Master Project:

Demand Estimation in a Two-Sided Market: Viewers and Advertisers in the Spanish Free-to-Air TV Market

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I hereby declare that this dissertation is all my own work, except as indicated in the text:

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Abstract

The Spanish Free to air TV industry is a two sided market in which viewers demand TV programs and advertisers demand advertising spots for which they pay a price that depend mainly on audience. On one hand, we specify Viewers Demand in the Spanish free-to-air TV through a logit model to analyse the impact of advertising minutes on the audience share and, on the other hand, we specify Advertisers Demand by an adaptation of the model of Wilbur (2008) in order to understand the effect of audience share and advertising quantity on prices of adds. For Viewers Demand model we found a elastic demand (-1.6), and that in general viewers are averse to advertising regardless of the day but during prime time they are a bit more ad tolerant, especially from 10pm to 11 pm. Our results of the Advertising Demand model show that advertisers are relatively inelastic to both an increase of adds (elasticity of -0.1) and an increase in audience share (elasticity of 0.46).

Keywords: Competition, two-sided market, Advertising.

JEL Classification: C23, D41, L13, M30

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Chapter 1

Introduction

The present Master Project aims to develop an econometric analysis of the Free to Air TV market in Spain to capture the dynamics of supply of advertising and demand of viewers. We estimate the reaction of viewers to a change in advertising quantity and the effect on price of adds that this would bring. We explain the motivation and the specific goals of our analysis in Chapter 1. We review the relevant literature in Chapter 2. Chapter 3 describes the Market Characteristics and the Data we have available for our research. We describe our model specifications of viewers demand and advertising demand in Chapter 4. Chapter 5 discusses our empirical results and Chapter 6 concludes.

1.1 Motivation

Several features make free-to-air TV industry attractive for antitrust practitioners. Television remains to be the most important advertising medium. A survey conducted in 2017[1] shows that advertisement influence 90% of consumers to make a purchase and the most influential method is TV advertising with 60% materialized purchases after seeing and add on TV, while only 43% of consumers purchase after seeing it online. This is so because watching TV is one of the main activities of the world population. In Spain the total number of daily TV viewers in 2018 was 31.433.000 persons and the average TV consumption was 234 minutes per day in 2018 [2], which amounts to almost 4 hours a day.

The Spanish free-to-air TV market is fairly entertaining for antitrust practitioners for other reasons too. This market has been increasingly concentrated overtime. In October 2010 the Spanish Antitrust Authority authorized the merger between Telecinco and Cuatro (later renamed

[1] https://clutch.co/agencies/resources/how-consumers-view-advertising-survey-2017

as Mediaset)[2] and in August 2012, the merger of Antena 3 and La Sexta (later renamed as Atresmedia)[3]. Both merger decisions were approved subject to conditions[4]. Furthermore, the Spanish Antitrust Authority (CNMC) has been studying the Spanish TV advertising sector for a long time being suspicious about potential anticompetitive practices. In fact, in November 2019 the CNMC imposed a considerably big fine to Atresmedia and Mediaset for an infringement of article 101 the Treaty of Functioning of the European Union (TFUE) and of Article 1 of 15/2007 Law (Spanish Defense of Competition Act) in the market for television advertisement. According to the CNMC, the two groups (Atresmedia and Mediaset) commercialized their advertising spots through vertical agreements that limited the ability to compete in the market for the rest TV channels. Given that Atresmedia and Mediaset channels are essential for adverting agencies, these vertical agreements allowed them to concentrate the market preventing others from receiving advertising revenues and therefore, it had a foreclosure effect in the market.
Furthermore, the functioning of the Free-to-Air TV industry is particularly interesting for its two-sided nature; e.g. broadcasters enable the interaction between viewers and advertisers. In two-sided markets it is crucial to understand how both sides relate to each other in order to understand pricing behaviour of firms (for example, the fact that viewers do not pay for watching TV programs and only advertisers do). In this case, we realized that there was no empirical study in the industry in Spain that considered the cross group externalities in the Free-to-Air TV market, this is, the effect of advertisement on audience and the effect of audience on advertisers demand. Thus, our main contribution is estimating both viewers and advertisers demand in order to understand the interactions of both sides of the Spanish Free-to-Air TV market.

1.2 Aims and Objectives

The objectives of the present Master Project are the following:

- develop an econometric model and analysis of the two sided market for Free to Air TV in Spain.
- estimate the reaction of viewers to a change in advertising quantity.
- understand the dynamics of supply of advertising and demand of viewers.

[2] C/0230/10 TELECINCO/CUATRO.
[3] C/0432/12: ANTENA 3/LA SEXTA.
[4] The tendency towards concentration of the Spanish free-to-air TV market is common in the industry. For example, in 2010 the Autorité de la Concurrence in France authorized the acquisition of two channels by the -already dominant- TF1 Group subject to behavioural remedies, including the remaining of the commercialization of advertising for the channels independent.

Chapter 2

Background and Related Work

The Spanish Free to air TV market is a two sided market: i) viewers demand TV programs and ii) advertisers demand advertising spots for which they pay a price that depend mainly on viewers watching the program. Rochet and Tirole (2003)[11] were the pioneers in studying platform competition in two-sided markets. They showed that a market is two-sided if the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side. In the Spanish free-to-air market, broadcasters act as the platform that tries to attract the two sides of the market (viewers and advertisers) by jointly maximizing price in both sides. The presence of viewers watching TV is being monetized by the broadcasting companies that sell audience (viewers) to the advertisers (See Figure 3.1). In order to maximize audience, broadcasters offer TV programs for free (subsidized side) while they get revenues only from the advertisers.

Both Rochet and Tirole (2003)[11] and Armstrong (2006)[1] defined the concept of single-homing and multi-homing in two-sided markets. When an agent uses different platforms, she multi-homes, for example using HBO, Netflix and Disney +. When an agent only uses one platform, she is said to single-home, for example, using google as their search engine. Usually when one side of the market single-homes, the other side has to multi-home to reach more consumers. According to Armstrong (2006)[1] platforms have monopoly power over providing access to their single homing customers for the multi-homing side, what leads to high prices being charged to the multi-homing side. In the Spanish free-to-air TV market TV viewers tend to single-home and this is what drives price equal to 0 for viewers whereas prices are higher for advertisers. This is different, for example, in streaming platforms such as Netflix or HBO, where viewers tend to multi-home given the exclusivity of the shows and this gives advertisers the possibility to single-home. The main purpose of the present Master Project is to understand both sides of

the market in order to estimate the reaction of viewers to a change in advertising quantity and the effect on add price that this would bring. As we have introduced in Chapter 1, the Spanish free-to-air TV market has been increasingly concentrated overtime. Already in the beginning of the 2000s, Cunningham and Alexander (2002)[7] found that an increase in concentration in broadcast media sector may lead to an increase in the fraction of broadcasting devoted to advertising. Furthermore, their results show that an increase in advertising time may lead to an increase in the unit price for advertising, with the corresponding consumer loss associated. Nevertheless, if a media broadcaster allocates a large amount of advertising during a program, a viewers would try to avoid advertising by switching channels or by turning the TV off. Media broadcasters take these effects into account in order to maximize audience size and consequently the advertising revenue.

As introduced in Chapter 1, the CNMC imposed a considerably big fine to Atresmedia and Mediaset for an infringement of article 101 of the TFUE and of Article 1 of the Spanish Defense of Competition Act, in the market for television advertisement and forbade Atresmedia and Mediaset to sell their advertising spots packing advertising channels together (lower and higher audience channels were sold together with a system of discounts) guaranteeing adds being shown at the same time in different channels owned by the same company). Ivaldi and Zhang (2018)[9] did an empirical analysis of a similar measure carried out by the French Antitrust Authority in 2010, when it approved the merger of three free broadcast TV channels, subject to behavioural remedies. They found the remedy imposed by the French Antitrust Authority unnecessary. They constructed a counterfactual situation in which the remedy was not imposed and therefore advertising was sold jointly. Interestingly, they found no significant difference in advertising quantities between the actual situation (with remedies) and the counterfactual.

JungWon Yeo (2017)[16] estimates the contraction on television viewership on weekend prime-time scheduling and decompose it into two parts: i) the one caused by broadcasting low quality programs and ii) other, due to a general demand contraction for watching TV. As we will see in Chapter 5 we also found evidence of the weekend effect during prime time in the Spanish Free-to-Air TV market.

Bel and Domenech (2009)[3] studied the competition between public and private broadcasters in Spain, obtaining a negative and significant relation between public ownership and ad price. This means that less aggressive competition in public TV channels may induce less willingness to pay in the advertisers side. We believe this fact could have partially motivated the Spanish Governments decision of eliminating advertising for the public TV channels from 2010 on. This

particular measure was approved by the 8/2009 Law, of August 28, "of Radio and Spanish Television Corporation financing". From 2009-2010, TVE stopped receiving advertising revenue for value of 394 million euros, having the effect of an increase of advertising revenue of 483 million euro for the rest of TV channels. Our advertisers demand model is different from theirs because we explicitly take care of endogeneity problems.

We attempt to analyze how the two sides of the Spanish Free-to-Air market interact with each other in order to understand pricing behaviour of broadcasters. This analysis is similar to those of Sweeting (2009)[12] and Berry (2016)[4], who studied the radio market estimating demand for listeners and price of advertising but in the Free-to-Air TV market. Notwithstanding, the closest work to ours is Wilbur (2008)[15] and the Report of Analysis Mason and BrandScience[10], who estimated viewer demand for programs on one side and advertising demand for audiences on the other. He[15] found that a 10% increase in advertising time decreases the median audience size on a highly rated broadcast network by about 25% and that advertising prices are highly responsive to audience size. He also found that ad avoidance by viewers increases advertising levels and decreases network advertising revenues.

Our experiment is different given that we have detailed information per channel and per minute of audience market share, quantity of advertising and price of advertising, this allows to estimate viewers demand an advertising demand per minute and per blocks of 30 minutes, to test the robustness of the models.

Our thesis contributes to this literature by analysing the effect of advertising on audience and the effect of audience on advertising demand, in Spain. The Spanish Antitrust Authority could use our model to simulate the expected effects of changes in advertising rules in the Spanish Free-to-Air market (for example, changing the maximum level of advertising minutes per hour).

This paper could be extended in several interesting directions. We could consider a nested logit model for viewers demand in order to capture the switching patterns among different TV channels. For example, a nested model would show whether there is more substitutability of channels within the same group or, on the contrary, consumers substitute among channels (Which is not shown by the logit model).

Chapter 3

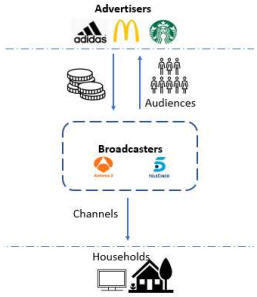
Relevant Market and Data Analysis

3.1 Market characteristics

Spanish free-to-air TV market:

The Spanish Free to air TV industry is a two sided market: i) viewers demand TV programs and ii) advertisers demand advertising spots for which they pay a price that depend mainly on viewers watching the program. An example, of this market is shown in Figure 3.1:

Figure 3.1: Two sided market



Broadcasters in Spain need a license to broadcast through the TDT platform[1] (or rent broadcasting capacity to the owners or the license) and they compete to attract viewers, which gives them the opportunity to charge advertisers for accessing those viewers. This differs from paid TV, whose principal source of revenue are viewers subscription fees[2]. While viewers of free-to-air TV have to bear advertising in order to get the service for free, paid TV differentiates itself from free-to-air TV by guaranteeing very limited (or no) advertising.

According to Barlovento Comunicacion (2019)[2], the total number of daily TV viewers in 2018

[1]Digital Terrestrial Television (TDT) is the result of the application of digital technology to the television signal and then transmitted by means of terrestrial hercytic waves, that is, those that are transmitted through the atmosphere without the need for cable or satellite and are received by conventional UHF antennas.

[2]From an economic perspective, this means that paid TV companies maximize number of subscriptions, while free-to-air TV companies maximize audiences.

was 31.433.000 persons and the average daily television consumption was 234 minutes per viewer. A surprising aspect of the Spanish TV consumption is that free-to-air TV is preferred over paid TV. The time consumption corresponding to free-to-air TV is in the range of 66%[3] to 75%[4], while the rest corresponds to paid TV[5].

The supply of free-to-air TV in Spain is integrated by five nationwide broadcast groups and a diverse local channels. There are two largest groups: Atresmedia and Mediaset with 6 and 7 channels respectively; CRTVE a major public group with 5 channels; G. Vocento and U. Editorial with 2 channels each; 7 other independent channels and the remaining small autonomic and local channels. Figure A.1 shows the evolution of audiences by broadcast group and channel from 2015 to 2018.

The Spanish TV advertising market:

The TV advertising market represents the "money" side of the free-to-air TV market (viewers represent the "subsidized" side of the market). Broadcasters usually sell advertising impressions (audience). Impressions account for the number of exposures of a particular advertisement[6]. Media cost is the price advertisers pay to place their commercials on TV on a given time of day and it usually has a standard length (in Spain usually 20 seconds). There are different ways to buy TV advertising spots in Spain:

- GRP cost: A Gross Rating Point (GRP) is a measurement of the audience size. Each GRP guarantees a number of impressions equivalent to 1% of the potential targeted universe[7]. A specific number of GRP can be obtained either through high audiences and low repetitions or through high repetitions and low audiences. This means that, to maximize impressions with lower number of frequency, the best advertisers can do is place their ads in channels with high audiences and specially during prime time[8]. The advantage of GRPs sale is that advertisers do not bear the risk of programs not being sufficiently popular because they pay for actual impressions.
- Discounts: Advertisers buy spots (time) instead of audience at specific price. Under this

[3]Ofcom (2017), The International Communications Market 2017

[4]Telecommunications and Audiovisual Sector Economic Report, CNMC (2018)

[5]This is different in other countries, where paid TV is more important, as we can see in the figure A.2. For example, in Netherlands paid TV represents 98%, in Germany and UK it is almost 60%.

[6]Viewers can receive several exposures over time. A total of 1000 impressions can be reached through different ways: for example: i) 100 targeted people watching a commercial 10 times, ii) 1000 targeted people watching the commercial once, and iii) 50 targeted people watching the commercial 20 times.

[7]A potential targeted universe could be, for example, young people or homemakers.

[8]Prime time is considered to be from 10 pm to midnight and sometimes from 8:30 pm to midnight.

scheme the broadcaster does not guarantee a specific audience, it only sells the spot in which the ad is going to be broadcasted.

In Spain, the minutes of advertising a channels can broadcast is limited by law. According to article 14 of the 7/2010 General Audiovisual Law, TV channels can only broadcast 12 minutes of advertising per hour. Our data shows in Table A.1 that the observed advertising time per hour may not always comply with this regulation.

The fact that advertising is limited means that premium time (high audience) is especially valuable for advertisers, which prefer to broadcast their ads during those hours to maximize impression and minimize frequency of their ads.

The Telecommunications and Audiovisual Sector Economic Report of the CNMC(2018)[6] reported barely changes in the classification of channels by audience, with the exception of Telecinco, which was the channel with the highest growth that year (audience share of 14.1%). In second place was Antena 3 (audience share of 12.3% and third was La 1 (public TV with audience share of 10.4%). The main two channels of Mediaset and Atresmedia compete with each other more in terms of advertising (Telecinco with Antena 3). However, they both compete in audiences with the main public TV channel: La 1 (part of the CRTVE Group, which does not broadcast advertising by law). The two second channels of both groups (La Sexta and Cuatro) also tend to compete with each other, as our results confirm.

In this regard, Higher audience levels means higher advertising revenues. Figure A.3 shows that Atresmedia and Mediasets revenues from advertising amounted for 84% of the market in 2018 while other operators only represented 16%[9]. We can conclude then that Atresmedia and Mediaset are the big players in terms of advertising revenue and therefore infer significant results from our available data.

3.2 Data

Our data set, provided by Kantar Media, consists of 218,700 minute by minute observations, of prime time[10] of the most viewed channels in Spain[11]: i) the main public channel (La 1); ii) the most viewed Atresmedia channels (Antena 3 and La Sexta); and iii) the most viewed Mediaset channels (Telecinco and Cuatro) from July 2018 until February 2019[12]

[9] http://data.cnmc.es/datagraph/

[10] From 8 pm to 12:30 am. This specific time frame is of crucial importance for advertisers, given the fact that they tend to maximize rating using the least frequency possible. In order to do so, advertisers prefer to place their ads during prime time.

[11] In 2018, theses channel represented 72% of average audience share.

[12] The dataset comprehend information of the second fort nigh of each month, starting from July 11, 2018 to February 28, 2019. We have around 143 days with observations for the 5 channels.

The data set contains detailed information of the number of viewers watching each channel (segmented by gender) and the name of the program being broadcasted on each channel, at a given time. A program is any kind of content broadcasted but not an advertisement (news, sports, series, movies, talk show, etc.) In total the data set contains 684 programs.

We included program characteristics as genre, producer, country of production and first issue year (this is the year in which the program was released), which has been manually encoded based on what is shown in Wikipedia page or Film-affinity website.

With respect to the genre of a program we classified each program in one of the following six categories:

- Accion/Science fiction /Old movies/Crime/War. (Represent 26% of broadcasted programs).
- Drama/Thriller/Suspense/Intrigue. (Represent 32% of broadcasted programs).
- Talk show/Weather/News/Documentary/ Magazine/Entertainment/Kitchen/Debate (Represent 13% of broadcasted programs).
- Lottery/Coaching/Realities/Talent show/Contest. (Represent 6% of broadcasted programs).
- Sports and Sport News. ((Represent 1% of broadcasted programs).
- Adventure/Infantile/Comedy/Romance. (Represent 21% of broadcasted programs).

The Producer of each program was classified in one of the following categories: i) CRTVE[13], ii) Atresmedia[14], iii) Mediaset[15], iv) Big producers[16] as Warner Bros. Pictures, Paramount Pictures, Walt Disney Pictures, Pixar Animation Studio, Hallmark Entertainment, Touchstone pictures and Gestmusic, and v) Others producers.[17]

The dataset also contains an Advertising Indicator which takes the value of one if there is being broadcast advertising at a given time, and zero otherwise.

The monthly advertising price per day and hour was constructed with the publicly available information of Atresmedia[13] and Mediaset[14][18]. For each channel, month, day and time we recorded the monthly price per a 20 second spot.

As our data set contains detailed information about the most popular channels in Spain (Telecinco, Antena 3, La 1, La Sexta and Cuatro), we have constructed the variable "narrow audience chan-

[13] 4% of the program broadcasted where produced by CRTVE.
[14] 5% of the program broadcasted where produced by Atresmedia.
[15] 5% of the program broadcasted where produced by Mediaset.
[16] 36% of the program broadcasted where produced by a Big Producer.
[17] 50% of the program broadcasted where produced by other producer.
[18] Tariffs published by Mediaset España and and Grupo Atresmedia for the III and IV quarter of 2018 and the I quarter of 2019

nels" by subtracting viewers of the most popular channels to total viewers of free-to-air TV. The lack of disaggregated data on each narrow audience channel restricts the empirical model due to the fact that all other channels are aggregated into one composite option of watching "Narrow audience channels". Therefore, the model is not able to capture the heterogeneity among these small channel[19]. Notwithstanding, these narrow audience channels have very small audience level allowing us to still draw conclusions about the behaviour of the most viewed channels[20]. We considered that a viewer does not change every minute from one channel to another but might continue watching the same program for a longer period, thus we reprocessed the data to group each observation in blocks of 30 minutes to capture variations in the audience level and in the number of minutes of commercials within programmes.

[19]There are national channels such as FDF, Neox, etc, regional (Telemadrid, TV3, etc) or specialized channels (Paramount Channel, Gol, Disney Channel, etc) in this variable.

[20]On average, the most viewed channels account for more than 70% of the audience level.

Chapter 4

Model specification

We specify two models of demand for the Spanish free-to-air TV industry. The demand of TV viewers will be specified by a multinomial logit model to estimate the effect of a change in advertising minutes on audience shares for a specific program. The demand of advertisers will be specified by an adaptation of the model of Wilbur (2008)[15], to analyze the effect of audience share and advertising quantity on prices of adds. We account for the interaction of both sides of the market through the fact that number of viewers influence advertising prices, viewers in the free-to-air TV market do not pay for watching TV programs but audience is the main driver for advertising prices.

4.1 Demand of TV Viewers

Following the previous literature we assume that each television viewer i watches one channel at the time and that a viewer may choose to watch a given channel or doing something else (the outside option).

We represent the individual i conditional indirect utility for alternative j at time t as:

$$U_{ijt} = \delta_{jt} + \epsilon_{ijt} \tag{4.1}$$

where

$$\delta_{jt} = \bar{X_{jt}} B_j + \alpha A_{jt} + \xi_{jt} \tag{4.2}$$

The term $\bar{X_{jt}}$ represent the set of observed and common characteristics of the TV program broadcast on channel j at time t, captured by dummies (e.g, genre, day, hour). The term A_{jt} is the quantity of advertising on channel j at time t (blocks of 30 minutes), ξ_{jt} reflects the effect of unobserved characteristics of channel j at time t. The term ϵ_{ijt} is an individual specific

component of utility. δ_{jt} is the mean utility and is common to all consumers. The mean utility of the outside good is normalized to zero , so δ_{0t}=0. this is necessary, since we never observe utilities, instead we observe quantities.

Therefore, we specified the demand viewer as:

$$ln\Big(\frac{q_{jt}}{L-Q_t}\Big) = X_{jt}\bar{B} + \alpha A_{jt} + \xi_{jt} \tag{4.3}$$

The term q_{jt} represent the number of viewers watching channel j at time t. L is the potential market size represented by population having access to TV service in Spain (in 2018 was 44.6 million[1]) in time "t". Q_t is the total amount of viewers watching TV at time t. The term X_{jt} represent the observed characteristics of the program broadcast on channel j at time t. A_{jt} are the minutes of advertising on channel j at time t and ξ_{jt} represent the unobserved characteristics of channel j at time t.

The problem with the logit models is that the Independence of Irrelevant Alternative (IIA) Property generates unrealistic substitution patterns. This means that two identical channels will have equal market shares by construction and therefore, if we introduce a new channel that is identical to an existing one, it will receive a market share identical to the the later and reduce the market shares of other channels[8]. The logit model, thus, creates implausible substitution patterns following new product introduction. This issue, however, is not a big problem in our analysis since there has not been any entry in the market during the studied period.

We expect that advertising has a negative impact on viewers utility and that the number of viewers might decrease (increase) in response to a increase (decrease) in advertising.

Nevertheles, there are endogeneity problems caused by the fact that the more audience a channel has, the higher the advertising price. But, at the same time, the more adds a channel broadcasts, the higher the risk that viewers switch channels. In order to solve for this problem we use instrumental variables to estimate viewers demand. We use program characteristics as instruments as it is commonly used in the industry. Program characteristics are presumed to influence audience receptivity to advertisements. Thus, we construct BLP instruments[5], with the observable program characteristic (genre and producer): We sum the characteristics of the programs being broadcasted each half an hour and we compare them with other channels. We proceed the same way for producers of programs. For instruments to be valid they need to be correlated with the independent variable we want to instrument and not correlated with the dependent variable. Program characteristics are correlated with advertising level and it is

[1]Barlovento Comunicación (2018)[2] considered this amount to be the consumption universe of TV.

reasonably to assume that they are not correlated with advertiser preferences for unobserved program characteristics.

4.2 Demand for Advertising

The demand of advertisers will be specified by an adaptation of the model of Wilbur (2008). Demand for advertising is influenced by audience size and program characteristics. We assume that aggregate demand for advertising on a given time is given by:

$$P_{jt} = \lambda A_{jt} + \alpha V_{jt} + \beta X_{it} + \xi_{jt} \tag{4.4}$$

P_{jt} is the price of an ad in t in the channel j where is being broadcasted. A_{jt} is the quantity of advertisement. The term V_{jt} is the percentage of viewers (share) watching channel j in t, X_{jt} are the program characteristics that affect advertising effectiveness, and ϵ is the error term, which reflects unobserved program and audience characteristics that influence advertiser demand for ads. For example, viewers fidelity to certain channel. Bel and Domènech (2009)[3] suggest that viewers do not have a linear relation with advertising price, which led them to use a nonlinear function. The drawback of assuming that Equation 4.5 is linear is the lack of clarity in the underlying assumptions about advertiser preferences and behaviour and the risk of specification error. However, Wilbur (2008)[15] considered the linear relationship suitable given that it explained 87% of the variation in advertisement prices. Our results show that our model explains 63% of the variation in add prices.

Advertising prices in Spain are usually based on expected audience, which is information not publicly available. Therefore, we consider the price publicly charged for advertising in each of the channels[2] and real audience size.

We use instrumental variables to estimate advertiser demand. We use program characteristics as instruments as it is commonly used in the industry. Program characteristics are presumed to influence audience receptivity to advertisements. We have included as program characteristics genre, producer, country and first issue year. For instruments to be valid they need to be correlated with the independent variable we want to instrument and not correlated with the dependent variable. Program characteristics are correlated with audience and it is reasonably to assume that they are not correlated with advertiser preferences for unobserved program characteristics.

[2]We do not have access to discounts rappels or any other commission paid to the agencies (intermediaries)

Chapter 5

Estimation and Results

5.1 Viewers Demand Model

Firstly, we estimate Viewers Demand Model using OLS model with two different specifications; in the first we only account for the effect of advertising minutes on the audience market share, while in the second we include female as a demographic variable. With both OLS specifications the coefficients seems to be underestimated. Secondly, we corrected for endogeneity using instrumental variables approach[1], again we follow the same specifications as in OLS. The results are shown in Table 5.1. When comparing the results of OLS and IV model, the effect of an increase in one minute of advertising on the market share of a program is higher with the IV model than on OLS model (with both OLS specifications the coefficients seems to be underestimated). For instance, in the IV model, when we do not account for female viewers, an increase of a minute of advertising decreases audience market share by 3.5%, while under OLS the effect is of 1.6%, if we do not account for female viewers. All the coefficients are significant and have the expected signs in both approaches. Also, in both approaches we control for program characteristics, day, hour and channel.

[1]The instrument were found to be significant in the first stage.

	(1) OLS	(2) OLS	(1) IV	(2) IV
advertising	-0.0169***	-0.0106***	-0.035***	-0.0047
female		0.0006***		0.0006***
20h			0.0239**	0.0662**
21h			0.2338***	0.1614***
22h			0.4887***	0.2653***
23h			0.3175***	0.1879***
_cons	-3.0587***	-3.5402***	-3.1007***	-3.6022***
N	7,284	7,284	7,284	7,284
R^2	0.81	0.89	0.80	0.89

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.1: OLS and Instrumental Variables Viewers Demand

With the advertising coefficient estimated using IV model (1) we calculate the elasticity of viewers demand with respect to advertising and found that TV viewers are relatively elastic to an increase of adds (elasticity of -1.6). This results is a expected as more minutes of advertising in a program block of 30 minutes[2] means a higher implicit price for viewing this program and more people willing to switch to a channel which is not broadcasting advertising at the time.

5.2 Advertising Demand

Adverting Demand Model as explained in the previous Chapter, we have modelled Advertising Demand by regressing price of adds on quantity of advertising[3] in a given block of 30 minutes,[4] audience share and program characteristics controlling for day, time, channel, genre and producer of the content. We first run an OLS model that shows we have endogeneity problems. As we can see in Table 5.2 endogeneity seems to cause biased estimators given that the sign of the advertising coefficient is completely wrong (it would mean that advertising quantity would increase price which we know it is not correct).

Thus, we need to tackle the endogeneity problem caused by the fact that advertising quantity, viewers and price influence each other with BLP instruments. In order to do so, we have constructed BLP instruments[5] with the observable characteristics of the programs: genre, producer, year and country of production. Given that we have two endogenous variables in this model (viewers share and advertising quantity), we use two sets of BLP instruments[5]: characteristics of the programs and producer companies. We sum the characteristics of the

[2]The results of the estimations with data per minute are presented in Appendix A.

[3]We have assumed that there are 5 adds in 1 minute of advertising

[4]The results of the estimations with data per minute are presented in Appendix A.

[5]We constructed both instrument, nevertheless the instruments constructed with genre are weaker than those constructed with producer characteristics.

programs being broadcasted each half an hour and we compare them with other channels. We proceed the same way for producers of programs.

Table 5.2 shows that once we correct for endogeneity the results mainly match our expectations. An increase in advertising quantity decreases add price by 26 euros, while a 1% increase in audience share increases the add price by approximately 120 euros.

Furthermore, our results show evidence of the weekend effect identified by Jung Won Yeo (2017)[16] reflected by a decrease in prices from Friday to Sunday. Wednesday is the most expensive day of the week and within prime time and the most expensive hour for advertisers is 10 pm.

Since we have constructed the model in levels, the estimated coefficient does not show the elasticity directly. Thus, we have used the following formula to calculate elasticities and we found that advertisers are relatively inelastic to both an increase of adds (elasticity of -0.1) and an increase in audience share (elasticity of 0.46). As expected, advertisers are more elastic with regards to audience share than to quantity of advertising.

$$E_i = -\beta * \frac{\bar{Q}}{\bar{P}} \tag{5.1}$$

We think this may be due to the fact that the data available to us is precisely coming from the most viewed channels, for which advertisers would have more inelastic demand. If we had data of smaller channels we would expect this elasticities to increase.

	(1) OLS	(1) IV
advertising	9.2692***	-26.4261*
audience share	89.7869***	119.8403
monday		2267.7***
tuesday		1847.2***
wednesday		2119.5***
thursday		1317.3***
friday		840.3***
saturday		-824.5***
20h		1917.4***
21h		3437.7***
22h		6768.0***
23h		6542.5***
_cons	5883.11***	7420.2***
N	4.856	4.856
R^2	0.65	0.63

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.2: OLS and Instrumental Variables Advertising Demand

Chapter 6

Conclusions

The present Master Project is the first one estimating Viewers Demand and Advertising Demand for the Spanish Free-to-Air TV market.

We have found that the effect of advertising on audience share is negative and significant, with a mean own elasticity of -1.6. In general, we can conclude that viewers are averse to advertising regardless of the day but during prime time they are a bit more ad tolerant, especially from 10 pm to 11 pm.

With respect to advertising demand, our results show evidence of the weekend effect identified by Jung Won Yeo (2017)[16] reflected by a decrease in prices from Friday to Sunday.

We found that advertisers are relatively inelastic to both an increase of adds (elasticity of -0.1) and an increase in audience share (elasticity of 0.46). As expected, advertisers are more elastic with regards to audience share than to quantity of advertising. This may be due to the fact that the data available to us is precisely coming from the most viewed channels, for which advertisers would have more inelastic demand. If we had data of smaller channels we would expect this elasticities to increase.

This Master Project could be extended in several interesting directions. We could estimate Viewers Demand with a nested logit model, in order to understand the subsitutability between different channels. Individual advertisers demand for audiences could be estimated. It would also be interesting to estimate a complete structural model (with supply of advertising).

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Appendix A

Figure A.1: Evolution of audiences by group and channel (percentage)

Operators	2015	2016	2017	2018	Variation 2018/2017
Private operators	**66,2**	**65,9**	**65,2**	**65,1**	**-0,1**
Mediaset	**31,0**	**30,2**	**28,7**	**28,9**	**0,2**
Telecinco	14,8	14,4	13,3	14,1	0,8
Cuatro	7,2	6,5	6,2	6,0	-0,2
FDF	3,5	3,2	3,1	2,9	-0,2
Divinity	2,3	2,3	2,2	2,0	-0,2
Energy	1,5	1,9	2,0	1,9	-0,1
Boing	1,6	1,5	1,4	1,3	-0,1
Be Mad	n/a	0,4	0,6	0,6	0,0
Atresmedia	**26,8**	**27,1**	**26,5**	**26,8**	**0,3**
Antena3	13,4	12,8	12,3	12,3	0,0
La Sextan	7,4	7,1	6,7	6,9	0,2
Neox	2,6	2,5	2,5	2,4	-0,1
Nova	2,4	2,2	2,2	2,4	0,2
Mega	0,9	1,8	1,7	1,6	-0,1
Atreseries	n/a	0,8	1,1	1,2	0,1
G. Vocento (NET TV)	**3,4**	**2,9**	**3,1**	**2,9**	**-0,2**
Paramount Channel	2,0	1,8	1,9	1,7	-0,2
Disney Channel	1,4	1,1	1,2	1,2	0,0
U. Editorial (VEOTV)	**4,2**	**2,2**	**2,7**	**2,6**	**-0,1**
Discovery Max	2,1	1,9	1,7	1,6	-0,1
Gol	n/a	0,2	1,0	1,0	0,0
Trece TV	**n/a**	**2,1**	**2,1**	**2,0**	**-0,1**
Dkiss	**n/a**	**0,4**	**0,9**	**0,8**	**-0,1**
Ten	**n/a**	**0,3**	**0,4**	**0,3**	**-0,1**
Real Madrid TV	**n/a**	**0,2**	**0,4**	**0,3**	**-0,1**
Other Private regional channels[1]	**0,8**	**0,5**	**0,4**	**0,5**	**0,1**
Paid TV	**6,8**	**7,0**	**7,8**	**7,6**	**-0,2**
Public operators	**27,0**	**27,1**	**27,0**	**27,3**	**0,3**
CRTVE Group	**16,7**	**16,8**	**16,7**	**16,4**	**-0,3**
La 1	9,8	10,1	10,4	10,4	0,0
La 2	2,7	2,6	2,6	2,7	0,1
Clan TV	2,4	2,2	2,0	1,8	-0,2
24H	0,9	0,9	1,0	0,9	-0,1
Teledeporte	0,9	0,9	0,7	0,6	-0,1
Other (including regional channels)	**2,8**	**2,9**	**2,7**	**3,0**	**0,3**
Forta[2]	**7,5**	**7,4**	**7,6**	**7,9**	**0,3**
Total	**100,00**	**100,00**	**100,00**	**100,00**	

[1] Includes 8TV, CYL7, La 8, TV MEDITERRANEO, 8MADRID, RAC105, HIT TV.
[2] Forta is conformed by TV3, TVG, C.SUR, ETB2, ARAGON TV, EXTREMADURA TV, CMM, TPA, TVCAN, TELEMADRID, LA 7TV, IB3, ETB1, 3/24, A PUNT.

Table A.1: Average minutes of advertising per hour and channel (july 2018 to february 2019

Hour	**La 1**	**Antena 3**	**Cuatro**	**Telecinco**	**La Sexta**
8:00pm	4,31	9,44	13,89	10,41	12,15
9:00pm	0,25	10,11	14,91	11,15	12,67
10:00pm	3,19	11,53	14,47	12,17	13,13
11:00pm	0,03	12,73	14,51	14,74	12,25
12:am	0,25	9,53	12,03	8,09	10,62
Total	**1,60**	**10,66**	**13,96**	**11,30**	**12,16**

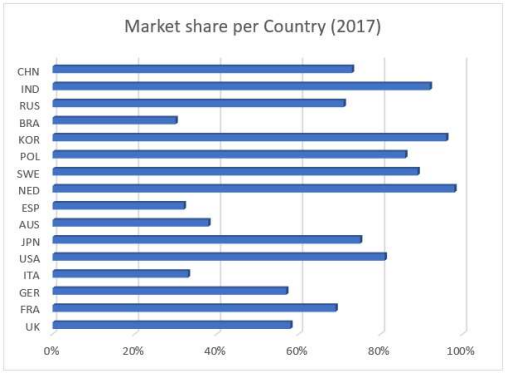

Figure A.2: Market share of Paid TV by Country, 2017

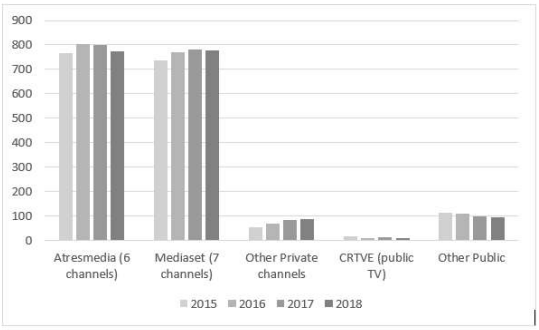

Figure A.3: Evolution of Advertising Revenue by group (Mill euro)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(1) IV
advertising	-.0601***	-.0372***	-.0264***	-.0263***	-0.0531***
	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0037)
female		0.0006***		0.0006***	
		(0.0000)		(0.0000)	
lag_advertising			-0.0888***	-0.0886***	-0.1164***
			(0.0031)	(0.0031)	(0.0146)
_cons	-2.915***	-3.495***		-3.469***	-3.1951***
	(0.0145)	(0.0104)		(0.0103)	(0.0062)
N	218,577	218,577	218,577	218,577	218,577
R^2	0.78	0.88	0.88	0.88	0.78

standard error in parentheses

*** $p < 0.001$

Table A.2: Viewers Demand: OLS and IV with Instrumental Variables. Results of estimations with data per minute.

	Coefficient	Variable	Coefficient
advertising	-0.0531***	20h	.0121***
	(.0037)		(.0040)
lag advertising	-0.1164***	21h	0.3061***
	(.0146)		(.0036)
Monday	-0.0813	22h	0.5586***
	(.0034)		(.0034)
Tuesday	-.0432***	23h	0.38705
	(.0034)		(.0033)
Wednesday	-0.0905***		
	(.0034)		
Thursday	-0.0860***		
	(.0033)		
Friday	-0.2179***		
	(.0034)		
Saturday	-0.2350***		
	(.0034)		
_cons	-3.19***		
	(.0062)		
N	218,577	R^2	0.78

standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.3: Viewers Demand: Logit model with Instrumental Variables. Results of estimations with data per minute.

	(1) OLS (log P)	(2) OLS	(1) IV (log P)	(2) IV
advertising	0.0013 ***	10.5962***	-0.0788***	-853.94***
audience share	0.0094***	51.3588***	0.0048***	169.981***
monday			0.2195***	2373.1***
tuesday			0.1906***	1936.1***
wednesday			0.1918***	2178.9***
thursday			0.1424***	1422.3***
friday			0.1160***	1038.1***
saturday			-0.0269***	-584.9***
20h			1.3904***	7316.7***
21h			1.4411***	8188.0***
22h			1.6599***	11052.6***
23h			1.6586 ***	10896.5***
_cons	7.5881***	2460.483***	7.5235***	-599.925***
N	145,755	145,755	145,755	145,755
R^2	0.84	0.81	0.78	0.68

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.4: OLS and Instrumental Variables Advertising Demand. Results of estimations with data per minute.