**The Good Monopoly
A Case for Joint Ownership of Competing Systems?**

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Abstract

In this paper we show that, in a framework in which there are two competing systems (for example, GSM cellular and trunk radio telecommunications networks) and consumers value more highly the good available in the system in which production costs are higher, the usual result that separate ownership increases welfare may be reversed. In fact, we are able to show that when the difference in costs from the least preferred system to its competitor system is relatively large, the usual result is reversed and joint ownership leads to a higher level of welfare than separate ownership.

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1 Introduction

Economists know that monopolization hinders economic efficiency and welfare and that in any particular monopolized market the entrance of a second firm always significantly improves welfare. Similarly, it is also argued that, when goods produced by different firms are (non-perfect) substitutes in consumption separate ownership of the substitute producing firms represents a welfare improvement, whenever that constitutes a departure from joint ownership.

This argument has been the base for policy decisions forbidding the operation of competing telecommunications networks, notably trunk radio and GSM cellular or, in other cases, analog and digital mobile telephone networks, by jointly owned operators. Analog and digital mobile telephony networks can be seen as competing systems in the sense that from an end-user view point they are close substitutes. Access to analog mobile telephone networks provides the possibility of accessing services which are, for most purposes, close substitutes to those available through access to more modern digital mobile networks. There are cases in which their joint operation by a single entity was forbidden on the ground that otherwise the monopoly power of the firm providing telephony through both systems would be enhanced. Likewise, as was mentioned before, the same argument was used to preclude mobile GSM operators from providing trunk radio systems.¹ In a trunk radio network clients have access to radio transmitted telephony services in a way which is somewhat more limited than the one provided by digital telephony operators. That is, trunk radio is, in broad terms, a substitute to mobile telephony, since it constitutes an affordable though downgraded version of cellular telephony: the number of users that can be reached by each subscriber is typically small and, in addition, the quality of services provided and its availability and number of system capabilities, e.g., call waiting/forwarding, mailbox call storage, roaming, is usually restricted when compared to that of modern mobile networks. In both these examples the argument for separate ownership of competing systems providing services which are, to some extent, substitutes in consumption, stems from the notion that separate ownership (duopoly) generates a larger social surplus than joint ownership (monopoly).

In this paper we find that circumstances may arise in which such is not true. In a framework in which there are two competing systems and consumers value more highly the good available in the system in which production costs are higher, we show that the usual result that separate ownership increases welfare may be reversed. In fact, we are able to show that when the difference in costs from the least preferred system to its competitor is

¹In Portugal, GSM operators were barred from the trunk radio business because that was seen as a means of increasing their market power in mobile communications.

relatively large, the traditional result is reversed and joint ownership leads to a higher level of welfare than separate ownership. The reason for this is that separate ownership of competing systems may lead to excessive adoption of the system most favored by consumers when costs are sufficiently different. When this effect is big enough, it more than compensates the "monopoly distortion," *i.e.*, the welfare cost resulting from the monopolist's (joint owner's) enhanced ability to extract rents, which in turn decreases with the differential cost.

This result provides important policy insights in different contexts. The framework developed in the paper may also be used to analyze the desirability of promoting market coordination in the replacement of aging technological standards by new technologies. Suppose a case in which in its early stages a newer, more sophisticated technology providing goods or services which are preferred by consumers is more costly to operate. Our result indicates that if, in the early stages of adopting a new technology, its operating costs are sufficiently larger than the ones associated with the old standard, then it may be preferable, from a welfare maximization view point, to promote market coordination. Of course, as technological progress causes a decrease in the cost of the more sophisticated standard, ownership separation will always be welfare maximizing. Nevertheless, our result can be seen as an argument for market coordination in the early stages of the diffusion of a new technology.

The effect we capture in this model is different from the usual result that a monopolist practicing perfect price discrimination amongst consumers, sets a level of output such that total welfare exceeds that which results in a duopoly setting. The perfectly discriminating monopolist charges each consumer a price equal to its willingness to pay, thereby appropriating all the rents generated in the market. It is therefore able to charge different prices because it has a way to find how each consumer values the good. In the present case, the joint owner of competing systems, which knows the differential valuation of one system versus the other, induces consumers to join one system versus the other so that it maximizes profits.

Our setting also differs from the case in which the monopolist does not know which agents are in each market since, in our model, agents may join one market or the other depending upon the tariffs set by producers and hence knows that consumers that value quality the most are in the most "sophisticated" system.

The remainder of the paper is organized as follows. Section 2 presents the basic model and the equilibria under joint and separate ownership. The welfare analysis is conducted in Section 3. Section 4 extends the model to include a two-part tariff for the superior system. Next, Section 6 shows how the analysis should be adjusted for the presence of network externalities and surplus distribution effects. Section 7 outlines future research and concludes the paper.

2 The Basic Model

Consider the setup in which we have a more sophisticated system, e.g., a cellular phone operator (firm 1) and another less preferred system, e.g., a trunk radio operator (firm 2). There is a continuum of consumers which value system 1 phone more highly than system 2. This valuation is described by $\theta \sim U[0, 1]$, where θ denotes this preference for system 1. That is, we assume that for each consumer system 1 is always better or equal than system 2. To keep things simple we start out by considering the case in which consumers are charged for access to each system and there are no charges for use. Additionally, we assume unit dimension for total demand.

Denote T_1 the fee to access system 1 and T_2 the price for access to system 2. Hence, the net benefit for any consumer of system 1 is $u_1 = \mu + \theta - T_1$, being $u_2 = \mu - T_2$ for system 2, where $\mu > 1$ is the utility of accessing the system.

We also make the following assumption regarding costs. Cost of system 1 is $\beta \in [0, 1]$, while the cost of system 2 is normalized to 0.² That is, β is the differential cost between system 2 to system 1.

In the technology description of telecommunications systems it is often considered the existence of scale and scope economies. Its explicit inclusion in our framework would not qualitatively change the main results. We abstract from this since we want to focus on the effects resulting from the existence of a cost differential between a less sophisticated system (trunk radio) and a more elaborate technology (cellular telephony) and this effect is fully captured by the parameter β .

In this setting, the indifferent consumer between system 1 and system 2 is one with preferences (i.e., an additional valuation of the cellular phone network in our example) such that $\theta^* = T_1 - T_2$.

Then, we can write demand for system 1 and for system 2 as, respectively:

$$D_1 = \begin{cases} 1 & \theta^* \geq 1 \\ 1 - \theta^* & 1 > \theta^* > 0 \\ 0 & \theta^* \leq 0 \text{ or } T_1 \geq \mu + \theta, \end{cases} \quad (1)$$

and $D_2 = 1 - D_1$ (provided $T_2 < \mu$).

The profits of firm 1 and firm 2 can be written as:

$$\Pi_1 = (T_1 - \beta)(1 - \theta^*) = (T_1 - \beta)(1 - T_1 - T_2), \quad (2)$$

²If $\beta > 1$, system 2 dominates system 1, given that the extra cost (β) is always lower than the increase in valuation (θ).

and

$$\Pi_2 = (T_1 - T_2)T_2. \quad (3)$$

Another difference between systems lies in the cost of equipment to be bought by consumers. Our formulation can accomodate easily this extension, provided that competition in equipment sales is not explicitly included in the analysis. This can be done in two ways.

If equipment is sold by the system operator, than access pricing can be seen as including such cost.

On the other hand, if consumers buy equipments on the market, we can include the price of equipment in μ , or if different equipments are associated with different systems (a reasonable assumption in our setting), the price differential can be included in the parameter θ and the analysis goes through in a very similar way. In this case, the problem is equivalent to having some consumers with preference for system 2 (for equal access prices). Utility from system 1 is $\mu + \theta - T_1 - p_1$ and from system 2 is $\mu - T_2 - p_2$, where p_i is the equipment price of system i (which are taken as given). The following redefinition states a very similar problem to the one developed in the main text: $u_1 = \mu + \bar{\theta} - T_1, u_2 = \mu - T_2, \bar{\theta} = \theta - p_1 + p_2$. The crucial point to note is that the indifferent consumer is the same before and after this redefinition.

We now turn to the analysis of market allocations under the alternative assumptions of separate ownership (duopoly) and joint ownership (monopoly).

2.1 Separate ownership case

Firm 1 and firm 2 have different owners and thus are independently managed. This is the case that corresponds to situations in which GSM operators are not allowed to take dominant positions in trunk radio operators and vice versa, as is the case of Portugal. We shall refer to this as the duopoly case. Solving first order conditions for profit maximization yield: $T_1 = 2T_2 = 2(1 + \beta)/3$. In this case, the indifferent consumer is the one with an additional valuation of system 1 such that $\theta_D^* = (1 + \beta)/3$, where subscript D stands for duopoly (separate ownership). Hence, profits of firm 1 and firm 2 can be rewritten as

$$\Pi_1^D = \left(\frac{2 - \beta}{3} \right)^2 \quad (4)$$

and

$$\Pi_2^D = \left(\frac{1 + \beta}{3} \right)^2. \quad (5)$$

Note that operating system 1 is more profitable if the cost differential is not too high ($\beta < 1/2$).

2.2 Joint ownership case

Suppose now that firms 1 and 2 had the same owner. In this case, we would assist to the joint maximization of profits in both markets. Since the indifferent's consumer additional valuation of system 1, θ^* , can be written as $T_1 - T_2$, the profit maximization problem is given by:

$$\max \Pi = (1 - \theta^*)(T_2 + \theta^* - \beta) + T_2\theta^* \quad (6)$$

subject to

$$\mu - T_2 \geq 0 \quad (7)$$

$$\mu + \theta - T_1 \geq \mu - T_2. \quad (8)$$

In this case, $\theta_M^* = (1 + \beta)/2$, $T_2 = \mu$ and $T_1 = \mu + (1 + \beta)/2$. Since $\beta \in [0, 1)$, $\theta_M^* \in [1/2, 1]$. Adoption in the monopoly case is always lower than under duopoly. This results from the fact that under competition and starting from the monopoly allocation, the operator of system 1 has an higher incentive to lower its price that is,

$$\begin{aligned} \left. \frac{\partial \Pi_1^D}{\partial T_1} \right|_{\{T^M\}} &= 1 - \mu \\ \left. \frac{\partial \Pi_2^D}{\partial T_2} \right|_{\{T^M\}} &= \frac{1 + \beta}{2} - \mu \end{aligned}$$

and

$$\left| \left. \frac{\partial \Pi_1^D}{\partial T_1} \right|_{\{T^M\}} \right| > \left| \left. \frac{\partial \Pi_2^M}{\partial T_2} \right|_{\{T^M\}} \right| \quad (9)$$

where superscript D stands for separate ownership and superscript M for joint ownership. Hence, the tariff-reducing incentive is greater in system 1.

Equilibrium profits for the monopolist are

$$\Pi^M = \mu + \left(\frac{1 - \beta}{2} \right)^2 \quad (10)$$

and it can easily be checked that $\Pi^M > \Pi_1^D + \Pi_2^D$.

3 Welfare comparisons in the basic model

Total surplus, i.e., the sum of consumer and producer surplus is

$$W = \mu + \int_{\theta^*}^1 \theta d\theta - \beta(1 - \theta^*). \quad (11)$$

It is straightforward to check that welfare is maximized for $\theta^* = \beta$.

Total welfare in the separate ownership case, W^D , is given by:

$$W^D = \frac{1}{2} + \mu - \beta + \left(\frac{1+\beta}{3}\right) \left(\frac{5\beta-1}{6}\right). \quad (12)$$

In the joint ownership case, total welfare, W^M , is given by:

$$W^M = \frac{1}{2} + \mu + \left(\frac{1+\beta}{2}\right)^2 / 2. \quad (13)$$

Comparing total welfare in both scenarios, we have that, if β is high enough total welfare is higher in the joint ownership case than when both firms are separately owned. That is, since $W^M - W^D = (1+\beta)(5/7 - \beta)/72$,

$$\begin{cases} W^D > W^M & \text{when } \beta < 5/7 \\ W^D < W^M & \text{when } \beta > 5/7. \end{cases} \quad (14)$$

Hence, joint ownership enhances welfare when cost are high for the more sophisticated technology. In fact, for sufficiently different costs, separate ownership of competing systems may lead to excessive adoption of the system 1. On the other hand, it remains that the monopoly distortion, i.e., the welfare cost resulting from the monopolist (joint owner's ability) to extract rents decreases with β . Figure 1 illustrates this point.

Adoption of system 1 under duopoly is always higher than under monopoly. For low values of the cost, both market structures imply too few adopters. However, for higher values of cost (namely, $\beta > 1/2$ in our framework), duopoly leads to too much adoption of system 1 - see Figure 1. Therefore the distortions associated with each market structure are of different nature. The monopoly distortion is decreasing in β , and the duopoly distortion is increasing in β .

In Figure 2, the vertical axis is valuation of the good (θ) and cost of production, while in the horizontal axis we have the number of customers that opted for system 1. The 45 degrees line corresponds to the uniform density on valuation and the area under this line measures the consumers' surplus in excess of basic utility level (minus price). The cost of providing system 1 is β , which also measures the social cost. Therefore, this figure evaluates the social welfare effects of joint and separate ownership.

Figure 1: Indifferent consumer

Figure 2 illustrates our main result.³ The social optimum is obtained at cutoff point equal to β . When the duopoly critical level of preferences is closer to β , its distortion cost is small and given by the area “-”. On the other hand, the monopoly distortion (too few adopters) is marked by the shaded area “+”. It is clear that for θ_M close to β , the monopoly distortion (rent extraction) is much lower than the duopoly distortion (too much adoption).

4 A model with a two-part tariff

In the present section, we extend previous section results to the case of a two-part tariff in system 1. In addition to utility from joining the system, the consumer also derives utility from usage, denoted by q . The corresponding individual utility level is assumed to be of the form

$$v(q) = aq - bq^2/2 \quad (15)$$

The optimal choice of quantities implies equilibrium values of

$$q(p) = (a - p)/b \quad (16)$$

$$\bar{v}(p) = \frac{(a - p)^2}{2b} \quad (17)$$

where p denotes the price per quantity used and $v'(\cdot)$ is the indirect utility function.

³Figure 2 is drawn for the interesting case of $\beta > 1/2$.

Figure 2: Welfare Effect

Extending the definition from Section 2, utility from choosing system 1 is given by:

$$u_1 = \mu + \theta + \frac{(a-p)^2}{2b} - T_1 \quad (18)$$

Computation of the indifferent consumer yields:

$$\theta^* = T_1 - T_2 - \frac{(a-p)^2}{2b} \quad (19)$$

Profit of firm 1 is defined by

$$\Pi_1 = (1 - \theta^*)((T_1 - \beta) + q(p)(p - \alpha)) \quad (20)$$

where α is the (constant) marginal cost of providing "units of consumption" of the good. Profit definition of firm 2 remains unchanged.

Let's take first the case of separate ownership. Solution of first-order conditions of each firms' profit maximization problem gives:⁴

$$T_1 = \frac{2}{3}(1 + \beta) + \frac{(a - \alpha)^2}{6b} \quad (21)$$

$$T_2 = \frac{1}{3}(1 + \beta) - \frac{(a - \alpha)^2}{6b} \quad (22)$$

$$p = \alpha \quad (23)$$

As standard in two-part tariff models, it is optimal to price usage of the system 1 at marginal cost. In turn, a higher fixed payment is established in equilibrium by the operator of system 1 (this constitutes no surprise, as utility is now increasing with the use of the system).

The joint ownership allocation has as equilibrium values:

$$T_1 = \mu + \frac{(a - \alpha)^2}{4b} + \frac{1}{2}(1 + \beta) \quad (24)$$

$$T_2 = \mu \quad (25)$$

$$p = \alpha \quad (26)$$

From direct comparison of the cases, an important result emerges: price of use is not affected by the ownership structure, and it is set at marginal cost. Therefore, an efficient rule is followed independently of the ownership structure. This suggests that our previous model does capture the main intuition at play.

⁴Full derivations are available from the authors upon request. Also some restrictions have to be imposed upon the parameters in order to assure that $\theta^* \in [0, 1]$. In what follows, we assume those conditions to hold.

The welfare function is now defined as

$$W'' = \mu + \frac{1}{2} - \frac{1}{2}(\theta^*)^2 + (1 - \theta^*)(\bar{v}(p) - \beta - \alpha q(p)) \quad (27)$$

Welfare assessment formulae are more involved. The welfare difference between monopoly and duopoly is given by:

$$\frac{-(7a^2 - 38a\alpha + 31\alpha^2 + 10b - 14b\beta)(-(a - \alpha)^2 + 2b(1 + \beta))}{288b^2} \quad (28)$$

whenever $\theta_k^* \in [0, 1]$, $k = D, M$, where D stands for separate ownership (duopoly) and M for joint ownership (monopoly).

In this model, monopoly may entail more or less adoption than duopoly. In the duopoly case, rivalry induces lower prices and more adoption than the monopoly. However, in the monopoly there is now an extra gain, resulting from more intensive use. This latter effect increases adoption of system 1. The expression for $\theta_M^* - \theta_D^*$ illustrates these forces:

$$\theta_M^* - \theta_D^* = \frac{1 + \beta}{6} - \frac{(a - \alpha)^2}{12b} \quad (29)$$

On the welfare comparison, for $\alpha = a$, we recover the previous result: $\beta > 5/7$ leads to higher welfare under monopoly. Hence for an open set of values of α sufficiently close to a , joint ownership is superior to separate ownership. Therefore, Section 2 analysis carries over to this extended framework. Welfare improvements of joint ownership may result and they are more likely to appear when costs are high (of both usage and per consumer). This is depicted in Figure 3.⁵

⁵Parameter values: $a = 2$; $b = 1$.

Figure 3: Welfare effects with a two-part tariff

5 Learning curve effects

In previous sections we have analysed the existing trade-off between joint ownership and separated ownership in a static framework.

However, costs of telecoms services are usually characterized by the existence of a learning curve. That is, future costs depend on how fast firms go down on the learning curve.

In our model, since total demand (number of customers) is fixed, if one system gets more customers in the first period it will lower in the second period. Therefore, competition or its absence will have another channel of effects. It's the purpose of this section to evaluate if such type of effects do change the basic intuition provided by the one-period model.

To keep matters as tractable as possible, the simple model of section 2 is used.⁶

We model the learning curve in a very simple way: the differential cost, β , is decreasing on the number of consumers in system 1. This learning curve modeling follows that of Fudenberg and Tirole (1983).

The rationale for this approach is the following. The existence of a learning curve in both systems means that second period costs are a decreasing function of the volume of consumers in the first period.

The number of consumers in system 1 is sufficient to characterize the evolution of the differential cost across systems. From this discussion, it is natural to argue that all the qualitative effects will be captured if there is learning in system 1, as in this case the cost differential can only decrease in the second period.

In the first period, firms maximize total profits. No discounting is assumed. Social planner, separate ownership and joint ownership problems are considered. It is assumed that firms cannot commit to multi-period pricing schemes. The second period price game is similar to the model developed in Section 3. Hence, we will make use of earlier results, namely equilibrium profits.

5.1 The social optimum

Our benchmark is provided by the social planner's problem. The two-period welfare function is the straightforward extension of expression (11):⁷

$$W(\theta', \theta) = \mu - \beta(1 - \theta') - (\beta - \gamma(1 - \theta'))(1 - \theta) + 1 - \frac{\theta^2}{2} - \frac{\theta'^2}{2} \quad (30)$$

⁶As shown the qualitative results of a model with two-part tariff in the 'better' system are essentially the same.

⁷ x' denotes first period variables. x denotes second period variables.

The learning effect in the second period is taken to be:

$$\beta = \beta' - \gamma N_1, \quad \gamma \in [0, 1/2] \quad (31)$$

where γ measures the extent of the learning effect.⁸

The solution to the first order conditions of the planner's problem gives

$$\theta'_S = \theta_s = \frac{\beta - \gamma}{1 - \gamma} \quad (32)$$

It is easy to check the expected feature that learning effects motivate higher adoption of system 1 in both periods. The effect is stronger the higher the learning parameter γ .

5.2 Separate ownership

For the case of separate ownership, in the first period, discounted profits are given by:

$$\Pi'_1 = (T'_1 - \beta')(1 - T'_1 + T'_2) + \Pi_1^D, \quad (33)$$

with

$$\Pi_1^D = \left(\frac{1 - \beta}{3} \right)^2 \quad (34)$$

for firm 1, and

$$\Pi'_2 = (T'_1 - T'_2)T'_2 + \Pi_2, \quad (35)$$

for firm 2. Note that both firms anticipate the effects of first period decisions on the price game of the second period. Intuitively, we should expect both firms to be more aggressive in the first period, as firm 1 wants to go down on its learning curve and firm 2 wants to prevent it, to avoid stiffer competition in the second period.

Resolution of first-order conditions of each firm's problem yields somewhat involved expressions for the equilibrium values of T'_1 and T'_2 . The indifferent consumer is defined by

$$\theta'_D = \frac{9(1 + \beta) + 4\gamma\beta - 2\gamma - 4\gamma^2}{27 - 4\gamma^2} \quad (36)$$

and, for the second period,

$$\theta_D = \frac{9(1 + \beta) + 3\beta\gamma - 2\gamma^2 - 6\gamma}{27 - 4\gamma^2} \quad (37)$$

⁸The range for γ is defined in order to ensure a positive differential cost in the second period. For $\gamma = 0$ there is no learning.

5.3 Joint ownership

The monopolist's profit is defined by

$$\Pi^M = (T'_1 - \beta)(1 - T'_1 + T'_2) + T'_2(T'_1 - T'_2) + \left(\mu + \frac{(1 - \beta + \gamma(1 - T'_1 + T'_2)^2)}{4} \right) \quad (38)$$

where the last bracketed term is monopoly profits in the second period. Solving the profit maximization for the single firm, it results

$$\theta'_M = \theta_M = \frac{1 + \beta - \gamma}{2 - \gamma} \quad (39)$$

Like in the social problem, also the monopolist induces higher adoption of system 1 in the first period than in the absence of learning.

5.4 Welfare comparisons

Equilibrium values for the indifferent consumer under the cases of interest are (for first-period variables):

$$\begin{aligned} \theta'_S &= \frac{\beta - \gamma}{1 - \gamma} \\ \theta'_D &= \frac{9(1 + \beta) - 2\gamma + 4\beta\gamma - 4\gamma^2}{27 - 4\gamma^2} \\ \theta'_M &= \frac{1 + \beta - \gamma}{2 - \gamma} \end{aligned}$$

From these values, it is straightforward to compute:

$$\begin{aligned} \theta'_M &> \theta'_D \\ \theta'_M &> \theta'_S \\ \theta'_D &> \theta'_S \text{ for } \beta \text{ small and } \gamma \text{ high} \\ \theta'_D &< \theta'_S \text{ for } \beta \text{ high and } \gamma \text{ low} \end{aligned}$$

Therefore, the existence of learning does not change the qualitative features of the model. Namely, for high values of β it remains true that joint ownership is closer to the social optimum than separate ownership.

However, it can be shown that the critical value of beta such that welfare under monopoly is greater than welfare under duopoly is increasing in gamma, the learning parameter. That is, the existence of learning favors the more competitive market structure.

Figure 4: Welfare effects under learning

Figure 4 illustrates the case, where the difference between joint ownership welfare and separate ownership welfare is depicted.⁹

⁹To sharpen the main point, whenever duopoly welfare is higher, the difference is set to zero. The figure assumes $\beta \in [1/2, 1]$, $\gamma \in [0, 1/2]$.

6 Other Extensions

6.1 Network externalities

We argue that network externalities need not to be explicitly introduced to make the point and that we can see them as included in the parameter θ .

A simple example makes more explicitly the point.

The network externality means that increasing the number of subscribers also increases the value of the system. This network externality is relevant for system 1 only. Given the technological features of system 2 is reasonable to believe that no network externalities are present.

The utility of choosing system 1 can be written as:

$$u_1 = \mu + \theta + \psi(1 - \theta^*) - T_1 \quad (40)$$

where $(1 - \theta^*)$ is the mass of subscribers of system 1 and ψ measures the extent of the network externality.

Solving the model yields

$$\begin{aligned} \theta_S^* &= \frac{\beta + 2\psi}{1 + 2\psi} \\ \theta_D^* &= \frac{1 + \beta + \psi}{3} \\ \theta_M^* &= \frac{1 + \beta}{2} \end{aligned}$$

It is almost immediate to show that the same qualitative features are inherited by the model if the network externality is not too big ($\psi < 0.5$).

6.2 Surplus distribution effects

The result of existence of "good monopoly" in some circumstances (joint ownership superior to separate ownership) is robust to the introduction of learning effects and network externalities, provided they are not too extreme.

However, one may object to joint ownership of competing systems on the basis of distributional effects. In fact, if consumers' surplus and profits have different weights in the social welfare measure, separate ownership may always dominate. Typically we expect a "benevolent" regulator to maximize consumers' surplus subject to a non-negative profit for the regulated firm.

To see this type of considerations at work, define the welfare measure as:

$$W = CS + \tau\Pi \quad (41)$$

where τ is a weighting parameter. CS is consumers' surplus and Π is aggregate profits. We know from earlier results that for $\tau = 1$ joint ownership may yield higher total welfare. However, since $CS(M) < CS(D)$ for all $\beta \in [0, 1]$, it exists $\tau^* \in (0, 1)$ such that $W(M) < W(D), \forall \beta$.

That is, if a sufficiently low social value is given to firms' profits, then separate ownership is socially preferred to joint ownership.

7 Final Remarks

In this paper, we have shown that, in a framework with two competing systems and with consumers giving more value to the good available in the higher-cost system, joint ownership may be superior, from a welfare point-of-view, to separate ownership. This emerges when the cost of the better system is sufficiently high. In this case, rivalry between the two systems leads to too much adoption of the high cost system. Too much adoption means that the extra valuation of the marginal consumer for the superior good is lower than its social cost.

A number of simplifying assumptions were used and they deserve some comments. First, it would be natural to allow for two-part tariffs. In Section 4 we introduced a two-part tariff in the superior system, which in our main example may be identified with the GSM cellular system. The trunk radio system has, usually, only a fixed fee. Intuition and qualitative results do not change, although calculus is more involved in this case. Considering a two-part tariff adds intensity of use to consumers' valuation of system 1. Thus, the extended model has, in equilibrium, more adoption of system 1 than our model. However, it is still possible to define a range of parameters values such that welfare is greater under monopoly. These parameters involve typically high values for β , the cost per user, of the superior system (and also for the marginal cost of utilization of the system). We conjecture that allowing for two-part tariffs in both systems will not change the basic intuition of the model.¹⁰

Another departure from the basic model was presented. Learning effects were assumed for the differential costs between systems. The qualitative properties of the model were unchanged by this extension: monopoly still dominates for high values of cost differential if learning is not too important. The existence of learning favors the separated ownership market structure. Competition between systems implies more adoption of system 1 than a monopolistic market structure, allowing more gains from learning.

Second, we argue that network externalities are fully incorporated in the parameter θ .

¹⁰Notice, however, that in case of the Portuguese market, which motivated this paper, system 2 (trunk radio) does not have a usage component in its pricing.

This is at odds with the usual procedure that endogenizes the network externality. The assumption was made by simplicity. It is justified by the fact that the main externality in mobile telephones arises from connection to the fixed-link telephone network. Therefore, the marginal contribution to this externality from within the mobile network calls is rather small. Nothing essential hinges upon this assumption.

Third, we have considered only one operator in each system. With competition within the system, assessments may change substantially. In particular, if within each system the services provided by more than one company are perfect substitutes, we conjecture that Bertrand competition will lead to the perfect competition outcome. Joint ownership versus separate ownership across systems maybe a less important issue than otherwise, as competition within the system will dominate competition between systems.

Finally, it should be pointed out that policy prescriptions about ownership should be made carefully, as no definite rule emerges. Also distributional aspects are likely to play a role. Even in the absence of such issues, in a second-best world, comparison between the monopoly distortion (too few adoption) and the duopoly distortion (too much adoption, induced by rivalry) must be made. Our model suggests that the latter tends to be more important when the differential cost across systems is high.

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