are not regulated, they are expected be more sensitive to changes in the competitive environment, compared to wireline charges.

2.4. Revenues

Table 6 Revenues in the Portuguese telecommunications sector, 1993-2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Revenues,10^6 Euros (2004 prices)	2,607	2,589	2,875	3,726	4,421	4,337	5,392	6,488	7,584	7,487	7,413	n.a.
PT market share	100%	100%	100%	83%	78%	83%	71%	94%	85%	81%	82%	
Mobile services, 10^6 Euros (2004 prices)	152	257	447	781	1,257	1,495	1,758	2,275	2,945	3,089	3,885	n.a
PT market share	46%	43%	35%	34%	46%	53%	49%	53%	48%	50%	42%	

Source: ITU and PT annual reports

The total revenues boosted between 1993 and 2003. Indeed, during this period, total revenues rose in real terms 11% on average per year. This boost was also accompanied by a remarkable reversal in the structure of total revenues. While in the early 90s, total revenues were mainly driven by the telephones fixed line revenues, one decade later they were composed essentially of mobile network revenues. Telephone revenues lost gradually their importance in favour of the mobile and other services whose magnitude has been increasing steadily.

Figure 2 breaks down PT total revenues according to its main business areas classified into five categories. The wireline category refers to telecommunications services that are based on the use of the wireline network. It consists of wireline services for retail customers (including public domestic and international call services), wholesale services including leased lines, transmission of TV and radio signal and internet interconnections and telecommunications equipment. The mobile category refers to all mobile services, such as voice, data and internet-related services through TMN. The multimedia category offers multimedia and internet-related services for the residential market. It includes cable and satellite television, broadband internet, TV programming, cinema distribution (Lusomundo Audovisuais and Lusomundo Cinema), and the production and distribution of daily newspapers, news, radio, etc. Mobile Brazil refers to the mobile services offered through VIVO in Brazil. Other is a residual category and consists of other international investments and instrumental companies of PT.

Figure 2 PT revenues by business, 1993-2004

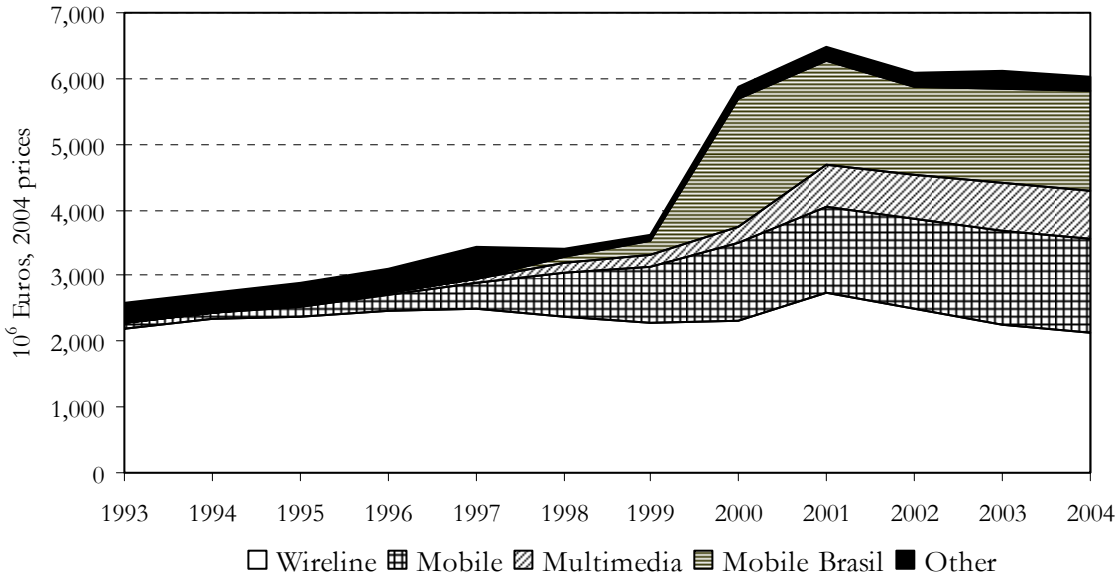


Figure 2 illustrates the pattern already detected in the previous table. Moreover, it clearly shows that 1999 is the turning year in terms of increase in total revenues corresponding to the investments in Brazil. The magnitude of the wireline business has been declining, in particular after the liberalisation of the fixed network in 2000. Note that this decline would have been sharper and earlier had this category not included data communications services such as Internet that uses telephone wireline. Despite this reduction, the wireline segment still represents in 2004 a substantial part, more than one third, of the total revenues. Mobile revenues also grew, representing 25% of total revenue in 2004. Finally, multimedia services also became very widespread representing more than 10% of total in 2004.

2.5 Investment and profitability

Florio (2003) postulated that private firms are more efficient than public firms when selecting technologies and consequently achieve higher levels of capital productivity than their counterparts. Newbery (2001) uses the World Bank database to study a variety of performance indicators of a wide range of public enterprises in countries with different development levels. This author concludes that in most of the countries analysed, public firms are more capital intensive but present lower rates of profitability. The results seem to be consistent with

other empirical literature, which finds evidence of public enterprises' low productivity and/or under-pricing of the output.

The public sector has the difficulty of raising tariffs enough to face investment needs (e.g. in result of political pressure groups influence, or because there are social equity objectives of not excluding poorer consumers in the access to public utilities) combined with difficulties in providing the necessary capital through loans implies public utilities tended to exhibit high capital expenditures (Newbery, 2001).

Telecommunications are a capital-intensive utility with a rapid demand growth, and high investment requirements, which was privatised at the edge of the industry's technological development.

In this study, we use PT published information on capital expenditures to determine some statistics comparable with Newbery's. To accomplish this aim we follow the same methodology of the mentioned work to estimate capital stock. The initial capital stock was determined as the initial net book value of fixed assets. Perpetual inventory method was used adding successive gross investments to the initial stock and depreciating the resulting capital at 4 percent per annum. The PT's capital-output ratio is then the annual capital stock divided by the correspondent value added. The average rate of return (ROR) is the gross rate of return, and it is defined as gross profits divided by gross capital stock. Newbery (2001) analysis of public enterprises investment and profitability by countries are summarised in Table 7. PT's investment and profitability estimates are presented in Table 8.

Table 7 Public enterprises investment and profitability*

Country*	Capital-Output average (ratios)		Average ROR (%)	Investment/Value Added		
	1979-91	1985-91		1978-85	1986-91	1978-91
Argentina	9.7	9.5	-5.6	55	30	40
Brazil	11.2	7.7	3.0	117	39	72
Chile	2.7	2.8	32.1	22	23	23
Turkey	1.0	0.8	33.5	142	81	97
India	4.9	4.9	8.7	79	61	68
Average (unweighted)	5.1	4.9	11.7	63.3	47.2	52.4

* Table adapted from Newbery (2001)

PT's capital expenditures (investment) represent a fraction between 15% and 35% of the firm's value added in the period from 1994 until 2004. This estimate is well within the range defined by the lower segment of Newbery's results. PT, Chile and Argentina's public enterprises seem to have a similar behaviour regarding this investment indicator.

Table 8 PT investment and profitability, 1994-2004

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Investment/Value Added	26	31	30	29	34	35	35	32	26	15	17
Capital stock/Output ratio	1.72	1.85	1.87	1.87	2.00	2.09	1.53	1.61	1.84	1.88	1,96
Profitability (ROR) (%)	29	26	26	25	25	24	27	25	23	22	22

The public firms' average investment/value added ratio published in Newbery study (Table 7) is considerably higher than PT's estimate calculated here. If Portuguese public firms´ investment decisions followed the average Newbery's results pattern, and if PT remained public owned, PT would have had a stronger investment effort whenever compared with the same level of value added.

PT capital stock amounted to 172% of output in 1994 and then progressively augmented to about 209% in 1999. In this year, PT's investment in the wireline network started to fall (Table 10). As a percentage of output capital stock dropped from the 1999 peak to only 153% in 2000, and then started augmenting again until 2004 where it reached 196%.

Once again it seems that this estimate is well within the range defined by the lower segment of Newbery's results. Turkey and Chile public firms' investment in the period 1979-1991 has similar estimates to PT's values for the period 1994-2004. But average capital/output for public firms seems to be much higher than PT's ratio. This result suggests that if PT remained a public firm it would have invested more.

Table 9 Portuguese electronic communications investment, 1994-2004

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Telecommunications Investment	n.a	n.a	n.a	n.a	1,383	1,425	1,516	1,614	1,118	604	513
Transmission network	n.a	n.a	n.a	n.a	n.a	432	265	329	194	108	72
Access network	n.a	n.a	n.a	n.a	n.a	717	635	568	322	233	236
Switching equipment	n.a	n.a	n.a	n.a	n.a	96	90	103	115	67	68
Other	n.a	n.a	n.a	n.a	n.a	181	526	615	487	197	137
Electronic Communications Investment	764	1,227	1,104	1,500	2,011	2,224	2,547	2,176	2,331	833	1,016
PT share in Communications Investment (%)	78	59	71	57	62	58	62	68	53	83	77
EC Investment as a % of Portugal GFCF	3.21	4.97	4.18	5.22	5.00	5.38	6.60	5.70	6.50	2.70	3.50

Source: Anacom Statistical Yearbooks and PT annual reports
2004 prices, 10^6 Euros

Note: PT capital expenditures were determined under proportional consolidation of TCP in 1998 and 1999; full consolidation of TCP in 2000-2002; proportional consolidation of Vivo in 2003 and 2004.

On average PT's gross profits represent 29% of its gross capital stock (ROR) in 1994 and then progressively declined until 1999. ROR declines again after 2000 until 2004. Privatisation and liberalisation of the Portuguese telecommunications market may help explaining these results. From Table 8 it is possible to admit that PT's rate of return could be somewhat smaller under public ownership as PT's estimates are all higher than 21% and public firms surveyed in Newbery (2001) showed on average an 11.7% estimate.

Portuguese telecommunications investment in transmission and access network declined from 2001 until 2004 (Table 9) but it still represents a significant fraction of total capital expenditures in the new electronic communications environment. Over 1998-2002 PT's accounts registered a peak in its capital expenditures. Although in this period PT's wireline investment declined. Investments in the mobile segment in Portugal (augmenting until 2000 and remained high until 2002) and abroad (Brazilian mobile investments reached its higher levels in 2000 and 2001) as well as the Multimedia investment's peak in 2000 and 2001 determined the PT's investment performance.

Table 10 PT capital expenditures, 1994-2004

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Wireline businesses	526	636	638	653	662	563	448	444	660	175	206
Domestic mobile	30	37	58	102	235	325	416	320	309	178	159
Multimedia	12	30	71	71	63	71	122	162	86	61	81
Other	30	26	5	15	33	29	93	43	76	101	73
Brazilian mobile	0	0	12	8	45	116	509	517	96	174	265
PT Investment	597	728	785	849	1,038	1,104	1,588	1487	1,228	689	783

Note: capital expenditure on tangible and intangible assets, 2004 prices. 10^6 Euros

2.6 Labour force adjustments and productivity

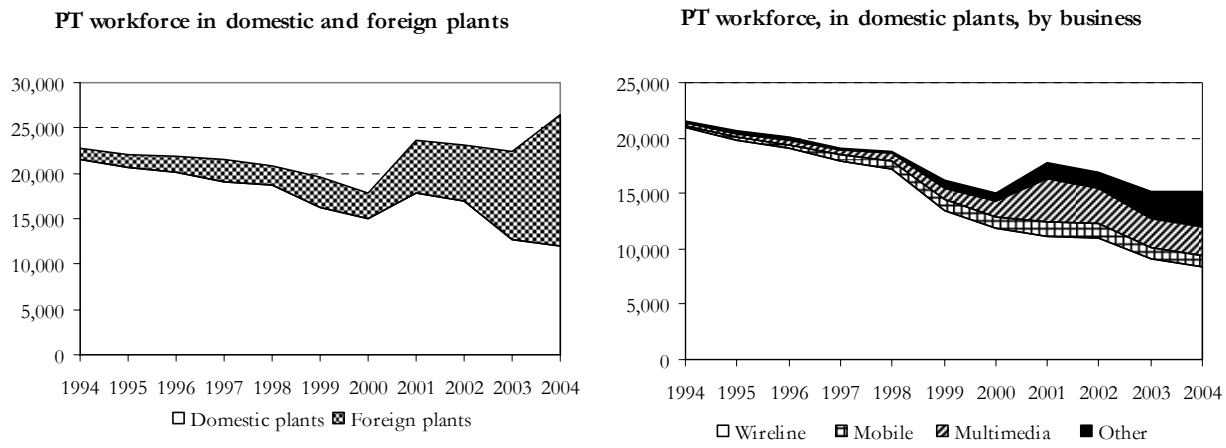
The main workforce adjustments that occurred in the Portuguese telecommunications sector during the period 1993-2004 are shown in Table 11. Four important results arise from this table. First, despite all reforms described earlier - privatisation and the liberalisation/opening of the sector to new firms – PT still dominates the employment in the sector, as the share of PT in domestic plants over the sector in 2004, 98%, attests it (see line (6)). However, there has been a continuous decline in the PT domestic workforce (starting with privatisation in 1995) particularly notable after 1998. Indeed, between 1993 and 2004, PT lost on average more than 550 employees per year, (see Figure 3). This reduction occurred mainly in the wireline segment, which has been partially offset by the growing of mobile and multimedia businesses after 1998 (Figure 3). The employment in the foreign plants has also been rising steadily, representing in 2004 half (49%) of the total employment of PT.

Table 11 Compensation and employment in the Portuguese telecommunications sector, 1993-2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
(1) Total Portuguese Telec. employment	22,520	22,761	21,243	20,900	20,807	21,476	19,647	18,481	18,652	18,140	15,395	15,405
(2) PT employment	21,394	22,807	22,023	21,961	21,524	20,856	19,654	17,811	23,575	23,106	24,872	29,535
(3) domestic plants	21,394	21,564	20,636	20,034	19,093	18,761	16,188	15,054	17,822	16,890	15,222	15,105
(4) foreign plants	n.a.	1,243	1,387	1,927	2,431	2,095	3,466	2,757	5,753	6,216	9,650	14,430
(5) = (2)/(1)	0.95	1.00	1.04	1.05	1.03	0.97	1.00	0.96	1.26	1.27	1.62	1.92
(6) = (3)/(1)	0.95	0.95	0.97	0.96	0.92	0.87	0.82	0.81	0.96	0.93	0.99	0.98
PT total personnel costs, 10^6 Euros (2004 prices)												
Total	565	582	596	630	623	640	632	682	755	759	746	746
% of turnover	0.22	0.21	0.21	0.20	0.18	0.18	0.16	0.11	0.12	0.12	0.12	0.12
% of operating costs	0.28	0.28	0.28	0.28	0.24	0.25	0.23	0.14	0.15	0.16	0.16	0.16
PT personnel costs per employee, 10^3 Euros (2004 prices)												
Total	26	26	27	29	29	31	32	38	32	32.	30	25
Decomposition of the variation of PT total personnel costs												
Absolute variation in total wage costs		17	14	34	-7	17	-8	50	74	3	-12	0
Price effect $(W_1-W_0)*L_1$		-20	34	36	6	36	29	109	-147	18	-70	-140
Quantity effect $(L_1-L_0)*W_0$		37	-20	-2	-13	-19	-37	-59	221	-15	58	140

Source: (1) ITU database; remaining PT annual reports; n.a.- not available.

Figure 3 PT Employment, 1993-2004



In terms of compensation, wages per employee went up in real terms from 26,408 Euros in 1993 to 32,832 in 2002 and then fell down to 25,264 Euros in 2004. This trend should be read with care as it does not control for changes in the composition of the workforce either between domestic and foreign plants or among different skill groups. Despite that, the increase in the average wage between 1993 and 2002 of 24,3% is noticeable as it outnumbers the real compensation growth rate prevailing in the economy for the same period (16.1%).[10]

The bottom part of Table 11 illustrates the employment and average wage trends by decomposing the absolute variation of the wage bill (total personnel costs) in quantity (employment) and price (average wage) effects. The positive price effect explains most of the changes in the total personnel cost.[11]

Overall, considering both effects (employment and wages per employee) the wage bill increased 32% between 1993 and 2000, but less than total sales (turnover), which in turn led to a significant reduction of 10 percentage points in terms of share of turnover. In terms of comparison, PT has a lower share of labour costs on the turnover than BT in the period 1992-1999 (18% versus 28.3%).

[10] Source: Banco de Portugal. Also in the public sector wages grew 8% in real terms between 1993 and 2000 (source: Ministério do Emprego e Solidariedade Social, Quadros do Pessoal).
[11] In the decomposition W refers to average wage per employee and L stands for total employment.

Table 12 Labour productivity in the telecommunications sector, 1993-2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Revenue per employee, 10^3 Euros, 2004 prices												
Telecommunications sector	116	114	135	178	212	202	274	351	407	413	482	n.a.
PT	121	121	131	141	160	164	185	329	274	264	245	204
Wireline		112	120	129	139	138	168	196	244	225	249	256
Mobile		398	465	617	735	915	930	1,150	1,109	1,160	1,284	1,275
Multimedia		45	34	78	128	216	198	181	164	214	279	289
Other		1,249	1,756	1,949	4,076	812	140	232	126	150	106	71
Subscribers per employee												
Total fixed lines		166	184	201	223	239	313	365	392	394	471	510
Total mobile	143	196	310	505	970		1,370	1,826	1,942	2,105	2,356	
TMN			547	881	1,434	1,940	2,274	2,884	3,271	3,713	4,407	4,460
Access paths per employee												
Portugal	149	160	188	215	265	335	453	594	663	710	885	871
OECD			203		240		300		382	427	470	
UK			225		238		281		348	334	362	

Source: PT annual reports, ITU database and OECD Communications Outlook 2005

The Portuguese telecommunications labour productivity rised significantly between 1993 and 2004, regardless of the measure used for labour productivity: either the revenue per employee or number of subscribers or access paths[12] per employee (Table 12). Moreover, in late 90s labour productivity levels are above either OECD or UK average levels. Despite this fact, there are significant differences in labour productivity between the incumbent PT and the new firms and also among different business segments. For instance, while labour productivity (measured by the revenue per employee) grew on average 15,3% per year between 1993 and 2003 in the overall telecommunications sector, in PT it increased at much modest pace, 5.4% between 1994 and 2004. This is a result of the weak evolution of the labour productivity in the residual category "Other", since PT presents high labour productivity growth rates in the most recent businesses - mobile and multimedia – with annual growth rates of 12.3% and 20,5%, respectively. In the fixed line network, the annual rate of growth of labour productivity of 8.6% between 1994 and 2004, is comparable to 7.2% found by Bishop and Thompson (1992) for the UK in the period between 1980 and 1990. If we compare the number of subscribers per employee in fixed line with that of mobiles, we also conclude that the productivity increased the most in the mobile sector.

[12] Access paths is defined by OECD as the sum of all forms of access – including traditional fixed lines, mobiles subscribers, ISDN channels and DSL broadband subscribers.

3. Methodology

The social cost benefit methodology

A cost benefit analysis starts with a measurement of the quantitative impact on the economy with the project (privatisation of PT and liberalisation of the Portuguese telecommunications market) relative to the counterfactual of the economy without the project (public PT operating in a entry protected telecommunications market).

The economic impact can be assessed in efficiency terms by analysing productive efficiency (determining cost differences between the actual and counterfactual scenarios) as well as allocative efficiency (whether there is a Pareto superior welfare equilibrium). Following literature (Newbery and Pollitt, 1997, and Domah and Pollitt, 2001), we will ignore allocative efficiency for reasons of simplicity, as standard measures of deadweight loss seem to be relative small given the size of annual productive efficiency gains.

In this study we follow a methodology proposed by Jones, Tandon and Vogelsang (1990) for evaluating the welfare impact of the privatisation of public firms. These authors implemented it in Galal et al (1994), where they analysed twelve privatisation case studies, of which three were telecommunications firms (Bristish Telecom in England; Compañía de Teléfonos de Chile (CTC) in Chile and Teléfonos de México (Telmex) in Mexico).

The impact on social welfare is made up of two components. The first component is the difference between the social value of the firm under private operation (welfare after the firm's sale) and the social value of the firm under government operation (welfare before the sale). The second component is the sale value itself. Privatisation would be considered as socially worthwhile if the resulting estimated impact is positive.

Following this approach, and in order to estimate the social welfare impact of PT privatisation and liberalisation of its markets, we only need to estimate the difference between the actual path of costs under private ownership and the counterfactual path of costs. In the counterfactual scenario we have to determine what would have happened if privatisation did not take place and the telecommunications market were still protected from entry of new firms. To evaluate the cost savings due to efficiency gains we deduct the controllable costs (operating costs excluding depreciation) under private operation from counterfactual controllable costs.

Studying the distribution of gains, enable us to measure the restructuring impact over all economic agents and to evaluate the "fairness" of the achieved allocation. Following the literature (e.g. Galal et al (1994)), we considered three types of economic agents: consumers, producers and government. The consumers' welfare change is assessed through the difference between private and counterfactual revenues (Domah and Pollitt, 2001). Revenues can be obtained summing operating profits (pre-tax), depreciation and operating costs. The profits' difference (less differences in tax) in actual and counterfactual scenarios measures the welfare gains (or losses) of producers. Finally, the difference between actual and counterfactual taxes gives us the gains (or losses) of the government.

Counterfactual scenarios

In this analysis we split controllable costs into wireline and mobile controllable costs. Multimedia and foreign PT's mobile affiliates' businesses are excluded from this analysis. We use the immediate post-privatisation year as the base year and then assume various counterfactual costs' declines.

We calculate five possible counterfactual costs scenarios: 0, 1, 2, 3, 4 per cent for counterfactual wireline costs decline and 0, 2, 4, 6, 8 per cent for counterfactual mobile costs decline. We could use other counterfactuals, but for simplicity and comparability with literature we do not explore other scenarios.

Once the counterfactual costs are calculated, it is an easy task to find the differences between actual and counterfactual costs. The annual values estimated were aggregated on a present-value basis using different discount rates. The reference discount rate should be the Treasury's preferred discount rate in the data period (Domah and Pollit, 2001). We used discount rates varying from as low as 3 per cent to as high as 10 per cent. This procedure accounts for the sensitivity of the results and help to evaluate the robustness of the welfare estimates.

In this study we assume that the demand growth of all PT telecommunications services is the same in actual and counterfactual scenarios. Counterfactual total revenues result from the sum of counterfactual profits, counterfactual controllable and non-controllable costs and counterfactual depreciation charges. We stated before that public utilities tend to invest more, and that it was expected that PT's investment would be greater in counterfactual scenario, but for reasons of simplicity and admiting a possible pro-public impact in the results, we assume that the firm would invest the same amount in the actual and counterfactual scenarios. So, depreciation charges will be the same for actual

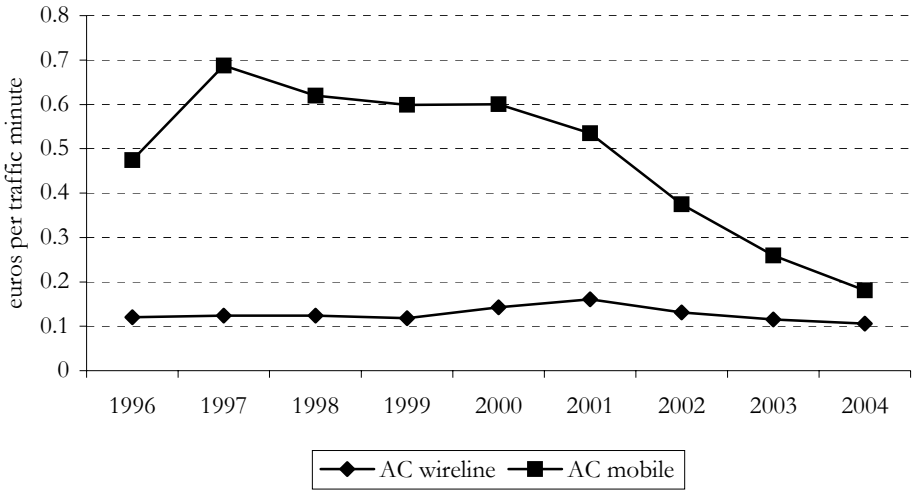
and counterfactual scenarios. Also non-controllable costs are assumed to reach the same magnitude in actual and counterfactual scenarios. Counterfactual profits (pre-tax) are calculated annually using the base year rate of return on working assets. We assume that in the immediate post-privatisation year actual and counterfactual working capital assets are equal and then counterfactual working capital assets grow at the actual demand growth rate.

Counterfactual taxes are estimated using a tax rate defined as the quotient of actual income taxes paid over operating profits. This tax rate is applied to the counterfactual operating profit in order to calculate counterfactual taxes. Actual less counterfactual taxes are summed on a present value basis to give us the government welfare change.

Actual Costs

To arrive at the efficiency gains we used PT published information on costs. We consider actual controllable costs as the sum of wireline and mobile costs. Wireline costs are extracted from PT Comunicações and PT Prime published annual accounts, and mobile costs correspond to TMN published accounts.

Figure 4 Actual controllable costs, 1996-2004



The actual wireline and mobile costs seem to present different growth patterns. While mobile costs rise immediately after privatisation and then declined until 2004, wireline costs remained quite stable during all sample years. Figure 4 demonstrates the trend in controllable costs per unit of traffic in 2004 real terms during all period of study. There seems to be a more clear relationship between the

mobile cost changes and the analysed changes in regulatory environment than between these and wireline costs.

This is the reason why we calculate five possible counterfactual costs scenarios: 0, 1, 2, 3, 4 per cent for counterfactual wireline costs decline and 0, 2, 4, 6, 8 per cent for counterfactual mobile costs decline.

Actual revenues and consumer surplus

We collected data from two PT's lines of business: wholesale and retail services. The wholesale line of business includes provision of interconnection, transmission of TV and radio signals, ADSL offer and leased lines to other telecommunications services providers. Retail services include PT Comunicações and PT Prime wireline services as well as TMN mobile services. Multimedia and foreign PT's mobile affiliates' businesses are excluded from this analysis.

Published PT's information on wholesale services shows only aggregate data on operating revenues and traffic. It aggregates all wholesale services sold to different telecommunications services providers such as cellular services providers, data service providers, Internet service providers or value added service providers. So, it can contribute to some criticism on the present welfare calculations. But we think that despite their limitations, they may give an idea of PT wholesale output and price variations after privatisation and liberalisation of the Portuguese telecommunications markets.

The other actual consumer welfare variation estimates presented here were obtained using publicly available PT retail services data. The operating retail revenues data correspond to PT Prime and PT Comunicações total retail wireline operating revenues data. In terms of physical output we used information on PT traffic originated in its fixed line network as a proxy to total retail traffic.

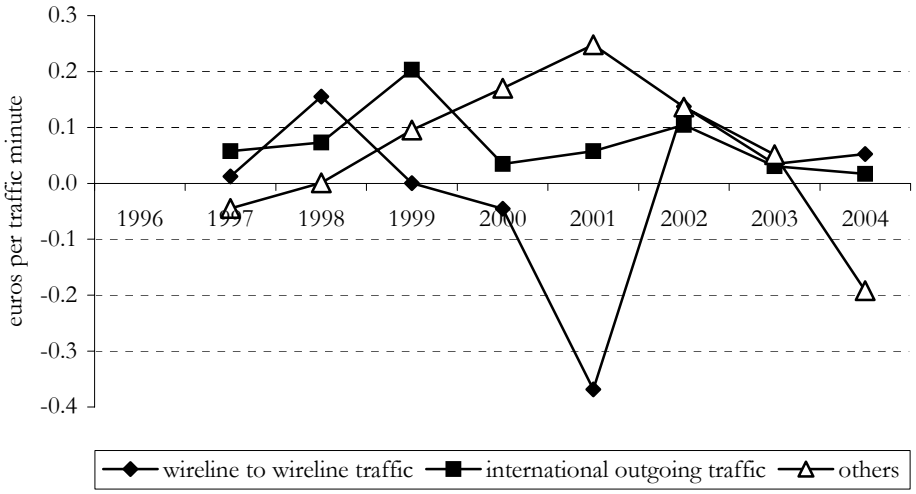
As there are other relevant economic issues, like "price rebalancing" economic effects, which demand more detailed information on retail services we subdivided retail data into "domestic", "international" and a residual "other" retail segments. There is some common agreement in the economic literature that liberalisation has a positive effect in reducing telecommunications cross-subsidisation (Cherry and Bauer, 2002). So, it is expected that "price rebalancing" schemes have taken place in Portuguese telecommunications prices. This means that international calls' prices have become lower at the same time as local or national calls prices have become higher, since the privatisation of PT.

To assess this actual price movements effects on consumer welfare we consider domestic and international traffic originated in fixed line network, more precisely we select "wireline to wireline"

traffic and "outgoing" international traffic measured in millions of minutes of conversation as retail quantity of output indicators. Accounting information on traffic charges revenues both for domestic and international calls is used to calculate average revenues per minute of conversation. The "other" retail estimates are calculated as the difference between total retail and the sum of "domestic" and "international" estimates.

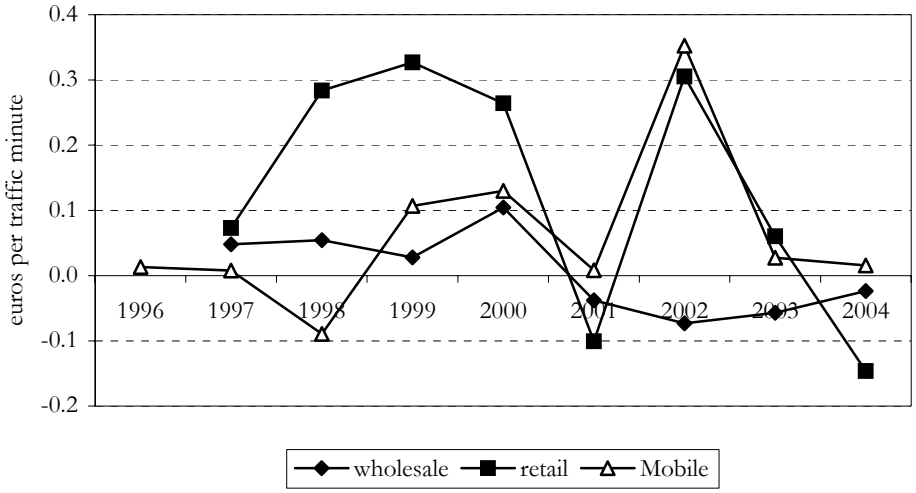
In order to derive Mobile consumers welfare variations after privatisation and liberalisation of Portuguese telecommunications, we collected data on TMN operating revenues (traffic, sales of handsets and subscription fees) and estimated TMN mobile traffic as a proportion of total Portuguese mobile traffic data published in ANACOM statistics. The estimated variation in consumers' welfare can be calculated multiplying annually the change in average traffic charges by previous year consumed traffic and deducting the correspondent annual subscription fees.

Figure 5 Actual benefits to retail consumers



There seems to be a clear positive gain on consumers' welfare during the after privatisation period. Estimated actual consumer surplus seem to have annually a positive level, improving more the international calls consumers' welfare than wholesale customers who may have experienced some losses during the more recent periods of analysis.

Figure 6 Actual benefits to consumers



See comments for fig above.

4. Empirical Results

Given our assumptions on counterfactual cost fall, we then calculate the efficiency gains of privatisation and liberalisation relative to each counterfactual public scenario. These results are shown in Table 13, where three different discount rates were used.

Table 13 Net efficiency gains

Counterfactual cost decline		Discount rate		
wireline	mobile	3%	6%	10%
0%	0%	11,269	11,904	12,818
1%	2%	8,759	9,251	9,957
2%	4%	6,468	6,824	7,335
3%	6%	4,375	4,605	4,931
4%	8%	2,465	2,575	2,726
Net efficiency gains expressed in millions of euros at 2004 prices				

Net annual efficiency gains range from 6 (in the strong pro-public scenario) to 32% of annual total PT's wireline and mobile revenues (in the strong pro-privatisation scenario). This is a result well between the efficiency gains range obtained by Vogelsang et al (1994). These authors calculated that BT's privatisation process generated annualised un-weighted benefits of 12 percent of the pre-divestiture annual sales (and annualised socially weighted benefits of 9.4 percent of these sales). Given their social cost-benefit analysis results, they concluded that privatisation was a success.

In the same study, these authors studied two more telecommunications privatisations cases occurred respectively in Chile and Mexico. The privatisations of Compañía de Teléfonos de Chile (CTC) in Chile and Teléfonos de México (Telmex) in Mexico were analysed. The privatisation results for Telmex indicate a net weighted loss of –13.3 percent of pre-divestiture annual sales. By contrast, CTC privatisation resulted in a success with a net gain of 142.5 percent of annual pre-divestiture annual sales.

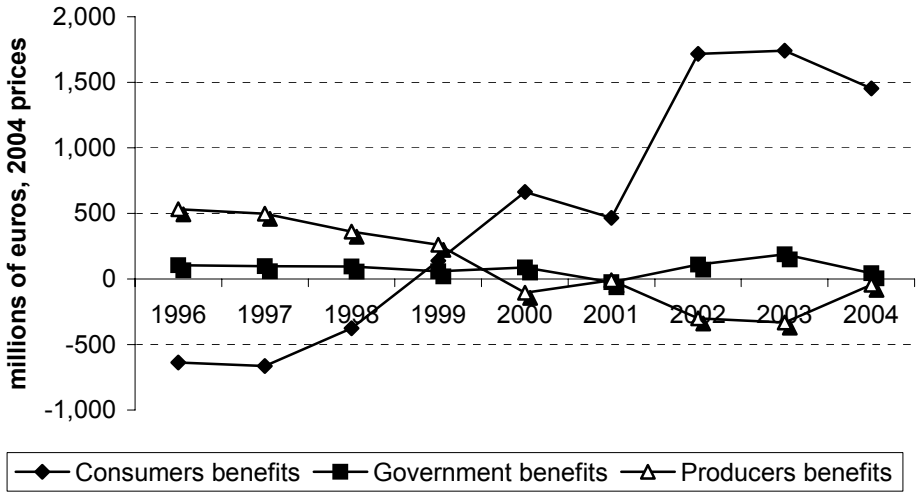
For each discount rate we then distribute net efficiency gains to the three defined types of agents. Net efficiency gains distributed to the government and to producers do not vary with counterfactual scenarios. This is a result of the methodology used to derive the distributional effects, where revenues are calculated as a residual, summing operational profits, depreciation and net operational costs.

Table 14 Distribution of net efficiency gains from privatisation and liberalisation

	Discount rate		
	3%	6%	10%
0% cost decline (strong pro-privatisation scenario)			
Consumers	9,221	9,347	9,429
Government	858	972	1,153
Producers	1,190	1,585	2,236
Total	11,269	11,904	12,818
1% wireline cost decline and 2% mobile cost decline (moderate pro-privatisation scenario)			
Consumers	6,711	6,694	6,568
Government	858	972	1,153
Producers	1,190	1,585	2,236
Total	8,759	9,251	9,957
2% wireline cost decline and 4% mobile cost decline (central-case scenario)			
Consumers	4,420	4,267	3,946
Government	858	972	1,153
Producers	1,190	1,585	2,236
Total	6,468	6,824	7,335
3% wireline cost decline and 6% mobile cost decline (pro-public scenario)			
Consumers	2,327	2,048	1,542
Government	858	972	1,153
Producers	1,190	1,585	2,236
Total	4,375	4,605	4,931
4% wireline cost decline and 8% mobile cost decline (strong pro-public scenario)			
Consumers	417	18	-663
Government	858	972	1,153
Producers	1,190	1,585	2,236
Total	2,465	2,575	2.726

In table 14 we show the distribution of the net efficiency gains among consumers, producers and government. We can conclude that all agents seem to have benefited from the PT privatisation and the liberalisation of the telecommunications markets. Perhaps government is affected the least but we are not including here the effects of the sale itself. Using equal (unit) social weights, consumers always have positive gains except in the strong pro-public scenario with a 10% discount rate.

Figure 7 Distribution of net efficiency gains (central case scenario)



Vogelsang et al (1994) also demonstrated that the privatisation of BT was beneficial for both government and consumers. Government gained the sale revenue and thereafter tax revenues. And consumers benefited from the price rebalancing registered after BT's privatisation. Between BT's consumers, business consumers benefited more than residential consumers. An important part of residential consumers may have made a net loss from the privatisation.

Figure 7 illustrates the distribution of net efficiency gains for the analysed period after-privatisation. Consumers seem to have experienced some losses during the first years immediately after privatisation, but liberalisation seem to have had a strong positive effect on the gains attributed to PT's consumers. As we have stated when describing PT´s historical background prices fall in a significant pattern after 1999, so it would be expected that consumers attracted a big share of total efficiency gains after this year.

In the opposite direction PT seems to have been loosing profits after 2000. The telecommunications markets' full liberalisation seems to have had an important effect on wireline and mobile operational profits. As we decided to exclude multimedia and other of PT´s lines of business´, there could have been any compensation on total PT's profits. In this study we only analysed wireline and mobile operating profits.

In this analysis we did not perform weighted social welfare change evaluation mainly because it requires more information on country level empirical evidence on weights that is beyond the scope of this study. Any attempt to simulate different weights, without a good reason to have selected one or the other possible weights, seemed to be meaningless for the purpose of the study.

5. Concluding Remarks

Between 1993 and 2004 there were significant changes in the Portuguese telecommunications sector:

- real prices declined significantly both in the wireline sector (in particular in the international segment) and in the mobile sector;
- output and traffic increased significantly; in particular in the late 90s and beginning of 2000s;
- as a result of increased demand and increased supply of telecommunications services, telecommunications revenues increased significantly. There are some structural remarkable changes: wireline business while important, lost a significant share in the total revenues; and mobile and multimedia became increasingly popular.
- PT invested less than what seems to be usual in foreign public utilities. PT capital stock as a percentage of output increased until 1999 and then dropped to previous 1994-1997 levels.
- PT's profitability was higher than the average of the public utilities analyzed in Newbery (2001). But, after a peak level attained in 2000, PT's rate of return declined until 2004.
- Labour productivity also increased substantially in particular in the mobile sector.
- Mobile unitary costs of production seem to have been declining since 1997.
- Wireline unitary costs of production seem to have remained constant during the period under analysis.

The distribution of these efficiency gains between economic agents was the subject of the present study. Given previously stated assumptions, this analysis results tend to demonstrate that all agents benefited from the reforms, in particular the government and consumers from international and mobile segments.

International customers may have benefited from the price "rebalancing" that is increasing the prices of regional and national calls and decreasing international. This price trend corresponds to an elimination of previous cross-subsidisation between local and long distance, or international calls. Mobile consumers may have benefited from increased competition in mobile networks.

Considerable net efficiency gains were also distributed to government. Despite the receipts of the sale itself, government registered a positive gain every year when comparing to actual and counterfactual taxes paid.

In the opposite direction, the producers seem to have benefited less with attained efficiency gains. After 2000, PT profits in the actual scenario were less than PT's profits in a public scenario where

wireline costs declined 2% and mobile costs declined 4%. In this same period, our wholesale consumers' surplus estimates indicate that they were experiencing a reduction in welfare.

If we have had access to a more detailed telecommunications database (e. g. one with information on prices and quantities desaggregated by telecommunications segment) we would have been able to produce more accurate estimates, and evaluate more precisely the Portuguese telecommunications reform impact in comparison with the British or North American experience. But, even so we think it contributes to the understanding of Portuguese telecommunications regulatory reform and provides some empirical evidence about the post-privatisation period.

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