

DOES OWNERSHIP, SIZE OR COMPETITION MATTER? THE EFFECTS OF TELECOMMUNICATIONS REFORM ON PRICING IN GREECE

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Abstract

This paper explores the effects of liberalization in the Greek telecommunication market on pricing for the period 1992-2005. In particular, we examine the implications of privatization, competition and regulation in fixed telephony, mobile telephony and the internet markets and we investigate a) whether the sector's reform influenced services pricing (descriptive analysis), b) the possible explanatory factors of these dependent variable (econometric analysis - Panel Feasible Generalised Least Squares – FGLS-). The data refers to 44 of the most prominent companies of fixed telephony, mobile telephony and internet services and was compiled by means of interviews with the help of a questionnaire. Our descriptive analysis concluded that liberalization of the telecommunication market induced price cuts. The main conclusion of econometric research is that a large market share provides in the companies the capability of cutting the prices of their services.

In this way, the present article offers useful information about a field that continues to be characterized by a vast researching deficit.

Περίληψη

Με το παρόν άρθρο αναλύουμε τις επιπτώσεις της απελευθέρωσης της ελληνικής τηλεπικοινωνιακής αγοράς στην τιμολόγηση των παρεχομένων υπηρεσιών για την περίοδο 1992-2005. Ειδικότερα, εξετάζουμε τις επιπτώσεις αυτής της απελευθέρωσης στη σταθερή τηλεφωνία, στην κινητή τηλεφωνία και στο διαδίκτυο και διερευνούμε α) εάν η μεταρρύθμιση του τομέα επηρέασε την τιμολόγηση των υπηρεσιών (περιγραφική ανάλυση), β) τους πιθανούς προσδιοριστικούς παράγοντες αυτής της μεταβλητής (οικονομετρική ανάλυση - Panel Feasible Generalised Least Squares – FGLS-). Τα στοιχεία αφορούν 44 από τις πιο σημαντικές επιχειρήσεις της σταθερής τηλεφωνίας, της κινητής τηλεφωνίας και του διαδικτύου και συλλέχθηκαν με τη μέθοδο των συνεντεύξεων με τη βοήθεια ερωτηματολογίου. Με την περιγραφική έρευνα διαπιστώνεται ότι η απελευθέρωση της αγοράς προκαλεί μείωση τιμών. Το βασικό συμπέρασμα της οικονομετρικής έρευνας είναι ότι η κατοχή ενός μεγάλου μεριδίου αγοράς παρέχει μεγαλύτερη δυνατότητα στις επιχειρήσεις να μειώσουν τις τιμές των υπηρεσιών τους.

Κατ' αυτόν τον τρόπο, το άρθρο μας προσφέρει χρήσιμη πληροφόρηση σε ένα πεδίο που παρατηρείται ακόμη ένα μεγάλο ερευνητικό έλλειμμα.

Keywords: Telecommunication, Greece, Pricing, Privatization, Competition

1. Introduction

The telecommunication sector operated in every country under the status of strict state monopoly and almost absolute protectionism (Nestor and Mahboobi, 1999, Wilson and Zhou, 2001, Spiller and Cardili, 1997, Shirley and Walsh, 2000, Sheshinski and Lopez-Calva, 1998, Smith, 1995). However, in the course of time, the rising customer demand for higher quality, new services and lower prices led to necessary structural changes (Koski, 2002, OECD, 1995, Heracleous, 1999, Nestor and Mahboobi, 1999, Gual and Waverman, 1998). This formed a deregulation tendency, which was made manifest through policies of privatization and market liberalization (Parker, 2004, Ricketts, 2004, Omran, 2004, Levi – Faur, 2003, Koski, 2002, Shirley and Walsh, 2000, Ramaswamy and Von Glinow, 2000, Li et al, 2000).¹

A number of empirical studies investigated the impact of the above policies, *inter alia*, on market structure and pricing either econometrically (using panel data analysis) or descriptively. More specifically, as far as the econometric ones are concerned, Boylaud and Nicoletti (2000) showed that in 23 OECD states the newly introduced companies implemented a lower price policy. Similarly, Wallsten (2001) used a sample of 30 countries from Africa and Latin America to reach the conclusion that the competition triggered the price cut

¹ The reform process originated during the 1970's in the USA and from the beginning of the 1980's in Great Britain and Japan where from it consecutively spread to the other OECD member states. Within the European Union the reform commenced in 1984 and was completed in 1998.

of a 3 minute local call. Nicoletti (2001) likewise, found out that average prices of provided services fell, both in mobile as well as in fixed telephony, as a result of the competition.

Within the framework of descriptive studies (which outnumber the former ones), Min (1999) concluded that the reform of the Japanese telecommunication sector led to price cuts in all related services. Hughes and Phillips (1999) analyzed the reform policy in the USA and found out that services prices were cut, especially in long distance, international and mobile telephony services. Haggarty et al. (2003) showed that the implemented reform policy in the telecommunication sector in Ghana has prompted price cuts. Price cuts of provided services were ascertained by a series of other descriptive studies, such as the one by Ypsilantis (2002a) on Canada, Xavier (1996) on Australia, Ypsilantis and Min (2001) and Sacripanti (1999) on Italy, Ypsilantis (2002b) on the United Kingdom, Xavier and Ypsilantis (2000) on Spain, Sato and Ypsilantis (2000) on Denmark, Min and Ypsilantis (1999) on Holland, Yamada and Ypsilantis (2001) on Ireland, Vanyai (1998) on Hungary, Spiller and Cardilli (1997) on Chile, Australia, Guatemala and New Zealand, as well as Heracleous (2001) on Singapore.

The liberalization of the telecommunication market had considerable consequences in Greece too (which as an EU member country has implemented the respective European policy in the specific industry). More specifically, from the beginning of the 1990's the market is gradually liberalized, the National Telecommunications Organization (NTO) is privatized, new private companies are launched, and the Hellenic Telecommunications and Post Commission (HTPC) is established as an independent regulatory authority. The reform policy is completed in 2001. This article examines the implications of the liberalization in fixed telephony, mobile telephony and the internet markets. In particular, we investigate:

- the influence of the sector's reform on services pricing (descriptive analysis),
- the possible explanatory factors of these dependent variable (econometric analysis).

Our original sample concerns 44 of the most prominent enterprises that were active in the Greek telecommunication market during the time period 1992 – 2005. We collected the primary data concerning these companies by means of interviews (see Appendix).

2. Model specification, variables and data

2.1 Model

There are cases where a sample is composed by cross-section units $i=1,2,\dots,n$ for a number of time periods $t=1,2,\dots,T$. A data set which combines cross-section data and time series is called “panel data”. The use of panel data exhibits a number of advantages in relation to the use of either only cross-section data or only time series. The main advantage is that the heterogeneity of the cross-section data can be assessed. Moreover, panel data offer more complete information, more variance which can be of econometric use, a lesser degree of multicollinearity, more degrees of freedom and more effective estimates (Hsiao, 2003).

For panel data analysis we use the following basic model (Wooldridge, 2002):

$$y_{it} = \mathbf{x}'_{it} \boldsymbol{\beta} + c_i + u_{it} \quad (1)$$

where y_{it} is the dependant variable, $\mathbf{x}_{it} = (x_{it,1}, x_{it,2}, \dots, x_{it,k})'$ is a vector of explanatory variables, $\boldsymbol{\beta} = (b_1, b_2, \dots, b_k)'$ is a vector of the coefficients of the explanatory variables to be estimated and c_i are the time-invariant unobserved cross-sectional effects.

In the relevant literature the interest focuses on the choice of the appropriate method of estimation. The choice depends on the hypothesis that the unobserved effects c_i are correlated (or not) with the explanatory variables. Thus there are two cases:

- **c_i are correlated with $\mathbf{x}_{it}$**

In this case, the “fixed effects” method is used according to which the variables are expressed as deviations from their mean values, i.e. model (1) becomes:

$$y_{it} - \bar{y}_i = (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)' \boldsymbol{\beta} + (u_{it} - \bar{u}_i) \quad (2)$$

Model (2) can be estimated by ordinary least squares (OLS) in order to produce reliable estimators.

- **c_i are not correlated with $\mathbf{x}_{it}$**

In this case, the covariance between the unobserved effects and the explanatory variables is zero for all t [$\text{Cov}(\mathbf{x}_{it}, c_i) = 0, t = 1, 2, \dots, T$] and the unobserved effects are mutually independent random variables normally distributed with zero mean and constant variance. In this case, model (1) becomes:

$$y_{it} = b_0 + \mathbf{x}'_{it} \boldsymbol{\beta} + v_{it} \text{ where } v_{it} = c_i + u_{it} \quad (3)$$

The error term v_{it} exhibits positive serial correlation with $\text{Corr}(v_{it}, v_{is}) = \sigma_c^2 / (\sigma_c^2 + \sigma_u^2)$, $t \neq s$

The appropriate method for estimating model (3) is the generalized least squares (GLS) by introducing the following transformation:

$$\lambda = 1 - \left(\frac{\sigma_c^2}{T\sigma_c^2 + \sigma_u^2} \right)^{1/2}$$

Then the following model of the transformed variables can be estimated with OLS:

$$y_{it} - \lambda \bar{y}_i = b_0(1 - \lambda) + (\mathbf{x}_{it} - \lambda \bar{\mathbf{x}}_i)' \boldsymbol{\beta} + (v_{it} - \lambda \bar{v}_i) \quad (4)$$

In practice, the value of λ is unknown. Therefore, in order to estimate model (3) the feasible generalized least squares (FGLS) method is used, according to which the estimated λ is used and the new model is estimated with OLS:

$$\hat{\lambda} = 1 - \left[\frac{1}{1 + \frac{\hat{\sigma}_c^2}{T\hat{\sigma}_u^2}} \right]^{1/2} \text{ where } \hat{\sigma}_c^2 \text{ και } \hat{\sigma}_u^2 \text{ are consistent estimates of } \sigma_c^2 \text{ και } \sigma_u^2 \text{ with:}$$

$$\hat{\sigma}_c^2 = [NT(T-1)/2 - (K+1)]^{-1} \sum_{i=1}^N \sum_{t=1}^{T-1} \sum_{s=t+1}^T \hat{v}_{it} \hat{v}_{is}$$

$$\hat{\sigma}_u^2 = \hat{\sigma}_v^2 - \hat{\sigma}_c^2$$

$\hat{v}_{it}$, $\hat{v}_i$ and $\hat{\sigma}_v^2$ are based on OLS residuals of (3).

In this paper we assume that the unobserved variables are not correlated with the other independent variables. This hypothesis prompts us to use the feasible generalized least squares (FGLS) method with random effects in order to estimate our model. Moreover, the F -test is used, in order to examine the statistical significance of the variables under consideration.

2.2 Variables

Variables were selected after having taken respective econometric studies into account, but were also dictated by the availability of historical information concerning the most extensive possible time period and the existence of efficient. Thus, as dependent variable, we always use the pricing (Price) of local calls (Pricelocal), long distance calls (Pricetrunk), calls to mobiles (Pricetomobil), international calls to EU countries (PriceEU) and the USA (PriceUSA), the annual standard subscription (PSTN 56k) for internet services (Priceinter) and the minimum charge per second for mobile telephony (Pricemobil). As independent variables we use the companies' size (Size), the market shares (Share), the ownership (Own), the administrative personnel's number (Man), the commercial personnel's number (Com), the technical personnel's number (Tech), the personnel's number with a university degree (Uedu) and the personnel's number with a high school and elementary degree (Bedu). This specialization is implemented for the first time in literature.

Available references for all the above variables are presented in Table 1.

2.3 Data

We gathered our primary data as follows. From the Companies' Register of the Hellenic Telecommunications and Post Commission (HTPC) we identified a total of 108 providers of main telecommunication services. Field research was conducted in 2005, in three phases. During the first phase, the questionnaire was edited and improved with the help of a pilot interview. During the second phase telephone contact was made with every company in the field followed by the questionnaire which was sent by e-mail. During the third phase telephone contact was resumed in order to finalize the meetings with the competent company executives. Finally, 44 companies (41%) took part in the research. The reliability degree of the sample is considered high,² likewise the information quality, which resulted from interviews with top management, marketing, public relations' and personnel's executives.

² A reliability analysis was conducted with the use of Cronbach Alpha coefficient, the value of which was 0.6456. This fact confirms the cohesion of questions asked. Consequently, the statistical analysis results (that follow) are deemed safe.

3. Results and discussion

3.1 Descriptive statistics

The complete liberalization of the Greek market triggered the continuous revision of the companies' pricing policy. In particular, the prices of every examined subcategory of fixed telephony (local, long distance, international calls and calls to mobiles) declined (Table 2a). The monthly fixed charge, which risen, was an exception.³ Moreover, mobile telephony tariffs showed a downfall during the period 1993-2005⁴ (Table 2b). To be more exact, the lowest monthly fixed charge⁵ and the minimum charge of a call fell markedly. Contrary to the two former indexes, the cost of sending an SMS rose.⁶

Furthermore, as regards internet market, significant competition dominated only regarding the fixed subscription charged by every company for the provision of internet services. As a result this subscription decreased significantly from 15,20 in 1998 to 10,34 in 2005 (Table 2c). By contrast, the monthly fixed charge paid by the subscribers almost doubled during the period 1998-2005. Moreover, the use charge remained the same for 7 consecutive years from 1999 to 2005 (0.352/ 0.176).⁷

3.2 Econometric results

Out of the econometric model was concluded that the most important interpretative variable for the pricing (dependent variable) was market share. Other interpretative variables were the administrative, commercial and technical personnel, the company's size and the ownership (Table 3). Specifically, it seemed that company's market share regarding long distance calls and calls to mobiles and pricing of the respective provided services move in opposite direction (at significance level 5%). Probably, scale economies offered companies the chance to be more flexible in their pricing. On the other, the situation in the internet market seemed to be different (at significance level 1%), may be due to abuse of dominant position.

Second, it seemed that there is a positive relationship between the number of the administrative, commercial and technical personnel and the pricing of provided services regarding long distance calls (at significance level 1%, 5% and 5% respectively) as well as internet services (at significance level 1%). It appears that the rise of operational cost can lead to the surcharge of the final price of provided services.

Third, it seemed that there is an inverse relationship between the size of the company and the pricing in the internet subsector (at significance level 5%). We express the view that scale economies realized by bigger companies ultimately lead to the lowest average cost of provided services.

Finally, private ownership led to price reduction in the internet market (at significance level 1%). In other words, private companies offered lower prices for internet services compared to the state companies. This conclusion partially differentiates from the results of Wallsten (2001), Nicoletti (2001) and Boylaud and Nicoletti (2000), who did not find any clear relation between ownership and prices.

4. Conclusion

In this article we have investigated if and to what extent the liberalization of the telecommunication market in Greece influenced pricing. In order to achieve this, we conducted an empirical research in 44 of the most important companies in the sector in 2005 and we gathered data for the period 1992-2005. We elaborated these data descriptively and econometrically using the FGLS method within the framework of panel data analysis. This method is regarded appropriate for our sample which is compiled by intersectoral data for more than one time periods and there is no correlation between the unobserved effects and interpretative variables.

Our descriptive research showed that market liberalization resulted in lower prices. In this way, our results confirmed those of other research studies conducted in developed as well as in developing economies (see *inter alia* the works of Min, 1999; Haggarty and Shirley, 2003; Min and Ypsilantis, 1999; Xavier, 1996; Sato

³ The main reason for this appears to be the monopolistic role of the state company in the public telecommunication network, which private companies hire in order to provide their services having the result of competition reduction.

⁴ According to company executives, high prices during the first years of mobile telephony are justified, by the huge investment required to obtain 2nd and 3rd generation permissions, the creation of a sound telecommunications network and the high expenses in developing new services and products.

⁵ It is useful to mention that a certain increase in the monthly fixed charge since 2003 is counterbalanced by offering new packages with free call time which were more attractive to consumers.

⁶ This is mainly attributed to low tariffs with which this service was initially offered in order to become more easily popular.

⁷ This was attributed to the fact that internet access was made possible via the use of a Single National Access Number or Regional Access Number, which were charged every time according to the respective rates set by the state company.

and Ypsilantis, 2000; Hughes and Phillips, 1999; Wallsten, 2001; Ypsilantis and Min, 2001; Sacripanti, 1999; Vanyai, 1998; Xavier and Ypsilantis, 2001).

Econometric analysis, on the other hand, took a step further to investigate the most important explanatory variables of prices and concerned, enterprises with large market shares had the chance to charge their services at lower rates (see also Nicoletti, 2001 and Boylaud and Nicoletti, 2000). Furthermore, we found that the excessive use of personnel can lead to higher operational costs and rising prices, a fact that companies should take seriously into consideration. In general, further significant price cuts seem to be hindered by the increase of the fixed monthly charges, which is still defined by the state company, (the only company with an integrated national telecommunication network).

We realized that during the present phase, in the corresponding literature the econometric research has some quantitative deficits comparatively to the descriptive analyses. Consequently, in the future the objective research should be the extension of the research also in other economic-political settings in order to have a better comparison and a possible generalization of our conclusions.

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Appendix

Table 1: Econometric analysis variables

Variable	Description	Available References
Pricelocal	Local call charge per minute	Boylaud and Nicoletti 2000, Wallsten 2001, Nicoletti 2001, Ros 1999
Pricetrunk	Long distance call charge per minute	
Pricetomobil	Call charge to mobiles per minute	
PriceEU	Call charge to the EU per minute	
PriceUSA	Call charge to the USA per minute	
Priceinter	Monthly fixed charges of an annual standard subscription (PSTN 56k)	
Pricemobil	Minimum call charge per second	
Sharelocal	Market share regarding local calls owned by a company (%)	Boylaud and Nicoletti 2000, Nicoletti 2001
Sharetrunk	Market share regarding long distance calls owned by a company (%)	
Sharetomobil	Market share regarding calls to mobiles owned by a company (%)	
ShareEU	Market share regarding international calls to the EU owned by a company (%)	
ShareUSA	Market share regarding international calls to the USA owned by a company (%)	
Shareinter	Market share owned by a company (%)	
Sharemobil	Market share owned by a company (%)	
Own	Company ownership in the research (state=0, private=1)	Boylaud and Nicoletti 2000, Nicoletti 2001, Ros 1999, Staranczak et al. 1994, Jha and Majumbar 1999, Madden et al. 2003
Size	Company size in the research (small=0, big=1)	Harper 2002, Staranczak et al. 1994, Jha and Majumbar 1999
Man	Number of administrative-financial personnel	Not available
Com	Number of commercial personnel	Not available
Tech	Number of technical personnel	Not available
Uedu	Number of personnel with university degree	Not available
Bedu	Number of personnel with high school degree	Not available

Table 2a: Fixed telephony's price development (in €-cents, VAT is excluded)

	2002	2003	2004	2005
Fixed charge (Monthly)	9,98	10,49	11,40	11,90

	2002	2003	2004	2005
Local calls (1 minute)	0,025	0,025	0,024	0,024
Long distance calls (1 minute)	0,049	0,050	0,048	0,048
International calls (1 minute)	-	-	-	-
a) EU country	0,181	0,177	0,177	0,166
b) European country outside EU	0,216	0,217	0,214	0,193
c) USA	0,181	0,179	0,176	0,166
d) Japan	0,196	0,191	0,186	0,170
e) South Africa	0,420	0,430	0,416	0,382
Calls to mobile (1 minute)	0,214	0,219	0,207	0,181

(Source: data research)

Table 2b: Mobile telephony's price development (in €-cents, VAT is excluded)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Monthly fixed charge	27,88	27,88	27,88	22,75	18,34	13,21	10,76	8,02	7,72	7,72	9,44	9,44	9,43
Minimum charge (1 second)	0,0052	0,0054	0,0056	0,0069	0,0060	0,0041	0,0054	0,0043	0,0043	0,0043	0,0040	0,0040	0,0037
1 SMS	-	-	-	0,079	0,079	0,078	0,082	0,084	0,083	0,085	0,081	0,081	0,083

(Source: data research)

Table 2c: Internet price development (in €-cents, VAT is excluded)

	1998	1999	2000	2001	2002	2003	2004	2005
Monthly fixed charge	6,02	6,75	6,75	8,22	9,98	10,49	11,40	11,90
Usage rental (per peak hour /non peak hour)	0,458/ 0,229	0,352/ 0,176	0,352/ 0,176	0,352/ 0,176	0,352/ 0,176	0,352/ 0,176	0,352/ 0,176	0,352/ 0,176
Annual standard subscription (PSTN 56k)	15,20	15,01	13,09	13,74	13,64	11,87	10,68	10,34

(Source: data research)

Table 6: Pricing

Dependent Variables	Independent Variables									F-test
	Price	Size	Share	Own	Man	Com	Tech	Uedu	Bedu	
Pricelocal		-0,0004 (0,0002)	≈0	-0,0003 (0,0004)	≈0	≈0	≈0	≈0	≈0	492,357*
Pricetrunk		0,002 (0,004)	-0,0006** (0,0002)	0,012 (0,009)	0,0006* (0,0002)	0,0004** (0,0001)	0,0005** (0,0002)	-0,0004** (0,0001)	-0,0005** (0,0001)	3,740*
Pricetomobil		0,006 (0,0101)	-0,006** (0,002)	-0,082 (0,049)	-0,004* (0,001)	-0,003** (0,001)	-0,003* (0,001)	0,003* (0,001)	0,003* (0,001)	9,359*
PriceEU		-0,001 (0,006)	-0,0007 (0,0008)	-0,015 (0,021)	≈0	-0,0002 (0,0005)	≈0	0,0001 (0,0005)	0,0001 (0,0005)	11,754*
PriceUSA		-0,0009 (0,007)	-0,0007 (0,0008)	-0,014 (0,022)	≈0	-0,0001 (0,0005)	≈0	0,0001 (0,0005)	≈0	10,496*
Priceinter		-2.681** (0,932)	0.067* (0,018)	-3.771* (1,075)	0,422* (0,060)	0,444* (0,063)	0,395* (0,063)	-0.395* (0,058)	-0.422* (0,062)	3.871**
Pricemobil		-0,0002 (0,001)	≈0	≈0	≈0	≈0	≈0	≈0	≈0	0,778

Note: Regressions have been estimated using Panel Feasible Generalised Least Squares (FGLS) method with random effects. Regressions include a constant as well, which does not appear on the table due to lack of space. Numbers in parentheses are the typical errors of the estimated parameters. F-test controls the joint statistical significance of the independent variables. If the absolute value of the estimated variable is <0,0001, then it is expressed with ≈0. ***, **, * indicate statistical significance at level 10%, 5% and 1%, respectively.

ANNEX: «RESEARCH QUESTIONNAIRE»

Pricing

Fixed telephony

	2002	2003	2004	2005
Fixed charge (Monthly)				
Local calls (1 minute)				
Long distance calls (1 minute)				
International calls (1 minute)				
a) EU country				
b) European country outside EU				
c) USA				
d) Japan				
e) South Africa				
Calls to mobile (1 minute)				

Mobile telephony

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Monthly fixed charge													
Minimum charge (1 second)													
1 SMS													

Internet

	1998	1999	2000	2001	2002	2003	2004	2005
Monthly fixed charge								
Usage rental (per peak hour /non peak hour)								
Annual standard subscription (PSTN 56k)								