WORKING PAPERS

N° 1492

DECEMBER 2023

“Media Mergers in Nested Markets”

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Media Mergers in Nested Markets *

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December 2023

Abstract

We analyze the effect of media mergers in a model that stresses, on the one hand, the fact that media are two-sided platforms willing to attract advertisers and viewers and, on the other hand, that strong competitors have emerged to challenge traditional media on both sides. We show that a merger has two conflicting effects on traditional media's incentives to invest in quality programs and to exploit their market power. When competition is primarily between traditional media, a Business-Stealing Effect dominates, and the merger is detrimental to advertisers and viewers. When the competition is mainly between the traditional media and their new competitors, an Ecosystem Effect dominates, and the merger benefits advertisers and viewers. We extend this setting to dis-

*The authors have greatly benefited from discussions with teams at *Altermind*, *TF*1 and *M*6 and acknowledge financial support from these organizations. We thank one referee and an anonymous Co-editor for their useful remarks and comments. At last, we thank all participants at the 2023 TSE Digital Conference and at the 50th Annual Conference of the *European Association for Research in Industrial Economics*. This paper has also been funded by the Agence Nationale de la Recherche under grant ANR-17-EURE-0010 (Investissements d'Avenir program) The usual disclaimer applies.

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cuss the role of financial constraints that might limit investments in the quality of programs and show that the same effects are at play.

Keywords: Media; competition; merger.

JEL Codes: L82; L22; G34

1 Introduction

MOTIVATION. The media industry is currently facing fundamental changes. On the one hand, Internet giants are rivals for its main source of funding, namely advertising. On the other hand, new players have appeared in the form of Internet and streaming platforms (*VOD* and *SVOD*), which diminish the ability of traditional media to capture the attention of viewers. In this context, the very survival of this industry is in question, leading policy-makers to cast a fresh eye on regulatory rules and traditional media themselves, particularly *TV* channels, to consider consolidating and joining forces through mergers. The objective of this article is to examine the consequences of such mergers, particularly their impact on the advertising industry and consumers.

Examples of media mergers, and plans for mergers, abound. In the *US*, *Warner Media* (*CNN*, *HBO*) and *Discovery* (*Discovery Channe*l, *HGTV*, *Eurosport*) completed their merger deal in May 2022, a deal that was rapidely approved by the European Competition Authority. In India, *Zee TV* announced in December 2022 its merger with *Sony*'s Indian subsidiary. In France, the two major private digital *TV* groups, *TF*1 and *M*6, tried to merge in 2022 to better face the growing competition from their streaming and pay-*TV* competitors. This proposal, like the other instances of merger in the field, was motivated by the major changes occurring in the media sector. *TF*1 and *M*6 derived their revenues from advertising. In this market, even if they capture

70 to 75% of the market share of *TV*-displayed advertisement, this share falls to 25% when one includes the amount spent on the Internet (display, social and search). On the viewers' side of the market, the overall picture is also changing quickly. Indeed, the subscription rate for *SVOD* jumped from 10% in 2016 to 46% in 2020 (half of which is attributable to Netflix), while the average time spent on *TV* decreased by 5% overall and by 25% for those between 15 and 34 years old. These profound changes in the market explain the incentives that traditional media have to grow and create structures large enough to compete with new competitors (see Evens and Donders (2016) for an overview and informal analysis of *M&A* in the *TV* industry). However, the impact that this trend could have on advertisers and viewers remains a matter of debate, and competition authorities tend to be conservative on these operations for lack of guidance in this type of environment.[2]

Key Elements of the Model. To contribute to build such guidance and analyze the global effect of media mergers, we propose a new model in which two free-to-air (*FTA*) channels compete in the market both for viewers and advertisers. Specifically, both channels are viewed as platforms that connect these two sides. In the viewers' market, two forms of competition coexist, one between *FTA* channels competing against one another and another between these channels and other forms of media, in particular paid-*TV*, *VOD* and, *SVOD*. Each viewer must choose either to watch one of the two *FTA* channels or switch to the alternative. This nested choice is based on the quality of the channels – a variable determined by each *FTA* channel that is derived endogenously – and some idiosyncratic tastes that make viewers be more or less attracted to one of the channels. The market for advertisers has the same formal structure as the market for viewers, with a continuum of advertisers choosing either to focus on the *FTA* channels or switch to the alternative media. Whereas viewers

[2]For example, the *TF*1-*M*6 merger was blocked by the French Competition Authorities.

are interested in the quality of the programming, advertisers care about the number of viewers on the *FTA* channels or, equivalently, the share of the market for attention that channels can capture. The two-sidedness of the market comes from the fact that advertisers care about the number of viewers, which implies that the more viewers a *FTA* channel can attract, the higher the price for ads it can charge.

In this setting, we compare two scenarios. In the first scenario, the pre-merger case, each *FTA* channel non-cooperatively chooses how much effort to devote to increase the quality of its programs and the price it charges advertisers. In the second situation, the post-merger case, the two channels coordinate on their choice of efforts and prices.

Business-Stealing and Ecosystem Effects. A merger affects strategic choices on both sides of the market. To see how it can be so, let us first consider the downstream market for viewers. On the one hand, competition between *FTA* channels creates a force that pushes each *FTA* channel to increase its own effort level so as to attract viewers away from its competitors; a *Business-Stealing Effect*. A merger certainly helps *FTA* channels to internalize this negative externality but would diminish effort. On the other hand, competition for viewers between *FTA* channels and other media makes their effort in enhancing the quality of their program a public good; an *Ecosystem Effect*. A merger helps to internalize this positive externality. When competition between *FTA* channels is stiff while the threat from the viewers' outside option is moderate, the *Business-Stealing Effect* is strong. A merger would have a negative impact on viewers. When competition between *FTA* channels is moderate while the threat from the outside option is intense, the *Ecosystem Effect* dominates. A merger would increase effort with a positive impact on viewers.

The effect of such a merger on advertisers follows the same logic, with some extra complexities due to the two-sided aspect of the markets. Note first that what matters most for advertisers is not the price charged by the *FTA* channels but the balance between this price and the benefit they derive from reaching an audience. This means that the impact of the merger should be assessed by investigating the net surplus left to the advertisers. Suppose that post-merger, *FTA* channels choose a higher level of effort. This would increase their market share on the downstream market for viewers and thus the surplus that advertisers gain when opting for an *FTA* channel rather than for their outside option. How this extra surplus is shared between *FTA* channels and advertisers again depends on the comparison between an *Business-Stealing Effect* and an *Ecosystem Effect*, but those effects now pertain to the upstream market for advertisers. If competition between *FTA* channels on this upstream market is intense, a merger decreases the surplus left to the advertisers. Instead, if competition is mainly between *FTA* and paid-*TV* (or *SVOD*) channels, a merger increases the surplus left to the advertisers.

Outside Financing Needs. We extend this model to the case in which traditional media must rely on outside financing to support their activity. This situation is reasonable since many *TV* channels (in particular *TF*1 and *M*6) are publicly quoted. The need for outside financing and the division between ownership and control can generate moral hazard issues and agency costs (Jensen and Meckling (1976) and Laffont and Martimort (2002)). We show that when the financial constraint is binding, the *Ecosystem* and *Business-Stealing Effects* both influence this financial constraint. In this scenario, it is again the case that, when the first effect dominates, which is more likely when financial needs are significant, a merger between *FTA* channels improves both the quality of content and the surplus left to advertisers.

Literature. The deregulation of ownership in the *US* media Industry 25 years ago and the more recent competition from Internet and *OTT* streaming platforms have given rise to a large body of economics literature on the media market. One common feature of this literature is to regard this market as two-sided (see Caillaud and Jullien (2003), Armstrong (2006), and Rochet and Tirole (2003)). Anderson and Coate (2005) propose one of the first models of the media market along these lines. One key assumption is that viewers dislike advertising. In this context, competition between media outlets tends to limit the amount of advertising displayed but at the cost of increasing the price of advertising. Gal-Or and Dukes (2006) adopt the same general framework with the aim of more directly investigating the profitability of mergers. In particular, they model the effect of advertising on the goods market and show that mergers in the media market can increase competition in the goods market, which reduces the price that advertisers are willing to pay. We adopt a different perspective, first by being agnostic on the positive or negative impact of advertising on consumers [3] and, second, by considering the quality chosen by the firms pre- and post-merger.

One of the main results of these models, that media mergers may lead to lower advertising prices, has been challenged by introducing multi-homing on the viewers' side. In this case, if the second impression has less value than the first, the advertising price of multi-homers is lower than that of single-homers. However, in the event of a merger/coordination, platforms can avoid this decrease in price and extract the full surplus that advertisers generate (see Athey, Calvano, and Gans (2018), Ambrus, Calvano, and Reisinger (2016), and Anderson, Foros, and Kind (2018)). Using a different modeling approach, Anderson and Peitz (2020) show that the effect of mergers on advertising prices depends on whether advertising harms or pleases consumers. Platforms and advertisers' interests are aligned in the first case and

[3] Note that, in media markets, the positive or negative externality generated by advertisers on consumers is debated and depends on the type of media. See Foros, Kind, and Sørgard (2015) on this point and for an overview about merger policy in the media industry.

opposed in the second. These approaches leave unexplored the change in strategy regarding quality choice following the merger, which may impact consumer surplus and participation and, thus, advertisers' profit.

There is also a link between our modeling of the *Ecosystem* and *Business-Stealing Effects* in our setting and the literature on generic and brand advertising (Krishnamurthy (2000) and Bass et al. (2005)). Indeed, generic advertising induces free riding among firms while brand advertising exacerbates competition. While generic and brand advertising are viewed there as two different choices variables, in our context, the quality-enhancing effort plays a dural role. It both attracts viewers towards the *FTA* ecosystem and splits market shares across *FTA* channels. The extent to which the effort is generic or specific depends on its magnitude.

With the presence of externalities in the media market, competition is likely to generate market failures. This creates the possibility that more coordination by the platforms may benefit society. This result stands in contrast with papers that investigate mergers in a one-sided setting (see, for example, Farrell and Shapiro (1990) and Werden (1996)). In this respect, Dewenter, Haucap, and Wenzel (2011) propose a model of a two-sided market to analyze such coordination. They assume that two media organizations compete for consumers and advertisers charging both sides. Their main focus is on semi-collusion, that is, a scenario where platforms coordinate on the advertising side only. In this case, they show that the advertising rate increases but consumers' price decreases, increasing consumers' participation. This augmented audience can offset the negative impact of the increased rate for advertising and allow advertisers to benefit overall from the merger. Our approach is different since the media we consider do not charge consumers. However, we share the idea that increasing consumers' participation may benefit advertisers enough to offset the negative effect of price changes on their surplus.

Last, Ivaldi and Zhang (2017) empirically analyze a merger that occurred in 2010 in the French digital *TV* market between two new entrants and a major media holding company. They show that this led to a significant increase in the price and volume of advertising. We adopt a similar approach for the viewers' market, assuming single-homing and some forms of nested choice. However, we insist, first, on the endogenous choice of quality of content by the merging parties and, second, on the role played by the competition from the Internet and streaming players on the advertising and viewers' markets.

Organization of the Paper. In Section 2, we present the model. In Section 3, we describe how and when media mergers can be welfare enhancing. In Section 4, we extend the analysis by introducing financial constraints. Section 5 concludes the paper. All proofs are relegated to an appendix.

2 The Model

2.1 General Structure

We consider the consequences of a possible merger in the *FTA* market. We view a *TV* channel as a two-sided platform. In the downstream market, a *TV* channel attracts viewers solely by means of the quality of its programs. In the upstream market, this channel attracts advertisers by selling access to its own viewers. To simplify the analysis, we assume that advertisers and viewers both single-home, i.e., cater only one platform at the time.

For future reference, we denote by C and C^* the two *FTA* channels pre-merger. For simplicity, we assume that these two firms are symmetric. Choice variables are accordingly indexed with a superscript or not in the sequel.

In a first pass, we express market shares in the upstream and downstream markets in general form. Later, in Section 2.2, we endogenize those market shares by introducing a nested discrete choice model where both advertisers and viewers first choose whether to cater *FTA* channels or their next best alternative and second which *FTA* channel to apply.

MARKET SHARES IN THE DOWNSTREAM MARKET FOR VIEWERS. Each *FTA* channel must choose a level of effort, e for channel C and e^* for channel C^*, in order to enhance the quality of their respective content. We denote by $\psi(.)$ the disutility of effort incurred by the firms C and C^* and assume $\psi' > 0$, $\psi'' > 0$ and $\psi'(0) = \psi(0) = 0$.

The market share of each form depends on the efforts by both channels in improving the quality of their respective programs. Accordingly, we denote respectively by $m(e, e^*)$ and $m^*(e, e^*)$, C's and C^*'s market shares in the market for viewers. There is overall a continuum of viewers with unit mass.

The following monotonicity conditions may determine how market shares evolve with those efforts.

- *Quality-Enhancing Effect.* $\frac{\partial m}{\partial e}(e, e^*) > 0$.This condition captures the fact that C's market share certainly increases with its own effort.

- *Business-Stealing Effect.* $\frac{\partial m}{\partial e^*}(e, e^*) < 0$. This scenario stems for the possibility that C^* might steal some market shares from C by increasing its own effort e^*. C^* thus exerts a negative externality on C.

- *Ecosystem Effect.* $\frac{\partial m}{\partial e^*}(e, e^*) > 0$. We might also entertain the possibility that C's market share increases when the competing channel expands its own effort. This possibility captures the idea that firms belong to the same ecosystem and benefit from one another's effort; the case of a positive externality of one firm on the other.

Market shares in the upstream market for advertisers. *FTA* channels also compete with one another for advertisers on the upstream market, setting prices p and p^* for these advertisers to access their viewers. When paying a price p to channel C to access a market share of viewers $m(e, e^*)$, an advertiser obtains a net surplus worth $\omega = \gamma m(e, e^*) - p$,[4] where $\gamma > 0$ is a scale parameter that represents how an advertiser values audience at channel C. Note here that this surplus ω varies with price and market share in opposite directions. This implies that a merger – or any structural change – that would increase the price but would at the same time significantly increase the market share could benefit advertisers.

The choice of ω and ω^* influences the competition between *FTA* channels but they also attract these advertisers away from other venues, which we refer to as pay-*TV* and mostly comprises Internet players (*SVOD*). As a result of such competition, which we keep unmodeled for the time being, channels C and C^* respectively enjoys market shares $s(\omega, \omega^*)$ and $s^*(\omega, \omega^*)$ on the upstream market.

We will adopt a taxonomy similar to that used above for the upstream market.

- *Surplus-Enhancing Effect.* $\frac{\partial s}{\partial \omega}(\omega, \omega^*) > 0$. C's market share of the market for advertisers increases as it transfers more of the surplus from the relationship to advertisers.

- *Business-Stealing Effect.* $\frac{\partial s}{\partial \omega^*}(\omega, \omega^*) < 0$. C's market share of the upstream market diminishes as C^* leaves more surplus to advertisers.

[4] A similar expression follows for C^*.

- *Ecosystem Effect.* $\frac{\partial s}{\partial \omega^*}(\omega, \omega^*) > 0$. Conversely, we may also entertain the possibility that C benefits from C^* giving more surplus to advertisers.

When C chooses the strategic variables (e, p) while its rival C^* simultaneously chooses (e^*, p^*), the distribution of surplus so induced becomes $(\omega, \omega^*) = (\gamma m(e, e^*) - p, \gamma m^*(e, e^*) - p^*)$. Of course, for a fixed equilibrium effort e^*, there is a one-to-one mapping between ω and p and we can as well use (e, ω) rather than (e, p) to describe C's optimization problem. To simplify the analysis, we shall use ω and ω^* as control variables in the optimization problems for the *FTA* channels. This assumption amounts to saying that the contract that links a *FTA* channel, say C, with advertisers catering this channel is a commitment to give some surplus ω irrespective of the possible realizations of audience that might occur. In that perspective, C *de facto* keeps any risk on any possible departure from the expected audience that could arise. C becomes residual claimant for the value $\gamma m^*(e, e^*) s(\omega, \omega^*)$ of a match between its viewers and its advertisers with the proviso that no such value is generated if no advertisers or no viewers are showing up.[5]

Formally, we may actually write C's profit in terms of (e, ω) and (e^*, ω^*) as

$$\pi^D(e, e^*, \omega, \omega^*) = (\gamma m(e, e^*) - \omega) s(\omega, \omega^*) - \psi(e) - I$$

When the two *FTA* channels merge, they jointly choose their efforts and the prices they charge to advertisers. If we assume symmetry between the two channels, the monopoly's profit (per channel) can thus be written as

$$\pi^M(e, \omega) = \pi^D(e, e, \omega, \omega).$$

[5] We could alternatively entertain the possibility that advertisers are residual claimants for the value of a match. This would make the formula derived in Sections 3 and 4 slightly more complex without changing the main results of our analysis.

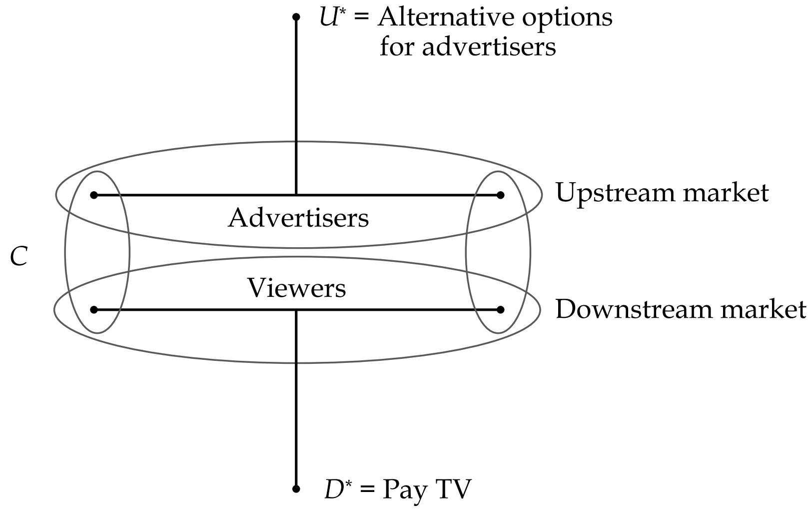

Figure 1: Market structure.

Timing. The game between viewers, advertisers and *FTA*-channels unfolds as follows.

1. The *FTA* channels C and C^* simultaneously and non-cooperatively choose the quality levels $(e, e*)$ of their respective contents and the share of the value of a match (ω, ω^*) they leave to advertisers.

2. Viewers observe those quality levels and first choose an ecosystem; either *FTA* channels or their alternative option. In the former scenario, viewers then select an *FTA* channel; thereby inducing an allocation of market shares $m(e, e^*)$ and $m^*(e, e^*)$ between *FTA* channels on the downstream market.

   Simultaneously, advertisers also first choose an ecosystem, either *FTA* channels or their next best option. When opting for *FTA* channels, advertisers then select to ad on one of the *FTA* channels; thereby inducing an allocation of market shares $s(\omega, \omega^*)$ and $s(\omega, \omega^*)$ between *FTA* channels on the upstream market.

3. Viewers enjoy the contents of the service provider they opt whereas advertisers get their surplus according to the contract with the FTA channels or enjoy their alternative options.

Our equilibrium concept is subgame perfection. In view of proceeding to backward induction, Section 2.2 shall determine market shares in terms of the effort levels and advertising prices charged.

2.2 Market Shares

Downstream market for viewers. A key aspect of this market is that FTA channels compete with pay-TV channels, which have a radically different business model. pay-TV content is financed through subscriptions from viewers, whereas FTA channels' content is financed with the revenues raised from advertisers.

We model the choice of a venue as a nested discrete choice problem that captures specificities of the TV market. Although, there is a lack of formal studies on the way viewers make their choice on the media market, there are many informal evidences showing that the main actors of this industry distinguish different ecosystems and make their choices accordingly. As noticed by Gunter (2010) and Towler (2003), viewers have a tendency to group TV channels in multi-channels environments, especially when those channels offer specialized programs. Pay-TV channels may be viewed as more specialized supports targeting specific contents (blockbusters, sport events, children programs and the like) while FTA channels are considered as more generalists. It has led regulators and practitioners to think about the market in terms of ecosystems.[6]

[6] On the viewers' side, the various regulators' studies (for example, see OFCOM (2022)) distinguish between different eco-systems, sometimes two (FTA vs pay-TV), sometimes three (FTA channels, pay-TV, internet).

Suppose that a viewer has thus already opted for *FTA* channels; he or she then chooses whether to view C rather than C^* whenever

$$e + \tilde{\varepsilon} \geq e^* + \tilde{\varepsilon}^*.$$

The shock parameters $\tilde{\varepsilon}$ and $\tilde{\varepsilon}^*$ represent biases towards channels C and C^*, respectively. We assume that $\tilde{\varepsilon}$ and $\tilde{\varepsilon}^*$ are i.i.d. from a distribution $\tilde{G}$ with zero mean and whose support is $\mathbb{R}$. We denote by $\tilde{g}$ the corresponding density that is supposed to be symmetric around 0. For future reference, we also denote by G the distribution of the convolution of $\tilde{\varepsilon}^* - \tilde{\varepsilon}$ defined as

$$G(\varepsilon) = \int_{-\infty}^{+\infty} \tilde{G}(\varepsilon + \tilde{\varepsilon})\tilde{g}(\tilde{\varepsilon})d\tilde{\varepsilon}.$$

In particular, it follows from $\tilde{g}$ being symmetric that $G(0) = \frac{1}{2}$. With these notations, the probability of choosing channel C conditionally on having already opted for *FTA* channels is $G(e - e^*)$. By the law of large numbers, this quantity can also be interpreted as the fraction of viewers who choose C conditionally on having opted for *FTA* channels. With equal effort by both channels, the market is equally split between channels.

Turning now to the first stage of the decision process, we assume that a viewer decides not to subscribe to other sources of content whenever

$$\mathop{\mathbb{E}}_{(\tilde{\varepsilon},\tilde{\varepsilon}^*)}(\max(e + \tilde{\varepsilon}, e^* + \tilde{\varepsilon}^*)) \geq \tilde{\eta}$$

where $\tilde{\eta}$ is a shock parameter that corresponds to the net surplus that the consumer can get at alternative venues.[7]

[7]To illustrate, if this alternative source is a pay-*TV* channel, we might posit $\tilde{\eta} = e_0 + \tilde{v} - \tilde{p}$, where $\tilde{v}$

We first compute

$$\underset{(\tilde{\varepsilon},\tilde{\varepsilon}^*)}{\mathbb{E}}(\max(e+\tilde{\varepsilon}, e^*+\tilde{\varepsilon}^*)) \equiv \underset{\tilde{\varepsilon}}{\mathbb{E}}\left((e+\tilde{\varepsilon})\tilde{G}(e-e^*+\tilde{\varepsilon}) + \int_{e-e^*+\tilde{\varepsilon}}^{+\infty}(e^*+\tilde{\varepsilon}^*)d\tilde{G}(\tilde{\varepsilon}^*)\right)$$
$$= \underset{\tilde{\varepsilon}}{\mathbb{E}}\left(e+\tilde{\varepsilon}+\int_{e-e^*+\tilde{\varepsilon}}^{\infty}(1-\tilde{G}(\tilde{\varepsilon}^*))d\tilde{\varepsilon}^*\right) = e + \int_{-\infty}^{+\infty}\tilde{G}(\tilde{\varepsilon})\left(1-\tilde{G}(e-e^*+\tilde{\varepsilon})\right)d\tilde{\varepsilon}$$

where the first and second equalities follow from integrating by parts and using $\underset{\tilde{\varepsilon}}{\mathbb{E}}(\tilde{\varepsilon}) = 0$.

Denoting by H the cumulative distribution of the preference parameter η and by h the corresponding density, the probability that viewers choose FTA channels is written as

$$H\left(e + \int_{-\infty}^{+\infty}\tilde{G}(\tilde{\varepsilon})\left(1-\tilde{G}(e-e^*+\tilde{\varepsilon})\right)d\tilde{\varepsilon}\right).$$

From this, it follows that C's market share in the downstream market for viewers can be expressed as

$$m(e,e^*) = G(e-e^*)H\left(e + \int_{-\infty}^{+\infty}\tilde{G}(\tilde{\varepsilon})\left(1-\tilde{G}(e-e^*+\tilde{\varepsilon})\right)d\tilde{\varepsilon}\right).$$

We immediately compute

$$m(e,e) = \frac{1}{2}H(e+\alpha)$$

where $\alpha = \int_{-\infty}^{+\infty}\tilde{G}(\tilde{\varepsilon})\left(1-\tilde{G}(\tilde{\varepsilon})\right)d\tilde{\varepsilon} > 0$.

From this expression, we can derive how the FTA channels' effort influences

is a taste parameter, e_0 the innate quality of content at this pay-TV channel and $\tilde{p}$ the price it charges to viewers.

market shares as:

$$\frac{\partial m}{\partial e}(e,e) = g(0)H(e+\alpha) + G(0)\left(1 - \int_{-\infty}^{\infty} \tilde{G}(\tilde{\varepsilon})g(\tilde{\varepsilon})d\tilde{\varepsilon}\right)h(e+\alpha)$$

or

$$\frac{\partial m}{\partial e}(e,e) = g(0)H(e+\alpha) + \frac{1}{4}h(e+\alpha)$$

and

$$\frac{\partial m}{\partial e^*}(e,e) = -g(0)H(e+\alpha) + G(0)\left(\int_{-\infty}^{\infty} \tilde{G}(\tilde{\varepsilon})\tilde{g}(\tilde{\varepsilon})d\tilde{\varepsilon}\right)h(e+\alpha)$$

or

$$\frac{\partial m}{\partial e^*}(e,e) = \underbrace{-g(0)H(e+\alpha)}_{\text{Business-Stealing} <0} + \underbrace{\frac{1}{4}h(e+\alpha)}_{\text{EcoSystem} >0}.$$

This expression highlights that C^*'s effort may be detrimental to C's market share when the *Business-Stealing Effect* dominates. Alternatively, C^*'s effort could enhance C's market share when the *Ecosystem Effect* dominates. We should stress that this *Ecosystem Effect* dominates when $g(0)$ is small. Indeed, $g(0)$ is an inverse measure of the intensity of competition between *FTA* channels for advertisers. To see this point more formally, notice that $g(0)$ small means that the taste difference $\varepsilon - \varepsilon^*$ is distributed away from the origin. This feature captures the existence of viewers with taste parameters that make them somehow captive of one of the *FTA* channels. Each of those *FTA* channels acts then as a local monopoly over its captive viewers. In this case, increasing marginally the quality level e (or e^*) does not change much the choice of viewers accross *FTA* channels but make them more likely to opt for one of the two *FTA* channels than for the alternative content providers.

Assuming that the *monotone hazard rate property* holds, i.e., $\frac{H(e+\alpha)}{h(e+\alpha)}$ is nondecreasing, we observe that

$$\frac{\partial m}{\partial e^*}(e,e) > 0 \quad \Leftrightarrow \quad e < \bar{e}$$

where $\bar{e}$ is defined as

$$\frac{H(\bar{e}+\alpha)}{h(\bar{e}+\alpha)} = \frac{1}{4g(0)}.$$

In other words, for (symmetric) levels of effort that are low enough, each FTA channel benefits from the other channel's effort in attracting viewers. The FTA channels thus have a common interest in attracting viewers away from other kinds of content providers. Because of this positive externality, each FTA channel may not exert enough effort relative to what would be optimal from their joint perspective. For higher levels of effort, competition between the FTA channels is the dominant driver. In this scenario, each FTA channel exerts excessive effort to stealing market share from its rival FTA channel relative to what would be optimal from their industry's viewpoint.

We believe that the *Business-Stealing Effect* and the *Ecosystem Effect* are important drivers in the TV market. Whereas the first effect is standard in competitive settings, the second is more specific and relates to our nested-choice model. It comes from the fact that a bigger effort by one FTA makes the FTA-option in general more appealing relative to pay-TV, so viewers are more likely to not sign up for pay-TV. As they spend more time on the group of FTA channels, they may in the end view more the other FTA that did not expend its effort. Therefore, the *Ecosystem Effect* captures a public good aspect in the choice of quality made by the FTA channels.

Running Example: Take the logistic distribution $G(\varepsilon) = \frac{e^{\mu\varepsilon}}{1+e^{\mu\varepsilon}}$ (for some $\mu > 0$) that has density $g(\varepsilon) = \mu\frac{e^{\mu\varepsilon}}{(1+e^{\mu\varepsilon})^2}$ (note that $g(0) = \mu$, $g(\varepsilon) = g(-\varepsilon)$ and $G(0) = \frac{1}{2}$ as requested). The distribution $\tilde{G}$ is the Gumbel distribution, $\tilde{G}(\tilde{\varepsilon}) = e^{-e^{-\mu\tilde{\varepsilon}}}$. Furthermore, take for H

a modified Beta distribution on $[0, \bar{H}]$, with $H(\eta) = \left(\frac{\eta}{\bar{H}}\right)^{\zeta}$. Then, $\bar{e}$ is defined as [8]

$$\bar{e} = \frac{1}{\mu}\left(\frac{\zeta}{4} - \ln(2)\right)$$

Observe that $\bar{e} < \bar{H}$ if $\bar{H}$ large enough. Moreover, $\bar{e}$ is positive and decreases with μ, if $\zeta > 4\ln(2)$. Hence, the softer the competition for viewers between *FTA* channels is (μ smaller), the higher $\bar{e}$ and therefore the more the *Ecosystem Effect* dominates the *Business-Stealing Effect*. ■

Upstream market for advertisers. Our modeling of the upstream market resembles that of the downstream market for viewers and relies also on a sequential discrete choice model. There is a continuum of advertisers of unit mass. Advertisers can sequentially choose whether to target the audience of the *FTA* channels or opt for an outside option. After choosing the *FTA* channels, advertisers decide to allocate their business between C and C^* according to the net surpluses they obtain from those channels. It is indeed common for firms to design their marketing plans first by choosing to allocate their budget between the main types of media (TV, radio, digital) before selecting a specific media within a pre-specified group.[9]

As we will see below, and much as what happens on the downstream market for viewers, this sequential choice leads to emergence of an *Ecosystem Effect* of a similar nature.

Formally, a given advertiser is characterized by a pair of shock parameters ν and

[8] We compute $\alpha = \int_{-\infty}^{+\infty} e^{-e^{-\mu\eta}}\left(1 - e^{-e^{-\mu\eta}}\right)d\eta = \frac{1}{\mu}\int_0^{+\infty} e^{-u}(1 - e^{-u})\frac{du}{u}$. Let $\int_0^{+\infty} e^{-u}(1 - e^{-u})\frac{du}{u} = \varphi(1)$ where $\varphi(t) = \int_0^{+\infty} e^{-u}(1 - e^{-ut})\frac{du}{u}$. We compute $\varphi'(t) = \int_0^{+\infty} e^{-u}e^{-ut}du = \frac{1}{1+t}$. Thus, we have $\varphi(t) = \ln(1 + t)$ and $\varphi(1) = \ln 2$. Hence, $\alpha = \frac{\ln 2}{\mu}$.

[9] For example, Rust and Leone (1984) present a mixed marketing model for television and magazines where they develop the concept of the *"mixed-media allocation schedule"*. See also Danaher (2008).

ν^* and accordingly chooses C whenever

$$\omega + \nu \geq \omega^* + \nu^*.$$

We assume that ν and ν^* are i.i.d. from the distribution $\tilde{F}$ with support $\mathbb{R}$ and density $\tilde{f} = \tilde{F}'$. We also assume that $\tilde{f}$ is symmetric with zero mean. We denote $\xi = \nu^* - \nu$ as the difference between those shocks and let F be the distribution of this latter random variable. Note that $F(0) = \frac{1}{2}$. Accordingly, the probability that a given advertiser selects channel C is thus $F(\omega - \omega^*)$.

By the law of large numbers, this quantity is also C's market share conditional on advertisers choosing FTA channels. To model the first-stage choice between the FTA channels and the outside option, we assume that the latter provides a reservation payoff w.r.t. $\tilde{\omega}$ to a given advertiser. This preference parameter is drawn from a distribution K with density k. Formally, a given advertiser chooses the FTA channels whenever

$$\mathop{\mathbb{E}}_{(\tilde{\nu},\tilde{\nu}^*)} (\max(\omega + \tilde{\nu}, \omega^* + \tilde{\nu}^*)) \geq \tilde{\omega}.$$

Mimicking the approach we adopted for the downstream market, we first compute

$$\mathop{\mathbb{E}}_{(\tilde{\nu},\tilde{\nu}^*)} (\max(\omega + \tilde{\nu}, \omega^* + \tilde{\nu}^*)) = \omega + \int_{-\infty}^{+\infty} \tilde{F}(\tilde{\nu})(1 - \tilde{F}(\omega - \omega^* + \tilde{\nu}))d\tilde{\nu}.$$

Accordingly, the probability that a given advertiser opts for the FTA channels is thus

$$K\left(\omega + \int_{-\infty}^{+\infty} \tilde{F}(\tilde{\nu})(1 - \tilde{F}(\omega - \omega^* + \tilde{\nu}))d\tilde{\nu}\right).$$

Thus, we may compute C's market share in the upstream market as

$$s(\omega, \omega^*) \equiv F(\omega - \omega^*)K\left(\omega + \int_{-\infty}^{+\infty} \tilde{F}(\tilde{\nu})(1 - \tilde{F}(\omega - \omega^* + \tilde{\nu}))d\tilde{\nu}\right).$$

In particular, we have for a symmetric allocation of surplus $\omega = \omega^*$,

$$s(\omega, \omega) = \frac{1}{2} K(\omega + \gamma)$$

where $\gamma = \int_{-\infty}^{+\infty} \tilde{F}(\tilde{v})(1 - \tilde{F}(\tilde{v}))d\tilde{v} > 0$.

It is immediate to derive from those expressions simple comparative statics. Indeed, we have

$$\frac{\partial s}{\partial \omega}(\omega, \omega) = f(0)K(\omega + \gamma) + \frac{1}{4}k(\omega + \alpha)$$

and

$$\frac{\partial s}{\partial \omega^*}(\omega, \omega) = \underbrace{-f(0)K(\omega + \gamma)}_{\text{Business-Stealing} <0} + \underbrace{\frac{1}{4}k(\omega + \alpha)}_{\text{Ecosystem} >0}.$$

An increase in the surplus ω^* left to advertisers by C^* has here also two effects on C's market share on the upstream market. First, it attracts advertisers aways from C; the *Business-Stealing Effect*, which is a negative externality. Second, it makes it more attractive for advertisers to choose the *FTA* channels; the *Ecosystem Effect*, which is instead a positive externality.

We should again stress that this *Ecosystem Effect* dominates when $f(0)$ is small. In fact, $f(0)$ is again an inverse measure of the intensity of competition between *FTA* channels for advertisers. Notice that $f(0)$ small means that the taste difference $\tilde{v} - \tilde{v}^*$ is distributed away from the origin. This feature captures the existence of advertisers with taste parameters that make them somehow captive of one of the *FTA* channels. Each of those *FTA* channel acts then as a local monopoly over its captive advertisers.

Assuming that the *monotone hazard rate property* holds, i.e., $\frac{K(\omega+\gamma)}{k(\omega+\gamma)}$ is nondecreasing, we observe that

$$\frac{\partial s}{\partial \omega^*}(\omega, \omega) > 0 \quad \Leftrightarrow \quad \omega < \bar{\omega}$$

where $\bar{\omega}$ is defined as

$$\frac{K(\bar{\omega}+\gamma)}{k(\bar{\omega}+\gamma)} = \frac{1}{4f(0)}.$$

In other words, the *Business-Stealing Effect* dominates when enough of the surplus is left to advertisers while the *Ecosystem Effect* does so otherwise.

Running Example (continued). Suppose that F is a logistic distribution, i.e., $F(\xi) = \frac{e^{\lambda\xi}}{1+e^{\lambda\xi}}$ for some $\lambda > 0$, with density $f(\xi) = \frac{\lambda e^{\lambda\xi}}{(1+e^{\lambda\xi})^2}$, and $f(0) = \lambda$. The distribution $\tilde{F}$ is then the Gumbel distribution, $\tilde{F}(\varepsilon) = e^{-e^{-\lambda\varepsilon}}$. Suppose also that K is modified beta distribution on $[0, \bar{K}]$ with $K(x) = \left(\frac{x}{\bar{K}}\right)^{\kappa}$. Then, $\bar{\omega}$ solves

$$\bar{\omega} = \frac{1}{\lambda}\left(\frac{\kappa}{4} - \ln(2)\right).$$

Observe that $\bar{\omega}$ is positive if $\kappa > 4\ln(2)$ and $\bar{\omega} < \bar{K}$ if $\bar{K}$ large enough. Finally, $\bar{\omega}$ decreases with λ, and hence the softer the competition for advertisers between the *FTA* channels is, the higher $\bar{\omega}$ and therefore the more the *Ecosystem Effect* dominates the *Business-Stealing Effect*. ■

Remarks. Our model has certainly some specificities both in terms of timing and derived market shares but those specificities are meant to echo real world features of those markets. First, our focus on a nested discrete choice model underlines the sequential aspect of decisions made by viewers and advertisers who both choose an ecosystem before opting for a particular *FTA* channel. Second, a model with discrete choice induces aggregate demand functions for channels. De facto, this structure imposes restrictions on the market shares cross-elasticities across market attributes (prices and/or quality-enhancing efforts). An alternative modeling strategy could be to specify those aggregate demand functions at the outset. The weakness of such an approach would be that it would require to put ad hoc restrictions on cross-elasticities to capture in a meaningful way both the complementarity between *FTA* channels in attracting viewers and advertisers and the substitutability between those *FTA* channels and other supports.

3 The Benefits of a Merger

In this section, we compare the equilibrium surplus in the upstream market for advertisers and the quality of contents under two alternative scenarios. In the first, C and C^* non-cooperatively choose (e, ω) and (e^*, ω^*) at equilibrium. In the second scenario, those variables are jointly chosen to maximize the overall profits of the industry.

3.1 Welfare Criteria

We evaluate the benefits of a merger with respect to its consequences for viewers and advertisers' surplus. For a symmetric choice $e = e^*$ and $\omega = \omega^*$, viewers' surplus can be written as

$$\mathcal{V}(e) \equiv \mathop{\mathbb{E}}_{\tilde{\eta}}\left(\max\left\{\mathop{\mathbb{E}}_{(\tilde{\varepsilon},\tilde{\varepsilon}^*)}(e + \max(\tilde{\varepsilon}, \tilde{\varepsilon}^*)); \tilde{\eta}\right\}\right).$$

It is straightforward to check that $\mathcal{V}'(e) > 0$ and thus that a higher quality of content unambiguously raises viewers' surplus.

Similarly, we may compute the advertiser's expected payoff when both *FTA* channels offer the same net surplus ω as

$$\mathcal{A}(\omega) = \mathop{\mathbb{E}}_{\tilde{\omega}}\left(\max\left\{\mathop{\mathbb{E}}_{(\tilde{\nu},\tilde{\nu}^*)}(\omega + \max(\tilde{\nu}, \tilde{\nu}^*)); \tilde{\omega}\right\}\right).$$

It is again straightforward to check that $\mathcal{A}'(\omega) > 0$ and thus that a higher share of the value of a match with viewers unambiguously raises advertiser′ expected payoff.

A merger between C and C^* is thus welfare-enhancing for both viewers and advertisers whenever both e and ω increase post-merger. The conditions for such a scenario are studied in the next subsection.

3.2 Pre-Merger Equilibrium

We first consider the duopoly scenario where the content qualities e and e^* and the net surplus levels ω and ω^* are chosen non-cooperatively and simultaneously by C and C^*, respectively. We shall also assume that I is small enough to ensure a positive overall net profit at equilibrium.[10]

A pair (e, ω) lies in C's best-response correspondence whenever

$$(e, \omega) \in \arg\max_{(\tilde{e},\tilde{\omega})} (\gamma m(\tilde{e}, e^*) - \tilde{\omega}) s(\tilde{\omega}, \omega^*) - \psi(\tilde{e}) - I.$$

A *symmetric Nash-equilibrium* is thus a pair (e^D, ω^D) that solves the fixed-point requirement:

$$(e^D, \omega^D) \in \arg\max_{(\tilde{e},\tilde{\omega})} (\gamma m(\tilde{e}, e^D) - \tilde{\omega}) s(\tilde{\omega}, \omega^D) - \psi(\tilde{e}) - I. \tag{1}$$

Assuming quasi-concavity of the above maximand w.r.t. $(\tilde{e}, \tilde{\omega})$, we obtain

Proposition 1. *A pre-merger symmetric Nash equilibrium (e^D, ω^D) satisfies the following conditions:*

$$\gamma m(e^D, e^D) = \omega^D + \frac{s(\omega^D, \omega^D)}{\frac{\partial s}{\partial \omega}(\omega^D, \omega^D)} \tag{2}$$

[10]Condition (17) below makes this requirement explicit. A similar feasibility condition, namely (4.2) also arises in the post-merger scenario and is also satisfied when I is small enough.

and

$$\gamma \frac{\partial m}{\partial e}(e^D, e^D)s(\omega^D, \omega^D) = \psi'(e^D). \tag{3}$$

Those equilibrium conditions deserve some comments. Condition (2) shows that advertisers obtain only a fraction of the overall value of a match with the audience $m(e^D, e^D)$ that selects channel C. Specifically, we may rewrite (2) as

$$\frac{\gamma m(e^D, e^D) - \omega^D}{\omega^D} = \frac{1}{\epsilon^d(\omega^D)} \tag{4}$$

where $\epsilon^d(\omega^D) = \frac{\omega^D \frac{\partial s}{\partial \omega}(\omega^D, \omega^D)}{s(\omega^D, \omega^D)}$ stands for the elasticity of market share in the upstream market with respect to the surplus ω left to advertisers. The left-hand side of (4) is the ratio between what an *FTA* channel obtains and what an advertiser obtains in equilibrium. The greater the market share elasticity is, the greater the share of the overall value of a match that accrues to advertisers.

Condition (3) shows how a *FTA* channel trades off the marginal cost of increasing the quality of content against its marginal benefits. To understand how it can be so, consider increasing marginally the effort $e = e^D$ by de. Doing so increases the disutility of effort by an amount

$$\psi'(e^D)de.$$

The marginal benefit of such perturbation increases audience and makes it more attractive for advertisers to cater channel C. It increases the value of a match between viewers and advertisers by an amount

$$\gamma \frac{\partial m}{\partial e}(e^D, e^D)s(\omega^D, \omega^D)de.$$

Gathering those marginal costs and benefits finally yields (3).

Figure 2 below represents the pre-merger equilibrium in the (e, ω) space.

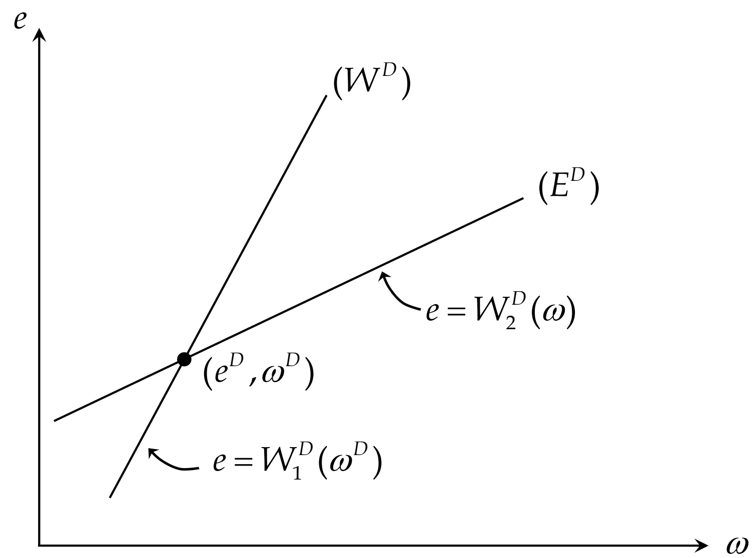

Figure 2: Best response: Pre-merger scenario.

The two curves (E^D) and (W^D) are not *stricto sensu* best responses; they merely describe all symmetric pairs $(e, \omega) \equiv (e^*, \omega^*)$ that lie on those best responses. However, those two curves intersect at the Nash equilibrium (e^D, ω^D).

For future reference, we may rewrite (2) and (3), respectively, as

$$\frac{\gamma}{2} H(e^D + \alpha) = \omega^D + \frac{K(\omega^D + \gamma)}{2f(0)K(\omega^D + \gamma) + \frac{1}{2}k(\omega^D + \gamma)} \tag{5}$$

and

$$\frac{\gamma}{2} K(\omega^D + \gamma) = \frac{\psi'(e^D)}{g(0)H(e^D + \alpha) + \frac{1}{4}h(e^D + \alpha)}. \tag{6}$$

First, observe that the *monotone hazard rate property* ($\frac{K}{k}$ nondecreasing) implies that (5) defines an upward-sloping relationship in the (ω, e) space, say $e^D = W_1^D(\omega^D)$. Similarly, (6) also defines another relationship $e^D = W_2^D(\omega^D)$ in that space. This relationship is also be upward-sloping relationship provided that ψ' increases sufficiently quickly, i.e., ψ'' large enough, an assumption that will be made throughout. The quasi-concavity of the objective function (1) implies that W_1^D and W_2^D only cross once at (e^D, W^D) and when they do so, $W_1^{D'}(\omega^D) > W_2^{D'}(\omega^D)$.

3.3 Post-Merger Outcome

Consider now the post-merger scenario where the quality of content e and the net surplus left to advertisers ω are jointly chosen. Given the symmetry between the *FTA* channels, the upstream and downstream market shares are the same, and the choice variables (e, ω) are identical.

A *cooperative outcome* is thus a pair (e^M, ω^M) that solves

$$(e^M, \omega^M) \in \arg\max_{(\tilde{e},\tilde{\omega})} (\gamma m(\tilde{e}, \tilde{e}) - \tilde{\omega}) s(\tilde{\omega}, \tilde{\omega}) - \psi(\tilde{e}) - I. \tag{7}$$

where the (symmetric) market shares in the downstream and upstream markets are, respectively, given by:

$$m(e, e) = \frac{1}{2} H(e + \alpha)$$

and

$$s(\omega, \omega) = \frac{1}{2} K(\omega + \gamma).$$

Proposition 2. *A post-merger cooperative outcome (e^M, ω^M) satisfies the following conditions:*

$$\gamma m(e^M, e^M) = \omega^M + \frac{s(\omega^M, \omega^M)}{\frac{\partial s}{\partial \omega}(\omega^M, \omega^M) + \frac{\partial s}{\partial \omega^*}(\omega^M, \omega^M)}, \tag{8}$$

and

$$\gamma \left(\frac{\partial m}{\partial e}(e^M, e^M) + \frac{\partial m}{\partial e^*}(e^M, e^M) \right) s(\omega^M, \omega^M) = \psi'(e^M). \tag{9}$$

Comparing (2) and (8) and taking into account that $\frac{\partial s}{\partial \omega^*} < 0$ if and only if $\omega^M > \bar{\omega}$, we observe that

$$\gamma m(e^M, e^M) > \omega^M + \frac{s(\omega^M, \omega^M)}{\frac{\partial s}{\partial \omega}(\omega^M, \omega^M)} \quad \Leftrightarrow \quad \omega^M > \bar{\omega}.$$

When $\omega^M > \bar{\omega}$ the *Business-Stealing Effect* dominates the *Ecosystem Effect* in the upstream market for advertisers. Post-merger, the level of surplus left to advertisers is thus too low with respect to the marginal value of a match. However, this comparison is only half of the story. Post-merger, the quality of content may also change and possibly increase under certain conditions that we identify below. In that scenario, the net surplus left to advertisers may thus also increase.

Turning now to the optimal level of content quality, we observe that the right-hand sides of (3) and (9) differ because now the *Business-Stealing Effect* and the *Ecosystem Effect* in the downstream market for viewers are internalized. Formally, we know that $\frac{\partial m}{\partial e^*} < 0$ for $e > \bar{e}$, and we have

$$\gamma \frac{\partial m}{\partial e}(e^M, e^M) s(\omega^M, \omega^M) > \psi'(e^M) \quad \Leftrightarrow \quad e^M > \bar{e}.$$

When $e^M > \bar{e}$, the *Business-Stealing Effect* dominates the *Ecosystem Effect*, and post-merger, there is insufficient effort devoted to improving content quality.

Observe that we may rewrite (8) and (9), respectively, as

$$\frac{\gamma}{2} H(e^M + \alpha) = \omega^M + \frac{K(\omega^M + \gamma)}{k(\omega^M + \gamma)} \tag{10}$$

and

$$\frac{\gamma}{2} K(\omega^M + \gamma) = \frac{\psi'(e^M)}{\frac{1}{2} h(e^M + \alpha)}. \tag{11}$$

Those two conditions define two curves (W^M) and (E^M), respectively, in the (e, ω)

space. Those two curves cross (W^D) and (E^D) only once at $\bar{\omega}$ and $\bar{e}$, respectively. Figures 3a and 3b represents how those curves (W^M) and (e^M) "turn" around (W^D) and (E^D) under two polar scenarios. In the first, $(\bar{e}, \bar{\omega}) < (e^D, \omega^D)$, and the merger is unambiguously detrimental to both content quality and the net surplus left to advertisers. This scenario corresponds to the case in which the *Business-Stealing Effect* predominates in both the upstream and downstream markets. Then, a merger reduces both content quality and the surplus left to advertisers to internalize this negative externality.

In the second scenario, we instead have $(\bar{e}, \bar{\omega}) > (e^D, \omega^D)$. The merger is now unambiguously beneficial both for content quality and the surplus left to advertisers. Under those circumstances, the *Ecosystem Effect* dominates both the upstream and downstream markets. A merger allows advertisers to better internalize the positive externalities that prevail here and avoid free-riding.

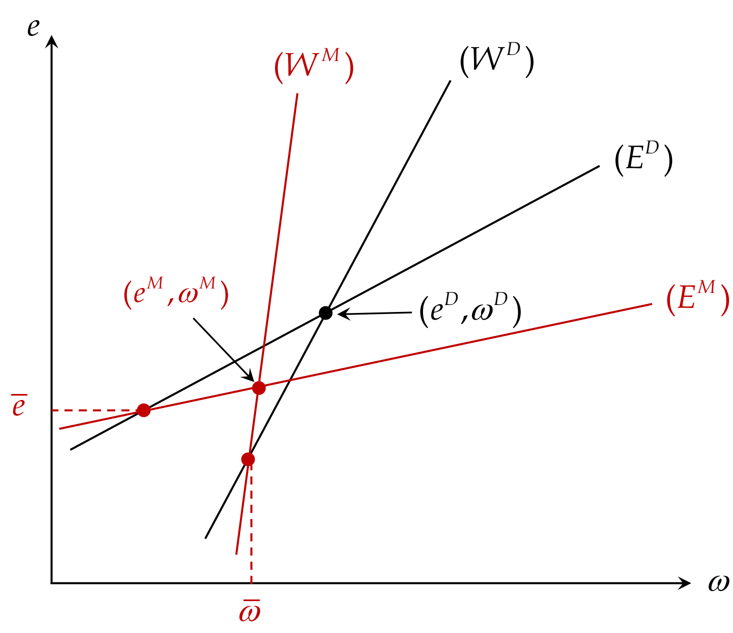

Figure 3a: *The Business-Stealing Effect* dominates.

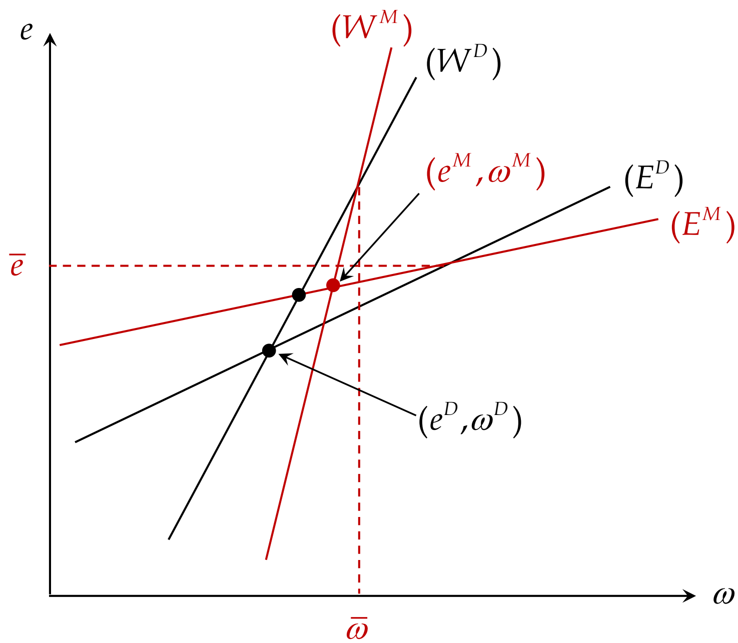

Figure 3b: *The Ecosystem Effect* dominates.

We can thus conclude our analysis as follows.

Proposition 3. Welfare comparisons.

- *Suppose that the Business-Stealing Effect dominates both upstream and downstream, i.e.,* $(\bar{e}, \bar{\omega}) < (e^D, \omega^D)$. *Then, a merger harms both viewers and advertisers' welfare*

$$(e^D, \omega^D) > (e^M, \omega^M). \tag{12}$$

- *Suppose that the Ecosystem Effect dominates both upstream and downstream, i.e.,* $(\bar{e}, \bar{\omega}) > (e^D, \omega^D)$. *Then, a merger improves both viewers and advertisers' welfare*

$$(e^D, \omega^D) < (e^M, \omega^M). \tag{13}$$

We have identified two forces in the competitive process. The first one is related to the market restricted to the *FTA* channels and the second related to the global market in which the set of *FTA* channels compete with pay-*TV* and more generally other media. When competition in the second market is more severe than that in the first market, the merger can improve both viewers' and advertisers' welfare.[11]

Another way to interpret this result is as follows. When the equilibrium effort levels are high, competition is mostly between *FTA* channels. This implies that a merger would lower each firm's effort, and make viewers and advertisers worse off. Conversely, when the equilibrium effort levels are low, *FTA* channels are weak vis-à-vis their online and pay-*TV* competitors. A merger would then drive the effort level up and benefit both viewers and advertisers.

4 Financial Constraints

Our analysis so far has supposed that the *FTA* channels have unlimited wealth to finance the investment outlay I necessary to innovate. In practice, financial constraints have been tightened over recent years as original contents have become more costly to create or acquire.[12] As a result, *FTA* channels must raise an increasing part of their investment from outside financiers. Unfortunately, relying on outside finance also comes with agency costs. Those agency costs in turn amount to raising the cost of providing effort and thus, exacerbate both the *Business- Stealing* and the *Ecosystem Effects*. In this section, we investigate how those agency costs considerations are modified when *FTA* channels may merge.

[11] Note that the cost of effort provides enough degrees of freedom to ensure that this case is possible as it does not impact the cutoff values of $\bar{e}$ and $\bar{\omega}$.

[12] See Financial Times (January, 2023, https://www.ft.com/content/d9a7cded-d43f-4d89-9271-44bf6516d476.) This article reports that expenditures on original content in the video media industry jumped from \$128bn to \$243bn over the last decade.

4.1 Pre-Merger Scenario

Outside financiers are poorly equipped to assess the quality of content chosen by *FTA* channels. Any financial contract between such a channel and its financiers is thus plagued with moral hazard. Moral hazard comes with agency costs when the borrower is protected by limited liability. It makes outside finance costly and affects the feasibility of the effort level derived in the previous section. The next lemma describes the *Financial Feasibility Condition* that must be satisfied when moral hazard is a concern. To this end, we first denote by W the wealth that a given channel can devote to investment. Accordingly, let $\tilde{I} = I - W > 0$ denote the net outlay that outside financiers must finance. Equipped with these notations, we can show the following lemma that first focuses on the pre-merger scenario.

Lemma 1. *Pre-merger, the Financial Feasibility Condition for channel C is written as*

$$(\gamma m(e,e^*) - \omega)s(\omega,\omega^*) - \frac{m(e,e^*)}{\frac{\partial m}{\partial e}(e,e^*)}\psi'(e) - \tilde{I} \geq 0. \tag{14}$$

Absent agency costs, the (net) investment $\tilde{I}$ would be viewed as valuable by channel C whenever

$$(\gamma m(e,e^*) - \omega)s(\omega,\omega^*) - \psi(e) - \tilde{I} \geq 0. \tag{15}$$

In fact, the difference between the left-hand sides of (14) and (15) stands for the agency costs of moral hazard, which are written here as

$$R^D(e,e^*) = \frac{m(e,e^*)}{\frac{\partial m}{\partial e}(e,e^*)}\psi'(e) - \psi(e) \geq 0.$$[13]

[13]It can be readily verified that $R^D(0,e^*) = 0$ and $\frac{\partial R^D}{\partial e}(e,e^*) = \frac{\partial}{\partial e}\left(\frac{\psi'(e)}{\frac{\partial m}{\partial e}(e,e^*)}\right)m(e,e^*) > 0$ under weak conditions. Hence, the above inequality holds.

This rent comes from the fact that the effort devoted to improving the quality of content is non-verifiable. To understand its source, it is interesting to consider, as a preamble, the case in which such effort would be verifiable. In this simpler scenario, outside financiers could simply demand the optimal effort from the perspective of the vertical structure they form with the channel. There would be considerable leeway in specifying the repayment of those financiers' investment. As long as, in expectation, the reimbursement when market shares are gained and that when they are lost just covers the investment, a financial contract is both feasible and induces the appropriate effort. When effort is non-verifiable, such direct control is no longer feasible. A financial contract must induce the channel to exert effort. *A priori,* this can easily be done by leaving more surplus from the vertical structure to the channel. To illustrate, financiers may require lower repayment when market shares in the downstream market are gained to stimulate effort; this is the carrot side of incentives. Because financiers must still cover the cost of the investment, they should also demand greater repayment when market shares hare lost. Unfortunately, the *FTA* channel has a limited liability constraint that precludes the use of such a stick and, as a result, the implementation of the optimal effort. Only carrots can be used, and financiers find it more costly to participate in the venture. To reduce those limited liability rents and facilitate access to outside finance, effort should be reduced.

We now turn to the analysis of those equilibrium efforts. A *symmetric Nash equilibrium* of the pre-merger scenario is a pair (e^{DF}, ω^{DF}) that satisfies the following fixed-point requirement $(\mathcal{P}^{DF})$:

$$(\mathcal{P}^{DF}) : (e^{DF}, \omega^{DF}) \in \arg\max_{(e,\omega)} (\gamma m(e, e^{DF}) - \omega) s(\omega, \omega^{DF}) - \psi(e) - I$$

subject to

$$(\gamma m(e, e^{DF}) - \omega)s(\omega, \omega^{DF}) - \frac{m(e, e^{DF})}{\frac{\partial m}{\partial e}(e, e^{DF})}\psi'(e) - \tilde{I} \geq 0. \tag{16}$$

Of course, the most interesting scenario is when the solution (e^D, ω^D) exhibited in Proposition 2 does not satisfy (16), a possibility that is confirmed by the next lemma.

Lemma 2. *The symmetric Nash equilibrium (e^D, ω^D) never satisfies the financial feasibility condition (16).*

To understand the force of Lemma 2, observe that, absent agency costs, financing is feasible when when

$$(\gamma m(e^D, e^D) - \omega^D)s(\omega^D, \omega^D) - \psi(e^D) - \tilde{I} \geq 0.$$

Taking into account the optimality condition for effort (3), this condition becomes

$$R^D(e^D, e^D) - \omega^D s(\omega^D, \omega^D) \geq \tilde{I}. \tag{17}$$

In other words, the investment is always feasible when $\tilde{I}$ is small enough and firms adopt their pre-merger efforts. In contrast, the pair (e^D, ω^D) is instead never implementable when agency costs with outside financiers arise. The intuition is as follows. At (e^D, ω^D), channel C has the first-best incentives to exert quality-enhancing effort from the point of view of the industry as whole as it can be shown from (3). With outside financing, exerting such effort requires that financiers make the firm residual claimant so as it pockets all incremental benefits of increasing effort. This would require a carrot in case the firm gains market shares on the downstream market for viewers and a stick otherwise. Because it is protected by limited liability, the usefulness of a stick is limited. In particular, outside financiers must be sure that C can fulfil its contract with advertisers and pay their due share of the value of a match. This commitment cannot be satisfied at the first-best effort and the financial feasibility condition (16) does not hold. More generally, the *Financial Feasibility Condition* (16) is more likely to hold for some pairs (e, ω) when those agency costs are low and profits in the upstream market are high.

A priori, satisfying (16) would then require the reduction of agency costs, by slightly reducing effort, and increasing profits in the upstream market. However, we observe that both the maximand of $(\mathcal{P}^{DF})$ and its constraint (16) are maximized when channel C maximizes profits in the upstream market. In other words, conditional on a given quality of content, the same optimality rule that determines the surplus left to advertisers is followed regardless of whether C is financially constrained. There is a dichotomy between pricing in the upstream market and the choice of content quality. Of course, satisfying the *Financial Feasibility Condition* requires effort distortions. These findings are illustrated in the next proposition.

Proposition 4. *A pre-merger symmetric Nash equilibrium* (e^{DF}, ω^{DF}) *necessarily entails*

$$\gamma m(e^{DF}, e^{DF}) = \omega^{DF} + \frac{s(\omega^{DF}, \omega^{DF})}{\frac{\partial s}{\partial \omega}(\omega^{DF}, \omega^{DF})}, \tag{18}$$

and

$$(\gamma m(e^{DF}, e^{DF}) - \omega^{DF})s(\omega^{DF}, \omega^{DF}) - \psi(e^{DF}) = \tilde{I} + R^D(e^{DF}, e^{DF}). \tag{19}$$

When being financially constrained, channel C modifies the quality of content. The binding *Financial Feasibility Condition* (19) is now replacing the incentive constraint (3) to determine the effort level, conditionally on a given share of the surplus left to advertisers. Condition (18) shows that this sharing rule of the surplus with advertisers nevertheless remains the same as when financial constraints are not an issue. Henceforth, most of the qualitative properties of the equilibrium remain, as we will see below.

First, and to familiarize ourselves with the properties of the model, it is useful to represent in Figure 4 below the binding *Financial Feasibility Condition* in the (e, ω) space, i.e., the set of allocations (e, ω) such that

$$(\gamma m(e, e) - \omega)s(\omega, \omega) - \psi(e) = \tilde{I} + R^d(e, e). \tag{20}$$

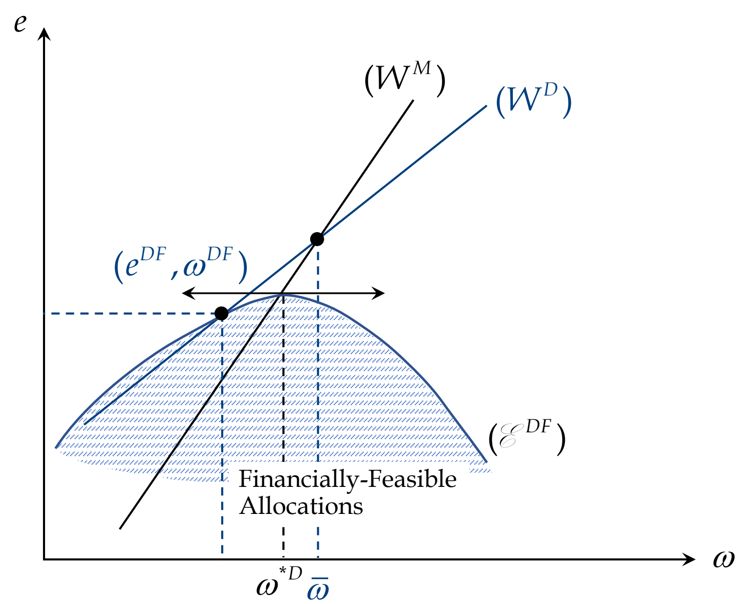

Figure 4: The pre-merger scenario with financial constraints.

The curve $(\mathcal{E}^{DF})$, which is implicitly defined through (20), as $e = \mathcal{E}^{DF}(\omega)$, reaches a maximum at a point ω^{*D} satisfying

$$\gamma m(e^{*D}, e^{*D}) = \omega^{*D} + \frac{s(\omega^{*D}, \omega^{*D})}{\frac{\partial s}{\partial \omega}(\omega^{*D}, \omega^{*D}) + \frac{\partial s}{\partial \omega^*}(\omega^{*D}, \omega^{*D})} \tag{21}$$

where $e^{*D} = \mathcal{E}^{DF}(\omega^{*D})$.

In other words, the extreme point of the set of *financially feasible* allocations that lies below ($\mathcal{E}^{DF}$) is obtained when the surplus left to advertisers is jointly chosen by the two channels and all externalities in the upstream markets are internalized, exactly as in the post-merger scenario. Intuitively, the *Financial Feasibility Condition* is relaxed when the profits of a given channel are maximized, and for a given effort level e, this is precisely when ω is given by (21), i.e., when ($\mathcal{E}^{DF}$) crosses the curve (W^D).

However, the equilibrium (e^{DF}, ω^{DF}) that satisfies (18) and (19) is *not* at this extreme point, precisely because, in the pre-merger scenario, the externalities in the upstream market are not internalized. In other words, the pre-merger equilibrium (e^{DF}, ω^{DF}) arises when (W^D) and ($\mathcal{E}^{DF}$) cross each other. Figure 4 describes a scenario where $\bar{\omega} > \omega^{*D}$. At ω^{*D}, the *Ecosystem Effect* dominates in the upstream market and, in the pre-merger Nash equilibrium, there is not enough surplus left to advertisers, namely

$$\omega^{DF} < \omega^{*D} < \bar{\omega}. \tag{22}$$

4.2 Post-Merger Scenario

Suppose now that channels C and C^* merge and jointly choose the pairs (e, ω) and (e^*, ω^*). Mimicking our earlier analysis, we observe that, by symmetry, it is again true that the merged entity should choose a symmetric allocation $e = e^*$ and $\omega = \omega^*$ to again fully internalize the *Business-Stealing* and *Ecosystem* externalities both upstream and downstream.

The next lemma describes the *Financial Feasibility Condition* in that post-merger scenario while maintaining the assumption that the symmetric effort level e chosen by the merger remains non-verifiable and that *FTA* channels are still protected by limited liability and can only dispose of liabilities worth W per channel.

Lemma 3. *Post-merger, the Financial Feasibility Condition for either channel is written as:*

$$(\gamma m(e,e) - \omega)s(\omega,\omega) - \frac{m(e,e)}{\frac{\partial m}{\partial e}(e,e) + \frac{\partial m}{\partial e^*}(e,e)}\psi'(e) - \tilde{I} \geq 0. \tag{23}$$

The main difference between (14) and (23) (beyond the fact that efforts are now symmetric across firms) derives from the fact that the agency cost of outside finance is now written as

$$R^M(e) = \frac{m(e,e)}{\frac{\partial m}{\partial e}(e,e) + \frac{\partial m}{\partial e^*}(e,e)}\psi'(e) - \psi(e).$$

Observe first that

$$R^{M'}(e) = m(e,e)\frac{d}{de}\left(\frac{\psi'(e)}{\frac{\partial m}{\partial e}(e,e) + \frac{\partial m}{\partial e^*}(e,e)}\right),$$

an expression that is assumed to be nonnegative from now on. Since $R(0) = 0$, it thus follows that $R^M(e) \geq 0$ for all e.

Comparing agency costs pre- and post-merger, we observe that

$$R^M(e) \geq R^D(e,e) \;\Leftrightarrow\; \frac{\partial m}{\partial e^*}(e,e) < 0 \;\Leftrightarrow\; e > \bar{e}.$$

In other words, when the *Business-Stealing Effect* dominates downstream, agency costs are greater if efforts are jointly chosen. The intuition for this result is straightforward. Post-merger, each *FTA* channel internalizes the impact of an increase in the quality of its own content on the loss of market shares for the other firm. This means that the incentives to increase effort are somewhat mitigated. To achieve the same content quality as under duopoly, outside financiers must receive a lower share of the value of a match between viewers and advertisers. Outside finance thus becomes more costly.

A contrario, suppose that the *Ecosystem Effect* dominates downstream. By internalizing this positive externality, a merger can provide cheap incentives and facilitates access to the financial market. Incentives to decrease effort are now somewhat mitigated.

We can now state the optimization problem that *FTA* channels face in this cooperative scenario. A *cooperative outcome* is now a pair (e^{MF}, ω^{MF}) that solves the following maximization problem $(\mathcal{P}^{MF})$:

$$(\mathcal{P}^{MF}) : (e^{MF}, \omega^{MF}) \in \arg\max_{(e,\omega)} (\gamma m(e,e) - \omega)s(\omega,\omega) - \psi(e) - I$$

subject to (23).

We next proceed as in the pre-merger scenario to assess how stringent financial constraints are.

Lemma 4. *The cooperative outcome (e^M, ω^M) never satisfies the Financial Feasibility Condition (23).*

To now understand the force of Lemma 4, observe that, absent agency costs, financing is feasible under a merger when when

$$(\gamma m(e^M, e^M) - \omega^M)s(\omega^M, \omega^M) - \psi(e^M) - \tilde{I} \geq 0.$$

Taking into account the optimality condition for effort (9), this condition is very similar to that that applies pre-merger, namely (17). It writes as

$$R^M(e^M, e^M) - \omega^M s(\omega^M, \omega^M) \geq \tilde{I}. \tag{24}$$

In other words, the investment is always feasible when $\tilde{I}$ is small enough even though firms jointly adopt their post-merger cooperative efforts. In contrast, the pair (e^M, ω^M) is never implementable when agency costs with outside financiers arise. More generally, the *Financial Feasibility Condition* (23) is more likely to hold when those agency costs are low and profits in the upstream market are high.

We are ready to characterize the constrained cooperative outcome as follows.

Proposition 5. *The post-merger cooperative outcome* (e^{MF}, ω^{MF}) *entails*

$$\gamma m(e^{MF}, e^{MF}) = \omega^{MF} + \frac{s(\omega^{MF}, \omega^{MF})}{\frac{\partial s}{\partial \omega}(\omega^{MF}, \omega^{MF}) + \frac{\partial s}{\partial \omega^*}(\omega^{MF}, \omega^{MF})} \tag{25}$$

and

$$(\gamma m(e^M, e^M) - \omega^M)s(\omega^M, \omega^M) - \psi(e^M) = \tilde{I} + R^M(e^M). \tag{26}$$

Mimicking our approach in the pre-merger scenario, we may consider the curve $(\mathcal{E}^{MF})$ and the set of allocations, $e = \mathcal{E}^{MF}(\omega)$, which are implicitly defined by the binding *Financial Feasibility Condition*

$$(\gamma m(e, e) - \omega)s(\omega, \omega) - \psi(e) = \tilde{I} + R^M(e). \tag{27}$$

The curve $e = \mathcal{E}^{MF}(\omega)$ now reaches a maximum at ω^{MF} since (25) and (26) holds. Contrary to the pre-merger scenario, the post-merger outcome now lies on the extreme point of the set of *financially-feasible allocations*. Figure 5 below summarizes our findings.

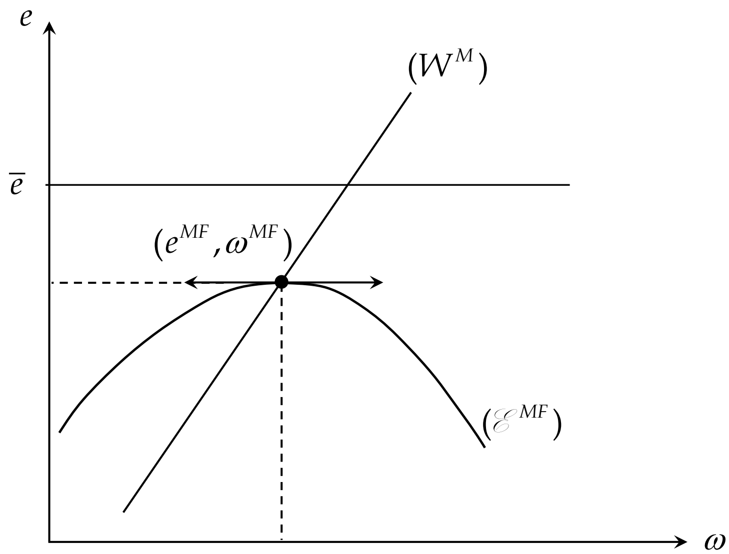

Figure 5: The post-merger scenario with financial constraints.

4.3 Welfare Comparison

The welfare comparison between the pre- and post-merger scenarios hinges upon the relative position of the sets of financially feasible allocations so achieved. To reach sharp conclusions, we assume that the financial constraint is sufficiently hard. Formally, we now suppose that

$$\max_{\omega} \left(\gamma m(\bar{e}, \bar{e}) - \omega\right) s(\omega, \omega) - \psi(\bar{e}) < \tilde{I} + R^M(\tilde{e}). \tag{28}$$

This condition ensures that all financially feasible allocations post-merger are such that $e < \bar{e}$ and thus $\frac{\partial m}{\partial e^*}(e, e) > 0$. In other words, when $\tilde{I}$ is large enough, the *Ecosystem Effect* necessarily dominates.

An immediate corollary is that any pair $(e = \mathcal{E}^{MF}(\omega), \omega)$ that is just *financially feasible* post-merger fails to be so pre-merger. Indeed, we also have for such pair:

$$(\gamma m(e, e) - \omega) s(\omega, \omega) - \psi(e) = \tilde{I} + R^M(e) < \tilde{I} + R^D(e, e), \tag{29}$$

since $\frac{\partial m}{\partial e^*}(e, e) > 0$ so that the curve $(\mathcal{E}^{MF})$ lies everywhere above $(\mathcal{E}^{DF})$.

Figure 6 below illustrates our findings. Gathering all previous observations, we can thus state our final result.

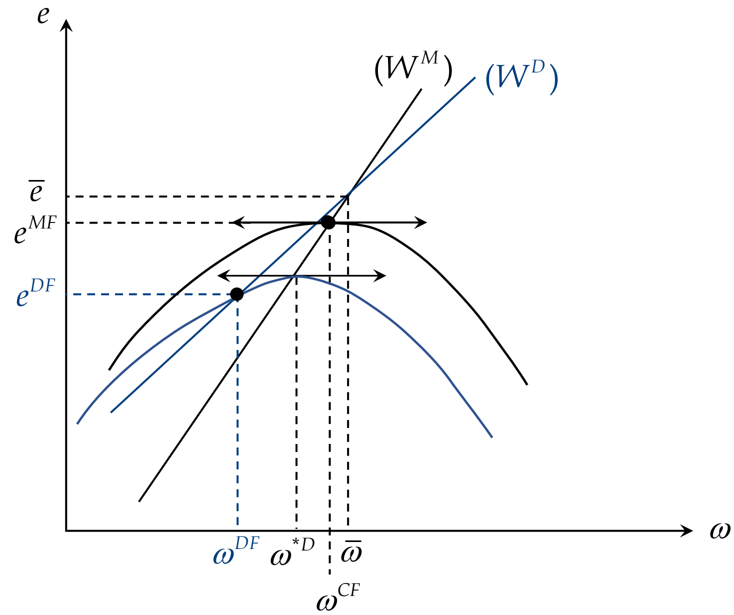

Figure 6: Welfare comparison.

Proposition 6. *Suppose that $\tilde{I}$ is large enough that (29) holds and suppose that $\bar{\omega} > \omega^{MF}$. Then, the post-merger allocation improves both the quality of content and the surplus left to advertisers:*

$$(e^{MF}, \omega^{MF}) > (e^{DF}, \omega^{DF}).$$

5 Conclusion

In this paper, we proposed a new model in which two free-to-air (FTA) channels compete in the markets for viewers and advertisers. We showed that, because of the existence of outside options on both sides of the market, two forces coexist when analyzing the effect of mergers. First, we identify a standard *Business-Stealing Effect*, which makes competition between *FTA* channels more likely to induce a high level of effort and, second, an *Ecosystem Effect*, which makes those channels more likely to jointly compete against the outside option for viewers and choose their effort accordingly. Assessing the impact of a merger amounts to comparing the strength of these two effects. In particular, we show that when the second effect dominates, a hypothesis that is quite reasonable considering the impressive growth of new Internet players, mergers can lead to a higher quality of content, greater consumer surplus, and higher profit for advertisers.

To perform our analysis, we made some assumptions that warrant discussion. First, on the *FTA* market, we neglect the possibility that other *FTA* channels exist and do not merge. The presence of alternative *FTA* channels would certainly affect our quantitive results but should have no impact on the existence of the two effects we highlighted. The main effect would be to lower the global impacts, both positive or negative, of any change in market structure. Second, we do not discuss the possibility that the mergers generate some economies of scale or scope in the provision of quality. Even if such a possibility is quite often limited by the competition authorities, it would be helpful to increase the quality of programming to benefit viewers and, in this two-sided industry, advertisers. Third, we assumed that the choice of both viewers and advertisers to opt for traditional vs. new media was nested, i.e., sequential. This assumption could be debated, particularly for advertisers because their level of commitment to one type of media is probably lower than that of viewers (who have to subscribe). As the main driver of our model relies on the choice of quality and this choice depends on viewers behavior, allowing advertisers to make their choice ex post would not fundamentally change our results.

We have modeled *FTA* channels as firms competing on quality, not only against one another but also against their paid and Internet competitors. One might argue that, for traditional media, diversity is also an important competitive tool. In this case, what could the consequences of a merger consolidating both TV channels be? Using ideas from Steiner (1952) (or, more recently, Anderson and Gabszewicz (2006)), it is commonly acknowledged that competing TV channels in traditional TV markets tend to duplicate their programs. However, for a few years, FTA channels have competed against both other FTA channels and many alternative options (e.g., pay-TV, $SVOD$). When the first type of competition is stiff, FTA channels tend to propose the median viewer's ideal program. When the second type of competition is more important, FTA channels tend to differentiate more, to avoid leaving all the niche segments to the alternative. We believe that the intuition we developed in our article would still hold in this framework with firms competing on diversity. Indeed, the incentives to offer diversified programming are lower when FTA channels compete than when they are coordinated. In this latter case, FTA channels would want to maximize viewer surplus in their core market to compete with the other competitors. This would imply that FTA channels will provide a higher surplus to their viewers when coordinating their activities, increasing their global market, to the benefit of viewers and, sometimes, advertisers.

To conclude, FTA channels evolve in a world of *"coopetition"* in which they compete against one another but also implicitly cooperate to preserve the sustainability of the traditional TV market against the new form of attention catchers, mostly Internet players. The more the sustainability of the traditional market is jeopardized, the more cooperation (in, e.g., quality, diversity) is needed. It is therefore up to the competition authorities to assess, case by case, what the most important issues are between preserving competition in the old TV market or preserving competition and the existence of traditional media in the global market for attention.

Appendix

Proof of Proposition 1. Conditions (2) and (3) are the necessary first-order conditions w.r.t. $\tilde{\omega}$ and $\tilde{e}$, respectively, for maximization problem (1). We assume that this maximand is quas-iconcave to ensure that those necessary conditions are also sufficient. □

Proof of Proposition 2. Conditions (8) and (9) are the necessary first-order conditions w.r.t. $\tilde{\omega}$ and $\tilde{e}$, respectively, for maximization problem (7). We again assume that this maximand is quasi-concave to ensure that those necessary conditions are also sufficient. □

Proof of Lemma 1. A financial contract between channel C and its outside financiers is of the form $(\bar{t}, \underline{t})$ where $\bar{t}$ is a reimbursement when C has obtained market shares $m(e, e^*)$ and $\underline{t}$ stands for the reimbursement otherwise. Those payments are counted per share of the upstream market. In other words, C's expected payoff is written as

$$(m(e,e^*)(\gamma - \bar{t}) - (1 - m(e,e^*))\underline{t} - \omega)s(\omega,\omega^*) - \psi(e). \tag{A1}$$

Because e is non-verifiable, the following moral hazard incentive compatibility constraint must hold:

$$\frac{\partial m}{\partial e}(e,e^*)(\gamma - \Delta t)s(\omega,\omega^*) = \psi'(e) \tag{A2}$$

where $\Delta t = \bar{t} - \underline{t}$.

We assume that channel C can pledge wealth W to finance the outlay I. The corresponding limited liability constraint is thus written as

$$W - (\underline{t} + \omega)s(\omega, \omega^*) \geq 0. \tag{A3}$$

Outside financiers participate in the venture whenever the reimbursements cover the investment outlay I, i.e.,

$$(m(e, e^*)\bar{t} + (1 - m(e, e^*))\underline{t})s(\omega, \omega^*) \geq I. \tag{A4}$$

We assume that channel C has all the bargaining power when dealing with outside financiers. The optimal financial contract must thus maximize (A1) subject to (A2), (A3) and (A4). Denote by $(\mathcal{P})$ this maximization problem.

Gathering (A2)-(A3) and (A4) immediately yields the following *Financial Feasibility Constraint*:

$$(\gamma m(e, e^*) - \omega)s(\omega, \omega^*) - \frac{m(e, e^*)}{\frac{\partial m}{\partial e}(e, e^*)}\psi'(e) - \tilde{I} \geq 0, \tag{A5}$$

where $\tilde{I} = I - W$ is the net investment covered by outside financiers.

Observe that solving $(\mathcal{P})$ also amounts to maximizing (A1) subject to (A5). Denote this maximization problem as $(\mathcal{P}^{DF})$. Whenever (A5) is binding, it must be that both (A2) and (A3) are also so in $(\mathcal{P})$. On the other hand, it can be easily checked that whenever (A5) is slack in solving $(\mathcal{P})$, there exists a pair $(\bar{t}, \underline{t})$ such that both (A1) and (A3) are also slack while (A2) still holds. Therefore, we can conclude that the optimal contract under financial constraints solves problem $(\mathcal{P}^{DF})$. □

Proof of Lemma 2. If (e^D, ω^D) were to satisfy the financial feasibility condition (FFC), we would have

$$(\gamma m(e^D, e^D) - \omega^D)s(\omega^D, \omega^D) > \tilde{I} + \frac{m(e^D, e^D)}{\frac{\partial m}{\partial e}(e^D, e^D)}\psi'(e^D). \tag{A6}$$

Inserting (3) into the right-hand side of (A6) and simplifying would yield

$$0 > \omega^D s(\omega^D, \omega^D) + \tilde{I};$$

a contradiction which ends the proof. □

Proof of Proposition 4. Consider a symmetric equilibrium (e^{DF}, ω^{DF}) that satisfies the FFC. maximization of the maximand in $(\mathcal{P}^{DF})$ yields $(e^{DF}, \omega^{DF}) = (e^D, \omega^D)$ in a symmetric equilibrium. When (16) holds, this cannot be. In this case, we must identify a solution to $(\mathcal{P}^{DF})$ that has (15) binding. It is immediate that the right-hand side of (15) and the maximand are maximized when

$$\omega^{DF} \in \arg\max_{\omega}(\gamma m(e^{DF}, e^{DF}) - \omega)s(\omega, \omega).$$

The corresponding first-order condition is thus given by (18) (while assuming quasi-concavity in (e, ω) of the maximand.) This is because (15) is binding and inserting the value of $\gamma m(e^{DF}, e^{DF}) - \omega^{DF}$ obtained from (18) into the right-hand side of (15), (19) must hold in a symmetric equilibrium. □

Proof of Lemma 4. The proof is similar to the Proof of Lemma 2 and is thus omitted. □

Proof of Proposition 5. The proof is similar to the proof or Proposition 4 and is thus omitted. □

Proof of Proposition 6. Immediate. □

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