ENTRY DETERRENCE AND MULTIDIMENSIONAL COMPETITION IN THE SATELLITE PAY-TV MARKET

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ENTRY DETERRENCE AND MULTIDIMENSIONAL COMPETITION IN THE SATELLITE PAY-TV MARKET

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Abstract

This model analyses competition in the satellite pay-TV market. Duopolistic firms commit to offer TV programmes to attract subscribers to their broadcasting platforms. However, under certain cost conditions, a first mover advantage acquired in programmes can result in the monopolisation of the pay-TV market, due to network effects. Welfare analysis shows that consumers are better off with duopoly, particularly with symmetric duopoly. Total welfare can be higher under monopoly, but only in the region where the fixed costs of the TV programmes are low. Moreover, the model suggests that a more balanced (ideally, symmetric) duopoly, promoted with the antitrust intervention, would improve total welfare, with respect to the asymmetric duopoly that would affirm spontaneously. This model offers an analytical benchmark for some recent antitrust cases, where antitrust authorities have chosen to limit the accumulation of broadcasting rights as a mean to prevent the monopolization of the pay-TV market. In particular, our results support and even reinforce the rationale of the antitrust decisions adopted on the case of the proposed merger/acquisition between Telepiù and Stream in Italy.

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1. Introduction

Since the Seventies, in US, the commercial exploitation of new communication platforms like coaxial cable systems and (later) geo-stationary satellites have been increasing the transmission capacity available for broadcasting programmes, thereby relaxing the endemic scarcity of electromagnetic spectrum\(^1\) which was affecting the radio-TV industry.

In the mid-Nineties the digital breakthrough pushed by the new information and communication technologies (ICTs) has further relaxed the barriers to entry into this industry. Basically, ICTs provide new and better techniques to compress and manipulate the signal broadcasted. These techniques, once transformed, have been promoting pay-TV as a new business model alternative to the traditional “free to air” broadcasting\(^2\). In fact, while traditional broadcasts are both non rival and non excludable services, digital encryption techniques transform the radio-TV signal into a private service, which can be offered to households in exchange of a direct payment.

The satellite pay-TV industry is a case in point and provides the best example of the recent pro-competitive trends in the

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\(^1\) Up to the Nineties, this bottleneck was among the main justifications of the tight regulatory regime of terrestrial broadcasting, both in US and Europe.

\(^2\) For the antitrust analysis “free to air” TV and pay-TV are separate markets, even though both compose the radio-TV industry (see Carter, 2001). In our jargon, they are also referred to as two different business models of providing radio-TV services.
industry\(^3\). In fact, in Europe satellite is currently the main platform of delivery for digital services: in 2001, it holds a share of 76\% of the digital market, while cable TV reaches 19\% and the terrestrial system only 5\% (see Crespi, 2002).

While during the first half of the Eighties the available satellite communication infrastructure was unable to offer an affordable and reliable domestic reception, in the second half of that decade a new generation of satellites was introduced, allowing the “direct to home” (DTH) transmission of the signal. With DTH, the domestic reception of broadcasts is based on a relatively cheap equipment, usually composed of a small dish antenna and a “set top box”. However, although already marketed, analogue pay-TV services presented severe drawbacks and encountered a limited diffusion both in US and Europe\(^4\).

In the mid-Nineties, the improvement of digital technology and other technological factors led to the commercial launch of the satellite digital pay-TV services, first in US (1994) and later in Europe (1996)\(^5\). This launch pushed the first noticeable wave of growth of the pay-TV market, accompanied by an increase in the number of competitors: soon the incumbent of each national market faced the entry of another competitor, and in some cases a market with three operators affirmed (like in Spain and France) (see IDATE, 2000c).

Indeed, although the average concentration of the European pay-TV markets remain high, nevertheless the introduction of satellite pay-TV has increased the degree of pluralism of each national radio-TV industry and has brought a sensible increase of the quantity and variety of the programmes available for consumers.

\(^3\) Instead, cable TV offers a partially different situation and its market structure remains more affected by “natural monopoly” characteristics, mainly due to the high sunk costs related to the deployment of cable rings and terminal equipment.

\(^4\) Among the technological obstacles, the lack of standardisation of the set top box and the separation between the receiving and the decoding equipment influenced negatively its diffusion. For the partially successful UK story, see Nolan (1997).

\(^5\) Particularly, in Europe the diffusion of digital satellite technology was greatly helped by the standardisation process carried out under the DVB consortium, strongly promoted by the European Union. For technical details, see Stienstra (1996) and Rysdale et al. (1996).
Currently, the pay-TV market’s dynamics witnesses a reversal of the initial trend: while the pay-TV market continues to grow in value added, the number of competitors tends to shrink, both in Europe and US. Moreover, the operators which plan to exit are not always marginal in size: there are cases in which the smaller operators have planned to merge or to acquire the bigger rivals. In any case, the most likely outcome is that in the near future the pay-TV market would end up monopolised or severely concentrated.

These facts have been giving rise to very complex antitrust cases. Sticking to the satellite market, in US a recently planned merger would consolidate Echostar and Direct TV in a new monopolistic entity: up to now it has not been authorised by the FCC (see FCC, 2002).

Similar stories have been characterising some European countries. In Italy, during 2001-2002, several plans of merger and acquisition between the duopolists Telepiù and Stream were proposed. One after the other, these plans were abandoned because of the severe conditions for clearance imposed by the Italian antitrust authority. In summer 2002, a new project of consolidation was announced, with Stream (the smaller operator) now willing to buy the entire stake of Telepiù and to form a new monopolistic operator (Sky Italia).

The European situation in the pay-TV market seems more delicate than US, due to the lower diffusion of cable TV. Italy is a case in point, since analogue cable TV was totally absent and the diffusion of digital cable is still at a very initial stage. So, while in US the merger between Echostar and Direct TV would end up in a duopolistic market (between cable and satellite) in the vast majority of the country, in Italy the consolidation of the satellite operators would leave just a monopoly; moreover, the monopolist would keep a huge amount of premium programming previously acquired under exclusivity terms.

In order to highlight the ‘mechanics’ of competition in the satellite pay-TV market and to assess the decisions adopted by antitrust authorities, we propose a model of entry deterrence and oligopolistic competition specifically focused on the satellite pay-
TV filière (section 3); we do this after having surveyed the existing literature (section 2). In section 4 welfare analysis will be carried out, together with its policy implications. In section 5 the policy implications stemming from our model will be compared with the actual policy adopted by national authorities. Conclusions and issues for future research agenda are presented in section 6.

2. The specificities of the pay-TV market

Models addressing oligopolistic rivalry in the digital radio-television industry are almost absent. Classic literature on analogue TV is abundant (both for terrestrial and cable TV), but not useful for digital TV, and especially for its pay-TV segment. For example, Steiner (1952) and Beebe (1977) analyse the effects of market structure on the endogenous variety of programming, but focus on “free to air” radio and TV broadcasting, financed by advertising and subject to spectrum constraints.

The features of analogue broadcasting differ radically from those of digital TV, either “pay” or “free to air”. In fact, nowadays the scarcity of the spectrum has been relaxed and new entry in satellite broadcasting does not require the high sunk costs typically necessary to build cable networks: the satellite transponder capacity is widely and cheaply available for lease. Moreover, in most OECD countries, political and regulatory control on commercial TV has been substantially reduced, with a further relaxation of the previous institutional barriers (see OECD 2001, chp. 6).

In addition, the logic of operation of pay-TV differs substantially from that of free to air broadcasting, given that in the former consumers pay directly to broadcasters in return for entertainment, while in the free to air model consumers do not pay anything and broadcasters get their revenues selling advertising slots to firms: because of this difference, they are also
treated as two different relevant market in the European antitrust law and practise\textsuperscript{6}.

Moreover, new kinds of bottlenecks have recently materialised along the digital and pay-TV filière, often of hybrid nature (technological and institutional). To tackle some of them, having an intellectual property right content and resembling closely the nature of an “essential facility”, the policy maker has promoted the principle of the interoperability among different transmission and receiving standards, echoing the logic of the “mandated access” principle used in TLC regulation. This is the case of the Directive on TV standards\textsuperscript{7}, which mandated a partial degree of interoperability among the existing conditional access systems (CAS) of the set top box\textsuperscript{8}, while for some other components technologically more fluid - like the operative and navigation software systems (API and EPG) - the restraints put on the incumbent’s dominant position were milder (see European Commission (1999)). In any case, the regulation set to promote interconnection has achieved only a partial success: it has remained confined to signal transmission and has not influenced substantially the receiving equipment (see below footnote 14 for the Italian case).

Moreover, the most complex antitrust and regulatory issue remains that affecting the segment of the production, packaging and commercialisation of TV programmes. Here, the main antitrust concern is represented by the large diffusion of exclusive dealing clauses to sell broadcasting rights for programmes: these clauses, facilitating accumulation of content, enable strategies of

\footnotesize{\textsuperscript{6} For a wider perspective on market definition in the TV sector, see Carter (2001). For a survey of the EU Commission decisions about the relevant market in pay-TV, see AGCM (2002a), sections 13-17.\textsuperscript{7} See Directive 95/47/EC, 24 October 1995, available at: http://europa.eu.int.\textsuperscript{8} The CAS is a proprietary technology embedded into the set top box which allows subscribers to descramble the encrypted signal and view the programmes: the CAS is typically protected by intellectual property rights. By definition, it cannot be duplicated but can be made available via a compulsory licence, since access to it is required to any operator willing to reach the consumers looked into the rival’s technology.}
“vertical foreclosure” of the downstream market\textsuperscript{9}. In fact pay-TV operators, in order to persuade subscribers to join their services, need to differentiate themselves from free to air TV; so, the attractiveness of the (downstream) digital platform is mainly function of the richness and variety of the content available over it, and depends particularly on the availability of some “premium” programmes, like certain sport events (like Prime League football matches and Formula 1 races) and “first release” movies, called informally “killer applications”. This interdependence can be interpreted as a “virtual network” effect.

In order to build an irreversible advantage, pay-TV operators may over-invest in content to deter entry. As a result, strategies of accumulation of premium content at the wholesale level can easily lead to the monopolisation of the retail market, with a deterrence mechanism more powerful than that of ‘traditional’ vertical foreclosure, where the key-input monopolised does not display network effects. Similarly, there is another analogy with the “raising rival’s cost” literature (see Salop and Scheffman, 1983, 1987): although here no cost is directly raised, the market share (and the profits) of the rival in the retail market are automatically reduced by the accumulation of the scarce input (content), via the network effect\textsuperscript{10}.

It follows that, to understand the logic of competition in pay-TV, it is essential to formalise the strategic interdependence existing between content accumulation and downstream competition for subscribers. A few papers have been written on pay-TV, but they have not addressed specifically the mechanics of competition and its relation with market structure. Doyle (1998) presents a two stage duopoly where a firm chooses first the kind of programme and second the model of financing, either

\textsuperscript{9} Indeed, this main tendency is not specific to pay-TV, being common to the other communication industries, where entry into transmission infrastructure has caused content to become the scarce input - especially premium content (see OECD, 1999).

\textsuperscript{10} Further, we can also argue that the exclusivity clauses used in pay-TV represent a particularly strong and self-reinforcing example of those exclusionary rights analysed by Krattenmaker and Salop (1986): in fact, demand and supply for content are inelastic and indirect network effects reinforce the exclusionary potential of the accumulation.
by advertising, pay or mixed: then, an analysis of which form of financing ensures the wider variety of programming and the highest social welfare is carried out. However, Doyle (1998) stylises the filière with one unique segment and its model does not treat strategies of vertical foreclosure and entry deterrence. The models proposed by Armstrong (1999) - which stylises separately the two main segments of the filière - are focused on network interconnection and compatibility between rival systems\(^\text{11}\), but they do not address vertical strategies based on content accumulation\(^\text{12}\). In a similar framework, Harbord and Ottaviani (2001) assume exogenously network effects, posing a parameter of preference for the platforms, and their model focuses on the optimal licensing scheme for trading broadcasting rights.

Our model, instead, draws on the literature originally developed for the consumer electronics industry (computers, videogames and videorecorders), which first formalised the concept of indirect network externalities (Chou and Shy, 1990; Church and Gandal, 1992; 1993). In fact, despite the differences, there is a strong similarity between these manufacturing industries and a tertiary sector like pay-TV: the original concept of indirect network externality developed there describes well also the interdependence existing between the attractiveness of a pay-TV platform and the variety and quality of its content.

Our model, in particular, builds on the framework presented in Church and Gandal (1996), which stylises a manufacturing filière composed of two basic segments (software and hardware) vertically integrated (or somehow connected\(^\text{13}\)). Similarly, in our framework, the assumption of exogenous vertical integration (or

\(^\text{11}\) These features are traditionally key issues in telecommunication competition, where “open access” provisions have been fully implemented. However, in pay-TV compatibility among rival platforms has not been achieved, despite the efforts made by the policy maker.

\(^\text{12}\) Although Armstrong (1999) is aware of the importance of premium programming for platform competition, he does not address endogenously programme’s variety and strategic exclusion and leaves the point to further analysis. The second model presented in his paper focuses on a related interesting point, that of the optimal trade regime for broadcasting rights.

\(^\text{13}\) As remembered by Church and Gandal (1996), a well designed set of vertical restraints can replicate the market outcome typical of vertical (equity) integration.
vertical restraints) between content and hardware reflects the typical European pay-TV filière, where content is either internally produced or externally acquired under exclusivity clauses (or both). Here, indirect network effects materialise between the availability of content and the attractiveness of the broadcasting platform.

Either in the case of “in-house” production or external acquisition, content is proprietary and cannot be viewed by the subscribers of the rival platform: this character represents an institutional kind of incompatibility among rival systems, different from the technological incompatibility considered in the network externality literature but similar in its strategic rationale. Moreover, since existing pay-TV platforms are often not compatible in hardware\(^{14}\), we will assume that interconnection between rival systems is not feasible\(^ {15}\).

From above, it follows that each platform operator will act as a monopolist with respect to its potential subscribers. This fact might represent a serious concern in the case of those premium programmes scarce by nature (“first release” films and the most popular sport events), for which supply and demand are rather inelastic and long term exclusive contracts are the typical trading scheme.

Moreover, content is usually chosen for its peculiar qualitative features and there could be a low degree of substitutability among the rival schedules of TV programmes—sport events and cinema are a case in point\(^ {16}\), our model will

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\(^{14}\) For example, in Italy, to mandate hardware interoperability among rival broadcasts, was issued the Decree (Decreto legislativo) n. 191 of 17 May 1999 on “Attuazione della direttiva 95/47/CE in materia di emissione di segnali televisivi”. However, compatibility resulted to be partial and strategically irrelevant, since pay per view services remained excluded from mandated interoperability.

\(^{15}\) Again, this is a main departure from the existing literature on pay-TV, like Armstrong (1999) and Harbord and Ottaviani (2001).

\(^{16}\) Typically, the person fancying for his preferred sport (football) will not subscribe to the pay-TV operator which lacks the rights for that sport (and even club), even if the same operator can offer in compensation a wider variety of options (horse riding, windsurf, cricket). Similarly, the lover of the French School cinema will not consider most Hollywood productions a good substitute, even though the latter have frequently higher budgets and better paid casts.
control for this character, including an horizontal preference parameter \((k)\) in the comparative statics analysis\(^{17}\).

Finally, our model radically departs from the “indirect network externality” literature for some substantive points of its welfare and policy analysis:

1) Contrary to the “network externality” and the “race for standard” literature, our analysis does not aim at finding the socially optimal standard and its related “market failure” aspects, nor it focuses on the trade off between technical efficiency of hardware and (vertical) variety of complementary goods. Indeed, in satellite pay-TV hardware technology is quite standardised and platform operators, belonging to big international conglomerates, are substantially identical w.r.t hardware efficiency; therefore, in pay-TV there is no socially optimal standard which clearly deserves to be promoted.

2) Our model, instead, focuses on the deterrence potential of the vertical differentiation strategies based on content accumulation, and their welfare and market structure outcomes; in particular, our welfare analysis highlights the mechanics of the distribution of total surplus between producers and consumers across alternative market structures. We believe that this welfare analysis is crucial for a mass-media sector, where the promotion of the operative efficiency should be coupled with a special safeguard of the consumer’s surplus and that of a minimum degree of pluralism of the market\(^{18}\).

3) Moreover, to better account for the specificities of this mass-media sector, we propose a positive (mirroring the existing market structure) and a normative (the ideal) version of the same model. This will allow us to draw some reflections on the welfare properties of the real markets and to assess the policy effectively undertaken by antitrust authorities.

\(^{17}\) These qualitative (horizontal) preferences are typically neglected in the original literature, developed for consumer electronics, since software is more likely to present vertical characteristics, like the extent of diffusion and the degree of compatibility with the hardware platforms.

\(^{18}\) As already suggested in the Green paper on the Convergence (see European Commission, 1997), we can even assume that in these sectors pluralism and consumer’s surplus have a particular ‘public’ status.
3. The model

3.1. Assumptions and structure of the game

Two rival platforms (A and B) composed each of a “content” and a “hardware” segment are located at the two extremes (respectively 0 and 1) of the segment representing the pay-TV market. Due to vertical integration and lateral incompatibility, the hardware of type $i$ ($i = A, B$) identifies also the overall platform. Consumers are uniformly distributed along the unit interval and their population is normalised to 1. Each consumer has income $y$.

The platforms are equally efficient and face identical fixed costs $C_i$ (rental of satellite transponders, transmission facilities and encryption techniques): we normalise them to 0. From the business practise we know that marginal costs of hardware are almost negligible and we assume them equal to 0\(^{19}\). As in most information good industries\(^{20}\), the fixed up-front cost ($f$) for content is the major relevant cost component, since the marginal cost is negligible (again, equal to 0); the exogenous cost $f$ is assumed identical for both platforms\(^{21}\).

Given the price, consumers value each platform $i$ according to two main characteristics, respectively horizontal and vertical:
1) according to the distance between their location (the ideal platform) and the location of the platform $i$ ($t_i$), times a parameter $k$ representing the intensity of this preference;
2) according to the number of the varieties of content available with each platform, $N_i$, a variable which also correlates

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\(^{19}\) In fact, household connection costs are zero, due to the wireless transmission of the signal. Set top box costs are the only non negligible direct cost for hardware, but they can be excluded from the analysis (hence, both from the cost and the hardware price), since they are substantially symmetric and paid to external manufacturers of consumer electronics.


\(^{21}\) The cost structure for the acquisition of external content could include also a “per subscriber” fee: in the Italian case, the pay-TV operators must pay this fee once they reach a certain threshold of subscribers; however, for the football rights, this threshold of subscribers was never reached in the past (see AGCM, 2002a, section 4.3).
positively with the level of the quality\textsuperscript{22} and the internal variety of the programmes.

In particular, the preferences of the potential subscribers with respect to the vertical variety ($N_i$) of each platform $i$ are such that:

a) The gross utility of each subscriber increases with the number $N_i$, although at a decreasing rate (see equation [1], where $0<\beta<1$).

b) The gross utility provided by hardware alone is $\alpha$, constant and equal for both platforms. Being hardware only instrumental to the fruition of content, if $N_i = 0$, $\alpha = 0$.

c) The demand for the hardware and a variety of content is perfectly inelastic.

In fact, hardware and programmes need to be bought together, and each consumer needs only one unit of hardware and one unit of each TV event (programme), without duplications; moreover, provided that the conditions for the optimal choice are verified, in general each consumer will buy more than one unit of content.

Equation [1] describes the (gross) utility function of a potential subscriber located distance $t_i$\textsuperscript{23} for platform $i$ when he enjoys $N_i$ different programmes; $o$ represents the consumption of an outside good:

$$U_i = \alpha + N_i^\beta + o - k \cdot t_i$$ \[1\]

Equation [2] describes the budget constraint for the same subscriber: $\rho_{ni}$ is the price of a programme of type $n$, (where $n = 1...N_i$) broadcasted over platform $i$ and $p_i$ is the price of the hardware component of platform $i$. $o$ is the price of the outside good and $y$ is the consumer’s income.

$$\sum_{n=1}^{N_i} \rho_{ni} + o = y - p_i$$ \[2\]

\textsuperscript{22} For example, a particularly valuable (premium) programme can correspond to a multiple of a basic programme.

\textsuperscript{23} By definition of Euclidean distance, if $t_i$ is the market share of the platform $i$, that of platform $j$ (with $j \neq i$) will be $t_j = 1 - t_i$. 
The timing of the basic (positive) version of the model develops over four stages. In stage 1 one firm (let it be firm A) enters the pay-TV market and commits to content, producing (or externally acquiring) $N_A$ programmes. To do this it sustains a fixed cost $f$ for each programme.

In stage 2, the other firm ($B$) makes an entry decision; if entry is feasible, it commits to $N_B$ programmes, sustaining a fixed cost $f$ for each of them. Both for $A$ and $B$ the investment decision is credible, since the total fixed costs $f\cdot N_i$ ($i = A, B$) cannot be later recovered.

In stage 3, given the programmes $N_i$ and $N_j$ ($i = A, B, i \neq j$) committed to and provided that $B$ has entered, the two platform operators invest in hardware and compete simultaneously à la Bertrand in the market of subscriptions; otherwise $A$ acts as a monopolist. In the same stage, the market shares of the platforms $(t_i$ and $t_j$) are determined.

In stage 4, the programmes’ prices $\rho_{ni}$ are set and subscribers buy them in order to maximise their utility. Technically, the maximisation of equation [1] subject to [2] for the subscriber implies a two-stage optimisation process, which is simultaneous to the firm’ decision of the prices $\rho_{ni}$. Solving backwards this two-stage process, first the consumer maximises equation [1] subject to [2] for each hardware, so that the subscriber selects the types and the number of the programmes to be bought in each of the two offers. These choices, once substituted back into [1], give the indirect utility functions connected to the two platforms. Finally, in the second stage, the potential subscriber compares the two indirect utility functions and chooses the most valuable platform.

The model assumes perfect rationality and complete information. The game is solved finding the (Selten) subgame perfect equilibrium, going through backward induction.

24 As suggested by Church and Gandal (1996), one can imagine the following cognitive process happening for each platform. First, the different programmes available are ranked in ascending order by price. The consumer will buy programmes if the marginal benefit of a programme (equal to $\beta N_{ni}^{\beta-1}$) is less or at least equal to its price $\rho_{ni}$. So, at the end, the $N_i$ lowest priced programmes are bought, and the price of the last is $\rho_{Ni}$. 
3.2. The equilibrium choice of content

Given the list of the prices of the programmes ($\rho_{ni}$) available for the chosen platform $i$, subscriber will buy them according to the optimal choice rule. Since demand for hardware and a programme type $n$ is perfectly inelastic, subscribers will buy one unit of hardware and one unit each of $N_i$ varieties of content, where the $N_i^{th}$ equates price and marginal utility.

By assumption, the operators know the consumer’s decision rule and realise that at stage 4 their platform subscribers are captive. So, the optimal price behaviour for content will be that expressed by Lemma 1:

**Lemma 1.**
When $N_i$ programmes have been committed to for platform $i$, the profit maximizing price for each variety of content is:

$$\rho_{N_i} = \beta \cdot N_i^{\beta-1}$$  \[3\]

Proof of Lemma 1 is presented in the Appendix.

So, in equilibrium each subscriber will find convenient to buy one unit of each programme available for the chosen platform. Moreover, the equilibrium price of content depends (negatively) only on its variety. It follows that the operators, when commit to content (stages 1-2), they credibly and implicitly commit also to its price.

Now, we turn to the consumer’s choice of the platform $i$. Solving the second of the two-stage optimization process, we substitute content equilibrium prices in [2] and we solve for $o$. Then, we substitute the resulting expression for $o$ into [1], getting the indirect utility function of a subscriber localised at distance $t_i$ from platform $i$:

$$V_i = \alpha + (1 - \beta) \cdot N_i^\beta + y - p_i - k \cdot t_i$$  \[4\]

From [4] one can see that the utility of the subscriber is increasing in the variety of content, decreasing in the adoption price of the
platform and in its Euclidean distance from the ideal platform.

The subscriber compares the two platforms’ indirect utilities and chooses the highest. The subscriber indifferent between the two will have $V_A = V_B$. Solving for $t_i$, we get the market share of platform $i$:

$$t_i = \frac{(1-\beta) \cdot \left(N_i^{\beta} - N_j^{\beta}\right) - (p_i - p_j) + k}{2k}$$  \[5\]

3.3. The equilibrium choice of hardware

In stage 3 we could have a duopoly or a monopoly, depending on entry at stage 2. We need to distinguish between the two subgames.

3.3.1. Both commit to content

If the operator $j$ has committed to content and entered at stage 2, in stage 3 we have duopolistic competition à la Bertrand. Recalling Lemma 1, the generic profit function of the duopolist $i$ is:

$$\pi_i = (p_i + \beta N_i^{\beta})t_i - N_if$$  \[6\]

To solve the optimum problem, we proceed to calculate the Nash equilibrium in the prices, conditionally on the varieties of content committed to at stages 1-2. We arrive at the following results:

**Lemma 2.**

**Case a)** If $\left|N_i^{\beta} - N_j^{\beta}\right| \leq 3k$

(i) The equilibrium hardware prices are:

$$p_i = \frac{(1-3\beta)}{3} N_i^{\beta} - \frac{1}{3} N_j^{\beta} + k, \quad i = A, B, i \neq j$$  \[7\]
(ii) The market shares are:

\[ t_i = \frac{1}{6} \left( \frac{N_i^\beta - N_j^\beta + 3k}{k} \right), \quad i = A, B, i \neq j \]  \[ \text{[8]} \]

(iii) The duopoly profits are:

\[ \pi_i = \frac{1}{18} \left( \frac{N_i^\beta - N_j^\beta + 3k}{k} \right)^2 - N_i f, \quad i = A, B, i \neq j \]  \[ \text{[9]} \]

**Case b)** If \( |N_i^\beta - N_j^\beta| > 3k \); without loss of generality, let us discuss the case \( N_i > N_j \):

(i) The equilibrium hardware prices are:

\[ p_i = \frac{(2 - 3\beta)N_i^\beta - 2N_j^\beta}{3} \]  \[ \text{[10]} \]

\[ p_j = \left( \frac{1}{6} \left( N_j^\beta - N_i^\beta \right) - \beta N_j + \frac{1}{2} k \right) \]  \[ \text{[11]} \]

(ii) The market share for firm i is \( t_i = 1 \).

(iii) The profits for firm i are:

\[ \pi_i = \frac{2}{3} \left( N_i^\beta - N_j^\beta \right) - N_i f \]  \[ \text{[12]} \]

The main result of Lemma 2 is that, to have a viable duopolistic competition (case a), the difference between the rival content bases should not be ‘too big’, taking into account the intensity of the preference for the ideal platform \((k)^{25}\).

Also, the price equations [7] highlights the fact that in

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\[25\] In other words, ceteris paribus, a more intensive interest for the preferred platform (higher \(k\)) relaxes the asymmetry constraint, allowing in equilibrium more difference between the players’ schedules of programmes.
equilibrium the hardware price is decreasing in the rival’s variety and increasing in $k$, which allow the duopolists to leverage on horizontal differentiation. With respect to an increase of its own variety, the price increases if subscribers get low utility from content ($\beta \leq 1/3$) while, if $\beta$ is higher, there is a negative relation (i.e., is better to price competitively to acquire an higher market share and to consequently focus on content profits). Finally, the price equations show that some hardware prices can be negative for a certain range of the parameters $\beta$ and $k$: in this case firms would give a hardware subsidy to subscribers. This feature of the model reflects the current business practice, where in special occasions the operators offer promotional packages to subscribers, like some equipment given for free (parable antenna, subsidisation or cheap rental of the set top box) or a waiver in the administrative costs of connection\textsuperscript{26}. Again, its underlying rationale is that hardware profits can be sacrificed to get a higher market share, promising to bring more content profits\textsuperscript{27}.

Finally, w.r.t. the parameter $\beta$, the profit functions of firm $i$ are monotonically increasing in $N_i$ and decreasing in $N_j$. This legitimises us to fix the parameter $\beta$ without loss of generality.

Before proceeding further, we verify under what conditions in duopoly the market is fully covered: a sufficient condition is to assume $\alpha \geq 3/2 \ k$ (see Proof III).

3.3.2. Only one operator commits to content

If the operator $B$ has not committed to content and not entered at stage 2, in stage 3 we have a monopoly with firm $A$, unchallenged by nothing but the participation constraint of the subscriber. While later we show how in this sub-game for the monopolist is convenient to serve the entire market, here we derive its monopoly price and profits, under the hypothesis of full market

\textsuperscript{26} Further, an underlying assumption is that firms must be able to impose a quantity restriction on the infinite demand faced with negative prices

\textsuperscript{27} This feature, in a truly dynamic model where content is bought several times, could even appear stronger.
coverage. From [4], posing the indifference condition \((V_A - y = 0)\)
for the subscriber located at \(t=1\), we solve for \(p_A\):

\[
p_A = \alpha + (1 - \beta)N_A^\beta - k
\]

Substituting [13] into [6], we get the monopoly profits for \(A\):

\[
\pi_A = \alpha + N_A^\beta - k - N_Af
\]

\[\text{[14]}\]

3.4. The content commitment of the entrant

In stage 2, \(B\) decides the entry and which variety of content to
commit to. In an interior equilibrium, the optimal (Nash) variety
of programmes for \(B\) is found maximising [9] w.r.t. \(N_B\). From the
study of the FOC we see that, to have an explicit solution, we
need to fix the value of \(\beta\). Without loss of generality (see above),
we set \(\beta = 1/2\).

Provided that \(f\neq 1/(18k)\) (so, we will assume as relevant
range \(f\geq 1/(18k)\)), an interior solution exists (we will see later that
this restriction is compatible with the solutions of the overall
game):

\[
N_B = \left(\frac{3k - N_A^{1/2}}{18fk - 1}\right)^2, \quad N_A < 9k^2
\]

\[\text{[15]}\]

The restriction on \(N_A\) comes from the second order condition,
verified in Proof IV. Substituting back [15] into [9], yields the
duopoly profits for \(B\), conditionally on \(N_A\):

\[
\pi_B = \frac{1}{9} \left(3k - N_A^{1/2}\right)^2 \frac{9fk - 2}{k(18fk - 1)}
\]

\[\text{[16]}\]

From [15] appears clearly that the varieties \(N_A\) and \(N_B\) act as
strategic substitutes (cfr. Bulow et al., 1985). Consequently, (see
[16]), in equilibrium the profits of \(B\) decline with the increase of
\(N_A\), since the latter reduces the market share of \(B\).
3.5. The content commitment of the incumbent

In stage 1 the incumbent A commits to content. Since this commitment is binding, at the same time A decides to deter or to accommodate the entry of B. Given the assumptions of perfect rationality and complete information, A will choose the strategy which maximises its profits.

3.5.1. Entry deterrence

The deterrence subgame, with the incumbent becoming a monopolist, is qualified in Proposition 1:

**Proposition 1.**
Starting from \( f \geq 1/(18k) \), for an initial range of values of \( f \), entry does not happen. In particular:

**Case a)** When \( f \) is relatively small (\( f \leq 1/(6k) \)), entry is blockaded. The monopoly equilibrium yields:

\[
N_A^b = \frac{1}{4f^2}; \quad p_A^b = \alpha + \frac{1}{4f} - k; \quad \pi_A^b = \alpha + \frac{1}{4f} - k
\]  

**Case b)** For \( f > 1/(6k) \) entry (and, consequently, duopoly), is feasible, but for A the profit-maximising strategy is to deter entry. The deterrence equilibrium yields:

\[
N_A^{de} = 9k^2; \quad p_A^{de} = \alpha + \frac{1}{2}k; \quad \pi_A^{de} = \alpha + 2k - 9k^2f
\]  

Proof (V) of Proposition 1 is given in the Appendix.

We notice first that, in equilibrium, (pure) monopoly and deterrence profits are decreasing in \( f \) and \( k \), two parameters which account for, respectively, supply and demand shocks. Moreover, in equilibrium, the higher is \( k \), the more A has to invest in content to deter entry. In fact, when a subscriber exhibits a stronger preference for the ideal platform (high \( k \)), ceteris paribus it needs a wider (vertical) variety and/or higher quality of content, to be compensated for the loss of the (horizontal) variety of the
platform excluded. Further, an higher $k$ affects in turn the (sustainable) deterrence price and profits, respectively positively and negatively.

Finally, being deterrence profits decreasing both in $f$ and $k$, we should expect that, after a certain level of the two, for $A$ is preferable to accommodate. In fact, being the deterrence strategy based on the over-investment in content, an higher $f$ and/or $k$ makes this conduct very costly.

3.5.2. Accommodation

If $A$ abandons deterrence, a spontaneous duopolistic equilibrium affirms. However, $A$ still enjoys a first mover advantage and, anticipating the best response function of $B$, commits to the variety $N_A$ which maximises its profits. We substitute [15] in [9] and maximise it; from the FOC we derive the optimal\(^{28}\) variety of accommodation for $A$:

$$N_A^a = \left( \frac{6k(9fk - 1)}{(18fk - 1)^2 - 18fk} \right)^2$$  \[19\]

Substituting back [19] in the profit function, yields the accommodation profits for $A$:

$$\pi_A^a = \frac{2k(9fk - 1)^2}{(18fk - 1)^2 - 18fk}$$  \[20\]

We now proceed to the joint discussion of the equilibria of the overall game.

3.6. Solutions of the game

Combining Proposition 1 and the subgame equilibrium under § 3.5.2, we can state the following:

\(^{28}\) The second order condition is satisfied for $f > 1/(9k)$, which contains the interval of existence of the deterrence equilibrium ($f > 1/(6k)$) and, therefore, also that of the accommodation equilibrium.
Proposition 2.

a) For $1/6k < f(\alpha, k)$, the incumbent deters entry. For $f(\alpha, k) < f$, the incumbent accommodates entry and an asymmetric duopoly affirms.

b) The duopoly market shares converge asymptotically in symmetry ($t_i = 1/2$) with the increase of the parameters $f$ and/or $k$.

Proof (VI) of Proposition 2 is given in the Appendix.

Therefore, after the critical point $f(\alpha, k)$, accommodation profits surpass deterrence profits and $B$ enters the market. It is interesting to notice that the exact location of the indifference point is shifted w.r.t. the horizontal axis according to a trade-off dynamics of the two parameters: the higher $\alpha$, the more the crossing point will shift on the right-hand side, the higher $k$, the more the crossing point will shift on the left. So, ceteris paribus, stronger preferences (higher $k$) of subscribers can implicitly promote the viability of a more pluralistic (duopolistic) market structure, enlarging its interval of existence.

3.7. The simultaneous version of the model

Let us abandon the initial assumption of a first-mover advantage for A. Consequently, the initial four-stage game will now collapse in a three stage game. In this new game, in stage 1 the two potential players decide simultaneously the content commitment ($N_i$) (and the entry). The following stages 2 and 3 are identical to stages 3 and 4 of the basic version of the model: in stage 2 the operators, conditionally on the varieties committed to in stage 1, compete à la Bertrand for hardware subscriptions, and in the final stage (3) they sell content to their (captive) subscribers. In this timing, also network effects are generated simultaneously for the two players, between stage 1 and 2.

The equilibrium choice of content

If entry is feasible, in stage 1 the operators commit to content and in stage 3 they set its price, with the same logic examined in
Lemma 1. According to this Lemma, the equilibrium unit price for each variety of content available for platform $i$ will be dependent only on the effective number of varieties developed:

$$\rho_{N_i} = 1/2 \cdot N_i^{-1/2}$$

*The equilibrium choice of hardware*

In stage 2, the duopolists compete à la Bertrand for hardware subscriptions, maximising the general profit function [6]. Substituting [5] in [6] and maximising w.r.t. $p_i$, yields the following best response function:

$$p_i = \frac{1}{2} p_j - \frac{1}{4} N_j^{1/2} + \frac{1}{2} k, \quad i = A, B, i \neq j$$

Solving the unlinear system of equations hereby identified, we find the Nash equilibrium of the prices, conditionally on the varieties of content:

$$p_i = -\frac{1}{6} N_i^{1/2} - \frac{1}{3} N_j^{1/2} + k$$  \[21\]

From [21] emerges a negative relation between the price and the varieties, both with the rival’s (stronger) and with the own’s. In fact, first of all, in equilibrium, a wider rival variety imposes a more competitive pricing, aimed at capturing an higher market share. Second, to increase the own variety causes the global profits to become more dependent on content profits, instead of hardware. Finally, substituting the Nash prices in [5], yields the following, equivalent to [8]:

$$t_i = \frac{1}{6} \left( N_i^{1/2} - N_j^{1/2} + 3k \right), \quad i = A, B, i \neq j$$  \[22\]
The simultaneous content commitment

In stage 1 the duopolists commit simultaneously to content, to maximise their duopoly profit functions. Substituting back [21] and [22] in [6], yields the duopolistic profit function dependent only on the varieties, equivalent to [9]. We need to maximise this expression w.r.t. \( N_i \). From the FOC we get a pair of best response functions:

\[
N_i = \frac{(3k + N_j^{1/2})^2}{(18fk - 1)^2}; \quad N_i = \frac{(3k - N_j^{1/2})^2}{(18fk - 1)^2}; \quad i = A, B, i \neq j; \quad N_j < 9k^2
\]

\[= [23]\]

The unlinear system of the best-response functions does not have an explicit solution. Therefore, imposing symmetry (\( N_i = N_j \)) in [23], we get the following:

**Proposition 3.**

The subgame perfect equilibrium of the simultaneous game, which features a duopoly with a symmetric market share, is characterised by:

\[
N_i^s = \frac{1}{36f^2}; \quad p_i^s = -\frac{1}{12f} + k; \quad \pi_i^s = \frac{1}{2} - \frac{1}{36f}; \quad i = A, B, i \neq j
\]

\[= [24]\]

Proof (VII) of Proposition 3 is presented in the Appendix. In the same proof we demonstrate that none of the two duopolists has incentive to deviate from the symmetric equilibrium: when the rival commits to the symmetric duopoly variety, the monopolisation strategy would yield negative profits. Moreover, the sustainability of the symmetric duopoly does not depend on the size of \( f \): even though the absolute loss from the monopolisation strategy is increasing in \( f \), profits are negative in any case, also for “small” values of \( f \).

\[29\] The restriction on \( N_j \) in [23] comes from the second order condition.
From above follows the most important result of the overall model (basic and extended version), possessing a strong policy implication: in such a kind of (non-cooperative) game, the key-instrument for the monopolisation strategy is the first mover advantage in content acquisition in itself, being the (exogenous) amount of the fixed cost $f$ just a “reinforcing mechanism”.

Finally, it is worth to notice that, in equilibrium, the vertical variety is decreasing in $f$, while the price and the duopolistic profits are increasing in $k$: in fact, if the subscribers display a stronger preference for the horizontal identity of the platform, the symmetric operators can leverage on that, appropriating the consumer’s surplus.

4. Welfare analysis and policy implications

Now we go to assess the welfare properties of the equilibria found in the basic (positive) version of the model and in the symmetric version.

Blockaded entry

From the indirect utility function ([4]), the generic consumer’s surplus equation associated to the (monopolistic) platform $i$ is:

$$CS_i = \int_0^1 \left( \alpha + \frac{1}{2} N_i^{1/2} + y - p_i - kt \right) dt = \alpha + \frac{1}{2} N_i^{1/2} + y - p_i - \frac{1}{2} k$$

= [25]

For $f \leq 1/(6k)$, entry is blockaded. The monopolist commits to the monopoly variety and charges the monopoly price (see [17]). Substituting these equilibrium values in [25], yields:

$$CS_A^b = y + \frac{1}{2} k$$

[26]
From [17] we know already the producer’s surplus in the blockaded entry equilibrium. So, summing up the two surplus\(^{30}\), it is immediate to calculate total welfare:

\[
W_A^b = \alpha + y + \frac{1}{4f} - \frac{1}{2}k \tag{27}
\]

**Deterred entry**

For \(f>1/(6k)\), entry can be deterred. Substituting in [25] the deterrence equilibrium values (see [18]), yields:

\[
CS_A^{de} = y + \frac{1}{2}k \tag{28}
\]

Recalling from [18] the deterrence profits, total welfare will be:

\[
W_A^{de} = \alpha + y - 9fk^2 + \frac{5}{2}k \tag{29}
\]

It is worth to notice that, at the indifference point (\(f=1/(6k)\)), both the consumer’s and the producer’s surplus connect themselves with continuity.

**Accommodated entry**

For \(f>1/(6k)\) and \(f \geq f(\alpha,k)\), an interior accommodation equilibrium exists. Since the exact location of the equilibrium depends on \(\alpha\), also the welfare analysis will be developed parametrically. The consumer’ surplus equation will be:

---

\(^{30}\) Here, to present a basic analysis, we adopt a simple additive form for total welfare, giving an equal weight to the consumer’s and producer’s shares. However, for the considerations previously made about the special status of consumer’s surplus and the pluralism of the market in media industries, one could legitimately propose a modified additive form assigning an higher weight to the consumer’s surplus. Public interest to pluralism is a feature more difficult to be included in the model.
We need first to have the equilibrium varieties, prices and market shares; then, after having developed the integrals of [30], we substitute these equilibrium values in (see Proof VIII). Going through long and complex algebraic manipulations, we finally get:

\[
CS_T^a = \alpha + y - \frac{1}{2}k + \frac{k(18f_k - 1)(9f_k - 1)}{(18f_k - 1)^2 - 18f_k} - \frac{-9k(6f_k - 1)^2}{(18f_k - 1)^2 - 18f_k}
\]

= [31]

The accommodation producer’s surplus is the sum of [20] and the corresponding profits for B, found substituting [19] in [16]. After a few passages, we get the following:

\[
PS_T^a = \frac{2k((18f_k - 1)^2 - 18f_k)(9f_k - 1)^2 + 9k(9f_k - 2)(6f_k - 1)^2(18f_k - 1)}{(18f_k - 1)^2 - 18f_k)}
\]

= [32]

Finally, summing [31] and [32], and doing some manipulations, we get total surplus:

\[
W_T^a = \alpha + y - \frac{1}{2}k + \frac{6k(9f_k - 1)(15f_k - 2)}{(18f_k - 1)^2 - 18f_k}
\]

[33]

**Symmetric duopoly**

For our policy discussion and empirical applications it is extremely interesting to compare the two versions of the model, to shed some light on a possible “normative” (i.e., socially preferable) market structure for the pay-TV market. So, now we conduct the same welfare analysis for the simultaneous version of the model.

For the consumer’s surplus, starting from a generic equation
similar to [30], where now $t_A=1/2$, we develop the integrals and we get:

$$CS_T^s = \alpha + \frac{1}{4} N_{A}^{1/2} + y - \frac{1}{2} p_A - \frac{1}{2} k + \frac{1}{4} N_{B}^{1/2} - \frac{1}{2} p_B$$ \hspace{1cm} [34]

Substituting in [34] the symmetric equilibrium values (see [24]), yields:

$$CS_T^s = \alpha + \frac{1}{6 f} + y - \frac{3}{2} k$$ \hspace{1cm} [35]

The producers’ surplus is the sum of the two profit functions (see again [24]):

$$PS_T^s = k - \frac{1}{18 f}$$ \hspace{1cm} [36]

Finally, summing the surpluses, total welfare in the simultaneous model will be:

$$W_T^s = \alpha + y + \frac{1}{9 f} - \frac{1}{2} k$$ \hspace{1cm} [37]

We now turn to the comparative discussion\textsuperscript{31}.

Let us start with consumer’s surplus. While [26] and [28] depend additively only on the parameter $y$, [31] and [35] depend also on $\alpha$ (positively). So, we simplify $y$ but we retain $\alpha$: let us remember that its minimum admissible value is $\alpha=(3/2)k$.

From the function study, complemented by numerical simulations, we can see that, for the admissible range of existence of $f$ ($f>1/(18k)$), [31] and [35] are decreasing in $f$. Instead, [26]

\textsuperscript{31} For the clarity of it, at some stage we need to fix some parameters. However, we will show that the results are not sensitive to the parameter choice or, if they are, we will study the changes. In any case, we will fix the parameters in a way that does not reinforce the results in an “ad hoc” manner.
and [28] are constant in $f$ and depend only on $k$. If $(3/2)k \leq \alpha < 2k^{32}$, the duopolistic surpluses are bigger than the monopolistic ones up to a certain $f$, but inferior going towards bigger $f$: in this region, the higher is $k$, the sooner the crossing appears. However, the crossing disappears completely and $k$ does not influence anymore the relation if we fix $\alpha$ a bit higher: just fixing $\alpha = 2k$ it’s enough to have the duopolistic surpluses always higher than the monopolistic ones.

It is easy to interpret this fact. Since the monopoly power from the hardware’s intrinsic value ($\alpha$) is transferred back to the subscribers by the duopolistic competition, while it’s retained by the monopolist as a profit (see later), “a sufficiently high” $\alpha$ ensures that the subscribers are always better off with the duopoly w.r.t. the monopoly, does not matter the intensity of their horizontal preference ($k$).

Second, the producer’s surplus. Here, from [17] and [18], we know that monopolistic profits are decreasing in $f$; concerning [32] and [36], instead, the function study tells that both are increasing in $f$ (although mildly, and [32] monotonically only after $f > 2/(9k)$). This is enough to say that, conditionally on the parameters $\alpha$ and $k$, at a certain point there will be a crossing between the monopolistic and the duopolistic surpluses. At the right-hand side of this point (w.r.t. the x-axis), the duopoly surpluses will be higher than the monopoly ones.

Moreover, the values of the parameters act in a trade-off: $\alpha$ pushes up the monopoly surpluses (and shifts the crossing on the right w.r.t. the x-axis), while $k$ pushes them down (for the deterrence profits, this happens for $k > 1/(9f)$ (shift on the left). Finally, it is immediate to see that symmetric profits are increasing in $k$ and $f$.

We can conclude saying that the advantage of monopoly over duopoly for the producer is rapidly eroded with the increase of $f$; moreover, this advantage is parametrically reinforced by $\alpha$ and

\[32\] In line with most of the literature on “horizontal differentiation”, in this model we assume $k \geq 1$.  

27
reduced by $k$. However, it is interesting to remember that the same parameters act in an opposite way in the consumer’s surplus: in fact, there the consumer’s surplus under monopoly was increasing in $k$ while under duopoly in $\alpha$. Given this comparative statics behaviour, a clear and synthetic account of the “best” market structure is given by the welfare analysis.

**Figure 1 about here**

Before going to discuss the welfare levels, comparing [27], [29], [33] and [37], we notice that the complexity of the discussion is dramatically reduced simplifying the addenda $\alpha$, $y$ and $(-1/2)k$. After that, it is immediate to notice that the deterrence welfare ($\chi$) performs very badly (see downward-sloped dotted line in figure 1): in fact, after an initial superiority over the duopolistic outcomes ($\psi$ and $\omega$)$^{33}$, $\chi$ is rapidly falling well under the two ($\psi$ and $\omega$) with the increase of $f$. Moreover, the rate of decrease is increasing in $k$: so, when subscribers display strong horizontal preferences, the “vertical differentiation” strategy underlying the deterrence behaviour is increasingly costly and resource-wasting. From above, we can derive a fundamental welfare property of the model:

**Proposition 4.**

a) The welfare levels of the four market structures decrease with the increase of $f$; the rate of decrease of the monopolistic structures is higher than the duopolistic ones.

b) After a certain $f$, with $f>f(k)^{34}$, the symmetric duopoly’s welfare is the highest.

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$^{33}$ At least, in this initial range of $f$, the superiority of $\chi$ is clear over the symmetric one ($\omega$), given that the accommodation equilibrium (whose welfare is $\psi$) exists (and hence is comparable) only after a certain $f(\alpha,k)$ (recall Proposition 1). The blockaded entry monopoly (whose welfare is $\varphi$) is preferable (and comparable) in its range of existence, that is $f \leq 1(6k)$ (recall Proposition 2).

$^{34}$ The value of $f$ needed for that is quite small and near to the left bound of existence of the deterrence equilibrium. For example, for $k=1$, we have $f= 1/6+(1/18)\sqrt{5}$. 
Moreover, the previous discussion has highlighted that monopoly and duopoly have very different distributional schemes. The parameter $\alpha$ illustrates well this point: we saw that, with the increase of $\alpha$, subscribers are better off under duopoly, while operators under monopoly. So, the consumer’s and producer’s surpluses are differently impacted by a variation of $\alpha$, even though total welfare as a whole is not affected.

Being in media industries, where it is wiser to give a preferential protection to consumer’s surplus and the pluralism of the market, the policy-maker choice of promoting duopoly appears as the best and socially preferable option\(^{35}\).

This is even more true when we are in a technological and economic context in which hardware operators possess an highly valuable transmission and receiving equipment (in our model, this means an high $\alpha$). In fact, especially for some countries like Italy, currently the satellite platform is the only communication facility able to deliver readily and efficiently new and revolutionary digital services everywhere\(^{36}\).

5. Antitrust policy in practise

The asymmetric duopoly equilibrium found in the basic version of the model reflects closely the typical market structure of the European pay-TV market. In particular, it is a realistic representation of the recent developments of the Italian market\(^{37}\). In Italy, up to the first half of 1998, only Telepiù was active on the satellite market and when Stream decided to enter, it faced a very difficult take-off phase.

Basically, in the first year of activity, Stream encountered severe difficulties in raising the attractiveness of its platform and

\(^{35}\) This fundamental result holds even if we do not normalise to 0 the fixed costs of hardware: their actual size is too small (20% of the total costs) to represent a significant source of efficiency gains from the acquisition/merger. In any case, a large portion of them would be sunk.

\(^{36}\) For an analysis of the potential of the satellite facility and of the different digital options in Italy, see Matteucci (2002), chp. 1 and 4.

\(^{37}\) For a fuller account of the origins and the recent evolution of the Telepiù-Stream duopoly, see Matteucci (2002), chp.4.
increasing its base of subscribers, since most of the premium broadcasting rights had already been bought by Telepiù. For this reasons, in February 1999 Stream presented a complain to the Italian antitrust authority, claiming that the Italian wholesale market for both premium sports and “first release” movie rights was practically monopolised by the incumbent; moreover, these rights had been acquired for a duration which was so long to prevent competition in the phase of renegotiations of contracts. This situation of premium content accumulation was so unfair, argued the plaintiff, that Stream was not allowed to remain and compete on the (downstream) pay-TV market (see AGCM, 2000).

The decision taken by AGCM confirmed the complains of Stream, even though a remedy was taken only for sport rights. In fact, although Telepiù at that time was having a dominant position in the “first release” movie rights (having the rights accounting for 85-90% of the Italian box-office revenues), this position had been acquired before the entry of the rival. Although the excessive time length of these rights was per se questionable (in some contracts, up to 10 years), the Authority at that time decided not to challenge the dominant position in movie rights and intervened only in the sport rights segment.

Concerning sport rights, the AGCM decision was taken on the basis of the abuse of dominant position, aiming at restraining the rival’s access to a necessary input. The AGCM decision was directly inspired at previous decisions, dating back to the notorious Coditel II case\(^{38}\), where the European Court of Justice similarly challenged the excessive duration of some exclusive broadcasting contracts. Moreover, although not directly infringed, for premium football rights a law (n.78/99) had been previously established, setting a limit if 60% in the accumulation of premium broadcasting rights.

Although the AGCM decision n. 8386 did not impact immediately and substantially on the asymmetric position of the two duopolists, it represented a first important assessment of the principle that, to have a fair and workable downstream

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competition in pay-TV, a contestable wholesale broadcasting rights market is needed. Further, beyond the specificity of the case under decision, this principle was recognised both for movie and sport rights.

Moreover, together with other (more specific) decisions (n. 6869, see AGCM, 1999, and n. 10985, see AGCM, 2002b) and laws (n. 78 in 1999), the decision n. 8386 initiated the build-up of a normative framework aimed at ensuring that the entrant can compete effectively, via a more contestable broadcasting rights market.

Finally, the issue of the contestability of the broadcasting rights market was indirectly reaffirmed in the related decision concerning the proposed acquisition of Stream by Telepiù (see AGCM 2002a). In this decision, authorising the acquisition under conditions, AGCM noticed that the consolidation of the market in a monopoly possessing a wide amount of exclusive broadcasting rights would have blocked any future entry, not only in the satellite pay-TV market, but also in any other pay-TV platform (cable or Internet-based media).

The logic of the argument is the same as in the previous decision. Translated into our economic jargon, being the accumulation of broadcasting rights a powerful mechanism of entry deterrence, via the indirect network effects which would materialise, a monopolist combining the exclusive contracts for sport and movie rights formerly possessed by the two duopolists would not be challenged in the future by any potential competitor. Moreover, this monopolist, having also the “negative” (holdback) pay-TV rights for the same events, would have prevented the development of alternative transmission platforms based on other electronic media. For these reasons, AGCM authorised the acquisition but requested the monopolist to be divested of a substantial amount of premium rights, together with a reduction of the duration of the rights it could maintain.

Comparing the policy implemented with the policy implications of our model, we can say that the AGCM decisions and the other normative initiatives promoted the socially optimal market structure. In fact, the policy implemented contributed
substantially to the reduction of the degree of asymmetry of the (initially) spontaneous duopoly, pushing the real market structure to converge to the ideal and symmetric duopoly: this market structure, especially in a setting of high fixed costs, ensures the highest welfare (recall Proposition 4).  

6. Conclusions

Digital technologies are thought to mark a fundamental change in broadcasting and in communication technologies in general, promising to increase the level of competition in media markets. This paper presents some first problematic insights into this perspective. Basically, the main argument of this work is that in electronic media markets we need to distinguish between what is affecting the hardware segment and what is more specific to “content”. We have argued that the increasing importance of intellectual property rights challenges the simplistic view that media markets are facing a reduction of barriers to entry, both technological and strategic.

Our model illustrates the mechanics of competition in a typical European satellite pay-TV industry, where an incumbent is challenged by the entry of a new operator. Thanks to the wide availability of new and cheap transmission capacity, new entrants can easily build new hardware platforms, but they may encounter severe difficulties in finding valuable content to attract subscribers. Since content is proprietary and broadcasted under exclusivity regimes, a first mover advantage in (premium) content acquisition is likely to result in vertical market foreclosure and monopoly, even when a duopoly would be socially optimal (high fixed costs regime). Moreover, even in the (purely hypothetical)

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39 The objection that under monopoly the fixed costs of content would be lower is not binding, since this outcome would be partial and temporary. In fact, only the prices of sport rights would be affected, being those of movie rights largely independent from national markets’ conditions. The temporary nature of the price cut can be argued from the fact that now in Italy some football clubs, face to the threat represented by the new monopsonistic buyer (the new merged pay-TV operator SKY), are promoting a new sport platform (Gioco Calcio), competing for a subset of (complementary) sport rights.
case that an accommodation duopolistic equilibrium spontaneously affirms, a normatively-induced symmetric duopoly would be welfare-superior (at least statically and in a non-collusive setting).

This policy option in favour of duopoly is even more justified when one comes to consider that media markets, for their particular status, might request to assign a particular priority to interests like consumer’s surplus and a minimum degree of pluralism in market structure. In any case, the welfare and policy implications of the model support and reinforce the policy orientation expressed in some recent antitrust decisions on the Italian pay-TV markets, aimed at a reduction of the degree of asymmetry between players in content acquisition.

Appendix of proofs

I. Proof of Lemma 1.

Consumers are captive and the operators act as local monopolists. Content commitment has been made in stages 1-2 and the marginal cost of each variety is zero, so that is optimal to offer all of them. The price of the $N_i^{th}$ (most expensive) variety is constrained at $\rho_{Ni}$ and the unit price of the previous cannot be higher than that. However, demand for a variety is perfectly inelastic w.r.t. the unit price and the market share for hardware has been decided in stage 3: so, in equilibrium, a unit price less than $\rho_{Ni} = \beta N_i^{\beta-1}$ would reduce profits without increasing the market share. It follows that the unit equilibrium price for all the $N_i$ varieties is $\rho_{Ni}$.

II. Proof of Lemma 2.

To maximize [6] w.r.t. price $p_i$, we first substitute [5] in [6]. Then, we impose the FOC, check for the sign of the second derivative and find the price best-response function for firm $i$:
\[ p_i = \frac{(1-2\beta)N_i - (1-\beta)N_j + p_j + k}{2}, \quad i = A,B,i \neq j \]

Solving the unlinear system of the best-response functions, we find the Nash equilibrium, conditional on content (equation [7]). Then, substituting [7] into [5] gives [8]. Finally, substituting [7] and [8] into [6], we get [9]. However, these results hold only for the economic existence of [8] (i.e., for \( 0 \leq t_i \leq 1 \), requesting \( |N_i^\beta - N_j^\beta| \leq 3k \)). Further, we need to discuss \( |N_i^\beta - N_j^\beta| > 3k \).

Imposing \( t_i=1 \) in [5] and substituting the corresponding best-response function for \( p_j \), we get [10]. Similarly, using [10], from the best-response function we get [11]. Finally, substituting [10] into [6], we find [12].

**III. Proof of full market coverage under duopoly**

This requests us to prove that the marginal consumer strictly prefers buying the pay-TV service and not only the outside good (whose indirect utility is \( y \)). Substituting in [4] the equilibrium values of duopoly prices and market shares ([7] and [8]), we get:

\[ V_i = \alpha + \frac{1}{2} N_i^\beta + \frac{1}{2} N_j^\beta - \frac{3}{2} k + y \]

A sufficient condition for having \( V_i - y > 0 \) is to assume \( \alpha \geq 3/2k \).

**IV. Proof on the second-order conditions of the duopolistic equilibrium.**

The second order condition requests:

\[ \frac{1}{36 N_i k} - \frac{1}{36} \left( \frac{N_B^{1/2} - N_A^{1/2}}{N_A^{3/2} k} + 3k \right) < 0 \]

This implies \( N_A < 9k^2 \).
V. Proof of Proposition 1.

Case a) Once B has not entered, A is a monopolist. Solving backwards, A maximises [14] w.r.t. $N_A$. From the first order condition the equilibrium variety is:

$$N_A^b = \frac{1}{4f^2} \text{ (see[17])}.$$ 

Substituting this variety into [13] and [14] yields the monopoly price and profits (see again [17]). The equilibrium variety, for $f \leq 1/(6k)$, implies $N_A \geq 9k^2$, which excludes the existence of an interior duopolistic equilibrium for B. However, in principle B could have an incentive to enter and monopolise the market while A acts as a pure monopolist. To prove that this strategy is not convenient for B, we impose $t_B=1$ in [8] and solve for $N_B$:

$$N_B = \left( N_A^{1/2} + 3k \right)^2$$

Substituting this expression and that of the equilibrium variety for A in [12], yields the profits for B associated to the counter-monopolisation strategy, which are negative:

$$\pi_B = -k - 9fk^2 - \frac{1}{4f}.$$ 

Case b) If $f > 1/(6k)$, from [17] the (simple) monopoly variety for A results to be $N_A < 9k^2$. However, in this case we know from [15] that an interior duopolistic equilibrium exists. Hence, if A wants to be a monopolist, it has to deter entry. Technically, we need to equate [16] to 0 and solve for $N_A$. Trivially, the deterrence variety is $N_A^{de} = 9k^2$. Substituting it in [13] and [14], yields the deterrence price and profits (see [18]). Once again, we need to verify that for B it is not convenient to enter and counter-monopolise the market (proof of credible deterrence). Similarly to the proof given under case a), we impose
$t_B=1$ in [8] and solve for $N_B$. Mutatis mutandis, we end up with the following profit function:

$$\pi_B = 2k - 36k^2 f$$

The profits are negative for $f > 1/(18k)$, whatever is $k$. Since we are discussing the case $f > 1/(6k)$, the credibility of deterrence is verified.

Finally, we must verify that the monopolist finds convenient to cover the entire market. We prove this in the deterrence case, the blockaded entry being analogous. We are looking for an endogenous determination of $t_A$. Starting from the generic profit function, we substitute in the deterrence variety and find:

$$\pi_A = t_A \left( p_A + \frac{3}{2}k \right) - 9fk^2$$  \[38\]

The relation between $t_A$ and $p_A$ is derived from the usual condition of indifference of the consumer located at $t=1$, which yields:

$$t_A = \frac{1}{2} \left( \frac{2\alpha + 3k - 2p_A}{k} \right)$$  \[39\]

Now, after having substituted [39] in [38], we maximise [38] w.r.t. $p_A$ and find that the FOC is verified for $p_A = 1/2\alpha$. This value, once substituted in [39], gives:

$$t_A = \frac{1}{2} \left( \frac{\alpha + 3k}{k} \right), \text{with } t_A > 1.$$  

This proves the convenience to serve the entire market for the monopolist.
VI. Proof of Proposition 2.

Section a)
We need to compare the two profit functions, which depend on three parameters: \( \alpha, k \) and \( f \).\(^{40}\) To perform the comparative statics analysis, we first derive the profit functions w.r.t the parameters. From [18], deterrence profits are increasing (additively) in \( \alpha \) and monotonically decreasing in \( f \); further, they are increasing in \( k \) for \( k < 1/(9f) \) and decreasing for \( k \geq 1/(9f) \) (or, equivalently, \( f \geq 1/(9k) \)). So, for any \( \alpha \) and \( k \), w.r.t. \( f \) the function reaches its absolute maximum at the left bound of its interval \( (f=1/(6k), \text{ and decreases thereafter.} \)

From [20], accommodation profits are increasing for \( f \leq 1/(9k) \), decreasing for \( 1/(9k) < f \leq 2/(9k) \), and increasing thereafter; further, they are increasing in \( k \) for \( k \leq 1/(9f) \), decreasing for \( 1/(9f) < k < 0.182f \) and increasing in \( k \geq 0.182f \). Therefore, for any \( k \), after 'a certain \( f \)' (which will depend on \( k \)), the accommodation profits are increasing in \( f \).

Therefore, at some point we can expect a crossing between the two profit functions, the exact point being jointly identified by the parameters \( \alpha \) and \( k \). At this point the incumbent is indifferent between deterrence and accommodation. At the right-hand side of this point, asymmetric duopoly affirms as the equilibrium strategy.

Section b)
We substitute in [8] the equilibrium varieties [15] and [19]; then, we take the limit of the resulting expression w.r.t. the parameters \( f \) and \( k \), proving the result.

\(^{40}\) While \( \alpha \) and \( k \) are technological and preference parameters, \( f \) is a truly supply-side parameter, more likely to be influenced by policy intervention. So, the comparative statics analysis will be focused on \( f \).
VII. Proof of Proposition 3

Having solved [23] for the symmetric equilibrium variety (see [24]), we substitute this variety in [21], [22] and [9], and we find the corresponding symmetric equilibrium values (see again [24]). Then, we need to prove that none of the symmetric duopolists finds convenient to monopolise the market, while the rival commits to the symmetric content variety. Let suppose that the monopolising operator is A. After having substituted the symmetric variety for $N_B$ in [22], we impose $t_A=1$ and solve for the corresponding $N_A$. We get the following monopolising variety:

$$N_A = \frac{(18f + 1)^2}{36f^2}$$  \[40\]

Substituting [40] and the symmetric variety for $N_B$ in [21] yields the monopolising price $p_A$. Once we have substituted the latter and the monopolising variety ([40]) in the generic profit function ([6]), we find the following expression, negative for any $f$:

$$\pi_A = \frac{-1(18f - 1)^2}{36f}$$

VIII. Proof on the accommodation consumer’s surplus.

Substituting [19] in [15] yields the accommodation variety for B:

$$N_B^a = \frac{(9k(6f_k - 1))^2}{((18f_k - 1)^2 - 18f_k)^2}$$

Substituting $N_A^a$ and $N_B^a$ in [7] yields the accommodation prices. Substituting these prices in [8], yields the accommodation market share:

$$t_A = \frac{(18f_k - 1)(9f_k - 1)}{(18f_k - 1)^2 - 18f_k}$$  \[41\]
Then, we develop [30], getting:

\[
CS^a_T = \alpha + y - \frac{1}{2}k + t_A \left( \frac{1}{2} \left( N_A^{1/2} - N_B^{1/2} \right) - (p_A - p_B) \right) + \frac{1}{2} N_B^{1/2} - p_B
\]

= [42]

Substituting in [42] the equilibrium values, we get a long expression, rather difficult to treat. Simplifying and factoring the fourth and separately the fifth and sixth addendum, yields [31].
Figure 1. The welfare levels of the four different market structures
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