Media Mergers in Nested Markets *

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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 discuss 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

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1 Introduction

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 Channel, HGTV, Eurosport) completed their merger deal last May, a deal just approved by the European Competition Authority. In India, Zee TV announced this December its merger with Sony's Indian subsidiary. In France, the two major private digital TV groups, TF1 and M6, tried to merge last year to better face the growing competition from their streaming and pay-TV competitors. This proposal, like the others, was motivated by the major changes occurring in the media sector. TF1 and M6 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 viewer's 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 the 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 consumers remains a matter of debate, and competition authorities tend to be conservative on these operations for lack of guidance in this type of environment.[1]

To fill this gap 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 analyzed 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 the 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 – an effort level determined by each FTA channel that we derive endogenously – and some idiosyncratic tastes that make each viewer more or less attracted to one of the channels. The advertising market has the same formal structure as the viewers' market, with a continuum of advertisers choosing either to focus on the FTA channels or switch to the alternative. Whereas the viewers are interested in the quality of the programming, the 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 FTA channels can attract, the higher the price they can charge.

[1]For example, the TF1/M6 merger was blocked by the French Competition Authorities.

In this setting, we compare two situations. In the first, 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 still operate in the market but coordinate on their choice of effort and price. The main difference stems from the fact that following the merger, the incentives to exert some effort to compete in the TV market decrease whereas the incentives to exert some effort to compete in the more global attention market increase. In other words, one must compare a *Business-Stealing Effect*, which makes competition more likely to induce a high level of effort, and an *Ecosystem Effect*, which makes the channels more likely to jointly compete for viewers against the outside option and choose their effort accordingly. When the competition between FTA channels is stiff while the threat from the viewers' outside option is moderate, the Business-Stealing Effect is strong. This makes each channel invest substantially in the noncooperative case, and a merger is likely to reduce the effort level and, thus, consumer surplus. When the competition between FTA channels is moderate while the threat from the outside option is intense, the Ecosystem Effect is strong. This makes each channel invests substantially in the cooperative case. A merger is likely to increase the effort level and, thus, consumer surplus.

The effect of such a merger on advertisers follows the same logic, with some complexities. Note first that what matters most for advertisers is not the price charged by the channels but the balance between this price and the benefit they derive from reaching consumers. This means that the impact of the merger should be assessed by investigating the net surplus left to the advertisers. Suppose that post-merger, the FTA channels choose a higher level of effort. This would increase their market share and the surplus each advertiser gains when opting for an FTA channel rather than for their outside option. How this extra surplus is shared between the

FTA channels and the advertisers will depend again on the comparison between the Business-Stealing Effect and the Ecosystem Effect, but now in the advertisers' market. If, the competition between the FTA channels in this market is intense, the merger will decrease the surplus left to the advertisers, whereas if the competition is mainly between FTA and paid-TV (or SVOD) channels, the merger will increase the surplus left to the advertisers.

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 TF1 and M6) 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 (2009)). We show that when the financial constraint is binding, the ecosystem and Business-Stealing Effects influence this financial constraint. In this case, again, when the first effect dominates, which is more likely for large financial needs, a merger between FTA channels improves both the quality of content and the surplus left to advertisers.

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 effect of advertising on consumers [2] 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 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.

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, in contrast with papers that investigate mergers in a one-sided setting (see, for example, Farrell and Shapiro (1990) and Werden (1996)). Dewenter, Haucap, and Wenzel (2011) propose a model of a two-sided

[2] 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 Media Industry.

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, platforms coordinating on the advertising side only. In this case, they show that the advertising rate increases but consumers' price decreases, increasing the latter's 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 participation by consumers 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 amount and price 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 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.

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, and Section 5 concludes the paper. All proofs are relegated to an appendix at the end of the paper.

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 the quality of its programs. In the upstream market, this channel attracts advertisers by selling access to its own viewers.

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 market shares.

• MARKET SHARES IN THE DOWNSTREAM MARKET FOR VIEWERS. Accordingly, we denote by $m(e, e^*)$, C's market share in the market for viewers. This market share depends on the two channels' effort, denoted by e and e^*, in improving the quality of their programs. We denote by $\psi(e)$ the disutility of effort with $\psi' > 0$, $\psi'' > 0$ and $\psi'(0) = \psi(0) = 0$. We expect the following monotonicity conditions:

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

- *Business-Stealing Effect.* $\frac{\partial m}{\partial e^*}(e, e^*) < 0$. This scenario captures the possibility that C^* steals market share from C by increasing its own effort. C^*'s effort thus exerts a negative externality on C.

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

In the sequel, our endogenization of market shares from first principles will highlight that, generally, the *Business-Stealing Effect* and the *Ecosystem Effect* coexist, albeit at different magnitudes. The key ingredient for this to be the case is that the ecosystem of FTA channels faces competition from other kinds of support with different characteristics.

- Market shares in the upstream market for advertisers. The FTA channels again compete with one another for advertisers in this market, 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, channel C enjoys a market share $s(\omega, \omega^*)$ in the upstream market, where ω (resp. ω^*) is the surplus left to an advertiser when the latter chooses channel C (resp. C^*).

When paying a price p to channel C to access a market share of viewers $m(e, e^*)$, an advertiser enjoys a net surplus worth $\omega = \gamma m(e, e^*) - p$,[3] for some $\gamma > 0$. Note here that this surplus depends upon two substitute variables, price and market share. This implies that a merger – or any structural change – that would increase the price but also significantly increase the market share could benefit the advertisers.

In other words, the outcome in this case is the same as if the contractual relationship between channel C and advertisers who choose this venue were entirely characterized by the net surplus pocketed by the advertisers, with the accounting convention that C directly enjoys the value $\gamma m(e, e^*)$ of the market share in the market for viewers. We will adopt a taxonomy similar to that used above for the upstream market.

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

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

- *Business-Stealing Effect.* Again, it may be that $\frac{\partial s}{\partial \omega^*}(\omega, \omega^*) < 0$. In other words, C's market share in the upstream market diminishes as C^* leaves more surplus to advertisers.

- *Ecosystem Effect.* Conversely, we may also entertain the possibility that channel C benefits from C^* giving more surplus to advertisers.

Equipped with these specifications, we may write C's profit as

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

where I is the level of investment that is requested to produce and distribute content.

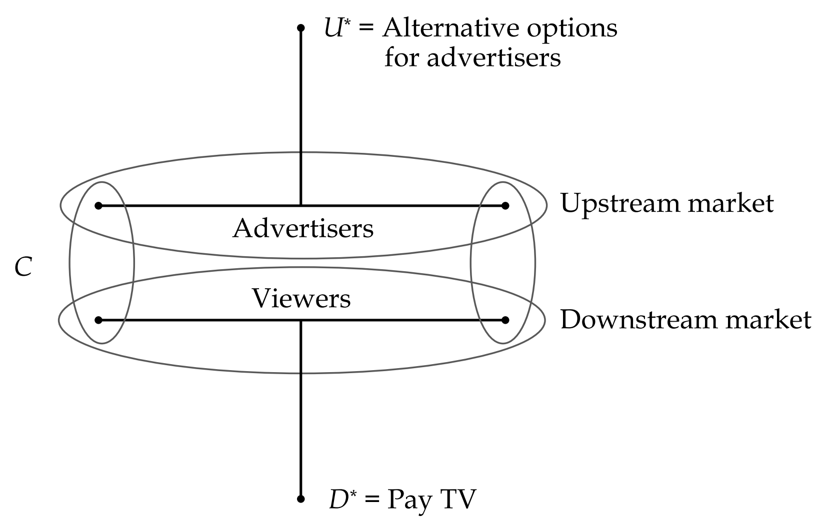

Figure 1: Market structure.

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

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

2.2 Market Shares

Downstream market for viewers. There is a continuum of viewers with unit mass. 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 sequential discrete choice problem that captures specificities of the TV market.

Suppose that a viewer has already chosen 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

$$G(\varepsilon) = \int_{\mathbb{R}} \tilde{G}(\varepsilon + \tilde{\varepsilon})\tilde{g}(\tilde{\varepsilon})d\tilde{\varepsilon}.$$

In particular, it follows from $\tilde{g}$ being symmetric that $G(0) = \frac{1}{2}$. The probability of choosing channel C conditionally on having already opted for FTA channels is thus

$$G(e - e^*).$$

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.

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

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

where $\tilde{\eta}$ is a shock parameter and v stands for the net surplus from accessing those alternative sources of content. For instance, if this alternative source is a pay-TV channel, we may denote $v = \tilde{v} - \tilde{p}$, where $\tilde{v}$ is the innate quality of content on this channel and $\tilde{p}$ is the price it charges.[4]

We first compute

$$\begin{aligned}\mathop{\mathbb{E}}_{(\tilde{\varepsilon},\tilde{\varepsilon}^*)}(\max(e + \tilde{\varepsilon}, e^* + \tilde{\varepsilon}^*)) &\equiv \mathop{\mathbb{E}}_{\tilde{\varepsilon}}\left((e + \tilde{\varepsilon})\tilde{G}(e - e^* + \tilde{\varepsilon}) + \int_{e-e^*+\tilde{\varepsilon}}^{+\infty}(e^* + \tilde{\varepsilon}^*)d\tilde{G}(\tilde{\varepsilon}^*)\right)\\ &= \mathop{\mathbb{E}}_{\tilde{\varepsilon}}\left(e + \tilde{\varepsilon} + \int_{e-e^*+\tilde{\varepsilon}}^{\infty}(1 - \tilde{G}(\tilde{\varepsilon}^*))d\tilde{\varepsilon}^*\right) = e + \int_{-\infty}^{+\infty}\tilde{G}(\tilde{\varepsilon})\left(1 - \tilde{G}(e - e^* + \tilde{\varepsilon})\right)d\tilde{\varepsilon}\end{aligned}$$

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

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

[4] For most of our analysis, it suffices to take this parameter v as given. When $\tilde{p}$ is a choice variable for pay-TV channels, new strategic considerations can emerge, but they do not alter the main tradeoff developed in our approach.

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 market shares.

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

or

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

Similarly, we may compute

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

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, it could enhance C's market share when the *Ecosystem Effect* dominates.

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 previous effort of the other in attracting viewers. The FTA channels thus have a common interest in attracting viewers away from other kinds of content providers. As a result, 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.

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

$$\bar{e} = \frac{\zeta}{4\mu} - \alpha \in [0,\bar{H}] \tag{1}$$

with $\alpha = \int_{-\infty}^{+\infty} \tilde{G}(\varepsilon)(1-\tilde{G}(\varepsilon))d\tilde{\varepsilon}$.

Finally, we compute

$$\alpha = \int_{-\infty}^{+\infty} e^{-e^{-\mu\eta}} \left(1 - e^{-e^{-\mu\eta}}\right) d\eta = \frac{1}{\mu} \int_{0}^{+\infty} e^{-u}(1 - e^{-u}) \frac{du}{u} = \frac{\ln 2}{\mu}.$$ [5]

Inserting into (1) yields

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

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

■

• *Upstream market for advertisers.* Our modeling of this market resembles that of the downstream market for viewers. There is a continuum of advertisers of unit mass. Advertisers can sequentially choose whether to target the audience of the FTA channels or an outside option. After choosing the FTA channels, advertisers decide to allocate their business between C and C^* according to the surpluses they obtain from those channels. Formally, a given advertiser is characterized by a pair of preference parameters ν and 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

[5] We have $\int_0^{+\infty} e^{-u}(1 - e^{-u})\frac{du}{u} = \varphi(1)$ when $\varphi(t) = \int_0^{+\infty} e^{-u}(1 - e^{-ut})\frac{du}{u}$. 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 $\varphi(1) = \ln 2$.

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

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

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

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

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 $\omega = \omega^*$,

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

where

$$\beta = \int_{-\infty}^{+\infty} \tilde{F}(\tilde{\nu})(1 - \tilde{F}(\tilde{\nu}))d\tilde{\nu} > 0.$$

We also compute

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

and

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

An increase in the surplus ω^* left to advertisers by C^* has two effects on C's market share. 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 a positive externality.

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

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

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

$$\bar{\omega} = \frac{\kappa}{4\lambda} - \beta \in [0, \bar{K}] \tag{2}$$

where

$$\beta = \int_{-\infty}^{+\infty} \tilde{F}(\varepsilon)(1 - \tilde{F}(\varepsilon))d\varepsilon.$$

We immediately compute

$$\beta \equiv \int_{-\infty}^{+\infty} e^{-e^{-\lambda\varepsilon}}(1 - e^{-e^{-\lambda\varepsilon}})d\varepsilon \equiv \frac{1}{\lambda}\ln 2.$$

Inserting the result into (2) yields the condition

$$\bar{\omega} = \frac{1}{\lambda}[\frac{\kappa}{4} - \ln(2)]$$

$\bar{\omega}$ 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 the $\bar{\omega}$ and therefore the more the Ecosystem Effect dominates the Business-Stealing Effect.

3 The Benefits of a Merger

In this section, we compare the equilibrium surplus in the upstream market for advertisers and the quality of content under two alternative scenarios. In the first, C and C^* adopt a noncooperative approach and choose (e, ω) and (e^*, ω^*) noncooperatively in Nash 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

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

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 surplus 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 $\mathcal{A}'(\omega) > 0$.

A merger between C and C^* is thus surplus-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 surplus levels ω and ω^* are chosen non-cooperatively and simultaneously by C and C^*, respectively.

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:

$$(e^D, \omega^D) \in \arg\max_{(\tilde{e},\tilde{\omega})} (\gamma m(\tilde{e}, e^D) - \tilde{\omega}) s(\tilde{\omega}, \omega^D) - \psi(\tilde{e}) - I. \tag{3}$$

Assuming the quasiconcavity 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:*

$$\gamma m(e^D, e^D) = \omega^D + \frac{s(\omega^D, \omega^D)}{\frac{\partial s}{\partial \omega}(\omega^D, \omega^D)} \tag{4}$$

and

$$\gamma \frac{\partial m}{\partial e}(e^D, e^D) s(\omega^D, \omega^D) = \psi'(e^D). \tag{5}$$

Those equilibrium conditions deserve some comments. Condition (4) shows that advertisers obtain only a fraction of the overall value of a match with the audience $m(e^D, e^D)$ that selects a given channel. Specifically, we may rewrite (4) as

$$\frac{\gamma m(e^D, e^D) - \omega^D}{\omega^D} = \frac{1}{\epsilon^d(\omega^D)} \tag{6}$$

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 (6) 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 (5) shows that each FTA channel trades off the marginal cost of increasing the quality of content against the marginal benefits in terms of a marginal increase in the value of a match. This last term is of greater magnitude because more advertisers are attracted by the resulting captured audience.

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

The two curves (E^D) and (W^D) are not *stricto sensu* best responses; they merely

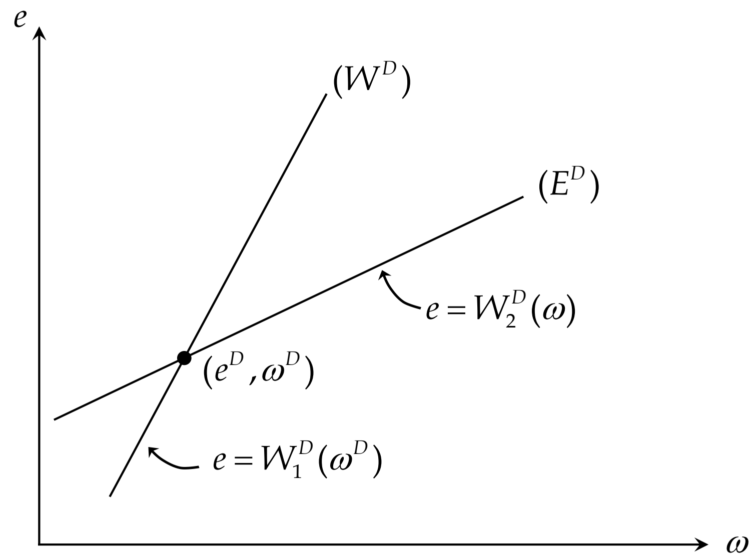

Figure 2: Best response: Pre-merger scenario.

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 (4) and (5), respectively, as

$$\frac{\gamma}{2} H(e^D + \alpha) = \omega^D + \frac{K(\omega^D + \beta)}{2f(0)K(\omega^D + \beta) + \frac{1}{2}k(\omega^D + \beta)} \tag{7}$$

and

$$\frac{\gamma}{2} K(\omega^D + \beta) = \frac{\psi'(e^D)}{g(0)H(e^D + \alpha) + \frac{1}{4}h(e^D + \alpha)}. \tag{8}$$

First observe that the *monotone hazard rate property* ($\frac{K}{k}$ nondecreasing) implies that (7) defines an upward-sloping relationship, say $e^D = W_1^D(\omega^D)$, between ω^D and e^D. Similarly, we also assume that the right-hand side of (8) is also nondecreasing in $e^D = W_2^D(\omega^D)$. It is straightforward to check that the quasiconcavity of the objective function (3) implies that W_1^D and W_2^D only cross once at (e^D, W^D) and when they do so, $W_1^{D\prime}(\omega^D) > W_2^{D\prime}(\omega^D)$.

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

$$(e^M, \omega^M) \in \arg\max_{(\tilde{e},\tilde{\omega})}(\gamma m(\tilde{e}, \tilde{e}) - \tilde{\omega})s(\tilde{\omega}, \tilde{\omega}) - \psi(\tilde{e}) - I. \tag{9}$$

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

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

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

$$\gamma m(e^M, e^M) = \omega^M + \frac{s(\omega^M, \omega^M)}{\frac{\partial s}{\partial \omega}(\omega^M, \omega^M) + \frac{\partial s}{\partial \omega^*}(\omega^M, \omega^M)}, \tag{10}$$

and

$$\gamma \left(\frac{\partial m}{\partial e}(e^M, e^M) + \frac{\partial m}{\partial e^*}(e^M, e^M) \right) s(\omega^M, \omega^M) = \psi'(e^M). \tag{11}$$

Comparing (4) and (10) 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 (5) and (11) 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 (10) and (11), respectively, as

$$\frac{\gamma}{2} H(e^M + \alpha) = \omega^M + \frac{K(\omega^M + \beta)}{k(\omega^M + \beta)} \tag{12}$$

and

$$\frac{\gamma}{2} K(\omega^M + \beta) = \frac{\psi'(e^M)}{\frac{1}{2} h(e^M + \alpha)}. \tag{13}$$

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) ad (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.

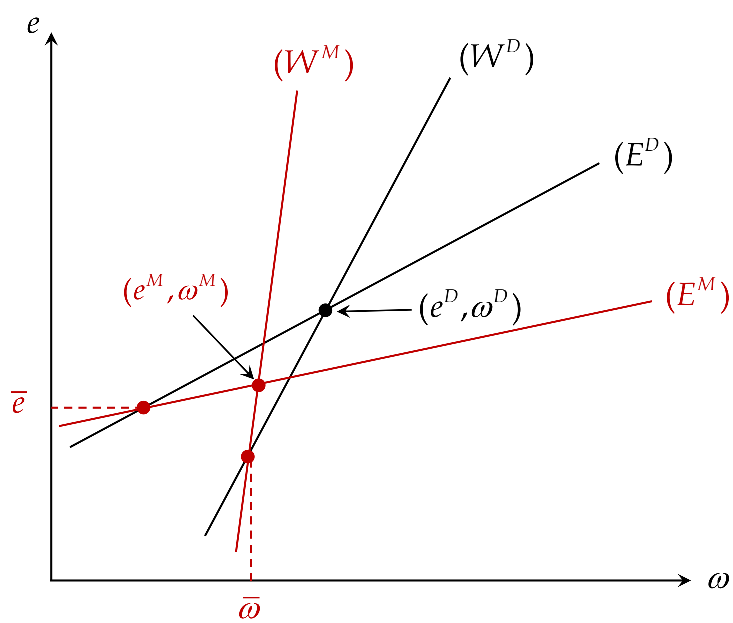

Figure 3a: *The Business-Stealing Effect* dominates.

We can thus conclude our analysis as follows.

Proposition 3.

- *Suppose that the Business-Stealing Effect dominates both upstream and downstream,*

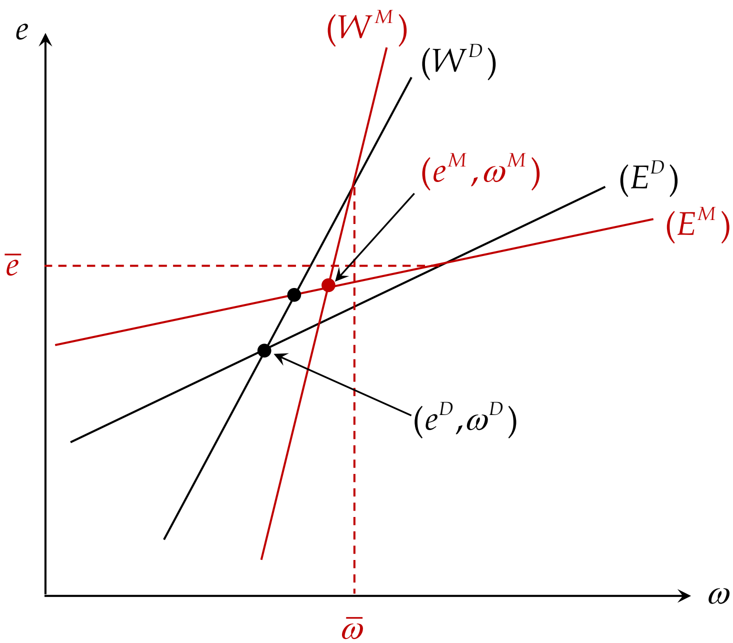

Figure 3b: *The Ecosystem Effect* dominates.

i.e., $(\bar{e}, \bar{\omega}) < (e^D, \omega^D)$*. Then, a merger harms both viewers and advertisers' welfare*

$$(e^D, \omega^D) > (e^M, \omega^M). \tag{14}$$

- *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.*

We have identified two forces in the competitive process, one 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. When the competition in the second market is more severe than that in the first market, then the merger can improve both consumer surplus and advertiser surplus.[6]

[6]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 $\bar{\omega}$.

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. When this is no longer the case, the FTA channels must raise part of those funds from outside financiers. Doing so comes with agency costs, the magnitude of which changes when those channels merge, as we will argue below.

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 when the borrower is protected by limited liability. Moral hazard comes with agency costs that make 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*

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

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

$$(\beta m(e, e^*) - \omega)s(\omega, \omega^*) - \psi(e) - \tilde{I} \geq 0. \tag{16}$$

In fact, the difference between the left-hand sides of (15) and (16) comes from the agency costs of moral hazard, which are written here as

$$R^D(e, e^*) = \frac{m(e, e^*)}{\frac{\partial m}{\partial e}(e, e^*)}\psi'(e) - \psi(e) \geq 0.$$[7]

This rent comes from the fact that the effort devoted to improving the quality of content is nonverifiable. 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 nonverifiable, 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 TV channel has a limited liability constraint that precludes the use of such a stick and,

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

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 $(\mathcal{P}^{DF})$:

$$(\mathcal{P}^{DF}) : (e^{DF}, \omega^{DF}) \in \begin{cases} \arg\max_{(e,\omega)} (\gamma m(e, e^{DF}) - \omega) s(\omega, \omega^{DF}) - \psi(e) - I \\ \text{subject to} \\ (\gamma m(e, e^{DF}) - \omega) s(\omega, \omega^{DF}) - \dfrac{m(e, e^{DF})}{\frac{\partial m}{\partial e}(e, e^{*})} \psi'(e) - \tilde{I} \geq 0 \end{cases} \tag{17}$$

Of course, the most interesting scenario is when the solution (e^{D}, ω^{D}) exhibited above does not satisfy (17), a fact that is confirmed by the next lemma.

Lemma 2. *The symmetric Nash equilibrium (e^{D}, ω^{D}) does not satisfy the financial feasibility condition (17).*

In other words, financial constraints always preclude the implementation of (e^{D}, ω^{D}).

More generally, the financial feasibility condition (17) is more likely to hold when agency costs are low and when profits in the upstream market are high.

A priori, satisfying (17) 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 (17) are maximized when channel C maximizes profits in the upstream market. In other words, conditional on a given quality of content, the same 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 quality 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

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

C being financially constrained will modify the quality of content, with the binding *Financial Feasibility Condition* (19) now replacing (5). However, the qualitative properties of the solution remain, as we will see below.

First, and to familiarize 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

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

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,

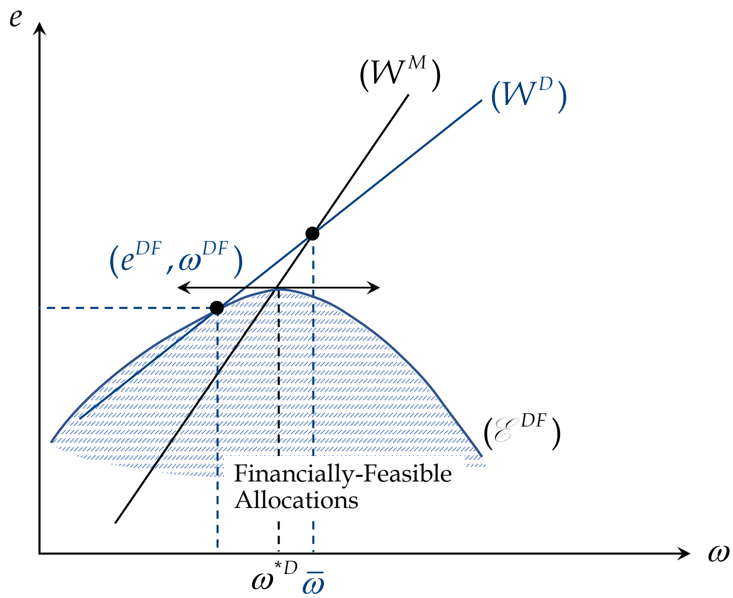

Figure 4: The pre-merger scenario with financial constraints.

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 insufficient surplus left to advertisers, namely

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

4.2 Post-Merger Scenario

Suppose now that 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 $e = e^*$ and $\omega = \omega^*$ to again internalize the *Business-Stealing externalities* both upstream and downstream.

The next lemma describes the *Financial Feasibility Condition* in that post-merger scenario while maintaining the assumption that e remains nonverifiable and that the FTA channels are protected by limited liability and can only dispose of liabilities worth W.

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 (15) 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 we assumed to be nonnegative. 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

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

In other words, when the *Business-Stealing Effect* dominates downstream, agency costs are greater when 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 share 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.

Equipped with the characterization of the *Financial Feasibility Condition* post-merger, we can now state the optimization problem that the FTA channels face in this 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.

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

Equipped with this condition, we are ready to characterize the constrained cooperative outcome as follows.

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

$$\gamma m(e^{MF}, e^{MF}) = \omega^{MF} + \frac{s(\omega^{MF}, \omega^{MF})}{\frac{\partial s}{\partial \omega}(\omega^{MF}, \omega^{MF}) + \frac{\partial s}{\partial \omega^*}(\omega^{MF}, \omega^{MF})} \tag{24}$$

and

$$(\gamma m(e^M, e^M) - \omega^M) s(\omega^M, \omega^M) - \psi(e^M) = \tilde{I} + R^M(e^M). \tag{25}$$

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*

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

The curve $e = \mathcal{E}^{MF}(\omega)$ now reaches a maximum at ω^{MF} since (24) and (25), and the allocation (e^{MF}, ω^{MF}) satisfies:

$$\gamma m(e^{MF}, e^{MF}) = \omega^{MF} + \frac{s(\omega^{MF}, \omega^{MF})}{\frac{\partial s}{\partial \omega}(\omega^{MF}, \omega^{MF}) + \frac{\partial s}{\partial \omega^*}(\omega^{MF}, \omega^{MF})} \tag{27}$$

and

$$e^{MF} = \mathcal{E}^{MF}(\omega^{MF}).$$

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.

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.

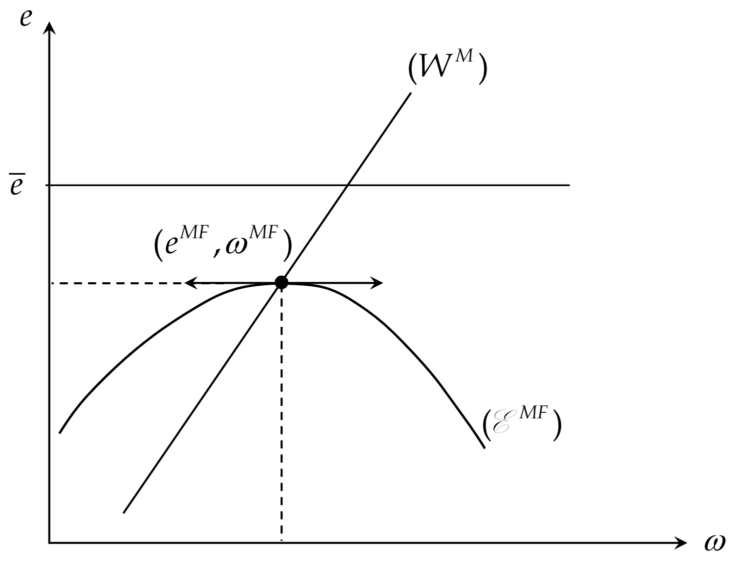

Figure 5: The post-merger scenario with financial constraints.

To reach sharp conclusions, we assume that the financial constraint is sufficiently hard. Formally, we suppose that

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

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* 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.

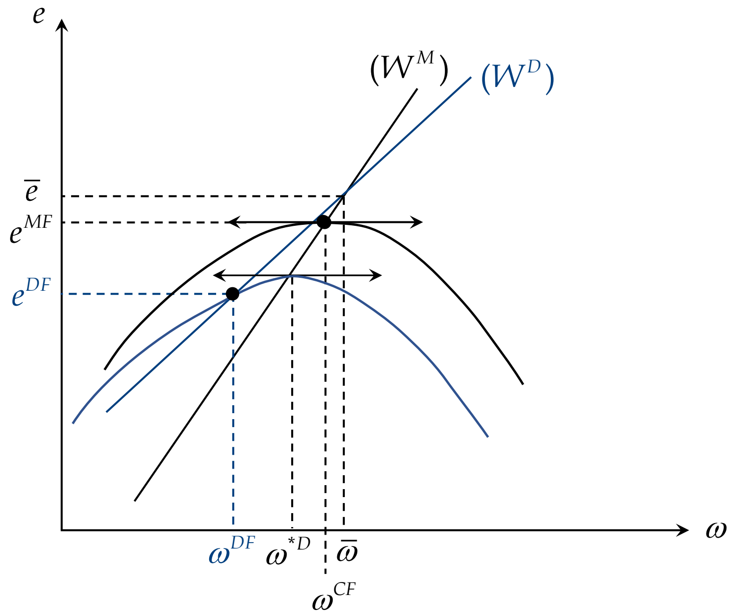

Figure 6: Welfare comparison.

Proposition 6. *Suppose that $\tilde{I}$ is large enough that (29) holds and suppose that $\bar{\omega} > \omega^{MF}$.*[8] *Then, the post-merger allocation improves both the quality of content and the surplus left to advertisers:*

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

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 more likely to induce a high level of effort and,

[8]Note that the condition for this to hold is the same as that studied in the previous sections.

second, an *Ecosystem Effect*, which makes the 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 the structure of the market. 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 consumers and, in this two-sided industry, advertisers. Third, we assumed that the choice of both consumers and advertisers to opt for traditional vs. new media was nested, i.e., sequential. This assumption can 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 consumer behavior, allowing advertisers to make their choice ex post would not fundamentally change our results.

We have modeled FTA TV 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 consumers 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 (4) and (5) are the necessary first-order conditions w.r.t. $\tilde{\omega}$ and $\tilde{e}$, respectively, for maximization problem (0). We assume that this maximand is quasiconcave to ensure that those necessary conditions are also sufficient. ■

Proof of Proposition 2: Conditions (10) and (11) are the necessary first-order conditions w.r.t. $\tilde{\omega}$ and $\tilde{e}$, respectively, for maximization problem (9). We again assume that this maximand is quasiconcave 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

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

Because e is nonverifiable, the following moral hazard incentive compatibility constraint must hold:

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

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

$$W - (\underline{t} + \omega)s(\omega, \omega^*) \geq 0.^9 \tag{A3}$$

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

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

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*:

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

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 $(\mathcal{P}^*)$. 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 $(\mathcal{P}^D)$, 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

[9] Observe that (A2) and (A3) taken together imply

$$W + (\beta - (\bar{t} + \omega))s(\omega, \omega^*) \geq \beta - \Delta t = \frac{\psi'(e)}{\frac{\partial m}{\partial e}(e, e^*)}.$$

Hence, if we were interpreting β as the "price" of a match between the audience and advertisers, the latter constraint could be interpreted as the limited liability (which holds) when a match realizes.

optimal contract under financial constraints solves problem ($\mathcal{P}^D$). ■

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

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

a contradiction that completes 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 (17) holds, this cannot be. In this case, we must identify a solution to ($\mathcal{P}^{DF}$) that has (16) binding. It is immediate that the right-hand side of (16) and the maximand are maximized when

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

The corresponding first-order condition is thus given by (18) (while assuming quasiconcavity in (e, ω) of the maximand.) This is because (16) is binding and inserting the value of $\gamma m(e^{DF}, e^{DF}) - \omega^{DF}$ obtained from (18) into the right-hand side of (16), (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. ■

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