Platform Quality and Advertising Regulation in Broadcasting Markets*

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Abstract

We consider the role of the endogenous choice of quality programs in a duopoly market where competing media platforms choose also their level of advertising. We compare the equilibrium levels of program quality and advertising under private and mixed duopoly competition, and show that the results are drastically different between both scenarios. We also consider the effects on program quality and welfare of recent policies tending to substitute advertising by taxation on private competitors as a way of financing publicly-owned platforms.

Keywords: endogenous quality, two-sided market, duopoly, publicly-owned platform, advertising regulation

JEL Classification: L11, L12.

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1 Introduction

This paper deals with the choice of program quality in the context of a free to air broadcasting industry. One important element in our analysis is the role of a publicly-owned platform in the broadcasting media industry. As pointed out by Coase (1966), in the free to air broadcasting industry the public policy might have an important role in regulating the quality and diversity of the available programming, as well as the level of advertising. However, despite of the empirical relevance of the presence of publicly-owned platforms in the media industries of many western countries,[1] there is a surprising lack of research about this form of public intervention in broadcasting markets. Recent exceptions, in connection with the role of advertising, are the theoretical works by Kind et al. (2007) and González-Maestre and Martínez-Sánchez (2010) and the empirical contributions by Alcock and Docwra (2005) and Bel and Domènech (2009).

The analysis of advertising in broadcasting media industries, with private platforms, has been extensively considered in recent literature.[2] Most of these previous contributions focus on the combination of advertising and horizontal product differentiation among private platforms in two-sided markets.[3] In particular, Gabszewicz et al. (2004) and Anderson and Coate (2005) consider the role of program substitutability on the equilibrium and socially optimal levels of advertising; Gantman and Shy (2007) analyze the profitability of improvements in advertising quality and Peitz and Valletti (2008) compares the levels of advertising intensities and content differentiation under two different scenarios: pay-tv and free-to-air.

Recently, the importance of platform's quality in television markets has been analyzed by many empirical papers. Beard el at. (2001) gauges that the increase in consumer gains due to a quality increase are almost exactly counterbalanced by reductions due to price increases. Chu (2010) studies the cable television market and finds that satellite entry typically causes cable platforms to raise quality and lower prices. Finally, Imbs el at. (2010) study

[1] See Bel and Domènech (2009, table 1 p. 167).

[2] See Anderson (2007) and Anderson and Gabszewicz (2006) for an interesting survey about advertising in the media.

[3] There are few papers that consider the existence of a public-owned firm in a model of horizontal product differentiation. Recently, the relationship between public ownership and welfare, in the context of a spatial duopoly model has been considered by Kumar and Saha (2008), Sanjo (2009) and Martínez-Sánchez (2011).

television prices across European countries and regions. They show that a large fraction of international price gaps corresponds to quality differences.

On the other hand, recent papers have taken into account quality competition in spatial models. In particular, Ishibashi and Kaneko (2008) analyze price and quality competition in a mixed duopoly. They show that the welfare-maximizing public firm provides a lower quality product than the private firm when they are equally efficient. Brekke et al. (2010) study the relationship between competition and quality in a spatial model where firm compete in prices and quality. They obtain that lower transportation costs always lead to higher quality if consumers' utility is strictly concave in income.

The aim of our paper is twofold:

First, in contrast with the previous theoretical literature (mainly focused on the role of horizontal product differentiation) we will analyze the combined role of the endogenous choice of program quality and the presence of a publicly-owned platform in the broadcasting industry. In previous contributions, Armstrong (2005) and more recently Crampes et al. (2009), those authors analyze the effects of endogenous quality improvements in broadcasting industries. In particular, Armstrong compares the equilibrium quality levels between the free to air duopoly regime and the case of subscription, while Crampes et al. (2009) analyze the effects of endogenous quality improvements under free entry. However, these previous contributions assume competition among symmetric private platforms while we consider the case of a publicly-owned platform competing with a private one. We compare the equilibrium levels of program quality and advertising under private and mixed duopoly competition, and show that the results are drastically different between both scenarios

Second, we also consider the effects on program quality and welfare of recent policies tending to tax private competitors as a way of financing publicly-owned platforms. This aspect of our analysis is related with some recent controversial policy decisions within the EU. Particularly remarkable is the decision by the public TV platform in France (more recently followed by its counterpart in Spain) of eliminating advertising as a way of financing. In substitution of this source of financing, the French government has established a tax on the revenues by private TV and telecom platforms, a decision which is currently under investigation by the European Commission.

The rest of the paper is organized as follows: Section 2 presents a spacial duopoly market with private platforms and endogenous choice of advertising

and quality, Section 3 analyzes the model with a mixed duopoly where one of the competitors is a publicly-owned firm that maximizes welfare, Section 4 analyzes the controversial policy decisions within the EU carried out by France and Spain, Section 5 considers the advertising, program quality and welfare comparisons among the three models and Section 6 concludes.

2 The model with private duopoly

We will assume two private platforms, each located at one extreme of a linear market of length 1. There is a mass of consumers of measure 1 indexed by $x \in [0,1]$ and distributed uniformly along this linear market. Each consumer watches at most one platform or neither. In our free-to-air tv model, the utility of each consumer obtained from watching platform i is given by the function $u(v_i, a_i, x_i) = v_i - \delta a_i - t x_i$; where v_i is the gross utility from the chosen platform, δ is the parameter representing the disutility or nuisance cost per unit of advertising (denoted by a_i)[4] and t is the transport cost per unit of the distance of departing from his/her favorite tv program. Moreover, t can be interpreted as the inverse degree of competitiveness, so a higher t means that market is least competitive.

The marginal consumer who is indifferent between watching platform 1 and 2, x_i, is given by the condition $v_1 - \delta a_1 - t x_1 = v_2 - \delta a_2 - t x_2$, where $x_2 = 1 - x_1$. Thus, the demand for firm i:

$$x_i(a_i, a_j) = \frac{1}{2t}(v_i - v_j - \delta(a_i - a_j) + t);\ i = 1, 2,\ i \neq j. \tag{1}$$

As in Gabszewicz et al. (2004) we consider that the advertising market is perfectly competitive, so advertisers' profits are zero. We assume that the advertising revenues obtained by firm i are given by $R_i = \gamma a_i x_i$, where γ can be interpreted as the revenue per ad per viewer, which in turn is assumed to be proportional to the level of advertising. On the other hand, the cost of achieving a quality v_i for platform i is a quadratic function $C(v_i) = \frac{v_i^2}{2}$. Thus, profits of firm i are given by:

$$\pi_i = \gamma a_i x_i - \frac{v_i^2}{2},\ i = 1, 2,\ i \neq j. \tag{2}$$

[4]Our assumption that $\delta > 0$ is consistent with the empirical evidence shown by Wilbur (2008), who obtains that viewers dislike advertising in the TV industry.

By substituting the demand function (1) in the profit function (2), we can obtain:

$$\pi_i(a_i, a_j) = \gamma a_i \left(\frac{1}{2} + \frac{v_i - v_j - \delta(a_i - a_j)}{2t} \right) - \frac{v_i^2}{2}, \ i = 1, 2, \ i \neq j. \tag{3}$$

We assume a two-stage game where, first, the platforms choose, simultaneously, their levels of quality and in the second stage they choose the advertising levels. Let us obtain the Nash equilibrium (NE) in the levels of advertising at the second stage of the game. From the first order conditions, we can obtain the reaction function of each firm:

$$a_i^{BR}(a_j) = \frac{v_i - v_j + t}{2\delta} + \frac{a_j}{2}, \ i = 1, 2, \ i \neq j. \tag{4}$$

Which yields the following NE levels of advertising, market shares and revenue, at the second stage of the game:

$$a_i^* = \tfrac{v_i - v_j + 3t}{3\delta}; \quad x_i^* = \tfrac{v_i - v_j + 3t}{6t}; \quad R_i^* = \tfrac{k(v_i - v_j + 3t)^2}{18t}. \tag{5}$$

where $k = \gamma/\delta$ is the relative value between the revenue per ad per viewer and the nuisance cost. From the previous analysis we have the following auxiliary result:[5]

Proposition 1 *In the case of competition among private platforms, we have that the level of advertising by platform i is increasing in its own quality and decreasing in the quality of its rival.*

By substituting the results (5) in function (3), we find the following expression for firm i's profit, evaluated at the first stage of the game:

$$\pi_i(v_i, v_j) = \frac{\gamma(v_i - v_j + 3t)^2}{18\delta t} - \frac{v_i^2}{2}, \quad i = 1, 2, \quad i \neq j. \tag{6}$$

From the first order condition we yield the following reaction functions of platforms, in terms of quality choices:

$$v_i^{BR}(v_j) = \frac{3\gamma t - \gamma v_j}{9\delta t - \gamma}; \quad i = 1, 2, \quad i \neq j. \tag{7}$$

[5]See González-Maestre and Martínez-Sánchez (2010) for a detailed analysis of this subgame.

Solving the above equations gives the subgame perfect equilibrium (SPE) levels of qualities, advertising and market shares:

$$v_1^* = v_2^* = \frac{k}{3};\ a_1^* = a_2^* = \frac{t}{\delta};\ x_1^* = x_2^* = \frac{1}{2} \tag{8}$$

As can be seen from (8), in equilibrium both platforms choose the same quality and ads, so that they obtain the same demand and profit. From (8) we find that a higher revenue per ad per viewer, γ, implies a higher quality by every platform. This is because platforms' profits positively depend on γ. On the other hand, a higher nuisance cost implies a lower tv's quality. The intuition behind this result is that the nuisance cost negatively affects platforms' profits because viewers' incentive to switch off tv is higher with a high nuisance cost since viewer's utility from watching a tv-platform decreases in the nuisance cost. Finally, we also find that the level of quality does not depend on the degree of substitutability. This is because we consider private firms and consumers' utility is linear in income. These results are summarized in the following proposition.

Proposition 2 *In the case of competition among private platforms, we have that at the SPE:*

i) Both platforms set the same level of quality and ads.

ii) The levels of quality is increasing in the revenue per ad per viewer and decreasing in the nuisance cost.

iii) The level of advertising is decreasing in the degree of substitutability and in the nuisance cost.

iv) Platforms' demands do not depend on the revenue per ad per viewer, nuisance cost and the degree of substitutability.

Consumer surplus (CS) is calculated as:[6]

$$CS = v_1 x_1 - \delta a_1 x_1 - t\int_0^{x_1} x dx + v_2(1-x_1) - \delta a_2(1-x_1) - t\int_{x_1}^{1}(1-x)dx. \tag{9}$$

We now calculate social welfare (W), which is defined as the sum of platforms' profits ($\pi = \pi_1 + \pi_2$) and consumer surplus (CS)

[6]Recall that $x_2 = 1 - x_1$.

$$W = (\gamma - \delta)a_2 + (v_1 - v_2 + t + (\gamma - \delta)(a_1 - a_2))x_1 - tx_1^2 + v_2 - \frac{t}{2} - \frac{v_1^2}{2} - \frac{v_2^2}{2}. \tag{10}$$

Taking into account the equilibrium value of advertising and market share by each platform, we obtain the social welfare when both platforms are private, which is:

$$W^* = \frac{\delta\left(36\gamma - 45\delta\right)t - 4\gamma\left(\gamma - 3\delta\right)}{36\delta^2} = \frac{\left(36k - 45\right)t - 4\left(k^2 - 3k\right)}{36} \tag{11}$$

Notice that the social welfare is increasing in k for low values of k.

3 The model with a mixed duopoly

In this section, we will assume that platform 1 is a publicly-owned firm that maximizes social welfare, while platform 2 is a private firm that maximizes its profits. Substituting (1) in (10) and maximizing the resulting welfare function with respect to a_1, we obtain the reaction function of the publicly-owned platform 1, which is:

$$a_1^{BR}\left(a_2\right) = a_2 + \frac{k-1}{\delta(2k-1)}(v_1 - v_2 + t) \tag{12}$$

In order to guarantee the second order condition of social welfare maximization by platform 1, we assume that $k > 1/2$. Notice that platform 2's reaction function is the same that the one in the previous section since it continues to be a private firm. Thus, from (4) and (12) we can calculate the NE levels of advertising, market shares and profits in the mixed duopoly:

$$
\begin{aligned}
a_1' &= \frac{(4k-3)t-(v_1-v_2)}{\delta(2k-1)};\ a_2' = \frac{(3k-2)t-k(v_1-v_2)}{\delta(2k-1)} \qquad (13)\\
a' &= a_1'+a_2' = \frac{(7k-5)t-(k+1)(v_1-v_2)}{\delta(2k-1)};\\
x_1' &= \frac{k(v_1-v_2+t)}{2(2k-1)t};\ x_2' = \frac{(3k-2)t-k(v_1-v_2)}{2(2k-1)t};\\
R_1' &= \frac{k^2\left((4k-3)t-(v_1-v_2)\right)(v_1-v_2+t)}{2(2k-1)^2t};\\
R_2' &= \frac{k\left((3k-2)t-k(v_1-v_2)\right)^2}{2(2k-1)^2t}.
\end{aligned}
$$

By substituting the NE values of market shares and advertising shown in (13) into expression (10) we obtain the welfare at the first stage of the game, in terms of the qualities:

$$
W' = \tfrac{4(k-1)((3k-2)t-k(v_1-v_2))t+k^2(v_1-v_2+t)^2}{4(2k-1)t} + v_2 - \tfrac{t}{2} - \tfrac{v_1^2}{2} - \tfrac{v_2^2}{2}. \qquad (14)
$$

The first order condition of welfare maximization, gives the reaction function of the publicly-owned platform, at the first stage of the game:

$$
v_1^{BR}(v_2) = \frac{k\left(kv_2+(k-2)\,t\right)}{k^2-2\left(2k-1\right)t} \qquad (15)
$$

Platform 2's reaction function is the same that the one in the previous section since it continues to be a private firm that maximizes its profit. Notice that the quality reaction function of the publicly-owned platform depends positively on the rival platform's quality. Thus, from (7) and (15) we calculate the NE levels of advertising, market shares and profits in the mixed duopoly:

$$
\begin{aligned}
v_1' &= \tfrac{9k^2t-18kt+2k^2+2k^3}{18t-2k-36kt+13k^2};\ v_2' = \tfrac{2k\left(k+3t-6kt+k^2\right)}{18t-2k-36kt+13k^2}\\
a_1' &= \tfrac{2t\left(15k-27t-72k^2t+90kt-34k^2+26k^3\right)}{\delta(2k-1)(18t-2k-36kt+13k^2)} \qquad (16)\\
a_2' &= \tfrac{-2t\left(18t-2k+54k^2t-63kt+4k^2-9k^3\right)}{\delta(2k-1)(18t-2k-36kt+13k^2)}
\end{aligned}
$$

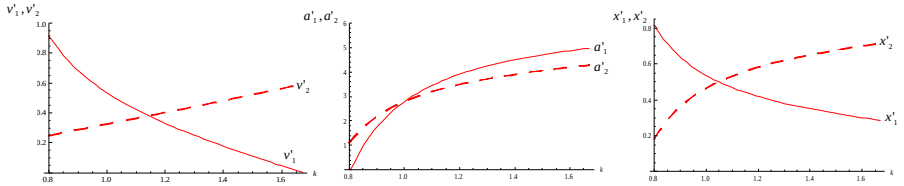

Figure 1:

$$
\begin{aligned}
x_1' &= \frac{18k^2t-9kt+13k^2-17k^3}{18t-2k+72k^2t-72kt+17k^2-26k^3}; \\
x_2' &= \frac{18t-2k+54k^2t-63kt+4k^2-9k^3}{18t-2k+72k^2t-72kt+17k^2-26k^3}; \\
\pi_1' &= \frac{2k^2t\left(9t-13k-18kt+17k^2\right)\left(15k-27t-72k^2t+90kt-34k^2+26k^3\right)}{(2k-1)^2(18t-2k-36kt+13k^2)^2} \\
\pi_2' &= \frac{2kt\left(18t-2k+54k^2t-63kt+4k^2-9k^3\right)^2}{(2k-1)^2(18t-2k-36kt+13k^2)^2}
\end{aligned}
\tag{17}
$$

When k is low, advertising is bad from the welfare point of view and the revenue per ad per viewer is low, so that private platform has low incentives to provide higher quality and the publicly-owned platform provides highest quality. Given that publicly-owned platform wants to encourage viewer to watch the platform with higher quality, it sets a lower level of ads. Thus, platform 1's market share is higher when k is low. However, when k is high, the contrary result is obtained because the private platform has higher incentives to provide higher quality. These results are summarized and showed in the following proposition and figures.[7]

Proposition 3 *In the case of competition between a publicly-owned platform and a private platform, we find that:*

i) when k is low, the publicly-owned platform sets lower ads, provides higher quality and achieves a higher market share than the private one; and,

ii) when k is high, the publicly-owned platform sets higher ads, provides lower quality and achieves a lower market share than the private one.

[7]We assume that $t = 3$ for elaborating figure, although the qualitative results is obtained for any t.

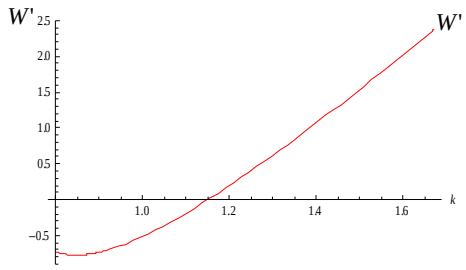

Figure 2:

$$W' = \frac{\left(\begin{array}{c} -16k^7 + 1070k^6t + 80k^6 - 5778k^5t^2 - 2774k^5t + 36k^5 + 8424k^4t^3 + \\ 15\,345k^4t^2 + 1783k^4t - 52k^4 - 23\,976k^3t^3 - 13\,356k^3t^2 - 296k^3t + 8k^3 \\ +24\,138k^2t^3 + 4716k^2t^2 - 28k^2t - 10\,368kt^3 - 576kt^2 + 1620t^3 \end{array}\right)}{2\,(2k-1)\,(18t - 2k - 36kt + 13k^2)^2}$$

4 The regulation in France and Spain: A Theoretical Approach

In this section we evaluate the consequences of the new regulation in the TV broadcasting industry by the french and spanish governments. Thus we will assume two platforms: a publicly-owned one that is financed by the tax on the revenues of the rival private platform and does not obtain revenues from advertising, and a private one that is financed only by advertising.

We consider that the revenue obtained by the private platform consists of the advertising revenue after tax and the revenue obtained by the publicly-owned platform consists of the tax revenue collected from the private one. So profits are given, respectively by[8]

$$\pi_1 = \tau\gamma a_2 x_2 - \tfrac{v_1^2}{2}; \quad \pi_2 = (1-\tau)\,\gamma a_2 x_2 - \tfrac{v_2^2}{2},$$

where τ represents the direct tax over private platform's revenue. By substituting the demand function (1) in the definition of profits, we can obtain:

[8]See González-Maestre and Martínez-Sánchez (2010) for an analysis of the role of γ and δ in the broadcasting industry.

$$\pi_1 = \tau a_2 \frac{v_2 - v_1 + t - \delta(a_2 - a_1)}{2t} - \frac{v_1^2}{2}; \quad \pi_2 = (1-\tau)\, a_2 \frac{v_2 - v_1 + t - \delta(a_2 - a_1)}{2t} - \frac{v_2^2}{2}. \quad (18)$$

Let us obtain the Nash equilibrium (NE) in the levels of advertising. From maximizing private platform's profit, we can obtain the level of advertising by the private platform 2, so:

$$a_1^{fs} = 0; \quad a_2^{fs} = \frac{v_2 - v_1 + t}{2\delta}. \quad (19)$$

By substituting the level of advertising (19) in the profit functions (18) we obtain the market shares and profits:

$$\begin{array}{ll} x_1 = \frac{v_1 - v_2 + 3t}{4t}; & \pi_1 = \tau \frac{k(v_2 - v_1 + t)^2}{8t} - \frac{v_1^2}{2}; \\ x_2 = \frac{v_2 - v_1 + t}{4t}; & \pi_2 = (1-\tau)\, \frac{k(v_2 - v_1 + t)^2}{8t} - \frac{v_2^2}{2}. \end{array}$$

We now consider the quality choice by platforms, so the publicly-onwed platform maximizes the social welfare and the private one maximizes his/her profit. Notice that the social welfare function is now different because the objective function of platform 1 has changed since it does not obtain revenue from advertising. In particular, the social welfare (W), which is defined as the sum of platforms' profits and consumer surplus, is given by:

$$W = v_2 - \frac{t}{2} + \frac{(v_1 - v_2 + 3t)(3(v_1 - v_2) + t)}{16t} + \frac{(k-1)(v_2 - v_1 + t)^2}{8t} - \frac{v_1^2}{2} - \frac{v_2^2}{2}, \quad (20)$$

where the platforms' profits (π) and consumer surplus (CS) are given by:

$$\pi = \pi_1 + \pi_2 = \frac{k\left(v_2 - v_1 + t\right)^2}{8t} - \frac{v_1^2}{2} - \frac{v_2^2}{2} \quad (21)$$

$$CS = v_2 - \frac{t}{2} + \frac{(v_1 - v_2 + 3t)(3(v_1 - v_2) + t)}{16t} - \frac{\left(v_2 - v_1 + t\right)^2}{8t}$$

From the first order conditions in the first stage of the game, we can obtain the reaction function of each platforms:

$$v_1^{BR}(v_2) = \frac{(2k-7)t + (2k+1)v_2}{2k - 8t + 1}; \quad v_2^{BR}(v_1) = \frac{(1-\tau)(t - v_1)k}{4t + k(\tau - 1)}.$$

From the intersection of platforms' quality reaction function, we obtain the NE levels of advertising, market shares and profits with the French and Spanish regulation:

$$v_1^{fs} = \frac{2k(1-\tau)+(2k-7)t}{2k(2-\tau)+1-8t} \quad v_2^{fs} = \frac{2k(\tau-1)(t-1)}{4k-8t-2k\tau+1}$$

$$a_1^{fs} = 0; \quad a_2^{fs} = \frac{-4t(t-1)}{(1+2k(2-\tau)-8t)\delta}.$$

$$x_1^{fs} = -\frac{6t-4k+2k\tau+1}{4k-8t-2k\tau+1} \quad x_2^{fs} = \frac{-2(t-1)}{4k-8t-2k\tau+1} \quad \pi_2^{fs} = \frac{2k(1-\tau)(t-1)^2(4t-k+k\tau)}{(4k-8t-2k\tau+1)^2}.$$

$$\pi_1^{fs} = -\frac{4k^2t^2-8k^2t\tau+8k^2t+4k^2\tau^2-8k^2\tau+4k^2-16kt^3\tau+32kt^2\tau-28kt^2+12kt\tau-28kt+49t^2}{2(4k-8t-2k\tau+1)^2}$$

$$W^{fs} = -\frac{(t-1)\left(\left(4t\tau^2-8t\tau+8t-8\tau+8\right)k^2-16kt^2+32kt\tau-44kt-4k\tau+4k+56t^2-7t\right)}{2(4k-8t-2k\tau+1)^2} \tag{22}$$

By maximizing welfare function (22) respect to tax, we find that the optimal level of tax is zero.[9]

$$\frac{\partial W^{fs}(\tau)}{\partial \tau} = -2k\left(2k\tau+1\right)\left(t-1\right)^2\frac{8t-2k-1}{\left(8t-2k\left(2-\tau\right)-1\right)^3} < 0$$

Therefore, the NE levels of advertising, market shares and profits when the level of tax is zero are:

$$\begin{gathered}
v_1^{fs} = \frac{2k+(2k-7)t}{4k+1-8t}; \; v_2^{fs} = \frac{-2k(t-1)}{4k-8t+1} \\
a_1^{fs} = 0; \; a_2^{fs} = \frac{-4t(t-1)}{(1+4k-8t)\delta} \\
x_1^{fs} = -\frac{6t-4k+1}{4k-8t+1}; \; x_2^{fs} = \frac{-2(t-1)}{4k-8t+1} \\
\pi_1^{fs} = -\frac{\left(4k^2t^2+8k^2t+4k^2-28kt^2-28kt+49t^2\right)}{2(4k-8t+1)^2} \\
\pi_2^{fs} = \frac{2k(t-1)^2(4t-k)}{(4k-8t+1)^2} \\
W_{\tau=0}^{fs} = \frac{(1-t)\left(8k^2t+8k^2-16kt^2-44kt+4k+56t^2-7t\right)}{2(4k-8t+1)^2}
\end{gathered} \tag{23}$$

[9] We do not consider the possibility of subsidies for the private platform.

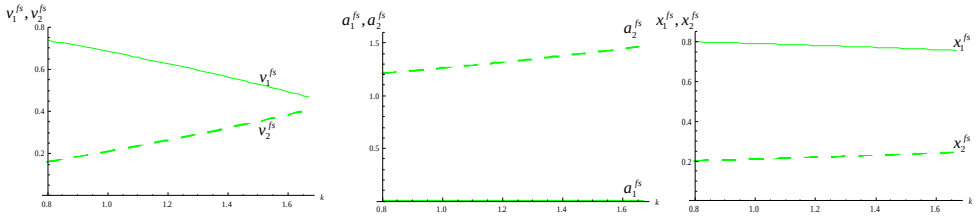

Figure 3:

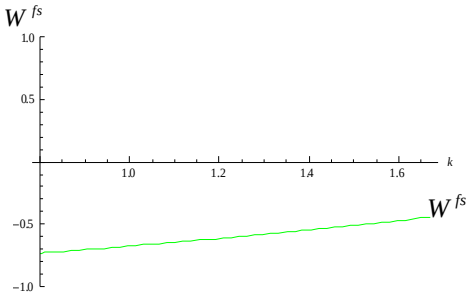

Figure 4:

Given the publicly-owned platform's commitment to set zero ads, private platform 2 sets a low level of advertising in order to become active in the broadcasting industry. So that platform 1 provides higher quality because platform 2's revenue from advertising is low. Thus, platform 1 achieves a very high market share. These results are independent of the value of k, although the quality and market share gap between the publicly-owned and private platforms is reduced as the social value of advertising increases. This is because, as k increases, platform 2 finds it more profitable to increase advertising and quality. These results are summarized and showed in the following proposition and figures.

Proposition 4 *In the case of french and spanish regulation in the broadcasting industry, we have that the publicly owned platform provides higher quality and achieves a higher market share.*

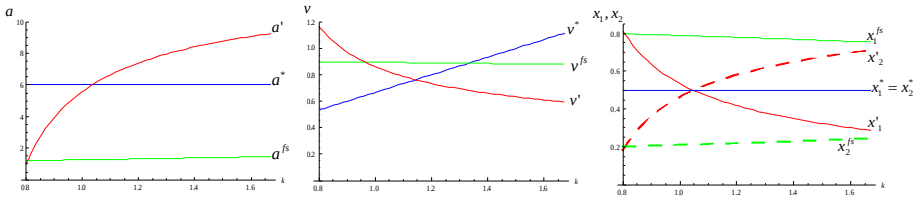

Figure 5:

5 Comparisons among the three models

$$
\begin{aligned}
a^* &= a_1^* + a_2^* = \frac{2t}{\delta};\ a^{fs} = a_1^{fs} + a_2^{fs} = \frac{-4t\,(t-1)}{(1+4k-8t)\,\delta} && (24)\\
a' &= a_1' + a_2' = \frac{2t\,(17k - 45t - 126k^2t + 153kt - 38k^2 + 35k^3)}{\delta\,(2k-1)\,(18t - 2k - 36kt + 13k^2)} \\
v' &= v_1' + v_2' = \frac{(4k - 12t - 3kt + 4k^2)\,k}{18t - 2k - 36kt + 13k^2} && (25)\\
v^* &= v_1^* + v_2^* = \frac{2}{3}k;\ v^{fs} = v_1^{fs} + v_2^{fs} = \frac{4k - 7t}{4k - 8t + 1}
\end{aligned}
$$

Proposition 5 *A duopoly under the French and Spanish regulation always provides the lowest level of total advertising (except for $k \in (0.80473, 0.8058)$). On the other hand, a mixed duopoly broadcasts lower ads than a private duopoly when advertising is socially harmful ($k \in (0.80473, 1.0347)$), but when advertising is socially beneficial ($k \in (1.0347, 1.67)$), a mixed duopoly broadcasts higher ads than a private duopoly.*

Proposition 6 *A mixed duopoly provides the highest level of total quality when advertising is socially harmful ($k \in (0.80473, 0.96357)$), and a private duopoly provides the highest level of total quality when advertising is socially beneficial ($k \in (1.3303, 1.67)$). However, for intermediate value of k, the regulated duopoly provides the highest level of total quality.*

Proposition 7 *A mixed duopoly is always socially preferred to a private duopoly. However, a duopoly regulates by the French and Spanish regulation is socially preferred to a mixed duopoly when advertising is socially harmful ($k < 0.923$). Otherwise, a mixed duopoly is socially preferred to a regulated industry.*

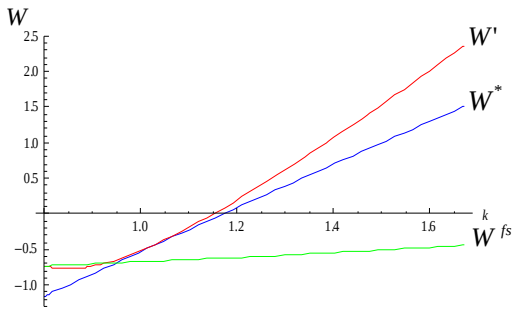

Figure 6:

Notice that it is socially desirable that viewers watch the platform that provides highest quality. On the other hand, it is socially desirable a setting with lower ads where advertising is socially harmful; otherwise, it is socially desirable a setting with higher ads. When advertising is socially harmful, both aims are achieved by regulating industry by the French and Spanish regulation. This is because when advertising is harmful this setting provides the lowest level of total advertising, and the publicly-onwed platform provides higher quality and achieves a higher market share, while in the mixed duopoly the platform that provides higher quality (platform 2) achieves a lower market share. However, this setting provides the highest level of total quality.

On the other hand, when advertising is socially beneficial, it is socially preferred the setting that provides the highest level of advertising, which is achieved in the mixed duopoly. Moreover, in this setting when k is low, private platform the highest level of quality and achieves a high market share. Thus, the mixed duopoly is socially preferred when advertising is socially beneficial.

6 Conclusions

In this paper we develop a model with a publicly-owned platform and a private one that compete in ads and quality, where platforms are differentiated in two dimensions, content (horizontal differentiation) and quality (vertical differentiation). We compare the equilibrium levels of program quality and advertising under private and mixed duopoly competition, and show that the results are drastically different between both scenarios

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