

**What influences advertising price in television channels?:**

**An empirical analysis on the Spanish market.\***

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## **Abstract**

Advertising has an important role in the media industry. In a context where advertising generates a negative externality for viewers, we analyze the factors explaining ad prices in free-TV empirically. We also consider the participation of government-owned broadcasters in the Spanish market. We find that private ownership is associated with higher advertising prices. Our results show a positive relationship between audience size and ad price and a negative relationship between ad price and advertising time. In addition, we find that higher prices are associated with the percentage of population between 14 and 29 years old and the regional GDP per capita in the broadcast area.

**Key words:** Television, Public Enterprise, Advertising.

**JEL CODES:** L82, L32, M37

## **What influences advertising price in television channels?:**

### **An empirical analysis of the Spanish market**

Consumption of television has increased worldwide in recent years. The main cause of growth has been the development of new technologies that increase broadcasting. The consolidation of satellite-TV and Cable-TV, the analog TV switch-off, TV-IP expansion, and the beginning of mobile-TV have all arisen in the years since countries planned their TV models.

Television broadcasting has traditionally been subject to a high degree of public intervention (Hargreaves, 2005). All European countries have government-owned broadcasters (public broadcasters henceforth) operating in their markets. All the European public broadcasters have provided free-to-air broadcasting, and their aim has been to provide a public service (Armstrong, 2005; Armstrong and Weeds, 2007).<sup>2</sup> Before the recent sweeping changes in television technologies, public broadcasters had a clear role in the market. Nowadays, however, public broadcasters must develop a new purpose as the number of sources competing for audience expands. Broadcasters are targeting programming at narrower audiences, and public providers need to increase the attractiveness of their programs to retain their audience. Higher quality programs, however, require increased expenditures, which bring increasing financial pressure.

The literature has traditionally considered free-to-air television broadcasts a public good (Adda and Ottaviani, 2005; Anderson and Coate, 2005). According to Anderson and Coate (2005), two different agents—viewers and advertisers—can consume TV broadcasting. The former receive direct benefit, since they enjoy free access to programs. For advertisers, the broadcast may be an excludable public good with congestion. Advertising time is limited by regulations in most countries, and broadcasters charge an

access price to advertisers in order to limit entrance. Revenues paid by advertisers finance (totally or partially) the free-to-air stations.

This paper undertakes an empirical analysis of the advertising price that free-to-air broadcasters charge advertisers. The question has important implications for the current discussions—particularly common in the European Union—about whether regulation of ad time should be strengthened or weakened in the near future. In the light of an empirical literature that generally finds a negative relationship between ad time and ad prices—and so we find—and taking into account that television channels have incentives to self-regulate, one can doubt whether any regulation is required at all.

In addition, most European public broadcasters compete with private channels for advertising. When the public channels receive public funds (via user-fees or subsidies from the budget) as they usually do, they may affect the private channels in the ad market by creating a crowding out effect. This is particularly so where subsidies allow the public channels to require lower ad prices than do private ones (as we find in our empirical analysis). In fact, some governments such as Britain's and—much more recently—France's have established regulations that do not allow the public channels to broadcast advertising.

We analyze how advertising prices are affected by factors such as advertising minutes, audience size, specific characteristics of programming, and viewers' characteristics. We use data on the Spanish free-to-air TV market. Our analysis allows us to find results that can be generalized to other countries. In addition, it is worth noting that many stations in Spain do not use Spanish in their broadcasts.

On the one hand, our analysis allows us to check hypotheses proposed in the literature, and our results provide additional evidence about the existence of externalities generated because of the interaction of two agents (advertisers and viewers) in the market.

On the other hand, we find new evidence for factors not considered in previous empirical studies. We analyze the effect of television channel ownership on advertising prices, and we find that private ownership is associated with higher advertising prices.

The paper is organized as follows. The next section describes the main characteristics of the free-to-view market in Spain. Section 3 reviews the theoretical and the empirical literature related to our work. In sections 4 and 5, we present our empirical model and the results from the estimation we obtain. Finally, in section 6 we discuss our results.

## **2. The free-to-air television market in Spain**

The free-to-air market in Spain is undergoing quick and intense change. The development of new technologies<sup>3</sup>, the entry of new operators, changes in European regulations, and growing financial problems faced by public broadcasters have encouraged the redefinition of the roles operators play in the market.

First, we need to explain some important traits in the organization of the Spanish free-to-air market. Both public and private television channels operate in this market, and channels can be national or regional. In addition to competing among themselves, the national television channels contend with the regional television channels for advertisers. Regional television channels are important in the market, because some use co-official languages other than Spanish in their broadcasting. Viewers perceive some product differentiation in the broadcasting language. Networks using a co-official language in their broadcasts enjoy a certain degree of monopoly over their viewers, since there are no relevant competing channels in the same language. Thus, networks using co-official languages have an advantage with viewers who prefer programs in those languages.

Another important characteristic in the Spanish market is that many channels contract out the management of their sales of advertising time. A television channel broadcasting exclusively in a specific region may have advertising time sold to national advertisers.

Several public television channels have contracted ad sales out to private firms. Such firms operate at the national level and compete with other television channels to attract national advertisers. Private broadcasters have created specific firms to carry out this task.

Third, we must note the significant financial deficit incurred by Spanish public broadcasters, national and regional. Consequently, several governments have designed and implemented reorganization plans.<sup>4</sup> The financial stress is due both to the inefficiency of the existing financing system and to a loss of audience.<sup>5</sup>

How public channels are financed is a very important question in countries where a mixed funding system prevails. In these countries, the public broadcasters receive funds via advertising as well as via budgetary subsidies or user fees. Hence, public channels compete with private ones for TV advertising, while receiving subsidies. This situation entails potential distortions of competition in the ad market, and may create a crowding out effect.<sup>6</sup>

Unlike most European public broadcasters, public television channels in Spain receive direct transfers from the national and regional public budgets, rather than relying on user fees. They have also incurred debt obligations backed by their governments. Table 1 shows the characteristics of some of the main public networks in Europe and their financial system (we include Switzerland because of its multi-lingual characteristics).

Finally, the number of private channels in Spain has increased since 2006. In that year, the sole analog pay-TV channel -*Canal Plus*- switched to the free-to-air system, and it is now called *Cuatro*. In the same year, a new private channel, *La Sexta*, began free-to-air broadcasting. It is worth noting that two private regional channels, *8TV* (Catalonia) and *Onda Seis Televisión* (Madrid), were established in 2007. This increase in the number of operators has provided advertisers more opportunities to reach viewers. This, together with the financial stress placed on public channels, has increased pressures in the

advertising market, the main source of revenue for private broadcasters and a substantial part of the total revenues of public providers.

**Table 1. Models of television public networks in Europe (nationwide).**

|                                       | Italy   | Germany   | France  | United Kingdom  | Switzerland  | Spain  |
|---------------------------------------|---|---|---|---|--|--|
| <b>Services</b>                       | 3 national channels, 21 regional windows, 13 thematic channels and 2 international channels | ARD: 1 national channel, 8 regional channels, 6 thematic channels and 2 international/multinationals<br><br>ZDF: 1 national channel, 5 thematic channels and 2 international/multinational channels | 3 national channels, 13 regional windows, and 5 thematic channels | 2 national channels, 13 regional windows, 15 thematic channels and 3 international/multinational channels | 3 national channels using German, 2 national channels using France, 2 national channels using Italian, and broadcast programs using romance language on German's TVs | 2 national channels, 17 regional windows, 5 thematic channels, and 2 multinational/international channels. |
| <b>Funding</b>                        | Fee, advertising, Budgetary funds   | Fee, advertising, Budgetary funds   | Fee, advertising, Budgetary funds                                 | Fee, Budgetary funds  | Fee, Advertising   | Advertising, Budgetary funds   |
| <b>Advertising market share</b>       | 35.4%   | ARD: 2.6%<br>ZDF: 2.1%  | 19.3%   | 0%  | 25%  | 26.4%  |
| <b>Average per capita cost (2003)</b> | 193.5 €   | 116.5€  | 97.1 €  | 164.4 €   | 292.0 €  | 27.8 €   |

Note: ARD and ZDF are two different public network TVs in Germany.

Source: Authors', using TVs' data

This mixed oligopoly type of market has some peculiar characteristics. Broadcasters are interested in having a large audience, since the greater the market share, the more attractive the channel will be to advertisers. The share is the indicator that best reflects the audience size, as it allows to calculate the number of viewers who are watching a television channel at one particular moment in time. Therefore, market share is the best indicator of viewers' preferences. Moreover, we can establish viewer's

preferences in different schedules. For that reason, share is a key variable in advertising sales, as advertisers pay a premium price for time on channels with larger audiences. Small percentage variations in the share level translate into large effects on revenues from advertising. Hence, there is intense competition between channels seeking to keep their shares high. Table 2 displays the main characteristics of Spanish channels during 2006.

**Table 2. Main characteristics of the Spanish Television channels. 2006**

|                       | National Share | Regional Share         | Ownership | Language | Advertising contracting |
|-----------------------|----------------|------------------------|-----------|----------|-------------------------|
| RTVE                  | 23.1           | --                     | Public    | Spanish  | Direct management       |
| Tele5                 | 21.2           | --                     | Private   | Spanish  | Publiespaña             |
| Antena 3              | 19.4           | --                     | Private   | Spanish  | Atres advertising       |
| Cuatro                | 6.4            | --                     | Private   | Spanish  | Sogecable Media         |
| La Sexta              | 1.8            | --                     | Private   | Spanish  | Publiseis               |
| Canal Sur             | 4.2            | 21.7 (Andalusia)       | Public    | Spanish  | GDM                     |
| TV de Catalunya       | 4              | 22.5 (Catalonia)       | Public    | Catalan  | Direct management       |
| ETB                   | 1.1            | 20.2 (Basc Country)    | Public    | Basc     | GDM                     |
| TVG                   | 0.8            | 14.4 (Galicia)         | Public    | Galician | Zeta Gestión medios     |
| TeleMadrid            | 1.7            | 11.6 (Madrid)          | Public    | Spanish  | Novomedia               |
| TV Valenciana         | 2              | 16.4 (C. Valenciana)   | Public    | Catalan  | Direct management       |
| Castilla La Mancha TV | 0.6            | 12 (Castile La Mancha) | Public    | Spanish  | Zeta gestión medios     |
| TV de Canarias        | 0.4            | 9.2 (Canary Islands)   | Public    | Spanish  | GDM                     |

Note: Source: Authors'. Information on TNS- Sofres 2007 and TVs.

### 3. Relationship to the literature

- *Theoretical literature*

An important stream of theoretical literature looking at the media sector has analyzed the interaction between advertisers, viewers and market structure. The level of competition in the market has important repercussions, which differ as we consider advertisers or viewers. It is worth distinguishing between those works focusing on the interaction between viewers and channels, and those focusing on the interaction between advertisers and channels. All, as does ours, share a market structure approach. The level



of competition and the advertising interactions have clear implications. Steiner (1952) considered that the broadcasters might over-duplicate programs. More recently, concerns emerged that broadcasters have failed to seek out programming that addresses the preferences of minority viewers. (Spence and Owen, 1977; Anderson and Coate, 2005; Anderson and Gabszewicz, 2006).<sup>7</sup>

Cunningham and Alexander (2004) is the first work using consumer elasticities to observe the reaction of viewers to advertising. These authors, considering competition level, find that an increase in concentration leads to higher advertising prices. By contrast, Anderson and Coate (2005) develop a theory about TV broadcasting that reflects the existing competition level in a given market. A monopolistic operator will broadcast more ads than duopolistic operators, although it will charge a lower price.

Recent literature has focused on the two-sided market concept. This concept defines an industry with a platform that connects two types of agents. Those agents generate externalities when they contact each other through the platform. Rosse (1979) first introduced the two-sided market approach when presenting an empirical analysis of the interdependence between a newspaper's subscribers and advertisers. Later, Blair and Romano (1993) offered a formal analysis of a monopolist advertiser who sells newspaper-advertising blanks. In their analysis, the demand for newspaper advertising blanks increases with circulation, and the demand for circulation increases as ads quantity grows. Regarding the television market, Owen and Wildman (1992) characterized the behavior of viewers and advertisers, and provided a graphic treatment of their interaction. Recently, Rochet and Tirole (2003), Evans (2003), Rysman (2004), Anderson and Coate (2005), and Armstrong (2006) have made relevant theoretical and empirical contributions to the two-sided markets literature.

The concept of two-sided market has been used to understand the television market as well. The networks perform as platforms that put two types of agents, viewers and advertisers, in contact. The relationship between viewers and television creates a positive externality on the advertisers. However, the relationship between advertisers and networks generate a negative externality on the viewers (Reisinger, 2004; Anderson and Coate, 2005). Beyond these last works, Bel, Calzada and Insa, (2007) and Kind, Nilssen and Sjørgard (2007) offer recent studies focusing on two sided markets in television.

Our goal is to determine whether public operators charge higher prices or lower prices than do private operators. Kind, Nilssen and Sjørgard (2007) have studied this question<sup>8</sup>. This work considers a mixed oligopoly model. Their main finding is that where public and private programs are close substitutes, channels will have a monopolistic power over their viewers. Such channels can broadcast a high level of advertising because the probability of maintaining their audience is high.

- *Empirical literature*

Other papers have contributed by studying the relationship between advertisers and channels. Of particular interest are works that have taken into account ownership and its impact on the market. Delaney and O'Toole (2006) observe the level of satisfaction and the willingness to pay for Ireland public TV, RTÉ, which has a mixed financial system.<sup>9</sup>

Others have considered the level of product differentiation offered by public and private television channels. With the increase in the number of operators in the Netherlands, Van der Wurff and Cuilenburg (2001) analyze how increasing competition in Holland has influenced the level of product differentiation offered in 1988 and 1999. Their results show that the monopolistic public operator has paid little attention to viewer demand. If competition increases, television channels should offer a higher degree of product differentiation. Tsourvakas (2004) finds the opposite result for the Greek case in

a comparison of public programs before and after commercial providers entered the market. After competition was introduced in the Greek market, commercial and public operators offered similar programs<sup>10</sup>.

Finally, Alcock and Docwra (2005) propose a simulation model for the Australian broadcast TV market. Their results show us that the existence of a public operator in an oligopolistic market increases the level of product differentiation, reduces collusion and increases market coverage. However, when sufficient competition in the market exists, the authors observe no clear evidence of benefits from public intervention.

Other works (Brown and Alexander, 2005; Kasuga and Shishikura, 2006) consider the market structure and the way in which this structure affects revenues. Brown and Alexander (2005) focus their attention on the US local television market. They show that if the local broadcaster has market power, it will increase ad prices and reduce ad time, making the programs more attractive to viewers. The advertising price should also go up if per capita income, size of broadcast area, and concentration of 18-34 years old increase.

Kasuga and Shishikura (2006) examine an empirical model for Japan's broadcasting industry. They examine income and revenues as functions of share, Herfindhal-Hirschman index (based on audience share), total assets, number of households, income per household, and the number of self-produced programs. Profits and revenues show: a) a positive relation with audience share (elasticity is 0.76), the number of households, and the income per households; and b) no significant relation with HHI.

Other works (Goettler, 1999; Kieschnick, McCullough and Wildman, 2002; Brown and Cavazos, 2005; Wilbur, 2008) seek to determine the factors explaining the advertising price<sup>11</sup>. To do so, they introduce program and audience characteristics into the price function.

Goettler (1999) estimates the relationship between ad prices and audience size, taking into account the composition of the audience. The author finds a convex relationship between price and number of viewers; that is, for a given high audience, the ad price is high as well. The price elasticity is 1.14. Also, he finds high prices for programs with a high percent of 35-49 years old viewers, and lower prices for programs with high percent of viewers 50 years old and more.

In the same direction, Kieschnick, McCullough, and Wildman (2002) assume that advertisers buying ad time are buying access to viewers. The cost of a 30-second commercial aired depends on the implicit price for groups of cable or broadcast-only viewers. The results show that advertisers will pay 2.3 cents more for an additional cable viewer than for a broadcast-only viewer.

Finally, several works analyze the relationship between program content and ad price in the US market (Brown and Cavazos, 2005; and Wilbur, 2008). Brown and Cavazos (2005) examine the effect of program content on ad price in *prime time*. Their results can be classified into three groups. First, the expected share has a positive and significant relationship (elasticity is 1.39) with ad price. Second, they observe that advertisers prefer high-income viewers. The obtained coefficient is 1.29. They also prefer homogeneity in viewers. Finally, advertisers prefer sitcoms to news, police dramas and magazines.

Wilbur (2008) proposes a two-sided empirical model. The author estimates the advertisers and viewers function, considering the direct effect of ad quantities. His results suggest that viewers dislike advertising, generating negative externalities. Moreover, program content is a good indicator of viewer characteristics. Wilbur (2008) estimates a negative elasticity (-2.9), between ad price and advertising time but a positive elasticity between share and ad price (0.83). In this study, advertisers prefer sitcoms and reality shows.

Fu, Li and Wildman (2008) explain the price for television ad time by considering the purchasing profiles of viewers. This analysis provides additional insights into the role of buyer-side considerations in the determination of price for television ad time. Their results show that per viewer prices paid for ad time are higher the more extensive is the set of products purchased by a program's audience and the more effective are ads in promoting products consumed by a program's viewers.

Summing up, the most relevant works, such as Kieschnick et al. (2002), Brown and Cavazos (2005), Kasuga and Shishikura (2006) and Wilbur (2008), find that audience, advertising time, and demographic characteristics are influential factors explaining advertising price. Some works have also considered the degree of competition between private and public channels, and the results suggest some beneficial effect from public intervention. Table A-1 in the appendix summarizes the theoretical and empirical literature.

#### **4. The model and the data**

In order to estimate our empirical model, we need to consider two aspects. Analyses from other countries show that share has a positive relationship with advertising price, and a negative relationship with advertising time (Anderson and Coate, 2005; Reisinger, 2004). This last reflects the externalities in the TV market. Hence, we need to examine the effect of advertising time and share on advertising price.

We assume that there exist  $i$  broadcasters broadcasting simultaneously. The broadcasters have to set a price for advertising time. Demand for that time is influenced by many factors. As in Kieschnick, McCullough, and Wildman (2002), Brown and Cavazos (2005) and Wilbur (2008), we estimate the inverse demand function for advertising on a given set of broadcasters, producing an advertising price estimate as a function of the following form:

$$P = F(V, M, T, R, \phi) \quad (1)$$

Where  $V$ = Number of viewers

$M$ = Advertising time

$T$ = Vector of channels' observable characteristics

$R$ = Vector that collects demographic and economic characteristics

$\phi$  = Vector of viewers' and channels' unobservable characteristics

To conduct our estimation we use data for national and regional television channels in Spain between 2002 and 2006. We have been able construct cross-section data, with semester data, for 2002 through 2006, for 13 broadcasters—public and private.

- *Dependent variables*

We want to explain TV advertising price ( $pmin$ ). However, we do not have direct information on prices since advertising contracts are confidential. Because of this, we consider revenues per minute to be a good approximation to advertising price. The variable  $pmin$  is specified as the quotient advertising revenues/advertising minutes. Data on advertising revenues is obtained from *Infoadex*.

- *Independent variables*

We consider the following variables as exogenous explanatory variables of advertising price.

First, we take audience size. We measure the (realized) audience sizes using two variables: *total viewers*, and *national share*. We obtained data on audience size, *national share*, and *total viewing* from TNS-Sofres. *The national share* measures the relationship between the channel's audience and the total audience in Spain that is watching any channel at a specific time. Hence, it is a percentage of total audience. Using this variable is advisable for two reasons: a) *National share* measures the penetration of each channel

in the market. Hence, this variable is understood as a television channel's market share, and the share shows viewer preferences; and b) this variable takes into account the differences in market size. This is important within our framework, since we examine the effect on advertising price of broadcasting either nationally or regionally. *Total viewing* is the numbers of viewers who watch the network during the measurement period.

The advertising time<sup>12</sup>, *minutes*, has been obtained from the *Television's Audience Yearbook* edited by TNS-Sofres. Table 3 shows that this variable varies a lot across television channels. Much of the variability is a reflection of the fact that regional television channels broadcast fewer minutes of advertising than do national television channels. Advertising time is about the same across all national channels, whether they are public or private. Regulation in Spain sets a clear upper limit for both public and private operators on how much ad time can be broadcast in any given hour, and national channels seek to maximize their benefit by selling all the ad time available within that limit.

Our central purpose is to determine the influence of two factors on advertising price: whether ownership is public or private (*public*), and whether advertising sales are managed in house or contracted out (*contracting out*).

The dummy *public* measures the effect of being a public network. In this sense, we want to check whether advertisers and viewers take into account ownership in making their choices. On one side, we take into account that some characteristics of the audience in public TV channels could be creating on the advertisers the perception of lower value added for advertising in public channels.<sup>13</sup> Besides, and even if this relates more to a supply side of the story, we think it is interesting to check the hypothesis that public operators could follow a different strategy for negotiating with advertisers than do private channels. Indeed, public funding might lead public entities to pursue advertising less

aggressively than do private channels. *Public* takes value 1 when the network is government-owned and 0 when it is private.<sup>14</sup>

The dummy *contracting out* captures the fact that some television channels contract out the management of their sales of advertising time. On the demand side, we believe that contracting out could be seen as more attractive by advertisers because the firms than intermediate advertising can make special offers consisting of bundles of advertising from different mass media. Besides, and more related to supply side considerations, we think it is interesting checking the hypothesis that public or private television channels that contract out behave more efficiently than others that keep management of ad time in house. *Contracting out* takes value 1 when the television channels contract out the management of ad time sales.

We include a dummy variable *language* that takes into account the existence of co-official languages in several regions in Spain. There is a single official language (Spanish) nation-wide, but co-official languages (Catalan, Galician, and Basque) exist in six regions (Catalonia, Comunidad Valenciana, Balearic Islands, Galicia, Basc Country, and partially in Navarre) containing more than 40% of the total Spanish population. In these regions, the regional public broadcasters use their respective co-official languages. Our model takes into account these singular situations in several regions. We posit that regional public broadcasters enjoy a partial monopoly, since in the period covered by our data, each is the only television using its respective co-official language. In this way, we believe that these broadcasters offer a different product and address a specific subset of viewers. Hence, we assume that advertisers might pay a premium for broadcasting their advertising on these channels. The variable *language* takes value 1 when the television channels' language is a co-official one other than Spanish, and 0 otherwise.



We must take into account the relationship between the channels' content and demand for advertising. For this reason, we include three variables, intended to capture the effect of program's content. The first one is football programs. We expect a positive relationship between football programs and both share and ad time (*minutes*), because in Spain football is—by far—the most popular sport. If a channel broadcasts a football program, more viewers will be watching and the channel increases its share. We construct a dummy *football* that takes value 1 if the channel broadcast the Spanish football league.<sup>15</sup>

The other two variables considered are the percentage of all programs that are (a) entertainment programs, and (b) cultural programs. Regarding entertainment programs, we expect a positive relationship with *share* and a negative one with *minutes*, because the series and quiz shows are very important and popular for viewers. Regarding cultural programs, regional as well as national public television channels offer them as a part of their 'public service' obligation. These programs do not tend to be very popular, and we expect a negative relationship with both *share* and *minutes* of advertising.

In addition, we consider three variables to take into account differences in population characteristics. On the one hand, we use the percentage of population between 14-29 and 30-44 years old in the region where a television channel broadcasts its programs. The first group has a high rate of consumption and is favored by advertisers because advertising has a stronger impact on its members. We expect the opposite regarding the 30-44 group. We also consider the number of women in the region where the channel broadcasts. In Spain, the proportion of women in the employed population is smaller than the European Union average. Housewives consume a significantly greater amount of TV programming than do other sectors of the population, and they are responsible for most decisions concerning household consumption. Because of this, they make a valuable target for advertisers, and in advertising negotiations the percentage of women in the audience

brings a premium in advertising price. We expect to obtain a significant and positive effect on price in our estimation.

We also include regional GDP per capita (*regional\_gdp*), which we obtain from the National Institute of Statistics (INE). This variable reflects the variation of wealth existing over the Spanish territory, since advertisers prefer wealthier viewers.

Table 3 displays the descriptive statistics and table A-2 in the appendix shows the correlation between the variables used in the empirical analysis; endogenous variables, the explanatory variables and the excluded instruments.

**Table 3. Descriptive statistics**

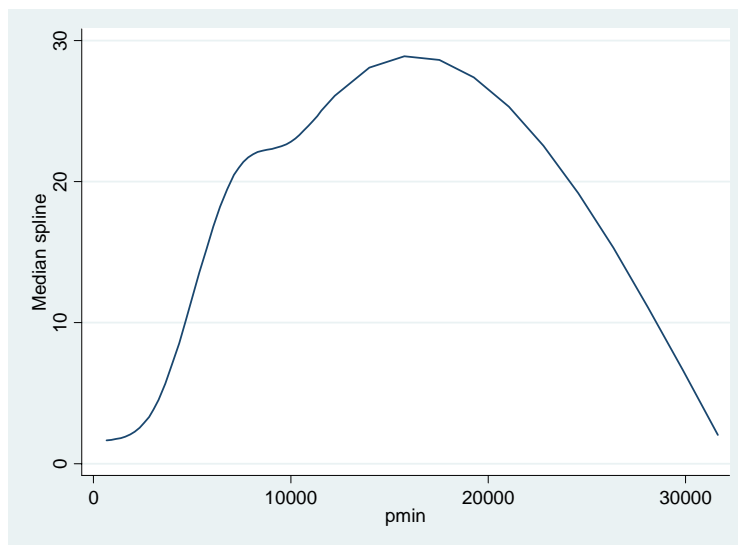
| Variable        | Observations | Mean     | Standard deviation | Minimum value | Maximum valor |
|-----------------|--------------|----------|--------------------|---------------|---------------|
| price           | 122          | 3343.12  | 4514.194           | 100           | 31622         |
| minute          | 122          | 25643.16 | 10002.78           | 1723          | 47081         |
| share           | 122          | 7.429    | 9.360              | 0.23          | 32.62         |
| audience        | 122          | 3157741  | 3968922            | 95583.24      | 1.34e+07      |
| Contracting out | 122          | 0.295    | 0.458              | 0             | 1             |
| Ownership       | 122          | 0.738    | 0.442              | 0             | 1             |
| Per14-29        | 122          | 21.202   | 1.306              | 17.34         | 24.52         |
| Per30-44        | 122          | 24.540   | 1.166              | 21.81         | 27.89         |
| women           | 122          | 51.015   | 1.354              | 47.6          | 54.47         |
| Regional_gdp    | 122          | 19785.85 | 3739.584           | 13206         | 28850         |
| language        | 122          | 0.328    | 0.471              | 0             | 1             |
| entertainment   | 122          | 42.344   | 10.784             | 19.9          | 74.7          |
| cultural        | 122          | 5.102    | 2.921              | 0.3           | 13.1          |
| football        | 122          | 0.557    | 0.499              | 0             | 1             |

## 5. Estimation

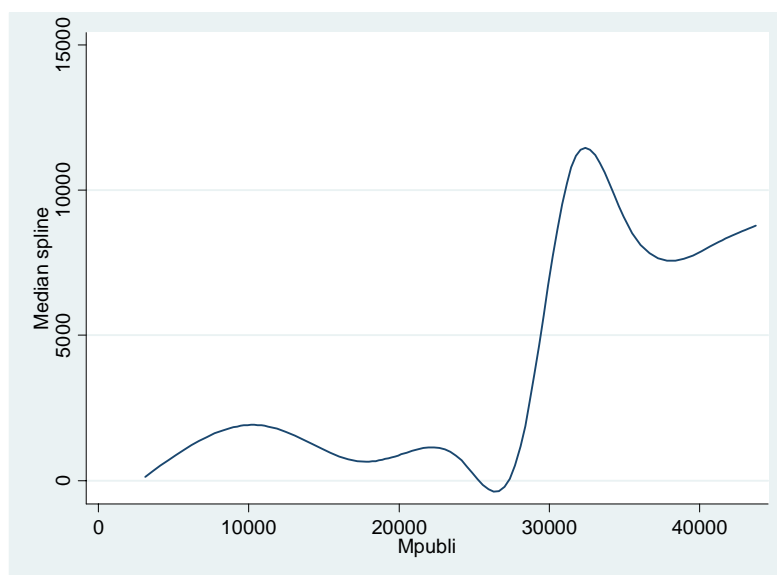
We estimate an advertising price function. To construct it, we use panel data made of prices per minute coming from 13 Spanish broadcasters (with simulcast technology and free-to-air broadcast). First, we estimate the median spline to have a preliminary result of the relationship between share and advertising price, and between share and advertising minutes.

Our non-parametric analysis shows that share does not have a linear relationship with advertising price and advertising minutes. This leads us to using a non-linear relationship between audience, ad minutes and ad price. We estimate the following function (2):

**Figure 1: Median spline between share and advertising price**



**Figure 2: Median spline between share and advertising minutes (Mpubli)**



$$\log(\text{price}_{it}) = e^{\alpha} + \beta_1 \log(\text{minute}_{it}) + \beta_2 \log(\text{audience}_{it}) + \beta_3 \text{contract}_{it} + \beta_4 \text{public}_{it} + \beta_5 \log(\text{per14-29}_{jt}) + \beta_6 \log(\text{per30-44}_{jt}) + \beta_7 \log(\text{women}_{jt}) + \beta_8 \log(\text{regional\_gdp}_{jt}) + \phi$$

The advertising price per minute for broadcaster  $i$  at moment  $t$  is a function of: (1) minutes of advertising<sup>16</sup> (*minutes*) in network  $i$  at moment  $t$ ; (2) the percentage of viewers (*share*) who are watching TV in network  $i$  at moment  $t$ ; (3) management of network  $i$  sales of advertising time (*contracting out*); (4) ownership of network  $i$  (*public*); (5) percentage of population 14 -29 years old (*per14-29*) in territory  $j$  at moment  $t$ ; (6) percentage of population 30 -44 years old (*per30-44*) in territory  $j$  at moment  $t$ ; (7) percentage of women (*women*) in territory  $j$  at moment  $t$ ; (8) and regional gross domestic product per capita in territory  $j$  at moment  $t$  (*regional\_gdp*).

Industrial organization theory suggests that there could be a potential problem of endogeneity between *minutes*, *share* and *price*. Advertisers buy advertising time well before their ads are broadcast. Programmers establish how many advertising minutes are available for purchase, and they estimate the expected audience. Advertisers can buy minutes, but they do not always use this advertising time. In such cases, the television channel broadcasts self-promotion. Our model uses data on audience size during this period.

Advertising prices in Spain are based on expected audience size, and television channels guarantee a minimum audience level. However, we cannot use data on expected audience because it is not publicly available. Instead, we consider the price actually charged for advertising (our data discounts rappels and commission charged by the mediator). Programmers, for their part, set advertising time before audience size is realized or the revenues generated by selling advertising have been established.

We estimate the price equation, introducing a time dummy (*tendency*). Table 4 displays the results obtained by using the ordinary least square (OLS) estimator. To control for this potential endogeneity problem, we estimate the price equation by means of two-stage least square estimator (IV/2SLS) estimation. The variables for entertainment, football, language, and the lag of minutes are used as instrumental variables for minutes and audience size. It is worth noting that our estimation procedure does not take into account the panel data nature of the sample. Using a fixed-effects model would not be appropriate in our context, since that technique drops anything that is time-invariant from the model, such as the variable *public*. Since the individual effects (that is to say, the networks), are correlated with the error term (as indicated by the Hausman test) the random-effects model is not appropriate either.

We have 122 observations in OLS estimation and 108 observations in IV/2SLS estimation. The four estimations have obtained a high coefficient of determination ( $R^2$ ). These results suggest that the models do not have problems related to misspecification or omitted variables. The F test considers the joint significance of regression coefficients in the model. The null hypothesis is that the estimated coefficients are jointly equal to zero. The F test rejects the null hypothesis.

Table 4 also shows the diagnostic tests. In the Wooldridge test for autocorrelation the null hypothesis of no serial correlation is not rejected. The result of the Breusch-Pagan test (designed to detect any linear forms of heteroskedasticity), implies rejection of the existence of heteroskedasticity. Furthermore, we prevent this potential problem by using robust standard errors.

We find substantial differences in the results when using IV/2SLS and OLS estimators, revealing that there is an endogeneity problem involving *share*, *price* and *minute*. Henceforth we only consider the results reported by IV/2SLS estimation.

The results for standard tests of instruments are reported by IV/2SLS estimation. We report the Anderson canonical correlations test, in which the null hypothesis is that the equation is under-identified; That is, the instruments are weak. We also report the Sargan test. In this case, the null hypothesis is that the instruments are valid instruments. Finally, we report the Shea's partial  $R^2$  measure for instrument relevance, which measures the correlation between the excluded instruments and the endogenous regressor, and the F-test statistic of the excluded instruments in the corresponding first-stage regression.

**Table 4. Estimation**

| Price equation (dependent variable: lpmi)  |                      |                       |                      |                       |
|--|----------------------|-----------------------|----------------------|-----------------------|
|  | OLS                  |                       | (IV/2SLS)            |                       |
|  | (1)                  | (2)                   | (1)                  | (2)                   |
| Lminutes   | -0.264<br>(0.272)**  | -0.262<br>(0.121)**   | -0.444<br>(0.231)**  | -0.443<br>(0.231)**   |
| Lshare   | 0.848<br>(0.069)***  | --                    | 0.947<br>(0.096)***  | --                    |
| Laud   | --                   | 0.847<br>(0.066)***   | --                   | 0.946<br>(0.096)***   |
| Contracting out  | 0.171***<br>(0.017)  | 0.174<br>(0.122)      | 0.085<br>(0.156)     | 0.087<br>(0.156)      |
| Public   | -0.478<br>(0.154)*** | -0.478<br>(0.131)***  | -0.380<br>(0.165)**  | -0.382<br>(0.165)**   |
| lPer14-29  | 5.814<br>(0.914)***  | 5.828<br>(1.801)***   | 4.515<br>(2.181)**   | 4.546<br>(2.179)**    |
| lPer30-44  | -9.282<br>(1.263)*** | -9.288<br>(2.191)***  | -7.316<br>(2.643)*** | -7.343<br>(2.641)***  |
| lWomen   | 2.856<br>(1.999)     | 2.869<br>(1.756)      | 3.030<br>(1.936)     | 3.050<br>(1.936)      |
| lregional_gdp  | 2.903<br>(0.299)***  | 2.907<br>(0.524)***   | 2.555<br>(0.644)***  | 2.565<br>(0.643)***   |
| Tendency   | 0.071<br>(0.171)***  | 0.0644<br>(0.024)**   | 0.060<br>(0.032)*    | 0.053<br>(0.033)      |
| Intercept  | -19.173<br>(9.024)** | -30.246<br>(8.648)*** | -17.034<br>(9.864)*  | -29.435<br>(9.665)*** |
| N  | 122                  | 122                   | 108                  | 108                   |
| R2   | 0.90                 | 0.90                  | 0.89                 | 0.89                  |
| Test F (Joint significance)  | 355.43***            | 386.54                | 86.64***             | 86.86***              |
| Test Sargan (Over identification test of all instruments)  | --                   | --                    | 5.586                | 5.621                 |
| Test Anderson canonical correlations (under identification and weak identification)                        | --                   | --                    | 32.852***            | 32.850***             |
| <i>Lshare</i><br>Shea's partial R2 (excluded instruments)<br>Test F (Significance of excluded instruments) |                      |                       | 0.547<br>(16.29)***  | 0.547<br>(16.35)***   |

|   |         |  |           |           |
|---|---------|--|-----------|-----------|
| <i>Lmin</i>                                   | --      |  | 0.311     | 0.311     |
| Shea's partial R2 (excluded instruments)      |         |  | (6.76)*** | (6.76)*** |
| Test F (Significance of excluded instruments) |         |  |           |           |
| Diagnostics test                              |         |  |           |           |
| Wooldridge test for autocorrelation           | 4.828** |  |           |           |
| Breusch-Pagan test for heteroskedasticity     | 3.21*   |  |           |           |

Note 1: Robust standard errors in parenthesis.

Note 2: \*\*\* significant at 1% level; \*\* significant at 5% level; \* significant at 10% level.

Note 3: The instruments for minutes and share are log (entertainment), football, language, log(minutesT-1) and log(cultural).

Our results show a positive and significant elasticity between *share* and *price*, 0.947, and *viewers* and *price*, 0.946. This is in line with results previously obtained in the literature, which have fluctuated between 0.83 and 1.4. We can interpret this result through the lens of the two-sided market theory.

Advertising time *-minutes-* shows a negative and significant elasticity (-0.444). Advertisers create a negative externality to viewers. When a television channel broadcasts ads, viewers will be more likely to switch to another channel, because viewers dislike advertisements. Broadcasters are aware of this behavior, and television channels that broadcast less advertising time are able to charge a higher price to advertisers for each minute.

Currently, governments are changing regulations covering advertising time, making them more flexible and less restrictive. Since market competition is intense, broadcasters will have more difficulty selling their ad time. According to our results, advertisers are willing to pay more when networks broadcast less advertising. Because of this, networks have incentives to self-regulate the advertising minutes they broadcast<sup>17</sup>.

Another variable in our analysis is *contracting out*. This variable is not statistically significant. When a television channel contracts out the management of its ad time sales, it does not receive more income per advert than those stations that do not contract out. This result is interesting because in Spain most television channels, public and private,

contract out the sale of ad time. Our empirical analysis does not allow us to make further claims concerning the desirability of contracting out and its potential encouragement by policy makers. On one side, contracting out will reduce production costs; on the other, external firms will impose costs on the channels that contract out, and these costs will include transaction costs derived from the contracting process and the monitoring. We have no specific information on reductions in cost of production. Nor do we have information on transaction costs or the costs incurred in compensating external providers. Hence, we cannot assess the balance between cost reduction and cost increase.

Our results also show a negative relationship between price and television channel ownership. Advertisers perceive differences between public and private owners, perhaps due to differences in management. The lower price paid for time on public channels might be a product of those perceptions. The management of advertising in private channels might be more aggressive than that in public entities, because these last enjoy a mixed funding system. Advertisers may assume that public entities, because they receive funding from sources other than advertising, are going to be less aggressive in pursuing higher prices than their private counterparts. Armed with this assumption, they may enter into negotiations determined to obtain a lower price from public broadcasters than they expect to pay to private operators.

We can refer now to the environmental variables. Regional GDP per capita shows a positive relation with ad price (2.555). This provides evidence that advertisers value advertising in wealthier regions. The percentage of population 14-29 years old also has a significant relationship with the price. We believe that the percentage of population 14-29 years old is an important target for advertisers. This group is more susceptible to advertising than others age groups. The opposite reasoning explains why we find a



negative and significant relationship between the percentage of population 30-44 and ad price.

Finally, while the variable *women* has a positive relationship with price, the coefficient is not significant. This result is somehow surprising, since housewives seem to be an important group for advertisers because they watch more television than do men. Perhaps changing habits in society and the increasing participation of women in the labor force in Spain imply more evenly distributed responsibilities in decisions concerning household consumption.

## **6. Conclusions**

The media industry is extremely dynamic, and it has experienced intense changes in recent times. Not long ago, the market in most European countries was made up of a public monopoly with a few national channels and analog technology. However, over the two last decades new operators—public as well as private—have entered the market. In addition, the development of new technologies has had a strong impact on the market. The increasing competition has provoked important changes in the market shares, which, in turn, have had strong effects on revenues from advertising.

The share is a key variable in advertising contracts. Our results show a high elasticity of advertising price with respect to audience size. We find a strong relationship, negative in this case, between ad time and advertising price. Advertisers pay more for advertising on those networks that have less total advertising time in the hopes that their ads will have a stronger impact on viewers.

Regarding variables related to the environment, we find a positive relationship between price and the percentage of population 14 and 29 years old and the strength of GDP in the region. On the contrary, a negative and significant relationship between price and percentage of population 30 and 44 years old.

Beyond these results, our main contribution has been to consider the competition between public and private broadcasters. We obtain a negative and significant relationship between public ownership and ad price. Less aggressive advertisement management in public television channels may induce less willingness to pay on the part of advertisers. We also contribute with an analysis of the effects of contracting out the management of sales of advertising time. If public or private television channels contract out that management, it does not result in more attractive offers than those made by channels that do not contract out.

Our study sheds some light on the market responses to increasing levels of competition. Some interesting issues emerge for future research. Among them, we wonder what this type of analysis will show when all television channels have migrated to digital technology.

**Appendix:**

**Table A-1. The main variables, hypothesis and empirical evidences.**

| <b>Variables</b>      | <b>Hypothesis</b>   | <b>Theoretical basis</b>   | <b>Empirical evidences</b>  |
|-----------------------|---|--|---|
| Share                 | Positive relationship with advertising price                                  | Share generates a positive externality to advertisers. The ad time generates a negative externality to share.<br>Cunningham & Alexander (2004), Anderson & Coate (2005), Reisinger (2004). | Positive relationship with price, and negative with ad time. Elasticities between 0.83 and 1.4.<br>Goettler (1999), Wilbur (2008), Brown y Cavazos (2005), Brown y Alexander (2004) y Kasuga y Shishikura (2006).                             |
| Minutes               | Negative relationship with share and price.                                   | Generates a negative externality to share. Negative relationship with ad price.<br>Anderson & Coate (2005), Reisinger (2004) and Bel, Calzada & Insa (2007)                                | Negative relationship with share and price.<br>Wilbur (2008).   |
| Contracting out       | Positive relationship with price  | Not considered in the literature   | Not considered in the literature  |
| ownership             | Differences between commercial and public channel Important variable on price | Differences between commercial and public channels.<br>Hansen & Keiding (2006) and Kind, Nilssen & Sjørgard (2007)   | Differences between commercial and public channels<br>Alcock & Docwra (2006), Delaney & O'Toole (2006), Van der Wurff & Cuilenburg (2001) & Withers (2001).<br>No differences between commercial and public TVs.<br>Tsurvakas (2004).         |
| Demographic variables | Demographic variables affect to ad price                                      | No specific hypothesis in the literature   | The literature considers the demographic composition.<br>Goettler (1999), Wilbur (2007), Hammervold & Solberg (2006), Withers (2001) y Brown & Cavazos (2005), Brown & Alexander (2004) and Kasuga & Shishikura (2006).                       |
| Economic variables    | High per capita income generates a positive effect on ad price.               | No specific hypothesis in the literature   | Economic variables used in the empirical literature.<br>Hammervold & Solberg (2006), Withers (2001).<br>Brown & Cavazos (2005), Brown & Alexander (2004), Kasuga & Shishikura (2006) show a positive correlation between ad price and income. |

**Table A-2. Correlation matrix**

|                 | price | minutes | share | Contracting out | public | Regional GDP | Per3044 | women | Per1429 | language | entertainment | football | cultural |
|-----------------|-------|---------|-------|-----------------|--------|--------------|---------|-------|---------|----------|---------------|----------|----------|
| Price           | 1     |         |       |                 |        |              |         |       |         |          |               |          |          |
| minutes         | 0.50  | 1       |       |                 |        |              |         |       |         |          |               |          |          |
| share           | 0.76  | 0.74    | 1     |                 |        |              |         |       |         |          |               |          |          |
| Contracting out | 0.27  | 0.21    | 0.39  | 1               |        |              |         |       |         |          |               |          |          |
| public          | -0.48 | -0.39   | -0.43 | 0.14            | 1      |              |         |       |         |          |               |          |          |
| Regional GDP    | 0.06  | 0.24    | 0.01  | 0.09            | -0.03  | 1            |         |       |         |          |               |          |          |
| Per3044         | -0.08 | 0.12    | -0.09 | -0.07           | 0.06   | 0.45         | 1       |       |         |          |               |          |          |
| women           | 0.04  | 0.05    | 0.02  | 0.02            | 0.02   | -0.06        | -0.25   | 1     |         |          |               |          |          |
| Per1429         | -0.01 | -0.09   | 0.03  | -0.01           | 0.03   | -0.55        | 0.21    | 0.06  | 1       |          |               |          |          |
| language        | -0.32 | -0.20   | -0.38 | 0.31            | 0.42   | 0.17         | -0.33   | 0.12  | -0.46   | 1        |               |          |          |
| Entertainment   | 0.12  | 0.20    | 0.18  | 0.10            | -0.06  | 0.12         | 0.12    | -0.14 | -0.29   | -0.02    | 1             |          |          |
| Football        | -0.02 | -0.25   | -0.11 | 0.29            | 0.29   | 0.39         | 0.06    | 0.12  | -0.01   | 0.27     | -0.24         | 1        |          |
| cultural        | -0.09 | -0.33   | -0.08 | 0.26            | 0.46   | 0.03         | 0.12    | -0.15 | -0.00   | -0.02    | -0.04         | 0.29     | 1        |

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<sup>2</sup> For public service broadcasting it is understood that programming should satisfy wide social purposes such as education, plurality, minority protection, and democratic values.

<sup>3</sup> The European countries have agreed on the migration away from analog to digital technology, Digital Terrestrial Television (DTT). In Spain, the migratory process is scheduled to happen in 2010.

<sup>4</sup> The most important reorganization plan is that undertaken for RTVE, the national public network. Its core objective is increasing efficiency in the management of public funds and offering attractive public service programming. In order to achieve these goals, the central government has replaced unconditional direct subsidies with program-contracts that include specific agreements and conditions to be met. Many regional governments have adopted too this type of contract.

<sup>5</sup> In 2004, Radio Televisión Española (RTVE) lost leadership in market share for the first time and has never recovered that position.

<sup>6</sup> In this sense, the relationship between ad prices and channels ownership is a heavily discussed issue in Spain. Indeed, the Spanish Association of Commercial Television (UTECA) has considered that if the public channels compete directly for advertising revenues, this could distort competition in the market [see UTECA (2008) *La Televisión en España. Informe anual 2007*]

<sup>7</sup> Mangani (2003) and Peitz and Valletti (2008) analyze the effect of advertisers on the level of product differentiation.

<sup>8</sup> Hansen and Keiding (2006) consider a mixed oligopoly model where the public TV's objectives are different to those of the private broadcasters, and analyze the consequences of privatizing public TV.

<sup>9</sup> RTVE receives funds from a canon or fee and from advertising sales. The canon or fee is approximately 155 euro, though there are discounts.

<sup>10</sup> Withers (1985) studies other aspects related to competition. The author estimates a viewers' demand function for Australian public TV during 1962 and 1982. The results show that rather than competing with programs offered by private TV, ABC and private programs complement each other.

<sup>11</sup> Brown and Alexander (2005) and Kasuga and Shishikura (2006) introduce as well audience characteristic, as the percentage of population 18 - 34 years old, and per capita income.

<sup>12</sup> We only consider the minutes sold to advertisers. Actually ad time used by the network for self-promotion is not affected by the regulation (and no data on this is publicly available).

<sup>13</sup> For instance, the audience in Spanish Public TV has a higher average age, and a much higher share in the viewers group of older than 65. In fact, TVE has a share of 36.4% in the age group, whereas her main competitors have much lower shares in the > 65 years group (22.2% Antena 3 and 22.5% Telecinco). Unfortunately, we cannot specify this type of characteristics in the equation because either we do not have information for all channels and periods, or it would introduce serious problems of correlation with core

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variables such as share (this is the case, for instance, when trying to introduce the variable share in older than 65).

<sup>14</sup> It is worth noting that we have conducted the estimation without introducing the variable *public*, to compare the results. They remain similar, and when excluding the variable *public* we do not meet the test for omitted variables.

<sup>15</sup> We use a dummy variable because the percentage of football among all programming is not available.

<sup>16</sup> In Spain, the minutes of advertising (by hour) are subject to national regulation. However, this variable shows variability because practices diverge among regional and national channels.

<sup>17</sup> It is worth mentioning that we do not imply from this that a network will not set a profit-maximizing number of ad minutes in the presence of a cap.