A joint Initiative of Ludwig-Maximilians-Universität and Ifo Institute for Economic Research

Venice Summer Institute 2004

Workshop on " Recent Developments in Antitrust Analysis"

21-22 July 2004

Venice International University, San Servolo

Ownership Structure of Cable Networks and Competition on Local Access

Pedro Pereira and Duarte Brito

CESifo
Poschingerstr. 5, 81679 Munich, Germany
Phone: +49 (89) 9224-1410 - Fax: +49 (89) 9224-1409
E-mail: office@CESifo.de
Internet: http://www.cesifo.de

Ownership Structure of Cable Networks and Competition on Local Access

(Preliminary Version)

Pedro Pereira* Duarte Brito†

Autoridade da Concorrência Universidade Nova de Lisboa

July 2004

Abstract

This paper does two things. First, it investigates if the joint ownership of a local telephone network and a cable network, increases or decreases incentives to invest in upgrading the cable television network. And second, it shows that separate ownership of the two networks is indispensable to promote competition in local access. In line with the common wisdom, we find that a firm that owns only a cable television network may have more incentives to invest than a firm that owns both networks. However, there are circumstances were the opposite may also happen.

Key Words: (...)

JEL Classification: (...)

*Autoridade da Concorrência, Rua Laura Alves, n^o 4, 1050-188 Lisboa, Portugal, Email: ppereira@autoridadedaconcorrencia.pt

†SACSA, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, Quinta da Torre, 2829-516 Caparica, Portugal. Email: dmb@fct.unl.pt

1 Introduction

In this paper we discuss the role of cable television networks and their ownership structure, in promoting competition in the local access market. First, we investigate if the joint ownership of a telephone and a cable television network, increases or decreases the incentives to invest in upgrading the cable network. An upgraded cable network, aside from television services, can offer interactive services, like telephony, broadband access to the Internet, or video on demand. And second, we show that separate ownership of the two networks is indispensable to promote competition in telephony services. In the next three sub-sections, first we discuss the importance of cable networks in promoting competition in local access, second we discuss the impact of the ownership structure in the incentives to upgrade the cable network and in competition in local access, and third we give an overview of the model and the paper's main results.

1.1 Cable Networks and Competition on Local Access

In this sub-section we discuss the importance of cable television networks for promoting competition in the local telephony market.

The Telecommunications Act of 1996 introduced an innovative view. Entry of new firms into the local telephony market could occur through two ways alternative to own facilities entry: **(i)** the resale of the incumbent's services, and **(ii)** the unbundling of the incumbent's local loop.[1]

These two forms of entry rely on the *Open Network Provision*, according to which all telecommunications firms should have access to the basic public telephone network, under the principles of: **(i)** non-discrimination, **(ii)** transparency, and **(iii)** cost orientation. The open network provision is part of the legislation of many countries, e.g., the Access Directive 2002/19/EC.

The open network principle is hard to enforce. In the 1974 anti-trust suit against *AT&T*,[2] the anti-trust division of the Department of Justice of the *US* asked for the divestiture of

[1] In *Own Facilities* entry new firms build their own local loop, switches, etc. This form of entry makes new firms independent of the incumbent's network, but requires time and large investments. In *Resale* entry new firms buy the incumbent's services at a discount under the price charged by the incumbent to its clients, and resell these services to their own clients. This form of entry is fast and cheap. However, it does not allow for much product differentiation. Besides, the arbitrage between the wholesale and the retail prices is the only profit opportunity. Firms can use resale temporarily to gain market share, while they build their own facilities. Entry throught *Local Loop Unbundling* is a hybrid between the first and second forms of entry. New firms lease unbundled elements of the incumbent's local loop, and combine them with their own infrastructures.

[2] The suit alleged monopolization of the long-distance, local, and equipment markets.

AT&T, on the basis of the argument that the sectorial regulator, the *Federal Communications Commission*, would not be able to stop *AT&T* from charging excessive prices, and providing inferior quality for its rivals' access to the local networks (Noll & Owen (1988)). In other words, on the basis of the argument that the *Federal Communications Commission* would not be able to enforce the open network provision. The process concluded 10 years later with the break-up of the *AT&T*. In a recent opinion regarding VERIZON v. TRINKO (540 U. S. _ (2004)) the Supreme Court of the *US* questioned whether the open network provision is within the domain of antitrust law.[3]

If resale and the unbundling of the local loop are unreliable ways of promoting entry, then one is left with facilities based entry as the main way of introducing competition on the local telephony market.

Deploying a local access network for non-residential clients might not be a problem. Building a fibre-optic ring for a commercial business district, or building a fixed wireless access for a large corporate client, might be profitable investments.

But for residential clients the situation is different. And unless the network is used to provide other services, it might not be profitable to build.

Of the various technologies alternative to copper wire the cable television has a special position: **(i)** for the functionalities it offers, **(ii)** for requiring smaller investments to allow offering the voice service, and **(iii)** for the coverage of the network already deployed. For these three reasons, cable television is the only technology that in the short run can compete with the public switched telephone network with respect to the supply of all telecommunications and multimedia services.

The cable television technology allows the supply of a complete range of telecommunications services, including telephony services or broadband access to the Internet. There are other alternative technologies, like the combination of *Powerline Communications* and voice over the Internet Protocol. However, these alternatives are only starting to be deployed.

(SEE) Cable television networks were originally designed to broadcast information, i.e., to deliver a one-way signal. However the cable television can be improved. Fiber optics can increase bandwidth. But they can be upgraded to carry a return signal. Bidirectional amplifiers

[3] "The 1996 Act is in an important respect much more ambitious than the antitrust laws. It attempts to eliminate the monopolies enjoyed by the inheritors of *AT&T*'s local franchises. (...) Section 2 of the Sherman Act, by contrast, seeks merely to prevent unlawful monopolization. It would be a serious mistake to conflate the two goals. The Sherman Act is indeed the "Magna Carta of free enterprise", (...) but it does not give judges carte blanche to insist that a monopolist alter its way of doing business whenever some other approach might yield greater competition."

	Fixed Access	Coverage	Homes Passed
Austria	*48,8*	*77*	*53*
Belgium	*50,1*	*93*	*100*
Denmark	*71,5*	*90*	*70*
Finland	*67*	*60*	*63*
France	*67,6*	*76*	*32*
Germany	*63,5*	*80*	*86*
Ireland	*48,5*	*0*	*50*
Luxembourg	*78,6*	*65*	*100*
Netherlands	*64,7*	*64*	*94*
Portugal	*43,5*	*n.a.*	*47*
Sweden	*75,5*	*70*	*65*
UK	*58,9*	*60*	*51*

Source: (...)

Table 1: Access Lines, DSL Coverage, and Cable Connections in the EU

and switches can enable switching capabilities. Digitalization increases quality and the range of range of services. And endowed with bidirectionality, cable television networks can also be used to offer fixed telephony services, and broadband access to the Internet, through cable modem.

Of the various technologies that give local access to consumers alternative to copper wire, cable television is the only with an infrastructure already deployed that offers almost complete coverage. This gives cable networks a special importance. They are already deployed in many countries (Table 1). And for a lower cost than deploying a new network, they can be upgraded to carry a return signal (**Numbers**). Cable television networks are thus a natural means of introducing facilities based competition on the local market.

The example of the *UK* is revealing. After seven years of legal duopoly, 1984-1991, *Mercury*, the rival of *British Telecom* gained about 1% market share. *Mercury* resold lucrative services, but did not invest in access lines. In 1991, with the publication of the 1990 Telecommunications Policy Review, the Duopoly Review, cable television firms where allowed to offer fixed telephony services.[4] Cable telephony rapidly overtook subscription television. Now the industry has more cable telephone lines, than television subscribers. In the third quarter of 2003 *NTL*

[4]Cable operators were allowed to offer their own telephony services, instead of merely reseling those of *British Telecom* or *Mercury*. In particular they were allowed to deploy their own switches, and to interconnect freely with other operators of adjacent cable franchises.

Home had 2,809,500 customers, or which 864,600 where broadband customers, 1,294,800 were digital television customers, 2,489,800 were telephony customers, and 551,100, i.e., 19,6%, took all three services. In the same period *Telewest* had 329,336 broadband customers, 911,191 digital television customers, and 1,588,358 telephony customers. In 1992 *British Telecom* for *UK* geographic calls, a revenue market share of 99,2%. In the second quarter of 2003 *NTL* and *Telewest* jointly had, for *UK* geographic calls, a revenue market share of 13.4%, and a residential revenue market share of 19.7%, whereas *British Telecom* had respectively, 65.7 and 70.6%.[5]

1.2 Ownership Structure, Incentives to Invest, and Competition

In the *US* the Telecommunications Act of 1996 recognized both the importance of the cable television networks for providing an alternative infrastructure to the incumbent's network, and a potential conflict of interests. Section 302 imposes the structural separation between firms that own local networks and firms that own cable television networks.[6]

The legislation of the *European Community*, reflecting the political equilibrium within the institution,[7] only requires the legal separation between firms that offer telecommunications

[5]The data on *NTL* is from the firm's "Quarterly Report", the data on *Telewest* is from *ECCA´s* "Web Site", and the data on market shares is from *OFCOM´s* "Market Information".

[6]" No local exchange carrier or any affiliate of such carrier owned by, operated by, controlled by, or under common control with such carrier may purchase or otherwise acquire directly or indirectly more than a 10 percent financial interest, or any management interest, in any cable operator providing cable service within the local exchange carrier's telephone service area." "No cable operator or affiliate of a cable operator that is owned by, operated by, controlled by, or under common ownership with such cable operator may purchase or otherwise acquire, directly or indirectly, more than a 10 percent financial interest, or any management interest, in any local exchange carrier providing telephone exchange service within such cable operator's franchise area."

[7]Section 2 of Directive 95/51/EC required that firms that offer simultaneously telecommunications and cable television networks should at least hold accounting separation between these two activities. However, it indicated a preference for the legal separation of firms offering telecommunications and cable television networks. In 1998, after the review of the measures taken in response to Directive 95/51/EC, the Commission concluded that the accounting separation was not enough to increase competition in the industry (Commission communication concerning the review under competition rules of the joint provision of telecommunications and cable TV networks by a single operator and the abolition of restrictions on the provision of cable TV capacity over telecommunications networks (98/C 71/04) do OJEC c 71, March 7, 1998, pg. 4-22). The Commission recommended that telecommunications and cable television activities should at least be legally separated, but added that the structural separation was preferable. I.e., it was preferable that the dominant telecommunications firm divested totally or partially its participation in the ownership of cable television infrastructures. Directives 99/64/EC, of June 23 Section 1, and Directive 2002/77CE of September16 , Section 8, imposed merely legal

networks, and firms that offer cable television networks.[8] However, several European countries followed a more assertive approach.[9]

It has been argued that firms that own both networks have no incentive to upgrade their cable networks to endow them with bidirectionality (**Reference**). The cable network endowed with bidirectionality will compete for clients with the telephone network, both on telephony services and on broadband access to the Internet services. It is unlikely that the investment in the cable network will generate any additional net revenues for the owner of both networks.

An independently owned cable firm does not have the same conflict of interests. Endowing an existing cable network is less costly than creating a new telecommunications network. And for independently owned cable firm the additional revenues do not deviate revenues from other businesses. It is even likely that offering telecommunications services will attract new clients.

We do not agree with this perspective. The self-cannibalization *effect* might reduce the incentives of a firm that owns both networks to upgrade the cable network. However, there are other factors that can mitigate or overcome the impact of self-cannibalization effect, and give a firm that owns both networks more incentives to upgrade the cable network than an independently owned cable firm.

And what matters is not which ownership structure gives more incentives to upgrade the cable network. What matters is which ownership structure promotes competition in local

separation.

[8] The accounting separation of the activities associated with telecommunications networks and the activities associated with cable television networks makes finance fluxes more transparent, and helps to detect and avoid abusive practices by the dominant firm, namely regarding price setting. Legal separation of firms that operate telecommunications and cable television networks, makes assets and costs more transparent. However, accounting and legal separation does not solve the fundamental conflict of interests. Legally separated firms that offer telecommunications and cable networks may be controlled by a third firm with majority positions on both firms. The third firm will effectively control both networks.

[9] In the *UK* and *Belgium*, the dominant firm offering telecommunication services is forbidden of offering cable television networks. *Holland* took several measures to limit the joint ownership by the telecommunications incumbent of the telecommunications and cable television networks, and to separate structurally the two activities. In 1997, *KPN*, the dutch incumbent was forced by the government to reduce its participation in the cable firm *Casema*, from 100% to 20%. In the remaining countries, the pressure exerted by the *Sectorial Regulators*, *Antitrust Authorities*, and financial difficulties, have lead the incumbents to divest their participations in firms that offer cable networks. In December 1999, *Swisscom*, *Siemens Schweiz*, and *Veba* sold group *Cablecom* to *NTL*. In July 2002, pressured by the *European Commission*, *Deutsche Telekom*, divided its cable television firm, *Kabel Deutschland*, in nine regional firms that it has been selling (Press Note of the Commission: IP/00637.). On May 2002, the merger of Telia and Sonera, the incumbents of *Sweden* and *Finland*, respectively, was approve by the Commission, conditional, among other things, that *Telia* divested from its cable television network.

access. Even if a firm that owns both networks upgrades the cable network, it will behave like a multiproduct monopolist. Only an independently own cable firm will compete with the telecommunications firm for clients.

1.3 Overview of the Paper

In this sub-section we give an overview of the model and the main results.

There are two networks: a telephone network, and a cable network. The telephone network provides fixed telephony services. The cable network provides subscription television services. However, the cable network can be upgraded to provide additional services, such as fixed telephony, broadband access to the Internet, or video on demand, etc.[10] These additional services can be packaged in a bundle with cable television services. Of all these additional services we focus on telephony services. Thus, there are potentially three products: telephony services provided through the telephone network, cable television services provided through the cable network, and a bundle that includes telephony services and cable television services, both provided through the cable network. There are scope economies associated with the provision of the bundle over the cable network.

There are two basic firms. Each firm owns one of the networks. The two firms may be owned separately, or jointly, through a holding company.

The game unfolds as follows under both ownership structures. First the cable firm decides whether to invest in upgrading the cable network. And second, both firms choose prices.

When the cable network is not upgraded, and the two firms are owned separately, each firm behaves like a monopolist with respect to the service it provides. When the cable network is updated, and the two firms are owned jointly, the holding company behaves like a multiproduct monopolist. When the cable network is updated, and the two firms are owned separately, the firm that owns the telephone network and the firm that owns the cable network compete for consumers.

We find that a firm that owns only a cable television network may have more incentives to invest than a firms that owns both networks. However, under other circumstances the opposite may also happen.

The paper is organized as follows. Section 2 presents the model, and section 3 characterizes the equilibrium. Section 4 conducts the analysis and section 5 discusses extensions. Section 6 concludes. All proofs are in the Appendix.

[10] Either network can provide broadband access to the Internet throught, respectively, DSL and Cable Modem.

2 The Model

2.1 The Environment

There are two networks: a public switched telephone network, *PSTN*, and a cable network, *CN*. The *PSTN* provides fixed telephony services. The *CN* provides subscription television services. And if it is endowed with bidirectionality, the *CN* can also provide other services such as fixed telephony. The networks are owned by different companies. The *PSTN* belongs to the *Telecommunications Company*, and the *CN* belongs to the *Cable Company*. There are two possible ownership structures for these companies: **(i)** separate ownership, and **(ii)** joint ownership, through a *Holding Company*. Denote the independent cable company by i , and the cable company owned by the holding company by h. We index the cable companies superscript $k = i, h$.

There are three basic products: **(i)** fixed telephony services, provided through the *PSTN*, denoted by f, **(ii)** subscription television services, provided through the *CN*, denoted by t, and **(iii)** a bundle, denoted by b, that includes subscription television and fixed telephony services, both provided through the *CN*. We index the products with subscript $j = f, t, b$.

The game has two stages, which unfold as follows, under either ownership structure. In stage 1, the *Cable Company* decides whether to upgrade the *CN*. In stage 2, both companies choose prices.

2.2 Firms

Upgrading the *CN* involves a fixed cost $\varphi > 0$. All players observe whether the *CN* is upgraded.

Marginal production costs are constant for the three products. Denote the marginal cost of telephony services by c_f. For subscription television services and the bundle, we distinguish between the marginal cost of an independent cable company, and a cable company owned by the holding company. Denote the marginal cost of product j produced by cable company k by c_j^k, $j = t, b$; $k = i, h$.

We assume that there are *Economies of Scope* in the joint provision of subscription television services and fixed telephony services over the *CN*, i.e., $c_b^k := c_f + c_t^k + -\Delta_s^k$, where parameter Δ_s^k on $\left[0, c_f + c_t^k\right)$ captures scope economies.[11]

[11] Scope economies stem from joint fixed and marginal costs of offering multiple servives over the same network. According to Cluny (1995) for a multiple services operator, about 10% of its operating costs are incremental to

We assume that there are *Coordination Economies*. This assumption means that a cable company will have lower costs if it is owned by the holding company than if it is owned independently.[12] More specifically: **(i)** $c_t^h := c_t^i - \Delta_{ct}$, and **(ii)** $\Delta_s^h = \Delta_s^i + \Delta_{cb}$. Parameter Δ_{ct} on $[0, c_t^i)$, captures coordination economies with respect to cable television services, and parameter Δ_{cb} captures coordination economies with respect to the bundle.

2.3 Consumers

There is a large number of consumers, formally, a continuum, which we normalize to measure 1. All consumers have access to the *PSTN*. Consumers come in three types indexed by $\tau = 1, 2, 3$ (see figure 1). Consumers may differ in two ways: **(i)** on their valuation of subscription television services, and **(ii)** on their valuation of the bundle. Denote the consumers' valuations for fixed telephony services by v_f; denote the consumers' valuation for subscription television services by v_t^τ on $\{\underline{v}_t, \overline{v}_t\}$; and denote the consumers' valuation for the bundle by $v_b^\tau := v_f + v_t^\tau + \theta^\tau$, where θ^τ on $\left\{\underline{\theta}, \overline{\theta}\right\}$ is a parameter that measures the valuation of the bundle. Let α be on $(0, 1]$, and β be on $(0, \alpha]$. *Type* 1 consumers, a proportion β, have a high valuation for subscription television services, i.e., $v_t^1 = \overline{v}_t$, and have a high valuation for the bundle, i.e., $\theta^1 = \overline{\theta}$. *Type* 2 consumers, a proportion $(\alpha - \beta)$, have a high valuation for subscription television services, i.e., $v_t^2 = \overline{v}_t$, and have a low valuation for the bundle, i.e., $\theta^2 = \underline{\theta}$. *Type* 3 consumers, a proportion $(1 - \alpha)$, have a low valuation for both subscription television services, i.e., $v_t^3 = \underline{v}_t$, and for the bundle, i.e., $\theta^3 = \underline{\theta}$. Thus, the proportion of consumers that have a high valuation for subscription television services, i.e., type 1 and type 2 consumers, is α on $(0, 1]$. We assume that when consumers are indifferent between buying and not buying the bundle they choose the former.

To summarize, the preferences of a type τ consumer can be compactly stated as follows:

$$U^\tau = \begin{cases} v_f + v_t^\tau + \theta^\tau - p_b & \text{if purchase the bundle} \\ v_f + v_t^\tau - p_t - p_f & \text{if purchase phone and CATV services} \\ v_f - p_f & \text{if purchase phone services} \\ v_t^\tau - p_t & \text{if purchase CATV services} \\ 0 & \text{if does not purchase} \end{cases}$$

To close the model we will make the following assumptions about the parameters. Let: **(i)**

subscription television, 20% to telephony, andt 70% or more are non-attributable, common costs.

[12] Coordination economies stem from the cable company being able to integrate its network with the *PSTN*, e.g., share infrastructures, if it is owned by the holding company.

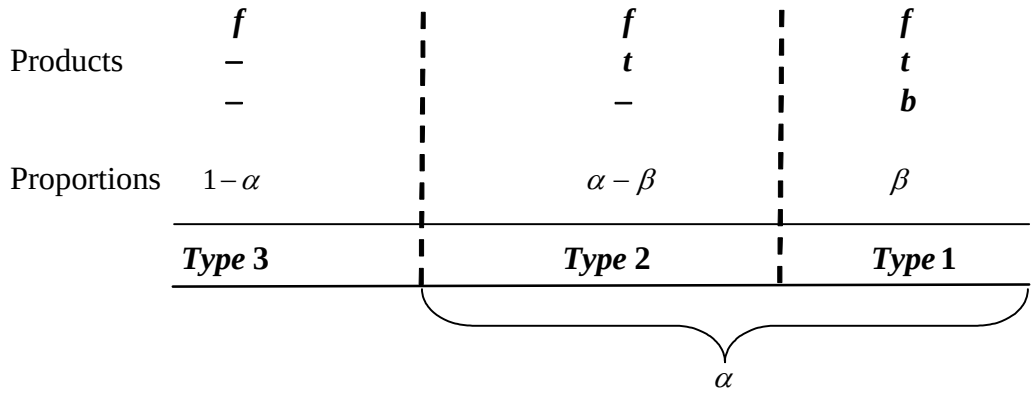

Figure 1: Consumer Types

$c_f < v_f$, **(ii)** $\underline{v}_t < c_{t_h} < \overline{v}_t$,[13] and **(iii)** $\underline{\theta} < -(v_f - c_f) - (\overline{v}_t - c_{t_h}) - \Delta_b < 0 \leq \overline{\theta}$. Note that assumptions (ii) and (iii) imply that: **(i)** $v_t^3 < c_t < v_t^2 = v_t^1$, and **(ii)** $v_b^3 < v_b^2 < c_b < v_b^1$.

3 Characterization of Equilibrium

In this section we characterize the game's equilibria. We solve the game by working backwards, for the two ownership structures: separate ownership and joint ownership.

3.1 Stage 2: The Price Game

In this subsection we characterize the equilibrium prices, under the two ownership structures, for the cases where the *CN* is, and is not upgraded. Denote the price of product $j = f, t, b$ by p_j.To simplify the exposition we assume that: **(i)** $p_f \leq v_f$, **(ii)** $p_t \leq \overline{v}_t$, and **(iii)** $p_b \leq v_b^1$.[14]

3.1.1 Demand

In order to establish the firms' profit functions, we will first derive the demand functions for the three products.

[13] In the case type 3 consumers do not have access to the *CN*, due to incomplete coverage, $\underline{v}_t = -\infty$.

[14] If, for at least one of the products, say t, the price was set above the reservation prices then, then consumers would rather buy the alternative to the bundle would be to purchase telephony services alone. By lowering its price to match v_t, the monopolist would not loose any of the consumers buying the bundle, and in addition, it would start selling the (...)

Demand for Fixed Telephony over the *PSTN* The $1-\beta$ type 2 and type 3 consumers that, respectively, have a high valuation for subscription television services and a low valuation for the bundle, and have a low valuation for both the bundle and subscription television services, buy fixed telephony services from the telecommunications company if: $p_f \leq v_f$. The β type 1 consumers that have a high valuation for subscription television services and for the bundle have two options: **(i)** buy the bundle, or **(ii)** buy telephony and subscription television services separately. The second option is preferable if $v_f - p_f + v_t^1 - p_t > v_f + v_t^1 + \theta^1 - p_b$, or $p_b > p_f + p_t + \overline{\theta}$. Summing up, the demand for fixed telephony services over the *PSTN*, f, is:

$$D_f(p_f, p_t, p_b) = \begin{cases} 0 & \text{if } v_f < p_f \\ 1-\beta & \text{if } p_b \leq p_f + p_t + \overline{\theta};\ p_f \leq v_f \\ 1 & \text{if } p_f + p_t + \overline{\theta} < p_b;\ p_f \leq v_f \end{cases}$$

Demand for Subscription Television The $(\alpha - \beta)$ type 2 consumers that have a high valuation for subscription television and have a low valuation for the bundle, buy subscription television services if $p_t \leq \overline{v}_t$. The β type 1 consumers that have a high valuation for subscription television and for the the bundle have two options: **(i)** buy the bundle, or **(ii)** buy telephony and subscription television services separately. The second option is preferable if $v_t^1 - p_t + v_f - p_f > v_f + v_t^1 + \theta^1 - p_b$, or $p_b > p_f + p_t + \overline{\theta}$. Summing up, the demand for subscription television services, t, is:

$$D_t(p_f, p_t, p_b) = \begin{cases} 0 & \text{if } \overline{v}_t < p_t \\ \alpha-\beta & \text{if } p_b \leq p_f + p_t + \overline{\theta};\ p_t \leq \overline{v}_t \\ \alpha & \text{if } p_f + p_t + \overline{\theta} < p_b;\ p_t \leq \overline{v}_t \end{cases}$$

Demand for the Bundle The β type 1 consumers that have a high valuation for subscription television and for the bundle have two options: **(i)** buy the bundle, or **(ii)** buy telephony and subscription television services separately. When $p_b \leq v_b$ the first option is preferable if $v_t^1 - p_t + v_f - p_f \leq v_f + v_t^1 + \theta^1 - p_b$, or $p_b \leq p_f + \overline{v}_t + \overline{\theta}$. Summing up, the demand for the bundle, b, is:

$$D_b(p_f, p_t, p_b) = \begin{cases} 0 & \text{if } v_b < p_b, \text{ or } p_f + p_t + \overline{\theta} < p_b \leq v_b \\ \beta & \text{if } p_b \leq p_f + p_t + \overline{\theta};\ p_b \leq v_b \end{cases}$$

3.1.2 Non-Upgraded *CN*

Next we characterize equilibrium prices when the *CN* is not upgraded.

The profit functions of the telecommunications and the cable companies are, respectively:

$$\begin{aligned} \pi_f^{nu} &= (p_f - c_f)D_f \\ \pi_t^{nu} &= (p_t - c_t^k)D_t \end{aligned}$$

The price equilibrium is simple, and is the same under both ownership structures.

Lemma 1 *If the* CN *is not upgraded, in equilibrium, the telecommunications and the cable companies charge:* ***(i)*** $p_f = v_f$, ***(ii)*** $p_t = \overline{v}_t$. ■

The telecommunications and the cable companies are monopolists, and charge their monopoly prices. The Telecommunications company sells telephony services to all consumers, and the cable company sells subscription television services to type 1 and type 2 consumers.

To simplify notation, we define $\mu_f = v_f - c_f$, $\mu_t^k = \overline{v}_t - c_t^k$, $\mu_b^k = v_b^1 - c_b^k = \mu_f + \mu_t^k + \overline{\theta} + \Delta_s^k$.

Using Lemma 1, the firms' equilibrium profits when the *CN* is not upgraded are:

$$\begin{aligned} \Pi_f^{nu} &= \mu_f = (1-\beta)\,\mu_f + \beta\mu_f \\ \Pi_t^{nu} &= \alpha\mu_{t_j} = (\alpha - \beta)\,\mu_t^k + \beta\mu_t^k \end{aligned}$$

3.1.3 Monopoly with an Upgraded *CN*

Next we analyze the case in which the *CN* is upgraded, and the telecommunications and the cable companies are owned jointly by a monopolist holding company.

The holding company maximizes joint profits given by:

$$\pi^m = (p_f - c_f)D_f + (p_t - c_{t_h})D_t + (p_b - c_{b_h})D_b \tag{1}$$

Lemma 2 *If the* CN *is upgraded, under joint ownership, in equilibrium, the holding company charges:* ***(i)*** $p_f = v_f$, ***(ii)*** $p_t = \overline{v}_t$, *and* ***(iii)*** $p_b = \overline{v}_b$. ■

The intuition of this result is straightforward. The holding company faces a trade-off. It can sell the bundle to type 1 consumers through the cable company. However, this means that the telecommunications company will not sell telephony services to these consumers, and also that the cable company will not sell subscription television services to these consumers. Recall that there are scope economies in the production of the bundle. Since in addition type 1 consumers have a high valuation for the bundle, it is more profitable to sell them the bundle than to sell them telephony and subscription television services separately (1):

$\mu_b^h = \mu_f + \mu_t^h + \overline{\theta} + \Delta_s^k > \mu_f + \mu_t^h$. Given that there is no heterogeneity within each type of consumers, the holding company charges the monopoly prices for all three services.[15]

The holding company sells telephony services to type 2 and type 3 consumers; sells subscription television services to type 2 consumers; and sells the bundle to type 1 consumers..

Using Lemma 2, the holding company's maximum profits are:

$$\Pi^m = (1-\beta)\,\mu_f + (\alpha-\beta)\,\mu_t^h + \beta\mu_b^h$$

3.1.4 Duopoly with an Upgraded *CN*

We now turn to the case in which the *CN* is upgraded, and the telecommunications and the cable companies are owned separately.

In this case, there exists no equilibrium in which the firms play pure pricing strategies with respect to all products.[16]

First, note that the cable company has a dominant strategy of charging the monopoly price for cable television services $p_t = \overline{v}_t$.[17] At this price, the cable company sells subscription television services to all type 2 consumers. Second, note that the cable company has no equilibrium pure pricing strategy for the bundle, and the telecommunications company has no equilibrium pure pricing strategy for fixed telephony services.[18]

To characterize the equilibrium mixed strategies, we proceed as follows. Denote by $G_i(.)$, the cumulative distribution of prices charged by firm i. Ignoring ties, the expected profit of the telecommunications company when it charges $p_f \leq v_f$ is

$$\pi_f^d(p) = (p - c_f)\{1 - \beta + \beta[1 - G_b(p + \overline{v}_t + \overline{\theta})]\}.$$

[15] The prices of fixed telephony services and subscription television services are set at the reservation price for two reasons. First to extract all the surplus of consumers that either have no access to the *CN*, or that have access to the *CN* but do not value the bundle. And second to induce the remaining consumers to buy the bundle.

[16] See Dinlersoz and Pereira (2004).

[17] Since there are economies of scope, the Cable company would like t Since the virtual shop is more profitable than the physical shop, the old firm would like to induce all consumers with Internet access to buy from its virtual shop. The old firm thus never charges a price at or below $1-v$ in its physical shop, and sells only to local consumers with no access to the Internet. But since it has monopoly power over these consumers, it charges the highest possible price of 1.

[18] Any fixed price p in $(c-\Delta, 1-v]$ charged by one of the virtual shops can be undercut by the other for a discrete gain in profit. The case in which both virtual shops charge a price equal to the marginal cost $c-\Delta$ is not an equilibrium, either: the old firm's virtual shop does not make any profit on switchers, but can increase its profit on loyals with Internet access by raising its price above the marginal cost.

Similarly, the expected profit of the cable company with respect to the bundle when it charges $p_b \leq v_b$ is

$$\pi_b^d(p) = (p - c_b^i)\beta[1 - G_f(p - \overline{v}_t - \overline{\theta})].$$

Let l_f be the lowest price the telecommunications company is willing to charge to sell to all consumers, i.e.,

$$(l_f - c_f) - (1 - \beta)\mu_f \equiv 0,$$

from which we obtain

$$l_f = c_f + (1 - \beta)\mu_f.$$

Note that l_f is decreasing in the proportion of consumers that have a high valuation for the bundle, β. The telecommunications company can sell to consumers with a low valuation for the bundle, whose proportion is $1 - \beta$, at price v_f. A larger β implies that the opportunity cost of charging a price lower than v_f to sell to consumers that have a high valuation for the bundle is smaller.

Denote by l_b, the lowest price the cable company is willing to charge for the bundle, to sell it to type 1 consumers, i.e.,

$$\beta(l_b - c_b^i) - \beta\mu_t^i \equiv 0,$$

from which we obtain

$$l_b = c_b^i + \mu_t^i.$$

Note that:

$$l_b - l_f - \overline{\theta} - \overline{v}_t = -\left(\overline{\theta} + \Delta_s^i\right) - (1 - \beta)\mu_f < 0.$$

If the cable company charges for the bundle $l_f + \overline{\theta} + \overline{v}_t$ with probability 1, it sells the bundle to type 1 consumers and earns

$$\underline{\pi}_b^d = (l_f + \overline{\theta} + \overline{v}_t - c_b^i)\beta = \left[\left(\overline{\theta} + \Delta_s^i\right) + (1 - \beta)\mu_f + \mu_t^i\right]\beta.$$

Since $l_b - l_f - \overline{\theta} - \overline{v}_t < 0$, this possibility is always feasible. (explain)

If the telecommunications company charges v_f with probability 1, it sells to all type 2 and type 3 consumers and earns

$$\underline{\pi}_f^d = (1 - \beta)\mu_f.$$

Equating the expressions of the expected profits to the expressions of the equilibrium expected profits for the two firms, the equilibrium price distributions can be characterized as follows.

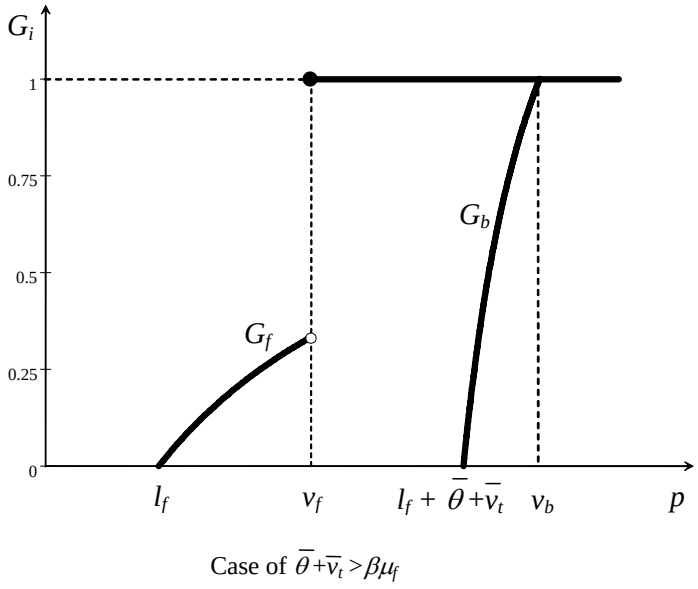

Figure 2: Price Distributions

Lemma 3 *If the* CN *is upgraded, under separate ownership, in equilibrium the firms charge:* ***(i)*** $p_t = \overline{v}_t$, ***(ii)***

$$G_f(p) = \begin{cases} 0 & \text{if } p < l_f, \\ 1 - \dfrac{\left(\overline{\theta} + \Delta_s^i\right) + (1-\beta)\mu_f + \mu_t^i}{p + \overline{v}_t + \overline{\theta} - c_b^i} & \text{if } l_f \leq p < v_f, \\ 1 & \text{if } v_f \leq p, \end{cases}$$

$$G_b(p) = \begin{cases} 0 & \text{if } p < l_f + \overline{\theta} + \overline{v}_t, \\ 1 - \left(\dfrac{1-\beta}{\beta}\right)\left(\dfrac{v_b^1 - p}{p - \overline{v}_t - \overline{\theta} - c_f}\right) & \text{if } l_f + \overline{\theta} + \overline{v}_t \leq p < v_b^1, \\ 1 & \text{if } v_b^1 \leq p. \end{cases}$$

. ■

The intuition behind Proposition 1 is clear. (...) (Figure 2)

Using Lemma 3 the equilibrium profits of the telecommunications company and the cable company are:

$$\Pi_f^d = (1-\beta)\mu_f$$
$$\Pi_{b+t}^d = (\alpha - \beta)\,\mu_t^i + \left[\left(\overline{\theta} + \Delta_s^i\right) + (1-\beta)\mu_f + \mu_t^i\right]\beta$$

3.2 Stage 1: The Investment Decision

In this subsection we characterize the firms' investment decisions for the two ownership structures.

The incremental profit for upgrading the *CN* for the holding company is:

$$\Delta^{HC} := \Pi^{m} - \Pi_{f}^{nu} - \Pi_{t}^{nu} - \varphi = \beta\overline{\theta} + \beta\Delta_{s}^{i} + \beta\Delta_{cb} - \varphi$$

The incremental benefit for the holding company for upgrading the *CN* has three parts. First, the *Bundle Value effect*, $\beta\overline{\theta}$. Second, the *Economies of Scope effect*, $\beta\Delta_{s}^{i}$. Third, the *Coordination Economies effect*, $\beta\Delta_{cb}$.

The incremental profit for upgrading the *CN* for the cable company is:

$$\Delta^{CC} = \Pi_{b+t}^{d} - \Pi_{t}^{n} - \varphi = \beta\overline{\theta} + \beta\Delta_{s}^{i} + \beta\left(1-\beta\right)\mu_{f} - \varphi$$

The incremental benefit for the cable company for upgrading the *CN* has three parts. First, the *Bundle Value effect*, $\beta\overline{\theta}$. Second, the *Economies of Scope effect*, $\beta\Delta_{s}^{i}$. Third, the *Business Stealing effect*, $\beta\left(1-\beta\right)\mu_{f}$.

Lemma 4 ***(i)*** *Under joint ownership the holding company should upgrade the* CN *if* $\Delta^{H} \geq 0$. ***(ii)*** *Under separate ownership the cable company should upgrade the* CN *if* $\Delta^{H} \geq 0$. ■

4 Analysis

In the section we...

4.1 Incentives to Upgrade the *CN*

In this sub-section we compare the incentives of the monopolist holding company and the separate cable company to upgrade the *CN*. We show that (...)

Let

$$\Psi(\beta, \Delta_{cb}, \mu_{f}) := \Delta^{HC} - \Delta^{CC} = \beta\left[\Delta_{cb} - (1-\beta)\mu_{f}\right]$$

Function Ψ is increasing in Δ_{cb}, decreasing in μ_{f}, and non-monotonic in β.

Proposition 5 ***(i)*** *If either* $\Delta_{cb} > \mu_{f}$, *or ,* $\Delta_{cb} < \mu_{f}$ *and* β *is on* $\left(\frac{\mu_{f}-\Delta_{cb}}{\mu_{f}}, 1\right]$, *then the holding company has more incentives than the independently owned cable company to upgrade the* CN.

(ii) If $\Delta_{cb} < \mu_f$ *and* β *is on* $\left(0, \frac{\mu_f - \Delta_{cb}}{\mu_f}\right)$*, then the independently owned cable company has more incentives than the holding company to upgrade the* CN*.* ■

4.2 Price Levels and Ownership Structure

In this sub-section we compare the price levels under the two ownership structures.

Proposition 6 *If the* CN *is upgraded, the prices of telephony services and the bundle are lower under separate ownership than under joint ownership.* ■

The holding company behaves as a multiproduct monopolist. Under separate ownership the telecommunications company and the cable company complete for consumers that value the bundle. This leads to lower prices for both telephony services and for the bundle.

From a social perspective upgrading the *CN* has two objectives. First, it gives consumers access to a new product, the bundle. Second, it may lead to more competition between the providers of telephony services over the two networks, and thereby to lower prices for telephony services. Regarding the first objective, the ownership structure is irrelevant. But regarding the second objective, separate is clearly preferable.

5 Extensions

In the section we discuss (...).

5.1 Other Reasons

In the subsection we discuss other reasons that might increase or decreases the firms incentives to upgrade the CN.

5.1.1 Investment Costs

If the holding company has easier access to funding than the cable company, perhaps because it is a larger firm and has been in the market for longer, then it could have a smaller cost of upgrading the *CN*. In this case the holding company could have, trivially, a larger incentive than the cable company to upgrade de *CN*.

Denote the cost of upgrading the *CN* by φ^k, $k = i, h$. Then the holding company has more incentives to upgrade the *CN* than the independently owned cable company if $\varphi^h < \varphi^i + \beta\Delta_{cb} - \beta(1-\beta)\mu_f$, which may hold even if $\Psi < 0$.

5.1.2 Regulatory Uncertainty

The holding company owns two potentially competing local access networks. This may put the holding company under pressure from the regulator or the legislator to sell one of the companies, possibly the cable company. If the risk that the holding company is forced to sell the cable company increases significantly once the *CN* is upgraded, then the holding company has no incentive to upgrade the *CN*, independently of other technological or strategic considerations.

5.1.3 Regulatory Arbitrage

(...)

5.1.4 Brand Preference

We assumed that type 1 consumers valued the bundle equally if it was offered by a independently owned cable company or by the holding company.

Let $\theta^{1h} = \theta^{1i} + \Delta_\theta$, where $\theta^{1i} = \overline{\theta}$, and $\Delta_\theta > 0$ is a parameter that captures the consumers' preference for the holding company. The incremental profit for upgrading the *CN* for the holding company becomes $\beta\Delta_\theta + \beta\overline{\theta} + \beta\Delta_s^i + \beta\Delta_{cb} - \varphi$, and there is more scope for the holding company having more incentives to upgrade the *CN*.

Note, however, that brand preference can work in both directions. The independent cable company is an entrant that competes with the incumbent, with which some consumers might have had grievances in the past. This might lead consumers to value more the bundle offered by the independently owned cable company because it gives them the opportunity to free themselves from the incumbent's grip.

5.2 More Heterogeneity

The model laid out in section 2 captures some of the aspects we wanted to discuss in this paper in a simple way. However, expository simplicity was obtained at the expense of straining the model a bit. In particular we assumed a demand structure, that in the case where the *CN* was upgraded and there is separate ownership, the equilibrium pricing strategies for telephony services and for the bundle are in pure strategies. In a companion paper (Brito&Pereira (2004) we develop a model that allows for more consumer heterogeneity, and where all price equilibria are in pure strategies. Otherwise the model leads to the same types of results.

6 Conclusions

This paper discuss the role of cable television networks and their ownership structure, in promoting competition in the local access market. We showed that a firm that owns only a cable television network may, or may not, have more incentives to invest than a firm that owns both networks. However, separate ownership of the two networks is indispensable to promote competition in local access.

A Appendix

In the appendix we prove the Lemmas and Propositions in the main text

Lemma 7 *Obvious.* ■

Lemma 8 *Obvious.* ■

Lemma 9 (...). ■

Lemma 10 *Obvious.* ■

Lemma 11 (...). ■

References

[1] Brito, D., & Pereira, P., 2004, "Incentives to Upgrade Competing Networks", *Universidade Nova de Lisboa*

[2] Cluny, J., 1996, "Cable Telephony as a Business: the UK Experience", *OFTEL*

[3] European Telecoms Regulation and Markets, 2003, "Ninth Report on the Implementation of the Telecommunications Regulatory Package", COM(2003) 715 final

[4] Narasimhan, C. (1988) "Competitive Promotional Strategies", *Journal of Business,* **61:** 427-449.

[5] Noll, R. & Owen, B., 1998, "The Anticompetitive Uses of Regulation: United States v. AT&T (1982)", in The Antitrust Revolution, John E. Kwoka, Jr., and Lawrence J. White, eds. Scott, Foresman,

[6] Woroch, G., 1997, "Turning the Cables: Economic & Strategic Analysis of Cable Entry into Telecommunications," in E. Noam eds., Globalism and Localism in Telecommunications, Elsevier