

ESSAYS ON THE EFFECTS OF DIGITIZATION ON MEDIA ECONOMICS

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To Prof. Gilles Le Blanc - *Studere, studere, post mortem quid valere?*

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Introduction

Publishing Brands and Digitization: Strategic Issues and Key Variables.

Abstract

This paper moves from the economic issues raised by digitization and by the roll-out of an innovative support such as Reading Tablets on Press Magazine's market. The switch from a "physical analogic model" to a "digitized model", by separating the concepts of meaningful expression from the support allowing for publishing, imposes a rethinking of media industries' business models. Tablets may accelerate the switch, allowing for new versioning and bundling possibilities and increasing the willingness to pay for digitized media expressions. Starting from this set up, the paper analyzes the key economic issues emerging for magazine publishers facing digitization, both at the firm level and at the industry level, where new strategic interactions may occur, changing the traditional dynamics in the value chain.

Coping with digitization involves establishing new vertical relations and dealing with the multiplication of coordination issues on the distribution side. The paper identifies the economic issues emerging in this context for different types of brand with different business models. The objective is to show that efficiently exploiting the enhanced discrimination opportunities and emerging network externalities is a very complex issue for a publisher, especially during the start-up phase of a new distribution channel.

Keywords: media economics, digitized media, publishing, pricing, copyright, two-sided markets, multi-channel distribution.

Introduction

What would be the optimal bundling and pricing strategy of a magazine publisher if the digitized market keeps growing in double digits? Under what product-market conditions (market share, “switching” and marketing costs) would be more profitable to offer a specific digital version of a magazine? Would digitization “kill” the traditional distribution channels (through cannibalization, piracy, etc.)? After a decade during which magazines brands have gone on-line on free or *freemium* models, new versions are emerging through smartphones and tablet devices. These versions can be offered on paying models, which might be more beneficial to publishers. At the same time, the introduction on the market of a substitute media, with the same meaning but with different economic characteristics and distribution channels, raises important strategic questions for publishers. The objective of this paper is to discuss these questions, exploring the key economic issues and trade-offs faced by a magazine Publisher under different digital scenarios.

The economic issues raised by digitization of information goods have been largely studied by economists. Digitization (Shapiro 1998) of copyrighted goods have had a growing impact on Media industries since it allows for a much cheaper and faster circulation of contents, the drawback being the increase of transaction’s costs, cannibalization of traditional industries and the creation of new challenges for legal institutions such as massive piracy and Creative Commons. Varian, H. (1995) introduces the problem of pricing goods with heterogeneous evaluations and a cost structure with high fixed costs – or costs of the first copy – and negligible marginal costs. He shows how engaging in price discrimination and bundling techniques in these cases lead to a situation in which both the industry and consumers are better off. By differentiating the product the market can be segmented and revenues can be recovered also from user with low willingness to pay without destroying the value from segments of consumers with high-willingness. Deneckere and McAfee (1994) show that even the conscious use of product degradation can make all parties strictly better off under specific circumstances. In addition to differentiation, bundling is a price discrimination

technique which is particularly important when dealing with information goods and experience goods (Nelson 1970), since a utility evaluation can be made only after the consumption of the good and the heterogeneity in evaluations can be important. Bundling consist in offering distinct products for sale as one package. Nalebuff, B. (1999) shows how this tool is effective in auto-sorting consumers into different groups according to their willingness to pay. Bundling is effective, under specific circumstances, even if products are partial substitutes, as it is in the case of thematic channels in pay TV, or as it is likely to be the case with different versions of the same media¹. The effectiveness of multi-form bundling (a package composed of the same product declined in physical and digitized versions) has been studied by Koukova, N., Kannan, P.K. and Ratchford, B. (2008). They show that complementarities exist between different formats and consumers tend to value them positively proportionally to the awareness they have about the differences between formats. Bakos and Brynjolfsson (2000) show that the optimal strategy for information goods (with low marginal cost) is pure bundling, while Venkatesh, R. and Chatterjee (2006) have analyzed the magazine markets the magazine market finding that it is always profit-enhancing for publishers to offer digitized versions although the domain of optimality of pure bundling is more limited.

Despite all this contributions, Media companies are struggling to define their optimal marketing mixes in a context of increasing digitization. In the case of magazine publishing, the complexity of the profit maximization problem is increasing proportionally with the incertitude on digital scenario and the multiplication of versions and distribution channels. Each magazine has a characteristic utility function, embedding a number of characteristics and strategic choices, which needs to be adapted to each new version and to consumers' revealed preferences. Traditionally publishers have adopted a trial by doing approach in which the strategy is adapted ex-post following the accumulation of experience. This approach, which has been successful in the paper model, may no longer be sufficient to keep competitiveness in a digitizing market. Not only the choice of marketing mix becomes more complicated for publishers, but new avenues for placing the products appear continuously involving new agents in the value chain. The creation of new vertical relations and the multiplication

¹ See Gentzkow, M. (2005) on complementarities between physical and online newspapers

of products and distribution channels may reduce the efficacy of ex-post responsiveness to the market and may complicate the interpretation of data gathered from experience.

The paper thus reconsiders the strategic decision-making process in the context of multi-form products under the current technological developments. We outline the economic implication of the basic available digital strategies, and we analyze which type of publishing firm could benefit more from a given digital strategy, through the identification of some common characteristics and key variables. Moreover, we show that no general differentiation or bundling strategy can be defined as optimal for the whole industry under current market conditions.

The remainder of this paper is structured as follows: the economics of a magazine publisher producing both paper and digitized versions is presented in the next section. The third section introduces the available strategies and the related economic issues. Section four concludes outline the results of the analysis and tackling some emerging policy issues.

Digital Publishing: Market and Strategies

Magazines are publishing (and distribution) platforms, bundling collections of articles subject to copyright, selected, edited and published on a regular schedule under a publishing brand. They are generally financed by advertising, by a purchase price and by pre-paid subscriptions. The utility of this good is composed by expressions of various kinds (texts, photos, covered by copyrights) gathered within articles under a publishing brand and coupled with a support allowing for its diffusion.

Although generally included in the same industry, press magazine differs from news press for at least two crucial aspects: first of all, life-cycle, although short in both cases, is not the same for the two media. Magazines provide a different kind of information, enriched with in-depth elaboration. Moreover, magazines allow for more differentiation in term of formats, topics and prices, just to outline a few. For almost a decade, while digitization was limited to PC, magazines' publishers observed the evolution of the

digital market, perceiving it as an unprofitable niche and a limited treat, due to the low compatibility of digital supports with the exploitation of magazines' utility. Innovations such as smartphones and tablets have accelerated digitization of written expression creating a new, more appealing market for publishers. Notably reading tablets, which are conceived as a dedicated support for written or generally visual contents, have substantially raised consumers' utility from digital versions and allowed for more versioning and bundling opportunities.

Digitization of press magazines relaxes traditional constraints of the industry such as space, copying and logistic issues. This additional flexibility provides more strategic options to publishers. This may enhance discrimination opportunities but complicates the strategic decision-making process. The model focuses on two strategic decisions for publishers, which are particularly relevant:

1. Multiform marketing mix: digitization allows for the multiplication of versioning and bundling opportunities, complicating the strategic choice of the optimal marketing mix.
2. Organization of the retailing network: digitization opens the possibility of directly distributing contents and extending direct interaction with consumers. This implies a rethinking of the distribution channels and the retailing network, considering cannibalization issues among alternative choices

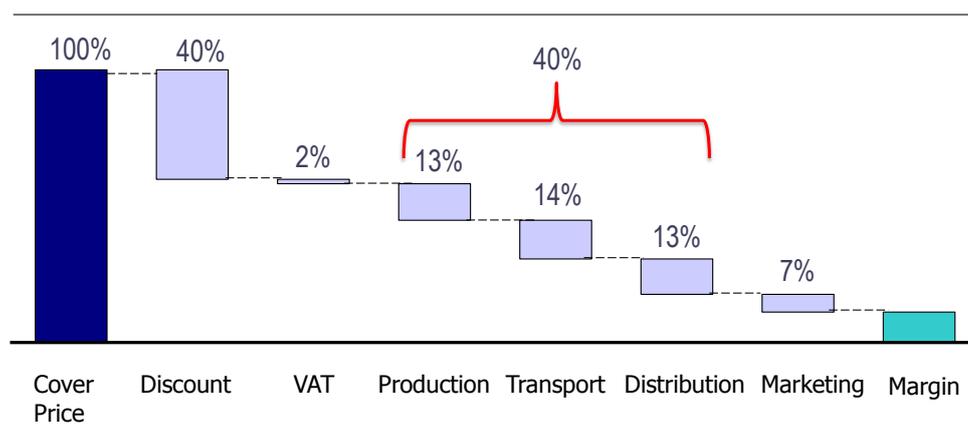
1. Multiform marketing mix

While the free or *freemium*² model of press websites has revealed not to be sufficiently profitable, mostly due to the redistribution of advertising revenues among medias, the potential development of paying digital versions represent an opportunity for media brands to seize. As shown in the graph below, digitized versions of magazines could reduce traditional marginal costs up to 40% of cover price. The tradeoff which needs to be calculated is whether these savings are sufficient to outweigh a number of emerging

² A business model which allows a consumer to receive basic services for free, but requires them to pay for any service deemed to be premium.

costs upraising with digitization. In order to exploit the opportunities offered by the digital market, a publisher needs to produce an investment effort (production and marketing of digital versions) that varies depending on the selected versioning and distributing strategy. Moreover, cannibalization³ effects must be carefully evaluated since each digital strategy may impact the traditional business model. Cannibalization is critical: not only it may reduce sales but, more important, it deprives the physical channel from economies of scale which are crucial for the business model. The fewer copies are sold, the higher becomes the production and distribution costs, as well as the fixed costs allocated to each copy. Moreover, digitization will impact first the more rentable zones with high densities, which are already equipped with broadband. Finally, digitized distribution fees needs to be paid to online retailers as well, unless a publisher set up his own digital retailing network. Estimations of the rate of technology adoption (potential market) and magazine-specific digitized market share are crucial to determine the optimal digital strategy for a publisher.

Magazine Cost Structure – Paper vs Digital Model*



* Weekly magazine subscription, France

Fig.1: Impact of dematerialization on a magazine’s cost function

The magazine market is structured as a monopolistic competition, in which each title has a share of the market including a base of loyal readers and a share of consumption

³ Cannibalization is the decreased demand for an existing product that occurs when its vendor releases a new and similar product.

by impulsion. The cost structure of a paper magazine includes important fixed costs – or costs of the first copy - related to editing and marketing. Marginal costs, related to quantity include mainly: cost of reproduction, logistics and distribution. Marginal costs accounts for 30% to 50% of the cover price. On the revenue side, publishing is a two-sided market in which both consumers and advertisers contribute to the global revenues for roughly 50% each in mean.

As said above, the introduction of digitized versions allows for more versioning and bundling opportunities. Digitized versions are substitute products of a paper magazine; nevertheless, different versions may have different degree of substitutability, due to their characteristics and the shape of consumers’ preferences. The table below resumes the characteristics, in terms of substitutability and revenues opportunities of the most common digitized versions.

Version	Revenues	Substitutability
Free website	Only advertising	Low due to format compatibility
Premium website	Subscription and advertising	Low due to format compatibility
PDF version on PC	Cover price and advertising	Medium
PDF version on tablets	Cover price and advertising	High
Smartphone app	Cover price, dynamic advertising	Medium due to low comfort
Tablet app	Cover price, dynamic advertising	High

Fig 2: Characteristics of Digitized Versions

Different versions can be combined, thanks to bundling techniques, to offer a marketing mix capable of discriminating efficiently. The most commonly offered bundles in publishing are:

1. **Bundle of editions (subscription):** consumer pays ex-ante the consumption of a certain number of editions of the same magazine at a discounted price. This allows reducing the risk for the publisher and allows for a better planning of capital investments. Publishers often charge subscribers at marginal cost or even lower. The low profits are compensated by the larger per number income from advertising.
2. **Bundles of titles:** one or more magazines are sold together with the main media as annexes.

Digitization increases the bundling possibilities eliminating physical constraints to the dimensions of the bundles. Moreover, it introduces a new bundling option:

3. **Bundle of versions,** allowing for multi-support consumption, basically unlimited access to magazines' content in time and space. This may include access to contents on up to "four screens" (namely TV, PC, Tablet and Smartphone) plus the paper version.

As in the case of versioning, each bundling strategy has different characteristics in term of profitability and emerging costs such as cannibalization.

2. Organization of the retailing network

Once a Publisher has decided to develop digital versions, he will have to establish a digital distribution strategy. He may decide to outsource distribution, in which case he will have to bargain with an independent agent to set a fee for this service. On the other hand he may choose to distribute directly through his own website. A digital distributor develops a digital offer and maximizes his profits. His profits are positively correlated with the quantity and quality (in terms of market share) of media available on his

platform. A digital distributor may exploit as well the available bundling strategies to create attractive offers and capture consumers' surplus. The market of digital distribution is characterized by barriers to entry, due to high fixed costs to set up the platform and to exclusive licensing contracts with publishers. This risks configuring the digital distribution market as an oligopoly. Moreover, the objective of the digital distributors may be different from the objective of the publishers, introducing an agency problem if the distributor is not directly controlled. To analyze the trade-off between setting up a digital retailing network and outsourcing digital distribution providing licenses to third parties, a number of economic effects need to be observed. Consider a Publisher facing a strategic decision for the distribution of digitized versions. If we exclude, for simplicity, hybrid strategies, the publisher is left with two options:

1. **Licensing.** Establish one or more contracts with digital distributors (same model as physical kiosks). This option implies lower investments (the only additional cost being eventually the implementation of specific reading applications for the different OS). Profits from selling would be reduced by a distributor fee which is usually calculated as a percentage of the cover price.
2. **Direct retailing.** A publisher may decide to sell independently the digital version of his paper magazine on his own distribution platform. This strategy implies a progressive switch to a digital model with potentially high cannibalization of paper sales. It embeds higher margins since the marginal cost of a digital version are null.

3. Advertising

Profitability of press, both paper and digital, depends also on advertising revenues. The observed advertising revenues for publishers in the digital markets are slightly lower than the equivalent in the physical market. This aspect is crucial and is responsible for the uncontrolled increase in the failure rates in the industry worldwide. The gap between online and offline advertising is not justifiable with technical reasoning. On the contrary, online advertising presents a number of advantages with respect to traditional

advertising. Online allows for sophisticated targeting of the audience and increased traceability and measurability. Despite these good features and the steadily increasing share of the global advertising investment that is moving through the internet the revenues that traditional publishers make online are very low. This gap can be a consequence of two factors. On the one side, the freeriding on brand investment made by digital intermediaries such as ISP, search engines, social networks, etc. These agents convey the traffic on their website using copyrighted contents or proprietary brands creating a transfer of surplus from the owners of these rights to the owners of the infrastructures. This trend, which has been tacitly approved by the policymakers in order to favor the development of the network, is now under serious questioning and the recent agreements signed by Google in France and Germany are a clear sign that we will observe consistent changes in the near future. The second factor is the multiplication of the offer of contents in the digital market, which is diluting both the market shares and the time spent on the single content by the consumers. The evolution of the regulatory framework and of the gap in advertising revenues between the digital and the physical markets is crucial for the strategic decisions and for the sustainability of many firms in the publishing industry. It deserves an in depth analysis that we will further develop in a later paper.

Bundling and Pricing Digitized Contents

This section analyses what marketing mix would be optimal for a given magazine as a growing share of consumers gets access to the new Media, in the literary sense of the support allowing for the exploitation of digitized contents. We also try to identify the implications of different pricing strategies of digitized versions for publishing firms operating in both markets. In the case of magazines' publishing, the firm's asset can be represented as a portfolio of brands, identifying different magazines. Each paper magazine is associated with a share of the global market, which is the result of the utility of the single content and the immaterial investment in the brand. The physical market is traditionally characterized by a few big players with relevant shares of the

market (above 1%) and a multitude of niche players with lower shares. For each brand included in the Portfolio, the Publisher may have to select a digital strategy.

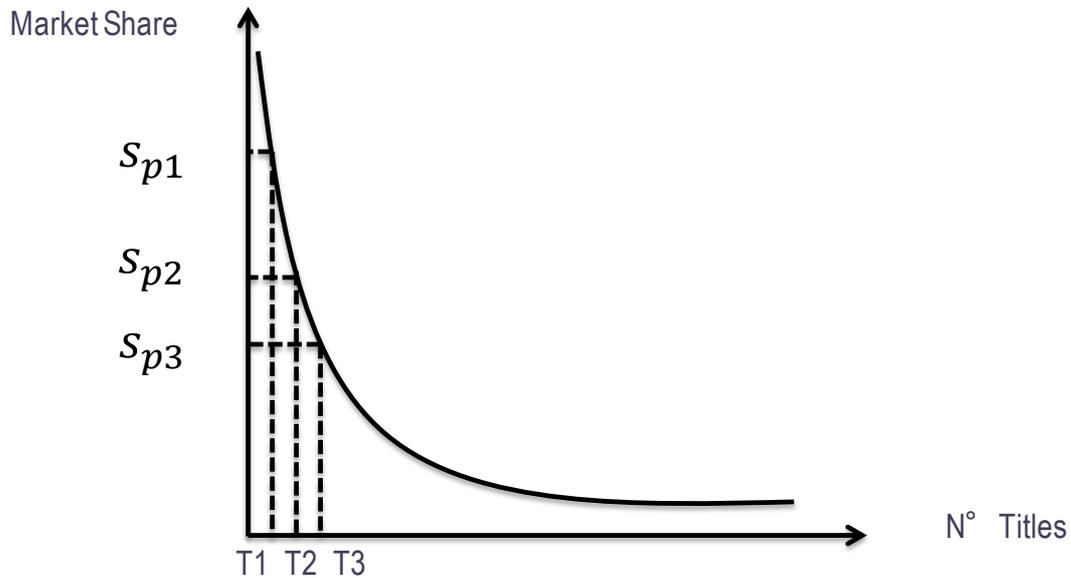


Fig 3: Representation of paper market and identification of publisher's portfolio

1. Definition of new agents, variables and space of strategic decisions

Excluding authors, we can simplify the emerging digital value chain to two rational agents:

- A Publishing Brand p
- A Digital Media Retailer r

Assume that the publishing Brand produces and owns the property rights of a magazine which is available in two versions: Paper or Digital. p is the only possible producer of the magazine but there exist substitutable products in the market, although not perfect substitutes. On the other hand r is a retailer that owns a platform allowing for the distribution of magazines in digital versions. If p chooses to distribute through r , it has to pay a distribution fee on each copy sold. The problem for p is to maximize his profit

function π_p , choosing the most suitable digital strategy and the appropriate pricing strategy for the different version of his magazine. Disregarding all the hybrid strategies, we can simplify the decision space of the publisher as follow:

1. In the first stage p decides, given his strategy in the traditional market, whether to enter the digital market
2. In the second stage, if she enters the digital market, the firm decides whether to distribute the digital versions directly or to outsource distribution to the retailer.
3. In the last stage, if p distributes directly, he chooses the marketing strategy and prices. To simplify again, we will assume that the available marketing mixes are limited to three pure strategies:
 - a. To sell the paper version and the digital version independently
 - b. To sell exclusively a bundle including both the paper and the digital versions
 - c. To sell both the paper version, the digital versions and the bundle

To resume, the model produces five possible outcomes, as outlined in the graph below:

- **Strategy1** (π_{ne}): *Not entering* digital market and keep doing with business as usual
- **Strategy2** (π_l): Outsourcing distribution of digital magazines through *licensing* to digital distributors
- **Strategy3** (π_{dr}): Setting up a direct distribution platform to sell the digital version of the proprietary magazine, a *direct digital retailer*.
- **Strategy4** (π_{pb}): Setting up a direct distribution platform but selling only the bundle composed of the paper and the digital versions of the magazine in a *pure bundling* strategy.
- **Strategy5** (π_{mb}): Setting up a direct distribution platform sell both the bundle and the digital version independently, in a *mixed bundling* strategy

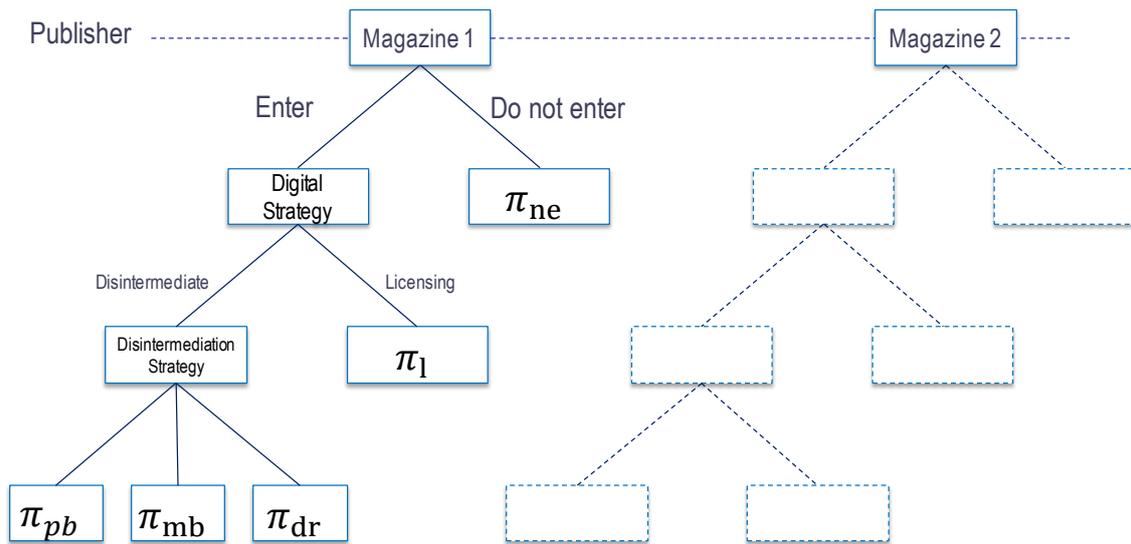


Fig 4: Sketch of the strategic decisions faced by a publisher

The above-mentioned strategies are likely to have different impacts on paper sales and on cost function. In fact, introducing a digital version of the same paper magazine is equivalent to introduce a substitute product in the market (at least partially) and will generate a cannibalization effect. Moreover, producing the digital version and setting up the digital distribution implies emerging costs. For example we can argue that every strategy introduces a cannibalization effect. This could be counter-intuitively at least for the non-entering strategy. We could think of at least three reasons to support this hypothesis. First of all, in order to access the digital version, a consumers need to be equipped with a specific device (costly). These consumers may be favorite magazine for a substitute if it is not available in digitized format. The second reason is that, as the digital market grows, the paper market is likely to keep a declining trend, which will impact sales on the traditional market. The third reason is the possibility of an increase of the costs in the traditional channel as the sector declines. As for the other strategies, licensing is likely to have the strongest impact on paper sales, since we are introducing in the market a substitute product and we are also introducing an agency problem since the distributor's maximization problem disregards the effects of his strategy on the traditional value chain. On the other hand, a pure bundling strategy will have no impact

since the paper version is always included in the bundle. The other strategies will have a cannibalization effect ranging among these two extremes. The debate on the cannibalization effect of the internet channel has been very rich. While many economists agree on a strong negative covariance between digital and paper sales, some other have found evidence that this covariance is not perfectly negative and that some complementarities can emerge among different Media, although both digitized and traditional products contains the same content. For example, in their recent study Koukova et al. have shown that the negative correlation is not perfect and can be reduced increasing the awareness of different usage functions among different versions.

As we said before, another issue can be represented by the fact that a publisher wishing to enter the digital market needs to invest in order to produce and promote his digital offers. Digital versions are commonly assumed to have zero marginal costs, but each strategy implies emerging extra fixed costs for the firm. We can assume that these costs will increase with the commitment in the digital market, and they are null if a firm does not enter the market or provides licenses to sell digital editions. As an example, setting up a direct retailing channel will be obviously more expansive than just setting up a digital format and then outsourcing distribution.

2. Demand and maximization problem with multi-channel distribution

The potential market consists of surplus-maximizing potential consumers who have heterogeneous evaluations of the magazine produced by p . The utility of the good for the consumer is revealed only after the purchase is made and the magazine has been examined. Moreover, consumers may have heterogeneous preferences for the format. Some of them may have a higher evaluation for the hardcopy for many reasons. They may value positively the marginal cost of the paper or they may like to keep the magazine for different reason. Some people even confess they like the smell of printed paper. On the other hand, a group of consumers may have a preference for the digitized versions, for example if they have invested in a specific digital reader. In such a context,

defining the maximization problem becomes far more complex for publishers than in the traditional market. In addition, the competitive environment and the regulatory framework of the two distributive channels may differ slightly. In the paper market, the publisher has a very good grasp of the dynamics of demand and of his competitors, he suffers limited piracy and free-riding, sometimes he pays less taxes and even receives public subsidies. On the other hand, in the digital market demand depends on totally new variables, the risk of piracy and free-riding is extremely high and taxation is usually higher for the same content, since in many countries a digitized magazine loses its status of cultural good and becomes an electronic good or even a service.

The first issue that we have already introduced is that the demand for digitized version depends on the diffusion of digital supports among consumers, especially among consumers with a high evaluation for the magazine produced by p . The second issue is that the market share of a brand in the digital market does not seem to reflect the share of the market in the traditional market. Since the whole offer is available for browsing on the same support, important masses of consumers may move to a different site or application in a very limited time. Traditional brands need to adapt and understand what drives these movements. Setting up a comfortable interface and adapted formats for exploiting the digitized contents is just a first step. In many cases many key processes of the firm have to be revised. For example, in the news press, we have observed the shift from a prevailing paying model with discrete timeframe to a free model with continuous timeframe. Digital journalists now need to produce news in real time, with very limited editing possibility, to attract consumer masses on their platforms. Some brands are now trying to propose new models, but the competitive environment is very unfavorable since many brands keep offering their contents free of charge and the differentiation of products is very limited by the real-time constraint.

Another issue for the publisher, if he decides to enter the digital market, is how to do it. In terms of cost there are two variables that need to be considered, both in the short and in the long term. On one side, the firm will be facing potentially high emerging fixed costs to produce and advertise the digital version. This investment should then be compensated by the savings on the marginal cost of production of digitized copies. On the other side, an effective control on the pace and amplitude of the shift to the digital market is crucial to manage the negative aspect of digitization. Investing more today to

keep the total control of the distribution through the set-up of a direct digital retail can prevent the firm from cannibalization and free-riding, but the competition with large digital retailers can become unsustainable in the long run. On the other hand, outsourcing distribution to a large retailer may increase the exposure of the brand and its diffusion in the short run, but in the long run, as the digital retailer increase his market power, may result in a transfer of surplus from the contents producers to the owners of the distribution network.

3. Strategic guidelines for publishers facing digitization

From the above discussion, it seems evident that there exists no unique optimal strategy for publishers facing digitization. The optimal strategy depends on the characteristics of the publisher, such as his market power in the traditional market and his capability of investing in the new market. In addition, it depends on the evolution of the digital market in term of size and regulatory framework.

In this section we outline in details the key economic implication of each of the digital strategies that we have previously defined above. Each strategy provides different discrimination opportunities and risks for a publisher. The problem for the publisher is thus simplifies to the selection of the strategy that generates the highest output for the firm between the available strategies (pure bundling, mixed bundling, direct retailing)

$$\max_i \pi_i: [\pi_{ne}, \pi_l, \pi_{dr}, \pi_{pb}, \pi_{mb}]$$

Let's analyze these outputs. We start from the bottom of the graph in Fig. 4 and we proceed backward analyzing all the decisions.

Strategy 3(π_{dr}) – Setting up a direct digital retailer

If the publisher decides to directly distribute digital versions, he needs to calibrate his investments and select a pricing strategy for the two versions. Beside the sum needed to set up and manage the digital retailer, the firm needs to establish a plan to advertise his own distribution platform at the same time taking in consideration the negative impacts

of cannibalization on the traditional retailing channel. One strategy could be to focus the strategy and the advertising campaign on enlightening different usage functions and complementarities within versions. Digitized version allow for more personalization, interactivity and for the addition of extra contents. Nevertheless, the introduction of digitized version sharing large chunks of the same content is likely to produce a cannibalization of the paper sales proportional to the diffusion of digital supports. As the digital market grows, the only variable that can drive this process is price. A common strategy in the industry has been to offer digitized contents at marginal cost (i.e. for free) on direct platforms. This strategy has not been effective for the hidden costs have not been calculated precisely by publishers. Offering digital versions for free, especially when the price of the hardcopy is positive, maximizes the shift of consumers to the digital market. If the model is based on the advertising revenues, to test the sustainability of the model the emerging advertising revenues should compensate not only for the investment made, but also for the direct and indirect losses in the traditional channel. Direct losses includes advertising and the margins lost on the share of paper sales that “gets cannibalized”, indirect costs could be the raise in marginal costs of production and distribution if the industry is subject to scale economies. The profit function of a firm offering the digital version for free can be represented with the extremely simplified expression:

$$\pi_{dr} = [(p_p + \gamma_p - c_p) \times (q_p - \alpha q_d) - FC_p] + [\gamma_d q_d - FC_{dr}]$$

Where the index p or d represent the paper or the digital version, p is the cover price, γ is the per copy advertising revenue, c is the marginal cost of production, $\alpha \in [0; 1]$ is the coefficient of cannibalization and FC is the fixed cost. In order for the pricing strategy to be sustainable, we must have:

$$\gamma_d \geq \frac{FC_{dr}}{q_d} + (p_p + \gamma_p - c_p)\alpha$$

Considering the condition for the digital market only, can lead to profit losses for the firm.

$$\gamma_d \geq \frac{FC_{dr}}{q_d}$$

Notice that if cannibalization is maximal, $\alpha = 1$, the per copy advertising revenues of the digital version should be higher than the total net margin per copy in the paper market $(p_p + \gamma_p - c_p)$. Th

Strategy 4(π_{pb}) – pure bundling strategy

A good option to mitigate this negative effect could be the use of bundling. Economists such as Bakos and Brynjolfsson (1999), Jeon and Menicucci (2006) and Nalebuff (2004), have analyzed the beneficial effects of this option for firms as a discrimination tool and as an entry barrier. The originality here is that we are not bundling different products or components, but rather different access to the same set of information. We call this multiform bundling. Bundling may help reducing cannibalization and consumers' heterogeneity in evaluations. On the other hand, the choice of a pure bundling strategy, which means selling only a bundle composed of both the paper and the digital formats of a magazine at a price which is lower than the sum of the two prices and is usually equal or higher than the higher of the two single prices, may imply an increase of marketing expenses in order to increase consumers' awareness of the added value (different usage functions) of a multi-support offer, as outlined in Koukova, et al. (2008).

An extreme pure bundling option that has been used frequently in publishing is to offer the digital versions for free to paper subscribers. This strategy allows for the total control of cannibalization and is a way of developing brand loyalty on the digital market. On the other hand, this strategy is costly for the publisher as the digital market does not produce any additional revenues, beside a potential expansion of the demand. In order to describe the profit associated to this strategy, we can write:

$$\pi_{pb} = [(p_p + \gamma_b - c_p) \times q_b - FC_p - FC_{dr}]$$

Where the index b denotes the bundle. With respect to the previous strategy, the cost for the company can be written as:

$$\Delta\pi_{pb} = (q_b - q_p)(p_p + \gamma_b - c_p) + (\gamma_b - \gamma_p)q_b - FC_{dr}$$

Where $(q_b - q_p)$ represent the increase in sales implied by the enhanced offer and $\gamma_b - \gamma_p$ represent the eventual increase in advertising revenues as a consequence of

increased diffusion. $\Delta\pi_{pb} \leq 0$ the strategy is profit enhancing for the publisher; otherwise it may still represent a possible initial digital strategy, since it allows a total control on the shift towards digital market. In addition, bundling reduces variance of consumers' evaluations for the different versions and allows for auto selection, allowing for testing of digital pricing strategies with a lower risk.

Strategy 5(π_{mb}) – mixed bundling strategy

The mixed bundling case is an intermediate strategy between strategy *dr* and strategy *pb*. The firm offers the paper and digital versions of the magazine as well as the bundle composed of both the versions. This strategy provides the publisher with a tool that can regulate the tradeoff between cannibalization and digital profits, better discriminating consumers with a high willingness to pay a specific version of the product. Since the optimal price of the paper version is already given when the digital strategy starts, by setting the price of the digital version and the bundle, the publisher can decide which objectives to pursue. Setting a higher price for the digital version or a lower price for the bundle will decrease cannibalization while increasing the price of the bundle and reducing the price of digital version will encourage the shift towards digital consumption. Increasing both the price of the bundle will reduce the quantity and profits in the digital market, this strategy can be used to slow down the switch to the digital market of consumers with a high evaluation for both the physical and the digital versions. This solution can be particularly effective if the indirect organizational switching costs are high. On the other hand, reducing both the price of the bundle and of the digital version will increase the demand in the digital market and the cannibalization of paper sales. This strategy is effective either to promote digital offers or if the firm expects a growing profitability for digital versions, for example an increase in γ_d or a favorable policy set by the government.

For a given p_p^*	Increasing $p_d > p_d^*$	Decreasing $p_d < p_d^*$
Increasing $p_b > p_b^*$	Economic impact: reducing total sales, slowing down digitization, reduced	Economic impact: Increase digital sales and cannibalization

	cannibalization	
Decreasing $p_b < p_b^*$	Economic impact: increases digital sales and reduces cannibalization	Economic impact: increases digital sales, accelerates digitization

Fig 5: The effects of pricing in a mixed bundling strategy

Having analyzed the output for the direct retailing strategies, we can move back one step on our decision space and analyze the tradeoffs that a publisher should consider before deciding whether to distribute digital versions or provide licenses to an external digital distribution.

Strategy 2(π_1) – Outsourcing distribution through licensing

As we said at the beginning of this chapter, r is a retailer selling digital versions of magazines. The retailer is already active in the digital market selling other magazines (or bundles of magazines). If r is given a license to distribute the good produced by p , he will get the control on the marketing mix, namely he will decide whether to offer the good in a bundle or as a single product or both. In order to distribute the digital content, r demands a licensee fee, usually calculated as a percentage on the cover price of each copy sold. The key differences between this model and the direct retailing thus:

1. Firm p does not need an initial investment to enter the digital market $FC_d = 0$, but her margin on the digital good is reduced to $(1 - x)_{dr}$
2. The publisher loses the direct control on distribution of her content. This has different economic implication.
 - a. On the one side the distributor gets in contact with the final consumer and canalizes the traffic on his platform. Exploiting the brands in his portfolio r becomes the recipient of a share of advertising revenues in the digital market which is hardly quantifiable for the publishers.
 - b. On the other side, the retailer objective function does not take in account the traditional channel and the retailer may try to put pressure on publisher to lower the prices of their digital versions

Moreover, if allowed to do so, the digital distributor will always have an interest in bundling the contents on his platform since this strategy would be profit enhancing for him. In fact, as shown in the bundling literature such as Nalebuff (1999), Venkatesh & Chatterjee, (2006), by bundling non substitutable products with null marginal costs, the firm is always capable of increasing her profits, exploiting auto-selection of consumers and introducing barriers to entry by leveraging the exclusiveness of his offer. While this strategy is certainly beneficial for the distributor, it may impact negatively publisher's profits. In fact, as seen in the previous section, lowering p_d increases digital sales but also the cannibalization effect on the traditional channel, with uncertain effects on the total profits of the firm.

Intuitively, being included in a bundle will be more beneficial for small publishers, which will be able to leverage their digital sales and free-ride on the strong brands within the bundle. On the other hand, participate in this bundle will be less beneficial for products with a high share of the traditional market, since they will be used as flagships in the bundle and will generate positive externalities on niche magazines that they are hardly able to internalize.

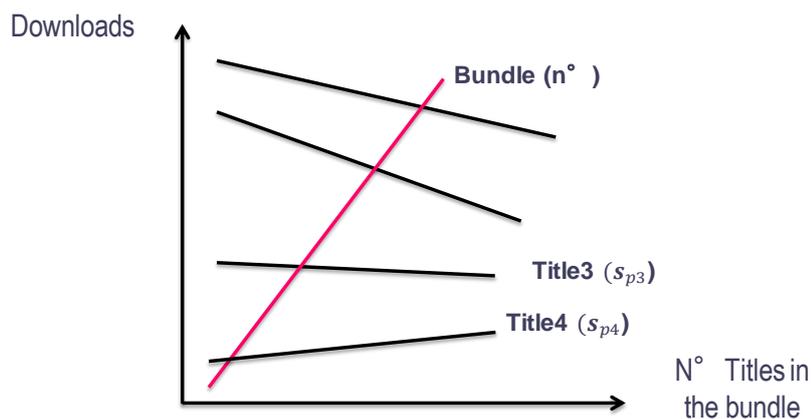


Fig 6: Externalities in an “all you can eat” type of offer

A recent survey from crmmatrix supports this intuition on consumers' behavior towards digital offers of the type known as “all you can eat” or “flat”: 75% of consumers' will download magazines they would have never bought in paper version. Among this, 42% have discovered titles they didn't know and are likely to keep downloading these new

magazines in the future. Finally, about 18% of consumers who discovered new titles have then bought a paper copy in the following period.

In order to mitigate this effect, strong publishing brands should establish very specific contracts with digital distributors, limiting their control on the marketing mix.

Strategy 1(π_{ne}) – Non entering the digital market

Having analyzed the economic issues behind every possible digital strategy, we can now look at the first strategic decision faced by a publisher; whether to set up a digital offer or to keep doing business as usual in the traditional market. The issue here is to model the effect of the growth of digital media markets on the traditional markets. The observation of previous cases and the economic literature clearly shows a negative impact of the growing diffusion of bit-encoding techniques on traditional media markets. In the last decade, digital media are attracting higher shares of advertising budget and people are shifting the allocation of their leisure time from traditional to digital media. Moreover, innovations such as smartphones and tablets have increased this trend. People with a high degree of preference for the new support may be willing to change their consumption habits if they cannot find a given content on their preferred support. Summing up, a publisher who decides to keep doing business as usual trades an uncertain result on the digital market for a very probable reduction on their traditional business. However, the strategy of limiting losses by not entering the digital market can be optimal for number of publishers with specific characteristics. A few examples:

1. Local free press, which relies on local advertisers which may find more convenient to invest in a limited area than to use sophisticated internet techniques to reach their target audience.
2. Magazines that target audiences with a very low preference for digital versions (i.e. third age press)
3. Luxury magazines, using special types of paper and pictures that cannot be reproduced digitally.

4. Regulatory framework and competitive environment

The last element that we need to analyze is the regulatory framework of the new market. As shown in the economic literature on multi-channel distribution and in this paper, when a new avenue of conducting business is set in parallel with the traditional distributive channel, two negative externalities are introduced in the business model: cannibalization and freeriding of immaterial investment. Non-homogeneous regulatory frameworks or competitive environments in the different retailing markets can increase the distortion in the market. In the case of digital publishing, we can identify two critical aspects related to heterogeneous or incomplete legislation

1. Taxation issues (or the different taxation of the same content).

The differential in gross profitability of physical and digitized versions, as we have seen, depends mainly on their different cost structures, on eventual distributor's fees, on consumers' preferences for formats and on differential in per copy advertising revenues. In order to calculate the net differential, we should add the differences in taxation, which can be observed in many countries. In fact, counter intuitively, the same content proposed in different versions can be subject to different regulations. In Italy and France, for example, a physical magazine benefits from the status of cultural good while a digitized copy of the same magazine is an electronic good, subject to regular taxation. We can write the net margin on paper copy as:

$$(p_p + \gamma_p - c_p) * (1 - VAT_p)$$

While the margin on a digitized copy reads:

$$(p_d(1 - x) + \gamma_d) * (1 - VAT_d)$$

We can use the differential in cover prices $\delta = \frac{p_p - p_d}{p_p}$ and substitute in the above expression to obtain:

$$\left((1 - \delta)p_p(1 - x) + \gamma_d \right) * (1 - VAT_d)$$

Setting the condition:

$$(p_p + \gamma_p - c_p) * (1 - VAT_p) = ((1 - \delta)p_p(1 - x) + \gamma_d) * (1 - VAT_d)$$

We can calculate the differential in cover price that equalizes the profitability of the two versions:

$$\delta = 1 - \frac{(p_p + \gamma_p - c_p) * \frac{(1 - VAT_p)}{(1 - VAT_d)} - \gamma_d}{(1 - x)p_p}$$

This way we can appreciate the effect of non-homogeneous taxation on the price differential that equalizes profitability. In the case of homogeneous taxation we have that:

$$\delta = 1 - \frac{(p_p + \gamma_p - c_p) - \gamma_d}{(1 - x)p_p}$$

While in the extreme case of $VAT_d \rightarrow 1$, or $VAT_p \rightarrow 1$ we have respectively that:

$$\delta \rightarrow -\infty \text{ and } \delta \rightarrow \frac{\gamma_d}{(1-x)p_p}$$

This differential is a strategic variable that needs to be considered while setting a digital strategy. The figure below shows the economic impact of setting a certain price for a version. The choice of a given differential should be done accordingly with the strategic objective of the firm. Setting an incoherent differential could otherwise worsen the negative externalities or reduce the effectiveness of a digital strategy.

Premium for paper version	Difference in marginality per copy
$\delta > 1 - \frac{(p_p + \gamma_p - c_p) * \frac{(1 - VAT_p)}{(1 - VAT_d)} - \gamma_d}{(1 - x)p_p}$	Paper copy has higher net margin
$\delta = 1 - \frac{(p_p + \gamma_p - c_p) * \frac{(1 - VAT_p)}{(1 - VAT_d)} - \gamma_d}{(1 - x)p_p}$	Equal margin for paper and digitized version
$\delta < 1 - \frac{(p_p + \gamma_p - c_p) * \frac{(1 - VAT_p)}{(1 - VAT_d)} - \gamma_d}{(1 - x)p_p}$	Digitized copy has higher net margin

Fig 7: The impact of taxation on net marginality of different versions

2. Policy issues (or the different regulation of the same content).

Taxation is not the only distortion introduced by regulation in the publishing industry. There are two other policy aspects which need an attention in order to create a level playing field. The first aspect is the regulation about vertical agreements. The recent cases in the U.S. and E.U., where publishers have been investigated for the establishment of tacit vertical agreements with a major digital retailer have outlined the different treatment that physical and digital media goods are subject to. While physical books market historically benefited from vertical agreements in various forms, regulation of e-books market has been more favorable to digital retailers in the last decade. Still immaterial investments are common for books in both physical and digital forms. While some countries have tried to homogenize regulation extending special provisions from the physical to the digital segment of the same industry (the law PULN on minimum retailing price for e-book), some others don't, generating more distortion between the two distributive systems.

The second policy issue is the revision of Copyright law, which does not seem able to protect intellectual property under current market conditions and to cope with the separation of meaningful content from a physical support allowing for its distribution. This aspect is vital for the industry and a more in-depth analysis of the economic effects of possible emerging regulation is left to a following paper. Nevertheless, we observe that the difficulty of conjugating the regulation with the new emerging business models has not permitted to create a convincing new framework yet. On the contrary, digitized copyrighted works are suffering the more and more since the uncertainty on property rights is coupled with confusing interpretations of the exhaustion principle (digitized copyrighted works are often sold as licenses, while their physical homologues are exchanged as goods). The only strategy available for publishers is to team-up with the providers of access to media catalogues. Distributors of digitized media and manufacturer of reading devices found that a way to protect and reward IP is the creation of non-compatibles, proprietary standards and environments such as kindle from Amazon.com or iPad from Apple. They are thus promoting "walled gardens" as an efficient way for protecting and valuing copyrighted goods. This solution is suboptimal

with respect to an efficient copyright law and presents intrinsic risks for the preservation of diversity in cultural industries since it leaves the authority on the intellectual property rights in the hands of private firms.

Conclusions

In this paper we have analyzed the economic issues raised by the development of digitized versions of magazines and then we have discussed the main available digital strategies for a publisher facing the emergence of this new market. After a decade in which almost every publisher created a free website offering exclusive copyrighted contents, the appearance of tablets has increased the utility of digital magazines and stirred up the offer and the consumption of digitized versions. The originality of the problem is that digitization introduces a new avenue of conducting business reformatting the same meaningful contents through bit encoding techniques. While the products share the same set of information and are thus close substitutes, the cost structures, the distribution dynamics, the competitive environments and even the regulatory frameworks differ slightly from the traditional to the digital market. Finding the optimal strategy to exploit this new market, exploiting the potential of a multiform marketing mix without devaluing the traditional value chain is not an easy task for publisher. We have tried to provide the reader with all the elements that are needed to take strategic decisions while dealing with growing digitization, starting from the evidence that there exist no optimal strategy that can be adapted to all publishers and all strategic objectives. As an example, the relevant investments needed to implement a direct digital retailing strategy may not be compatible with a niche publisher, while a well renown publisher may be reluctant to outsource distribution, since a digital distributors' may have an incentive to free-ride on her brand value to maximize profits. We have also discussed the strategic use of multiform bundling techniques to mitigate the negative externalities of multi-channel distribution with substitute products. By bundling different versions of a single brand and adjusting relative prices, a publisher can control the cannibalization effect on the traditional value chain and set her desired pace of growth for digital sales. Nevertheless, entering the digital market will not

necessarily be profitable for every publisher. In particular for some categories of magazines with specific local or social targets the optimal strategy may as well be not to enter the digital market at all, at least until the digital market will not be fully deployed. Furthermore, we have proposed a synthetic measure that allows calculating the price differentials that are compatible with the selected strategies with respect to objective parameters. Finally, we have discussed the main policy issues at stake and the effects they may have on a publisher's choice of his optimal digital strategy. The whole cultural industry suffers from the heterogeneity of the regulatory frameworks and from the inefficiency of copyright law since the beginning of the digital era. Distributors of digitized media found that a way to protect and reward intellectual property is the creation of non-compatibles, proprietary standards. This system seems effective but the lack of regulation and the loss of control from the authorities may result in a number of systematic risks in the long term.

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Chapter 1

Digital Media Economics: How bit-encoding techniques have changed the business?

Abstract

Media economics is undergoing a process of rethinking due to radical technology innovation on the support side. The originality of the problem is that digitization is quite not just a technologic innovation, improving efficiency through the value chain (search costs, copy costs, logistic costs, enhanced versioning, etc.), it is also a new written language. Bit encoding affects the meaning of copyrighted contents and their publishing protocols in many ways: unveiling model, creation of demand and resonance, temporality, appropriation and distribution of property rights, just to name a few. The study of these aspects is essential in order to fully understand the emerging economic models in media industries. In this paper we will explore some of the recent research efforts focusing on the effects of digitization and regulation on Media economics and in particular on the publishing industry. The main contribution of this analysis is that it tries to conjugate the economic literature that analyses technology related issues generated by digitization with contributions analysing the impacts of new publishing protocols, following a value-chain based approach. Economists will find in this article not only the more important contributions on pricing and bundling in digital two-sided markets or multi-channel distribution models, but also interesting contributions from other specialists, analysing questions related to regulatory framework and even epistemologic issues. The objective is to conjugate these contributions to provide researchers with a broader set of intuitions and a fresh approach. The main hypothesis is that fundamental questions such as: is an e-book a book or an electronic good and what will be the future competitive environment for a digital publisher, cannot be properly answered by focusing only on technical aspects of digitization.

Introduction

Bit encoding techniques represent an unrivalled opportunity to promote a wider diffusion of cultural goods. They allow for diffusing messages, images, music and videos with negligible copying and transport costs, both for correspondence or for publishing purpose. In order to deploy the social benefits (positive externalities) of digitalization, access to this technology needs to be provided to consumers. The support allowing for exploitation of digitized media is composed by a device capable of decoding strings of bits and a network connecting sources and receivers of these strings. Given these characteristics, digitization cannot be regarded just as a technical innovation. It is a new avenue for communication composed by a new support or “medium” (the internet) and a new language (the 0,1 alphabet). The advent of this innovation has permanently changed the traditional paradigms of Media industry. Moreover, the impact of these changes on the media value-chain is growing exponentially with the deployment of enhanced networks (such as ADSL) and the penetration in the market of new digital supports (smartphones, e-readers, etc.).

This article synthetize key contributions in different fields, related to the economic effects of digitization on media firms business models, with a value-chain based approach. The focus of the research is on the issues emerging for publishing firms that are active in the traditional media industries and approach the new avenues of conducting business offered by the internet channels. The originality of this problem is that it combines many fields of economics research: publishing is an example of a two-sided market and the introduction of digitized versions configures a multi-channel distribution of substitutable products. Moreover, the originality of information goods cost structure and distribution allows for profit enhancing bundling strategies but threatens the immaterial investment that are critical in the context of experience goods subject to copyright. In order to organize all these important aspect, we use a value-chain based approach, in which contributions are divided considering in which interface (i.e. interaction among agents) of the value chain they have an impact. Moreover, we consider two categories of effects for each interface: on the one side, the technologic

effects, defined as the changes generated by bit encoding techniques in the supply chain or in the industrial context. This include for example: gains in efficiency, reduction of transportation and production cost, new opportunities for price discrimination such as unlimited bundling or some drawbacks of online distribution such as increases in piracy and freeriding or cannibalization among competing distribution channels. On the other side, we address the effects of digitization which are related to the content of media goods, such as the creation of contents, their nature, their meaning, their publishing protocols and the distribution of property rights. These effects are slightly harder to analyse and to evaluate, since they affect the utility of media goods as well as customers' preferences and willingness to pay both for the new goods and for the traditional ones.

1.1. Overview of Research

To provide a visual mapping of this research, we can build a two-dimension matrix in which on one axis we describe the supply chain of a media industry and on the other axis we set the two categories identified in the previous section. In its most parsimonious form, a supply chain in the Media industry consists of authors, editors, retailers and customers (consumers of media or advertisers) who manage the bi-directional flows of goods, information and money. Digitization affects each interface in many ways. To simplify we try to regroup the effects occurring at each interface under one label, partially following the work of Cattani et al. 2005. We label the three columns corresponding to the interfaces in the supply chain as: procurement, distribution, and pricing. Regarding the lines of the matrix, we can label the categories of effects as technologic, if it does not affect the intrinsic characteristics of the goods or related to the publishing protocol if it does. We define publishing protocol as the set of transformations which are necessary in order to transform some meaningful expression in a media good. It is composed of different steps, the most important of which are: creation (transposition on an exploitable format), selection, edition (refining), risk evaluation, contextualisation, signalling, exhibition and critical evaluation. All of these

steps generate complex economic transactions and contribute to the bridge building between consumer and the evaluation of a media good.

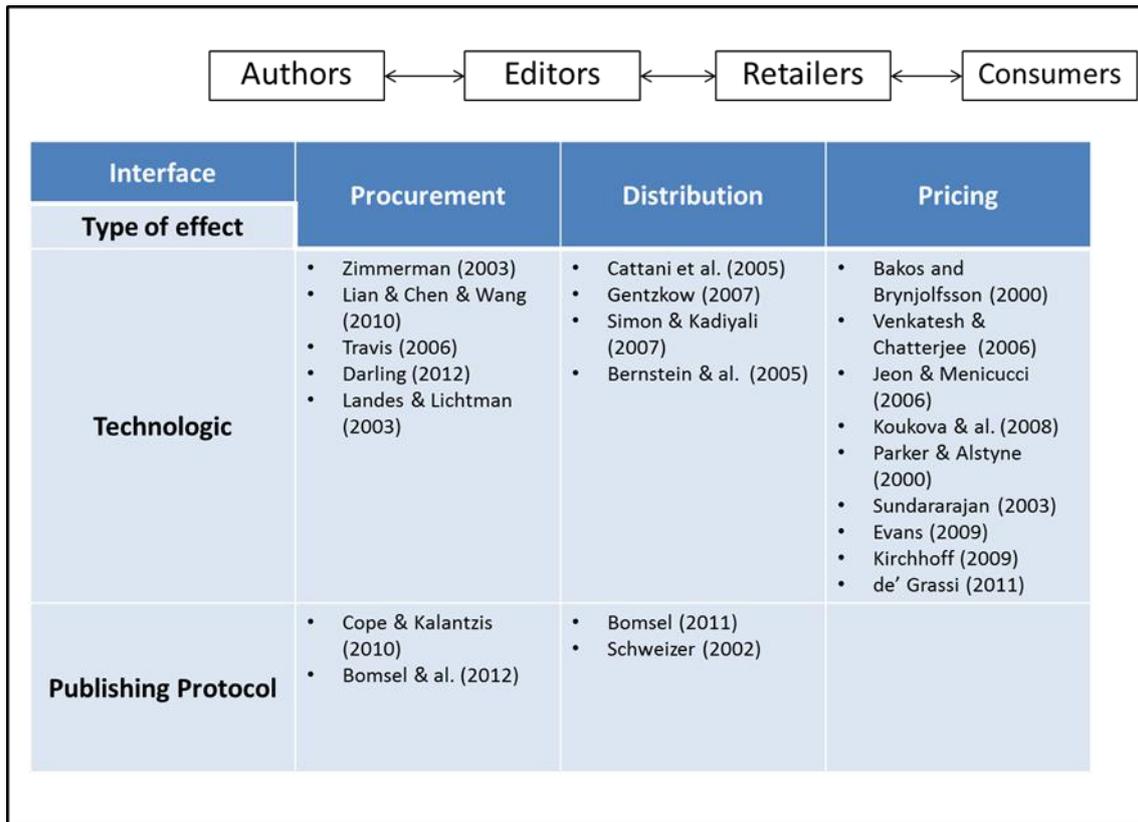


Figure 1: Map of research

In this paper, we identify and discuss research that has been conducted in each area. The amount of research produced in these areas is quite voluminous, we therefore focus especially our attention on papers analysing the publishing sector; this industry is undergoing large transformations due to the introduction of new digitized supports/network distributions (literally new “media”). For each interface outlined in the map, we highlight at first the results of recent studies on what are the effects induced by the technology on the supply chain. We then discuss the few papers that have tried to approach the problem starting from a broader question that is, what are the effects of digitization on publishing protocols themselves. The discussion on these field or research is still open and needs further development, which we will suggest at the end of this review. Figure 1 indicates the research papers that are discussed in detail in this chapter. For ease of exposition, we cover these areas roughly chronologically; first describing the effects of digitization on procurement, then discussing opportunities and

treats introduced by digitized distribution and finally addressing the different marketing and pricing issues emerging in the industry.

1.2. Procurement

Digitization has brought important changes in the relationship between authors and publishers. In the traditional model, the work of unknown authors would be reviewed by experts from a publishing firm. The ones with the highest economic or cultural potential would then be selected, put under contract and made available for a mass diffusion in a target, usually geographically determined, market. On the other hand, companies would compete to enrol famous artists to empower their brand and to signal the quality of their products. Thanks to the new technologies, an unknown or rejected work can now be literally “published”, or given to public, at very low cost and made available to the whole developed world through the internet, without any need of an editor. Moreover, authors may start growing or cultivate their audience by setting up a blog or a twitter account before even having physically published or produced any relevant work. They have the opportunity to by-pass the selection process by getting directly in contact with a digital distributor (Amazon, iBookstore, etc...). Their bargaining power with respect to publishers has potentially increased. On the other hand, the remuneration of published works is threatened by the ease with which works can be multiplied digitally. Copyright no longer seems capable of mediating between the interests of producers of works in getting paid for them and of their consumers in gaining access at a reasonable cost to what is produced. Moreover, digitized copyrighted works suffer from a lack of recognition and legislation. The problems are well known: unfavourable fiscal regimes with respect to their physical copies, widespread piracy, uncertainty on property rights and exhaustion principle (digitized copyrighted works are often sold as licenses, while their physical homologues are exchanged as goods). Finally, while bargaining power of authors has increased with respect to publishers, the bargaining power of an author with respect to a multinational digital distributor is infinitesimal.

One new role of publishers in the digital market is thus to federate authors and negotiate distribution conditions with the new agents in the value chain with relevant market power (distributors can often exploit larger economies of scale as well as control the access to contents in their networks).

1.3. Distribution

The deployment of network technologies based on bit encoding has opened new retailing channels for a large number of businesses. Digital distributors have a number of competitive advantages with respect to traditional shops: for example, they incur in lower costs for real estate, personnel and logistics. Moreover, they serve a global market without negligible transfer costs. In addition to this general features, in media industries digital distributors represent a differentiation opportunity, since they allow selling digitized versions of the same copyrighted products. The use of the Internet as an alternative distribution channel thus provides several opportunities to affect the interactions and performances of media industry's supply chain.

In order to manage the inevitable inclusion of the Internet as an integral part of the supply chain in a delicate industry such as the media one, which deals with experience cultural goods, subject to copyright, a number of strategic decisions and key variables, need to be analysed. The main strategic decision at the editor's level is whether to vertically or horizontally integrate digital distribution. This will determine the range of opportunities they have to coordinate different facets of the supply chain. This decision is affected by firm specific characteristics but also by a number of variables related to the digital market (i.e. concentration, consumer preferences) and regulation (i.e. copyright, network access and product group).

Starting from a standard abbreviated supply chain structure with a media editor selling products to a physical retailer, who in turns sells products to a customer through a traditional channel, such as a retail store or an industrial products distributorship, the basic options that are available for a Media editor to include digital distribution are the following:

1. Independent digital distribution: firm can establish cooperation with an independent digital distributor, such as Amazon, AppleStore or Google. (e.g. Gallimard)
2. Vertical integration on digital market: firm can open a proprietary internet channel to directly reach the customers of his products, forward integrating to provide an alternative channel that is under his direct control (e.g. New York Times and many other news brands)
3. Horizontal integration: physical retailer can use the capabilities of the internet to provide customers with multiple options for purchasing their products (e.g. relay kiosks network and its digital distributor relay.com)
4. Mixed competition on digital market: firm owns an integrated digital distributor but also provide his products to independent digital distributors (e.g. Feltrinelli)

1.4. Pricing

The last fundamental interaction occurring in the value chain is the determination of the pricing structure. Pricing in a supply chain that involves the Internet is affected by several important issues. First of all, the internet channel provides an alternative retailing channel, so pricing must be made in the context of a multi-channel distribution, which means that the risks of cannibalization and free-riding must be embedded in the pricing structure. Moreover, digitization causes an expansion of the marketing tools available as well as an enlargement of the product array of an editor. In particular, since the internet allows for a relaxation of space, copying and distribution constraints, this results in the multiplication of versioning and bundling opportunities available for a firm in the media industry. As for customers, they typically view the internet channel as an imperfect substitute for a traditional channel, meaning that differences in customers' expectations, format preferences or demographics must factor into any pricing decisions. These differences are themselves dependent on the degree of development of a network, which can be evaluated with the penetration rate in the population or with the share of media which are available for consumption in a given network. Finally the

emerging costs associated with the development of an internet channel may vary with respect to the distribution strategies and further complicates the pricing process.

2. Procurement

One major change caused by the development of digital platforms and networks in the media industry is the way in which procurement take place. Procurement can be defined for our purpose as the phase in which creators and editors of copyrighted contents bargain to settle the conditions for the economic exploitation of a media good. Digitization has certainly reduced transactions costs in this field and provided authors with a direct channel to publish their work. On the other hand, the separation of contents from their traditional support (book, cd, etc..) means growing possibilities of eluding copyright and uncertainty of regulation. These factors have further increased the risk of publishing for both authors and editors. In this section we present several papers that address important issues related to copyright issues in the digital era and regulation of digital media goods.

2.1. Models, Tools and Incentives for authors in the Digital Age

Most economists and lawyers agree on the fact that Copyright no longer is up to the job of mediating between the interests of producers of works in getting paid for them and of their consumers in gaining access at a reasonable cost to what is produced. The problem in economic terms is how to provide the right incentives, in the emerging market conditions, for artists to produce an optimal level of new works in terms of quality, diversity and quantity. Technology itself provides tools that can help excludability, such as indexing, encryption and watermarking. However, the necessity of reviewing legislation in many key aspects of digital market such as responsibility of intermediaries, accessibility of information, ownership and exhaustion is the most debated aspect.

Zimmerman (2003)

The author focuses the analysis on the Street Performer Protocol, one of the most interesting models based on voluntary compensation of artists, first introduced by Kelsey & Schneier in 1999. In this model, the author set a release price for a work, and commits to make it available in digital form, without copyright restrictions, once members of the public voluntarily contribute sufficient funds to meet the asking price. The releaser can of course be a publisher, which could be responsible, as in the traditional model, for selecting and signalling the quality of the future work and for internalizing transaction costs. The success of the expectations on the work would then become the key variable determining whether the work is actually released or not. Once the work is released, since it has already been paid for, it will then reside in the public domain.

The point of view of the author is that a public license for digital free use and distribution would solve the problem of authors' remuneration without the need of intrusive measures to police and prevent unmetered distribution. Furthermore, this limited license leaves open the opportunity for authors to exploit the most successful digitally published work in the traditional way with the advantage of knowing more about consumers' preferences. This model, besides its many interesting points, presents different problems from an economic point of view. First of all, the utility of experience goods such as books or music is revealed to consumers only after consumption, thus an ex-ante evaluation of the work made by the authors or a publisher is complex and will hardly match the revealed market value of the work. Moreover, the problem of information asymmetry will increase with the authors having an incentive in over promoting their work in order to reach the desired return. Finally, the future exploitation on the traditional channel of a content which is already public raises again the questions on whether a digital version should be treated equally, from a legal point of view, to the same content published on a different support.

Under current law, copyright vests automatically upon the fixation of a work in tangible (including digital) form; on the other hand, digital works are sold through licenses and are often regarded as "electronic goods", while physical works are regulated by ad hoc legislation regarding "cultural goods". Beside the complex general application of this

model as a substitute of the traditional publishing protocols, this example show that new way of producing media are available in the market. The Street Performer Protocol could apply, for example, to new publishing protocols in which ownership itself is under questioning such as blogs or tweets. With this protocol, consumers could reward authors through a sort of renewable subscription, which allow them to produce new contents and grow the number of readers as well as their loyalty.

Lian & Chen & Wang (2010)

The authors try to solve the problem of copyright in multimedia networks using technologic tools; more specifically, they set up a content distribution and copyright authentication system based on media index and watermarking techniques. Watermarking technique is commonly used to protect multimedia content's ownership. It consists in imperceptibly modifying the media good embedding the ownership information directly in the file. Once a media is watermarked, the ownership information can be extracted and used for authentication at a later point in time. In order to simplify the authentication process, the authors suggest that after the process, the robust features and content emendation are extracted from the watermarked media and registered in a feature database that constitute a database for copy detection so that it provides a filter for the file to be checked. Authentication of suspicious files becomes a smooth and immediate second step of the process. This system has the advantage that it is capable of detecting copyright infringements even if the file has been modified, for example through compression, rotation, shearing, scaling or translation.

The system proposed by Lian, Chen & Wang gives great results in terms of identification of authentic copies, but it does not actually solve the problem of authors' remuneration unless coupled with a regulation preventing users who have an authentic copy to share it as they would do with a physical book or video or compact disk. Moreover, regulation would need to provide the right incentives to digital distributors in order for them to apply these tools. In a digital market characterized by safe harbour status for distributors this system would not solve the issue.

Travis (2006)

In this article, the author discusses the legislation of fair use in the digital era based on the case of Google Books Search. It concludes that not only this service makes a fair use of copyrighted contents, but it has a positive effect both for publishers and authors by providing a solution to the paradox of experience good marketing . The arguments adopted are that Google service provides enhanced sampling possibilities for consumers, thus reducing the information asymmetry due to the characteristics of experience goods. Moreover, the author evaluates substitutability and finds out that it can be kept under control establishing limits on sampling and considering that the physical supports are not perfectly substitutable. In the authors opinion a digital sampling service does not have a negative impact on sales of book, like i-tunes 30 second sampling of songs. On the contrary, it has a positive effect for authors and publishers since it is a powerful marketing tool. Unfortunately the positive expectations of the model have not been realized in the last years, readers' and publishers' returns have been suffering constant reduction, since the introduction of Google Book Search. Two factors have contributed to mine the theory exposed in this paper. On the one side, the emergence of new digital technologies and networks have increased the substitutability between physical and digital versions of a media good, in particular concerning accessibility and comfort of reading. On the other side, in this article the author did not consider negative externalities of the application of traditional fair use and of digital sampling in the emerging competitive environment of digital media. An emerging trend is that the diffusion of digitized media, since they are all exploitable on the same support, has reduced the segmentation of media markets. On platforms such as tablets or smartphones, all media compete against each other more closely for the time consecrated to entertainment or learning activities by a consumer. Moreover, the search for information by samples is a new consumption habit that is steadily growing. Thus Google Search Book, by providing a large database of information without any compensation for the authors, can as well be included among the factors leading to structural decrease in sales of the industry. On the other hand, this service is undoubtedly beneficial for consumers in the short term since it has reduced the transaction cost to find information or books as well as providing an invaluable tool for the conservation of cultural heritage of human being. Nevertheless, we may argue whether the latter objective should be left in the hand of a private company which, by

following her objective of maximizing profits, may in certain cases be incentivised to distort the access to this worldwide bibliography.

Darling (2012)

In this work the authors analyse the approaches undertaken by the United States, Germany and France towards copyright law in order to deal with the problems of bargaining asymmetry and predicting the future success of creative works. While the former has instated author termination rights, some legal systems prevent authors from licensing the rights to unknown uses of their work. The perspective of the paper is a mix of law and economics. The conclusion is that surplus redistribution is likely to be unfavourable to authors if no action is taken to adapt copyright to the digital market. However, the authors find out also that restricting what she defines as “new-use-right grants” may not redress effectively this distortion in surplus reallocation. Since the prediction of the financial success of an experience good is rather complicated and subject to sudden changes during the timeframe of a contract, United States copyright law allows authors to grant publishers the rights to all known or unknown uses of a work. New media developments have prompted litigation and raised the issue of which exclusive rights should be implicitly licensed has never been resolved with consistency. In most European countries, granting rights to uses unknown at the time of the contract is prohibited. The objective of this approach is to ensure that authors are not excluded from unforeseen future returns because of incautiousness, inexperience, or lack of bargaining power in dealing with publishers. The author argues that this solution may have effects that counteract the legislative goals in the digital era. Restricting the grant of rights to unknown uses means that a new contract negotiation is necessary between author and publisher whenever a new distribution method or a new version of the product emerge. This renegotiation may resolve in consistent emerging transaction costs, especially if the number of negotiations is high or the emergence of new uses is frequent, as it seems to be the case in digital publishing in the last decade. This situation may put pressure on publishers’ margins without any benefit for authors or it may as well harm authors by decreasing the total number of rights transfers. In light of these results, restrictions on granting the rights to new uses in the digital era should be considered with caution, as they might not be suitable instruments for distributing

wealth to creators. The findings of this article thus confirm the difficulties of adapting traditional copyright law to a digital market.

Landes & Lichtman (2003)

The exponential increase of piracy in the digital media industry is partially caused by the uncertainty in responsibility for copyright infringement. When individuals infringe copyright on the internet, they often do that using tools, services, and venues provided by other agents. Thus before punishing infringements, regulation should establish to what extent private users and other parties such as distributors, ISP or others should be held liable for the resulting infringement. In this paper the authors introduce and evaluates from an economic perspective the main common law doctrines and statutory provisions in modern copyright law. The starting line is that unlike the Patent Act, the Copyright Act of 1976 does not explicitly recognize the possibility of indirect liability. Nevertheless courts have held third parties liable for copyright infringement under two long-standing common law doctrines: contributory infringement and vicarious liability .

A provision that has significantly expanded indirect liability is the Digital Millennium Copyright Act, which stated that it is illegal for a firm to manufacture, import, or provide to consumers a device primarily designed “to descramble a scrambled work, to decrypt an encrypted work, or to avoid technological measures used to protect copyrighted work. This provision is controversial since it holds a party liable for undermining technological protections even if no resulting act of infringement occurs. On the other hand, it is a clear recognition of the fact that traditional forms of copyright protection are not adapted to a digital market. The intuition on which it is based is, in fact, that many copyright owners use technology to protect their work since this sort of self-help is less costly and more effective than copyright enforcement. In the authors’ view, an efficient approach to indirect liability applied to a digital environment might start by applying a negligence rule to any activity that can lead to copyright infringement. Another critical aspect of regulation is the safe harbour provision. Thanks to this provision, Internet service providers and digital distributors have been immune from indirect liability until recent judgments against Ebay and Google. That has eliminated the risk created by an otherwise uncertain legal standard and has favoured

the development of a few large digital distributors in the digital market. Another authors' proposal for an efficient indirect liability regime, which is being discussed also in Europe recently, is to include a tailored tax applicable to particular tools, services, or venues associated with copyright infringement. The tax can be then used to compensate those agents which have been harmed excessively by the infringements. Indirect liability is not the only instrument to improve the efficiency of copyright in the digital era. The most obvious mechanism is to make adjustments to the scope and duration of copyright protection, or less obviously, to the criminal penalties now applicable to certain types of infringement. Another hypothesis is to set cash incentives put forward by the National Endowment for the Arts.

To summarize, the review of recent literature seems to suggest that technologic developments do not simply require the adaptation of traditional copyright tools; on the other hand, a deep rethinking of intellectual property rights exchange and protection is foreseeable in order to create a level playing field for authors and publishers in a multi-support and multi-distribution industry.

2.2. New perspectives in the economic analysis of digitization

Cope & Kalantzis (2010)

The authors explore key aspects of contemporary transformations, not just in the textual forms of digital representation, but the emerging social forms that digitisation reflects, affords and supports. They try to describe 'social web', a term the use to include in digitization the new relationships between knowledge and culture that are emerging in the era of pervasively interconnected computing. Then they use this analysis to evaluate the impacts and potentials of these changes on the processes of formation of new knowledge. In the first part of the article the authors review what is new and not new about the emerging regime of digitised text. Among the latter, authors name 'hypertext', considered nothing other than a version of the process of referencing, or the 'virtual'

aspect, which they suggest it is just a reincarnation of the modes of representation of distant people, places and objects that made books so alluring. On the other hand, among the truly new features of digitized contents, the authors include the economies of cultural and epistemic scale. Whilst something like one thousand copies needs to be sold to make a print run viable, there is no difference in the cost of one person or a thousand reading a web page, or a print-on-demand book. The consequence is that the amount of published and accessible content is rapidly growing and the average number of copies accessed of each academic work is declining (Waters 2004). These are ideal conditions for the development of every more finely grained areas of knowledge, cultural perspectives and localised applications of knowledge. The conclusion of the authors is that this change is so significant that knowledge itself may change. Another key feature is the intrinsic multimodality of the new media. Bit encoding make written words, images and sounds of the same zeros and ones of semiconductor circuitry. In what other ways might knowledge be represented today, and particularly in the areas of the sciences, the arts (Martin and Booth 2007) and design?

Finally, there is what authors call a shift in the balance of textual agency between the author and reader (Kalantzis and Cope 2008), namely a blurring of the boundaries between authors and readers. If print limited the scope for dialogue, the electronic communications web opens up that scope. Digitization has also changed the social relations of representation. Audiences have become users. The division of labour between the creators of culture or knowledge and their consumers has been blurred. The direction knowledge flows is changing. In fact, the flows are now multifarious and in many directions. Consumers are also creators, and creators, consumers. Knowledge and authority are more contingent, provisional, and conditional; they are more open to contestation and to critical reading on the basis of personal experience and voice.

The conclusions of the authors, is that to make the most of the new digital communications media, we need to move beyond the question of business models and the binaries of the commercial publishing/open access debate. The resolution will probably be found in hybrid models and a genuine pluralism of different solutions for different domains of knowledge creation. Open access publishing is likely to grow, and develop sustainability models based on explicit subsidy by institutions and research funders, and possibly also low cost author publication fees. Commercial publishing

needs to reduce its cost structures, and if the big publishers can't, innovative new entrants will. And then there will be hybrid solutions in which some knowledge is made available at no cost, and other knowledge at a price, all in the same space instead of today's bifurcated commercial/non-commercial spaces. Whatever the models of sustainability that emerge, in the author's view knowledge systems of the near future could and should be very different from those of our recent past. The sites of formal knowledge validation and documentation will be more dispersed. They will be more global, mainly using the lingua franca of English. The knowledge processes they use will be more reflexive and so more thorough and reliable. Knowledge will be published more quickly, and through semantic publishing it will be more discoverable and open to aggregation and reinterpretation. There will be much more of it, but it will be much easier to navigate. In conclusion, the author believes that it would be the responsibility of knowledge workers to realise the promise of the internet and to create more responsive, equitable and powerful knowledge ecologies.

Bomsel & al.(2012)

In this book the author analyses publishing industry with the objective of defining what the intrinsic meaning of the verb to publish is. This question is fundamental, in order to develop industry specific analysis or design policy measures in a context of structural changes imposed by digitization. The starting point is that media function is to make private expressions available for the appropriation of society. Media content, when published, is an edited object, adapted to a certain type of consumption, connoted with brands and labels, which provide it with a defined social usage. The dematerialization of books, sounds, images, movies, music, coupled with their real-time circulation on digital networks, obscure progressively these elements, these traditional supports of publishing. Moreover, the usage of the internet for correspondence and private transactions, ranged in social networks which are able to structure communities, blurs the borders of private and public in new ways. Mechanically attaching the attribute of information to any digitized string, bit-encoding technique has created a category of good which is common to all communication technologies. This category, by including in bits financial transactions as well as conversations, regulation as well as media, becomes often confusing, since strings of bits are immaterial; they represent costless

reproduction, infinite diffusion and free-lunch. As a consequence, this category becomes controversial when appropriation, transparency, privacy are in question.

The central hypothesis of the author is that digitization is a written language, a communication system based on a visual and spatial support capable of translating the meaning of language in a string of discrete signs that can be recognised and reused. In the digital era, digitization is the handwriting in which vectors of meaning are encoded and transmitted. The meaning transmitted by a media, however, is the result of accrued expressions, which take form only after its edition, when the « rotary press » starts working. It is the firm that transform natural expression in a work and the transition, which includes an effect on the meaning of the expression, is what the author calls the publishing protocol. The editor is the authority which gives a symbolic status to authors' expressions. The industrial transformation behind this institution is composed of different steps: selection, risk evaluation, contextualization, marketing mix elaboration, signalling, exhibition, critical evaluation, distribution, etc. Each step embeds complex economic transactions which contribute to create the utility of editing for consumers, the effect on the meaning. The economic impact of edition is thus significant in publishing, thus the author suggest that digitization may not abolish all kinds of publishing protocols, on the other hand it will create more protocols, because media never had such an important economic and institutional impact in history. The myths, brands, authors, actors, musicians, product, politicians that new media contribute to create have never been so powerful.

Another important question is the difference between publishing and posting. In the author's view, posting is not publishing. Making a file available online is not sufficient to create a demand for it. In media industries what structures utility is not quite the expression itself, but is the meaning of the media-good modelled through the publishing protocol. The intuition is thus that editing, which metaphorically can be described as decorating and create the value of decoration, in an overly-connected society requires a continuously growing investment effort. Digitization makes it harder for editors to perform their symbolic functions, which results in publishing, both from a practical and from an economic point of view

Economists have ignored this process for too long, concentrating research efforts on the organization of the supply chain and on transaction costs. The relationships between the firm and consumers that are systematically analysed are limited to vertical relations in distribution and pricing and advertising strategies. The questions related to publishing protocols, in the phase before the launch on the market, are often delegated to marketing experts. However, these operations which are informational and symbolic are associated to investments and risks, with scale and scope economies and with competitive markets with frequent innovations. Moreover, they are strictly connected with the distribution side of the supply chain of the products to which they add a value in term of meaning and mediatization. Finally, they create utility dynamics which require specific regulation. These processes are critical for firms' competitiveness and for territories since they make consumers pay for myths, imagination of products, allowing drifting away from pure price competition.

Among the conclusions of the paper, a number indicate interesting avenues for further thinking and research:

□ First of all the activities which compose publishing protocols and the media firms that contribute to the passage from expressions to media goods are substantially different from those of private correspondence. Research shows that these firms exist since the invention of handwriting, that they play an essential role in the organisation of societies and that they perform a variety of processes comparable to the variety of expression that they transform. These concepts are essential to model their economic function, their industrial organization or their market regulation.

□ The complexity of editing comes from the distance (in terms of time lag, physical distance, accumulation of meaning, etc.) between creation and public demonstration. This distance changes substantially among different publishing protocols. The distance generates a number of interactions, which need to be coordinated and organized with contracts, among agents in the publishing protocol.

□ The two key phases of each different protocol are: (1) accumulation, in which the architecture of meaning is established. (2) Display, is the phase in which expression is accrued and published. Editors are responsible for this phase, they validate the

publishing protocol. Only once the work is published, the commercial results come into play. The latter will be determined by the resonance of the work and its chronotope .

□ Digitization has reduced the business cycle of media industries by increasing infinitely the frequency at which publishing can occur online. Real-time information has reduced the attention and the utility of narrative chronotopes, which are constantly set on a time-lag with respect to present. In the author's opinion, the biggest revolution of digitization is thus not dematerialization of support but this reduction to real-time of the display phase of media contents. As an example, in the press industry this continuous need for "refresh" is producing negative externalities for it pollutes editorials articles and reduces publishers' profits eliminating the possibility of synchronized display of journals. The future of the industry will thus depend on the capacity of reconciliation, through bundle pricing, of the display phases and chronotopes of real-time information and editorials.

□ The media supply chain needs to be put under questioning by analysing where the creation of utility occurs. Decomposing the processes of creation edition and publishing the author identifies three economic issues: (1) The mediatisation allowing crystallising and disseminating the meaning of expressions; (2) the creation of value through accretion of context; (3) the institutions and regulations providing a framework for these operations.

□ On the regulation side, copyright is the institution entitled of protecting the accretion phase. It gives incentives to editors for investing in the accretion and financing the display phase. However, once the media-object gets published, it is published under a single or multiple publishing brands which are instituted to protect the investment made after the accretion phase. These two institutions are thus complementary and piracy affects both copyrighted work and publishing brand. Thus law makers should take a comprehensive approach when they try to design the instruments capable of protecting IP in the digital era.

□ The economics of mediatisation can be considered as a complementary good which generates utility by creating resonance for meaningful expressions. For some products, demand follows mediatisation, thus justifying intense advertising investments. For other products

3. Distribution

Digitization provides an alternative distribution channel, which can be added or substituted to the existing and which allows for selling products directly to customers. The internet is a viable option for selling traditional goods and, in the case of media industry, for the distribution of digitized works, which are substitutable products, although arguably not perfectly, for their physical homologues. This innovation thus affects in many ways the interactions and performance of media industries supply chain, further complicating firms' strategic decision. The new problem to solve is how to maximize profits, efficiently distributing an array of substitutable versions in a multi-channel scenario. On the demand side, typically customers view the internet channel as an imperfect substitute for a traditional channel and thus have different willingness to pay not only for different versions but also for different delivery modes. Moreover the costs associated with distribution through the internet are likely to vary from those of the existing channel, further complicating the analysis required to determine the optimal retailing structure for each product. In this chapter, we discuss the trade-off between the enhanced discrimination tools offered by digitization and the negative externalities caused by the introduction of a substitutable distribution network offering a larger array of products, in term of cannibalization and free-riding of investment.

3.1. Coordinating Traditional and Digitized Distribution

Cattani et al. (2005)

The author analyses a scenario where a firm with a traditional retailer adds a direct Internet channel that is in competition with the traditional channel. Initially, the firm chooses wholesale prices as a Stackelberg leader and commits to setting a direct channel retail price that matches the retailer's price in the traditional channel, in order to mitigate cannibalization. Under this general equal-pricing strategy, the authors study the

effects of different pricing strategies on profits. The strategies are: (1) keep wholesale prices as they were before, (2) keep retail prices as they were before, or (3) select wholesale and retail prices that optimize profits for the manufacturer. They found out that the latter may also be preferred by the retailer and customers. Another result is that the equal-pricing strategy is appropriate as long as the Internet channel is significantly less convenient than the traditional channel. If the Internet channel is of comparable convenience to the traditional channel, then the manufacturer has a strong incentive to abandon the equal-pricing policy, which results in a severe cannibalization of the traditional channel. The author's suggest an analogy to the parable of the boiling frog. The parable states that a frog thrown into a pot of boiling water will quickly jump out. But a frog thrown into a pot of temperate water may stay even if the temperature is slowly raised to boiling, leading to the untimely demise of the frog. By introducing an Internet channel with equal pricing, the firm places the traditional retailer in a mildly competitive position where the retailer may even benefit if the Internet is more costly and less convenient on average to the population of customers. However, when the costs and average convenience of the Internet channel become more favourable, then the manufacturer will be in a position to use the direct channel to undercut the prices in the traditional channel – and “boil” the traditional retailer. The model uses individual customers with linear utility, decreasing in the price and the channel-specific purchase effort of the product. At first, authors show that if a new channel is introduced by the firm, and she makes no adjustment to wholesale prices, then there is upward pressure on retail prices. Although the retailer faces increased competition (compared to the monopoly position of the base case), the competition effect is more than offset by the ability of the players to segment the market. With the addition of a new channel, some customers who were at a relatively far distance from the traditional channel will find the new channel to be convenient and will be willing to pay a higher price. Retailer will increase prices, extracting surplus from closer consumers. However, decreasing sales in the traditional channel, due to cannibalization, results in lower expected profits. The firm is constrained by equal prices, so she benefits only if her costs are sufficiently low that web sales are sufficiently profitable to offset reduced sales in the traditional channel. To sum up, the retailer is worse off in spite of the manufacturer's efforts to minimize cannibalization. On the other end, if the firm sets the wholesale price so that retail prices will remain unchanged, then this wholesale price will be lower than the

prior price. This strategy results in higher expected profits for the retailer, while the manufacturer experiences higher expected profits if and only if the costs in the new channel are sufficiently low. The introduction of the new channel in this case benefits to customers with a low web effort. All of the original customers continue to buy but market penetration is larger due to increased differentiation. Meanwhile, the reduction in wholesale price more than compensates the retailer for the loss of those customers who were willing to buy in the traditional channel but now switch to the direct channel. Finally, by allowing both the wholesale price and the retail price to vary, the authors find that firm's profits will be greater than in any other strategy. If costs in the new channel are sufficiently low, the retail price will be lower than the base case. However, if web channel costs are sufficiently high, the retail price that maximizes supply chain profits exceeds the base case retail price, even though double marginalization is eliminated. Other things being equal, higher web-channel costs reduce the average profitability of sales over the two channels.

To sum up, the introduction of a direct channel can harm or benefit the retailer. Surprisingly, the retailer prefers the scenario where the firm acts optimally in terms of her own objectives. While average retailer profits decrease notably under fixed wholesale price, they increase slightly under fixed retail price and grow substantially when the firm maximizes her profits. The objectives of the manufacturer and the retailer are connected through the manufacturer's commitment to matching the retail price set by the retailer. In this model, if free to set a different price on the web channel, the manufacturer would almost always want to price much lower on the web channel. Finally, if the web channel becomes more convenient over time, the firm has more incentives to undercut the retailer. The authors cite the music and software industries as examples of this behaviour, stating that by allowing differential pricing across the two channels and using her advantage as Stackelberg leader, the firm can sharply increase profits to the detriment of the retailer. Unfortunately, the predicted increase in profits for firms in the media and information good industries has not been observed in practice. While differentials in price have been observed, these have not resulted from strategic behaviour of firms but rather from higher pressure on retail prices in the new channel, due to increased competition among products, to the increasing market power of large digital distributors and even to devaluation of media goods caused by the

availability of cheap (or free due to illegal distribution) substitutable products. All these key factors are ruled out by this model in which the new channel is under direct control of the firm and has no competition, unlike what is observable in the market. Moreover, the authors do not consider in their analysis the negative externalities caused by the introduction of the new channel due to the freeriding effect on the investment in the traditional channels. These investments, especially for media industries such as publishing, are fundamental to create the resonance around new products as explained in the previous section. Cutting traditional retailers out may have negative externalities both on the variety and on the quality of media production.

Gentzkow (2007)

The author develops a model to study empirically the competition between hardcopies sold through traditional distribution channels and online versions sold through a direct digital distributor. Drawing data on newspapers' market, he estimates the relationship between the print and online papers in demand, the welfare impact of the online paper's introduction and the expected impact of charging positive online prices. The debate on the degree of substitutability between old and new products has always been an important input to many policy studies. More recently, policy makers have focused on substitutability between physical and digital products, for example on whether vertical agreements should be tolerated for industries with substitutable distribution channels.

In this paper the author extends techniques for estimating the impact of new goods, allowing for goods to be either substitutes or complements. The discrete demand model that he develops permits consumers to choose multiple goods simultaneously and allows the demand-side relationship between each pair of products to be freely estimated from the data. The results show that properly accounting for consumer heterogeneity both reduced-form OLS regressions and a structural model without heterogeneity suggest that the print and online editions of a newspaper are strong complements. In contrast, estimating the full model with both observed and unobserved heterogeneity, the author finds that the print and online editions are significant substitutes. Moreover, the author develops two approaches to estimate the effects of charging a positive price for online contents which are usually provided free of charge. The first approach assumes that the firm may be setting the price of the online edition sub optimally, and ask whether

profits could be increased by charging positive prices. The result is that, for the period under study, the optimal price is indeed positive, so the firm experiences some losses from charging the suboptimal price of zero. The second approach supposes that the zero price is optimal, and ask how large transactions costs would have to be to rationalize it. The result in this case is that a zero price would be optimal for any transaction cost higher than a threshold. Moreover, the author shows that because of growth in online advertising demand, the gain obtainable raising online prices was eliminated by 2004. This suggests that the zero price may have been part of a rational forward-looking strategy and is approximately optimal today. To sum up, the author finds that print and online versions are clearly substitutes; however, he finds that the magnitude of the crowding out of print readership is relatively smaller in his sample. His conclusion is thus that the advent of online newspapers does not appear to threaten the survival of print media. Moreover, he finds out that welfare benefits of the online newspaper appear to outweigh its costs since consumers gain from free provision of the online paper, and although the firm appeared to suffer a net loss during the 2000–2003 periods, an improved advertising market could outweigh the calculated annual effect on firm profits. Finally, the authors find that in the period under study, the firm could have increased profits by charging a positive price for online content. Both three conclusions have not been confirmed by the trend of the industry in the years following this paper. Digital distribution has proved to be a serious treat for print versions, with a boost in failing rates among traditional newspapers. Moreover, total welfare effect has not been so clear. The access to digitized information on the net is not completely free, on the other hand the remuneration has been progressively transferred from news providers to service providers or search engines or social networks exploiting media contents. The positive effect on profits due to increased advertising demand has never out-weighted the total costs for firms (cannibalization of paper sales plus investment plus organizational costs). This is due to the much lower rates which advertisers are willing to pay for digitized pages of newspapers or magazine with respect to paper pages. Last but not least, firm have been struggling to charge a positive price for their online contents, mostly because of the different competitive environment that has been developing on the digital market. As analysed in a previous section, the digital market have increased competition for media, both reducing transaction costs and decreasing

differentiation between broadcasting, delivering written or visual contents and other media segments.

Simon & Kadiyali (2007)

The authors examine how offering digital content affects demand for print magazines. They find strong evidence that digital content cannibalizes print sales. However, the effect varies with the type of digital content offered. Offering digital access to the entire contents of the current print magazine slightly reduces print sales. On the other hand, even if there is no evidence that digital content complements print magazines, offering limited access mitigates the cannibalization effect. The hypothesis from which the authors start is that a physical magazine and its websites are seemingly perfect substitutes for their print counterparts. Although we will see in the next session that this hypothesis can be argued, especially following the advent of portable e-readers, which have created new complementary utilities for consumers in terms of accessibility and portability, the fact that the substitutability effect prevails in media industries is confirmed both from theoretical and empirical studies. On the other hand, a magazine's website may complement its print version by increasing diffusion of a publishing brand. Moreover, the Web's interactive features are likely to increase loyalty of clients pushing more readers towards subscriptions. The key element of this paper is that it analyses the type and the amount of digital content that are made available through the new distribution channel. Unfortunately, the results indicate that digital content substitutes for print content no matter the type or amount of free content that is released online, while providing no evidence of complementarities. However, the results of the authors also emphasize that, for most consumers, digital content is not a perfect substitute for print media. More than 90% of readers continue to buy the print magazine when the identical content is available on line, for free. The new supports which are conceived in order to read articles and book more comfortably, have inevitably affected this trend. However, anticipating this further increase in cannibalization, many brands have started to set paying offers on these supports, leaving the free accessibility only to less comfortable devices. It thus seems that this is a key variable for the future of digitized market. If consumers' willingness to pay keeps increasing with the increased comfort of digital reading, firms will be able to mitigate cannibalisation by adjusting the price of

digital version, while if the free model keeps dominating the digitized market, the pressure on margins will keep to take a heavy toll on publishing firms.

Bernstein, Sheng Song & Zheng (2005)

This paper examines how free riding affects a firm's decision of running a direct distribution channel (online or offline), when there are fixed plus incremental variable costs for operating the direct store. Free riding in a multi-channel supply chain occurs when one retail channel engages in the customer service activities necessary to sell a product, while another channel benefits from those activities by making the final sale. The authors suggest that, although free riding generally has a negative impact on supply chain performance, certain recent practices seem to suggest an opposite view. For example a firm could choose to set up an Internet direct channel just to offer information to consumers, limiting product offerings online. The Internet increases exponentially consumers' ability to access a wide range of information sources at low costs and consequently in increase the possibility of free riding, introducing negative externalities in multi-channel supply chains. Common approaches that firms use to mitigate free riding among retailers include, for example, exclusive territory provisions or limits in the number of firms selling a product in one area, sharing sales effort expenses with retailers, engaging in resale price maintenance. In the digital market, however, most of these tools are unavailable or illegal. On the other hand, free riding can sometimes induce positive effects: it is the case when manufacturers knowingly allow retailers to free ride on the customer service efforts of their direct stores in order to increase global sales. However, even if potentially beneficial, this strategy embeds emerging risks. First of all, stores are costly to operate and incur high fixed costs. Secondly, consumers may use the stores to educate themselves about the product, but then buy a rival product at a lower price.

To investigate the effects of free riding when a direct channel is set up, the authors consider a setting with a firm selling its product through an independent retailer and, at the same time, contemplating offering the product through its own direct store. They investigate the manufacturer's and the retailer's pricing decisions with and without a direct store, at first assuming that there is only one product and that all consumers visit the direct store before deciding on a purchase. Later in the paper, they extend the

previous setting to consider the existence of a lower-end competing product carried by the retailer. Finally, they extend the single product setting to consider two consumer segments, thus only consumers in one segment need the service provided at the direct store before making their purchase decisions. The major findings include: (1) When the firm operates a direct store it sets the price higher than that at the retail store; (2) The retailer benefits with the presence of a direct channel only when the inconvenience experienced by consumers to buy the product at the retail store after visiting the direct store is not too high and not too low; (3) With the existence of a closely substitutable product, the value of the direct channel for the firm decreases as the consumers' valuation for the competing product increases, while the retailer is always better off by distributing two products, regardless of the presence of a direct channel; and (4) As the proportion of consumers in need of sales service increases, all firms' prices first decrease and then increase due to the combined effects of increased consumer valuation for the products and intensified competition between the two channels. (5) Extending the model to consider inventory availability at the retail store, they find that when the costs of operating the direct store are high, the manufacturer needs to ensure a high level of product availability at the retail store.

The analysis conducted in the paper suggests that, in some contexts, the direct channel may merely be a service provider and make no sales. For example, when the variable costs incurred for sales at the direct store are high, no sales occur at the direct channel. In contrast, the firm may be better off by selling its product through the direct store, avoiding sales through retail channels when the direct channel's variable operational costs are not too high. Interestingly, the authors find that, even if adding a direct channel generally favours the firm, the supply chain as a whole may not benefit, meaning that the incentives of the firm and the supply chain may not be aligned regarding the decision to open a direct store.

3.2. Multi-distribution Related Impacts on Media Industries and Total Welfare

Schweizer (2002)

In this paper the author explains how the quality certification processes for technological and stylistic innovations differ and how they may interact in the media industries. Stylistic and technological innovation may take place in the content or in the form of media products. The author argues that the interaction between these types of innovation depends on their location within the product and on the characteristics of the certification schemes faced by the producing firms. Innovation in the media industry has been discussed by economists mainly in the context of technological innovations and with reference to manufacturing. On the other hand, artistic innovation and the interaction of technological innovation with such other types of innovation have been neglected. According to the author, a media product can be deconstructed into three parts. First, there is the core of the product, which for a media product will represent the thematic part or message of the product. This core together with the inner form represents the content of a product, in turn surrounded by the outer form of the product. The inner form in the case of a book would be the 'literary form', while the outer form includes in a wider sense the way in which the content is transmitted and presented to the consumers. In the case of a book this would include design characteristics of the cover, but also new technologies in the mode and means of producing and transmitting content to the consumer. Technological innovation, however, may not only figure in the form, but also in the content of a product. In the content, technology may open up new stylistic opportunities in the 'inner form'. Vice versa, stylistic innovation may not only occur in the content, but also in the outer form, where it is usually referred to as design innovation. Content innovations in the media industries, such as stylistic innovations in the inner form of the content or innovations in its core tend to be highly certifier-dependent. This is mainly due to the experience and credence qualities of such innovations, which means that belief in the quality experienced by others forms a central part in the perception of such products, a belief, which the certifiers have the power to create. In the media content industries these certifiers are professional critics or experts who work independently or within publishing firms. The better the firm's or critic's reputation, the more it will act as a certifier of quality in its own right. Building on these considerations the author proposes a definition of stylistic innovation applicable to management analysis. In his view, stylistic innovation is the sum of the features in a product or the process of its production, which differentiate a producer from other producers, based on differences in their cognitive structures underlying the

realization of new means and ends in a product and its production process, which do not match with the collective expectations in a particular certification environment, but are recognized as novel. This concept, coupled with the concepts of reputation, identity and the certification scheme are then used by the author to try and explain variations in the interaction between the different innovation types. Drawing on two case studies the author indicates that, although the representatives of the media technology industry do not seem to be conscious of these interactions, some of their statements do refer to the tension between style and technology. In contrast, in the media content industry the awareness of the techno-stylistic interactions seems stronger. Finally, the author sets a number of hypotheses as potential departure points for future research in this area. (1) The interaction between different types of innovation in the content and the form of media products depends on the characteristics of the certification schemes typically faced by the producing firms in particular industries. (2) In the certification scheme governing sectors of the publishing industry in which the importance of stylistic innovation as a quality indicator is higher, technological innovation visible in the form of a product is more likely to unfavourably influence the certifiers' perception of the product's content quality. (3) Publishers who have built-up either very strong or very weak reputational resources with respect to stylistic content innovation within a technological innovation-averse certification scheme are more likely than those with average reputations to be receptive to technological innovations. (4) The more resources firms operating within a technological innovation-averse certification scheme have built up with respect to direct customer contact, the less dependent they are on certifiers, and therefore the more receptive they are for technological innovations affecting their production and distribution channel. (5) The introduction of a technological innovation visible in the form of a media product is more likely to be successful if it is presented with content which is already well-established in the media content industry, rather than with innovative contents.

Bomsel (2011)

In this article, the author analyses a number of characteristics of media goods that are affected by the expansion of digital distribution although they are related to the meaning of media. These factors can result in permanent competitive advantages of certain media goods with respect to others, independently of the meaningfulness of the content.

Among these factors the author includes well-known issues such as copyright regulation, riskiness of experience good and the complexity of bundling and pricing choices in a context with multi-version substitutable products and multi-distribution channels. However, an original aspect added in this paper is fragmentation along linguistic and cultural borders. The level of fragmentation varies slightly among countries. For instance, the European media industry is highly fragmented both from a language and a cultural point of view. Moreover, the patchwork of different media markets in Europe is the result of diverging consumer preferences and varying technological, economic and regulatory circumstances across the EU. The thesis of the article is that this high fragmentation may result in a permanent competitive disadvantage in a context of expanding digitization of media distribution, unless specific regulation policies are implemented. To support this reasoning, the author shows that multilingualism not only adds specific costs to all media distribution systems, but it also prevents economies of scale in producing or marketing the media across Europe. Such fundamentals explain why multi-territory licensing is counter-productive for media creation. The organisation of media industries in Europe is specific to the national regulation of each Member State, but is now being challenged by the rollout of new media markets. Digital networks do not capture all the value of the media, but have to get inserted in their complex and path-dependent multi-version discrimination schemes. Consequently each member state has built up specific media regulations aiming at shaping discrimination schemes compatible with its national goals of media creation and diversity. The problem is that these regulations are complicated to harmonize, especially because of multilinguism. In fact, media goods provide a meaningful experiences that generates cultural paths affecting their relative value within the different cultural communities. Therefore, both creation and distribution are highly sensitive to linguistic and cultural parameters. Moreover, media industries are capital intensive both for producing and marketing. This means that large linguistic markets, such as the United States, have a structural competitive advantage. On the other hand, European media industries carry high discrimination costs: the investments required for shaping consumers' utility for a product or service, are comparably higher and riskier than in larger linguistic markets. This penalise creation, diversity, and curtail potential economies of scope. In the author's view, the key factors are thus discrimination costs. Having them low allows efficient media distribution, which increases returns on

creation of new products and new brands. The problem of the European media industry is that linguistic segmentation increases these costs incentivising the protection of national media sector with idiosyncratic rules. In conclusion Europe suffers a lack of competitiveness compared to monolingual markets such as the United States or even China, both at the production, marketing and distribution level. The multiplicity of languages and cultures creates a wide distribution of individual preferences that requires expensive versioning that adds to the high discrimination costs created by the path-dependency of each individual member state. On the other hand in big linguistic communities digitization can be exploited to improve discrimination efficiency in media distribution. As a consequence, digital distributors' strategy focuses on benefitting from scale economies of a large monolingual markets on which the media discrimination systems are homogeneous. The problem faced by the European media industries is thus to avoid an excessive concentration in digitized distributions and harmonize media regulations in order to mitigate the competitive disadvantages deriving from multilingualism.

4. Pricing

The effects of digitization on pricing strategies have been largely studied by economist. The main feature of bit encoding is the reduction of traditional costs in production and transactions, which have resulted in a general trend of price reduction in many industries. In the media industry, the effects are even stronger since additional economic constraints such as space limitation (on the support), copying capacity and logistic are relaxed in a digitized supply chain. Relaxation of constraint means enhanced versioning and discrimination opportunities for publishers and authors. On the other hand, consumers may not have the same preferences' structure for the same work consumed on different supports. As an example, despite new supports such as tablets are specifically designed to read text on it, most consumers still seem to have a higher willingness to pay for a physical book rather than a digital one. Even if this gap in evaluation may decrease in time proportionally to the diffusion and the adaptation to new supports, rational consumers may anticipate the reduction in costs for publishers

and maintain a lower willingness to pay for digital copies, putting pressure on prices. Gap in pricing may also increase if pirated contents increase their diffusion. In addition to that, distributors' fees and taxation may reduce margins on digital sales to the point of exceeding the savings in costs. Last but not least, marketing strategies in a supply chain with multichannel distribution should address the problems of cannibalization and freeriding which may emerge if distribution is not vertically integrated.

4.1. Enhanced opportunities for versioning and bundling

Bakos and Brynjolfsson (2000)

In this paper the authors show that, when the marginal costs are very low, bundling can create economies of aggregation for information goods even in the absence of network externalities or economies of scale or scope. These economies have important competitive implications for the digital market. The first is that when competing for upstream content, larger bundlers are able to outbid smaller ones. On the other hand when competing for consumers, bundling practices may be used to discourage entry even when potential entrants have a superior cost structure or quality. Conversely, by adding contents to a bundle, a firm may be able to profitably enter a new market and even dislodge incumbents who do not bundle. Finally, since large bundlers are able to capture larger shares of the market, single brand firms may have lower incentives to innovate and create such markets. Following their previous studies on the benefits of bundling large numbers of information goods, in which they found that the critical variables are the low marginal costs and the correlations in valuations for the goods (namely aggregation is less attractive when valuations are highly correlated), the authors use a set up with a single seller providing n information goods to a set of consumers. Each consumer can either demand 1 or 0 units of each good and resale not permitted. Valuations for each good are heterogeneous among consumers and they depend on the number of good purchased. If (1) the marginal cost of copies of all goods is zero for all information goods, (2) for all n consumer valuations are independent and uniformly bounded, with continuous density functions, non-negative support and given mean and

variance and (3) consumers have free-disposal, then the authors show that selling a bundle of n goods can be superior to selling the goods separately, since the deadweight loss per good and consumers' surplus converges to zero as n increases, maximizing firm's profits. Assume that there is competition in the market (two firms with given endowments and non-overlapping goods), that consumers' valuations are i.i.d. and that there is one good (call it n) left which is not in the endowments. Initially, firms bid for good n in the first period, but they can bid for an exclusive license or a non-exclusive one. Subsequently, both firms decide whether to offer their goods to consumers individually or in a bundle (no mixed bundles allowed) and finally they set prices. The authors show that in this setting, if the bundles are large enough, it is more profitable to add the outside good to the larger bundle. This implies that the largest bundlers in the market will tend to grow further relatively to other firms that compete in the upstream market. The availability of contents is very similar to traditional economies of scale. Thus distributors with enough initial funding can get a competitive advantage by adding a large number of contents on their platform. Finally, if there exists substitute products in the market, bundling is a dominant strategy since it allows to gain a competitive advantage both on producers of single good and to firms selling substitute goods separately. Moreover, a bundler of a large number of goods can increase his profits on all goods he is selling by adding a new good to the bundle, even if this good is a partial substitute of a good already included in the bundle. Another consequence of these results is that a large bundler obtain a relevant market power and can use bundling to strategically deter small potential entrants from entering the market or to force single-product firms out of the market, even if it would not be able to do so offering a substitute product. This last result can be applied to digital media industry in these terms: a large distributor can deter entrance or force out of the market a single brand even if the latter has a higher market share or diffusion with respect to the substitute brands available in the bundler portfolio. This risk must be considered by publishers while setting up digital strategies. Naturally, other tools such as versioning or changes in goods can be used to mitigate these effects.

Venkatesh & Chatterjee (2006)

In this paper the authors analyse the product market conditions under which a publisher should start offering online contents. Moreover, they discuss optimal online marketing

mixes (bundle, unbundled contents, or both). Finally, they address pricing implications and they find that going online is profit enhancing even when the market strongly prefers the traditional medium and there are no advertising revenues. Differently from the previous paper, they nevertheless find that under specific market conditions the online modules, rather than the bundle, better complements the print bundle. The authors start their set up building on three considerations. First of all, in the case of multiform products, consumers' reservation prices depend not only on their valuation of the content but also on their preferences for the different supports (i.e. tablets, smartphone, PC, hardcopy). Moreover, with multiform products the range of options is expanded beyond pure components, pure bundling, and mixed bundling. For example, the print magazine and its bit-encoded version are two distinct bundles and offering them both is arguably neither pure bundling nor mixed bundling. Finally, subscription and advertising revenues gaps related to the support (when applicable) must be included in the decision concerning digital strategies. The authors find out that it is profitable for publishers to go online even when consumers strongly prefer the traditional support. Moreover, in their view the optimal strategy is to offer initially only online modules in addition to the print version; the bundle should be added to the product line only when the market is more accepting of the digital versions. Moreover, they found that low priced versions should be targeted at consumers with low valuation for the content. Finally, the optimum price of the hardcopy is influenced by the presence of online offerings. It decreases initially as the market's acceptance of digital versions grows, but increases subsequently. The model set-up starts with a monopolist publisher who is to decide which products to offer and at what prices to maximize profit. Potential revenue sources are hardcopy and/or online subscribers and advertisers. Advertising revenues are medium specific and increase proportionately with diffusion of that version. The market consists of surplus-maximizing consumers who value one or more of the modules of the magazine. Consumers are heterogeneous in their (1) preference for contents and (2) preference for support. The latter is driven by magazine-specific and consumer-specific factors. In terms of its content, we stylize the print magazine as a bundle of two modules. A consumer's valuation of a module in hardcopy form is captured by her reservation price for each module. The authors assume consumer's reservation price for the bundle is additive and that distribution of evaluations across consumers is iid uniform in the interval $[0, 1]$. A consumer's preference for digital to

hardcopy is given by the ratio of reservation prices denoted γ , distributed uniformly in the interval $[0, \gamma_{\max}]$. Using this web preference and print and online advertising revenue as exogenous product-market parameters, the authors find out all the above mentioned results.

Jeon and Menicucci (2006)

In this paper, the authors analyse publishers' incentives to practice bundling, the ensuing effects on social welfare as well as implications for merger analysis, through the case of academic publishing. They consider a mature stage of e-journals in which publishers practice price discrimination based on usage, assuming heterogeneity among libraries and building a model in which each publisher offers a set of journals to a library which wants to build a portfolio of journals and monographs. Their model analyses how bundling affects journal pricing through its impact on the library's allocation of budget between journals and books under a budget constraint. Consider independent pricing (i.e. no-bundling) the authors find that industry concentration does not affect prices. In the general case of heterogeneous journals, they show that there is a unique equilibrium candidate regardless of the level of industry concentration and that the equilibrium always exists both under the maximum concentration (i.e. the monopoly case) and under the minimum concentration in which each publisher sells only one journal. Moreover they find that when bundling is allowed each publisher has an incentive to bundle all his journals. They identify two effects of bundling:

1. Bundling has the direct effect of softening competition from books.
2. Bundling has the indirect effect of generating negative pecuniary externalities for all other publishers.

Therefore, bundling is a profitable and credible strategy: it increases the publisher's profit and decreases the profits of rivals. The direct and indirect effects of bundling suggest that any merger increases the merging publishers' profits because of the direct effect while reducing rivals' profits because of the indirect effect. Moreover, bundling (or any merger) increases industry profits. However, the authors conclude that bundling decreases social welfare and that any merger among active publishers reduces social welfare as well. Moreover, they examine publishers' incentive to acquire a journal from

a third-party, finding that in the absence of bundling all publishers has the same willingness to pay for the journal, while under bundling the largest publisher has the highest willingness to pay. This suggests that bundling might affect industry dynamics increasing the market power of the largest publishers and forcing small publishers out of the market. The paper overcomes the conventional idea that bundling has no effect when sellers have complete information on the buyer's valuation for each product and there is no interdependency among valuations of different products, showing that when the budget constraint is binding, each firm has a strict incentive to adopt bundling. The paper suggest that there is a strong conflict between private and social incentives in the bundling of e-journals; each publisher wants to bundle his journals and bundling increases industry profits but reduces social welfare. Moreover, they found that bundling creates incentives for mergers, but this again reduces social welfare by reducing book and journal consumption. However, mergers among publishers who would not be able to sell their journals because of their lack of size might increase social welfare. Finally, in the authors' view, bundling can have a serious impact on the evolution of industry concentration by affecting the incentives to acquire other journals. While in the absence of bundling each publisher has the same willingness to pay for a journal, under bundling the largest publisher has always the highest willingness to pay. Hence, bundling might create a vicious cycle through which big publishers induce the exit of small publishers and become even bigger by purchasing their titles. This article has demonstrated how powerful bundling is in a context of with a large number of copyrighted goods. However, because of the specific characteristic of the academic publishing industry, the authors have been able to disregard two elements that are crucial for the analysis of the publishing industry and may overrule some of the results when you consider the industry as a whole, namely the effects of multi-channel distribution on the value chain and the effects of digitization on the advertising dynamics in the industry.

Koukova, Kannan & Ratchford (2008)

In this article the authors investigate the problem of product form bundling, defined as marketing two or more versions of the same product, available on different supports, as a bundle. This is a general problem in the media industry since differentiation of contents among versions is usually limited, especially for industries such as book publishing where the work is one well defined written text which can be hardly

differentiated. The media inherent substitutability may consistently limit the attractiveness for consumers of acquiring more than one version. On the other hand, the author outline that digital and physical formats may provide different type of utilities connected with specific usage situations. Using experimental manipulation by providing consumers with communications that emphasize differentiation in usage functions, the authors find that for book and newspaper subscription categories, this manipulation do significantly increase intent to purchase more than one version of the content, as long as the bundle is discounted. The authors start from the intuition that bundles of information goods differ from bundles of physical goods. Information bundles tend to have very low marginal cost of producing digital versions in addition to print and the individual versions may be redundant, since after experiencing a content, such as an online book, consumers do not benefit in the same way from the hardcopy to read the same content. On the other hand, conventional bundles generally have positive marginal costs and are not redundant. In their experiment they test four hypotheses: (1) when presented with advertising messages emphasizing different usage situations, consumers will be more likely to choose the bundle as compared to when presented with stimuli emphasizing the same usage situations for the product forms. (2) The likelihood of buying the information product bundle is low if there is no bundle discount. If there is a bundle discount, then the likelihood of buying the bundle will be significantly higher if awareness of different usage utilities is high than if it is low. (3) Consumers of information goods will be less likely to purchase a bundle consisting of different versions than consumers of conventional goods for all discount levels and usage situations. (4) Consumers will be more likely to choose the product form bundle when the hardcopy is priced at a premium and the electronic product is discounted as compared to when both forms are equally priced. As for the methodology used in the experiments, they confirm the relationship between perceived product form complementarity and bundle choice by varying bundle discount and product category type between-subjects and manipulating awareness of usage situations creating perceptions of either low or high complementarity between the alternative versions, using a panel of 406 undergraduate students. The implications of these results for the industry are various: first, there may be potential gains increasing consumers' awareness of differences in terms of usage functions of digital versions. However, when different versions are not perceived as having a relative advantage in different situations, the

cannibalization among versions is large and it cannot be mitigated by discounting the additional version. On the other hand, when different versions are perceived to have an advantage in different situations, a mixed bundling strategy with a discount for buying the second item is superior to pricing only the individual items.

Parker & Alstyne (2000)

This article models the possible benefits arising for firms in the digital market even if they have to concede contents for free. The intuition is that free strategic complements can raise a firm's own profits while free strategic substitutes can lower profits for competitors. The author uses a model of cross-market externalities based on network effects, price discrimination and product differentiation that shows how the characteristics of digital media market may lead to novel strategies such as eagerness to enter into Bertrand price competition. The three main results are: (1) a firm can rationally invest in a product it intends to give away into perpetuity even in the absence of competition. (2) Markets for content-providers and end-consumers can both be a candidate for free good. (3) A firm can use strategic product design to penetrate a market that becomes competitive post-entry. This model is adapted to a number of digital industries but it does not seem to be adaptable to digital media industry for three main reasons that we have outlined in previous section. On the one side, the procurement model of content creation is peculiar, since it entails high risks and involves authors who are themselves publishing brands with different evaluations. Moreover, the products are hardly substitutable, since they are unique by definition. Another critical issue is the size of the market. While digital distributors have the critical mass of users required to apply this type of strategy, which they do putting pressure on editors' margins, the latter have a cost structure which does not allow for the same economies of aggregation. This is mainly due to the existence, for many of them, of a traditional brick and mortar distribution channel, which is strictly connected with the publishing protocols, from the demonstration to the creation of demand for media products, and cannot be dismantled without a long and costly transition. The third problem is that under the current product market condition the margins in the digital market are not sufficient to support the author's hypothesis for which by raising digital demand the profits of the firm will grow. This is due to variables such as network

diffusion, cannibalization, taxation and competitive environment in the digital distribution, which may exceed the benefits in terms of cost saving for media firms.

4.2. Marketing of digital media: cannibalization and freeriding issues

Sundarajan (2003)

The article analyses optimal pricing strategies for copyrighted goods and technological deterrence levels in a market with digital piracy. The firm's optimal pricing schedule is characterized as a combination of the zero-piracy pricing schedule and a piracy-indifferent pricing schedule, which makes all customers indifferent between legal consumption and piracy. Other results of the paper include the fact that while increases in piracy reduce prices and profits, on the other hand may improve welfare by expanding the ratio and volume of legal uses. Moreover, the author shows that in the absence of price-discrimination, the optimal level of technology-based protection against piracy is shown to be the technologically-maximal level, which maximizes the difference between the quality of the legal and pirated goods. However, when a seller can price-discriminate, it is always optimal to choose a strictly lower level of technology-based protection. Moreover, if a DRM system weakens over time, due to its technology being progressively hacked, the optimal strategic response may involve either increasing or decreasing the level of technology-based protection and the corresponding prices. This direction of change is related to whether the technology implementing each marginal reduction in piracy is increasingly less or more vulnerable to hacking. The model used by the author to analyse technological protection of copyright builds on the commonly used notion of pirated good as an inferior (vertically differentiated) substitute for the legal good. The model generalizes the pricing analysis significantly, deriving a continuous pricing schedule which explicitly takes into account the differing value of pirated products to different customers. The model involves an information good which may be used by consumers in continuously varying quantities. The firm selling this legal good is a monopolist, by virtue of owning a copyright. Fixed costs of production or IP protection are assumed to be sunk while variable costs of

production are zero. In addition to the legal good, there is a pirated good, which is a lower-quality substitute and is free. Customers are heterogeneous, indexed by type. The preferences of a customer of a given type for the legal good are represented by a utility function depending on the quantity of the legal good used by the customer, and on a measure of the quality of the legal good. The problem with this study is, once again, that it does not consider the negative externalities that may occur by reducing the price of a good, when a substitute distributive channel with higher margins exists. Moreover, the hypothesis that the illegal good is lower in quality is adapted to a number of media industries such as movies and music for instance but it is not adapted to many others. In particular, this hypothesis is likely not to apply to publishing (particularly for segments such as news or academic articles). Moreover, the article does not consider the effect of advertising which may mitigate negative externalities in some segments if illegal diffusion can be quantified and embedded in remuneration.

Evans (2009)

In this essay, the author presents the characteristics and evolution of the digital advertising business as well as future scenarios from which we can derive the effects on business models of multichannel distribution industries. He explores some of the key developments such as behavioural targeting for matching advertising messages to consumers and economic aspects of the privacy issues that these technologies arise. The differences between digital and traditional advertising result from a combination of technologies and the nature of the web. The structure of online communications makes it easy for publishers and ad networks to learn considerably more about consumers than has been possible with traditional media. Digitized brands typically know from the internet technologies that an individual is viewing their site and this is very different from a radio station or a newspaper, which have limited ability to determine whether a particular individual is listening or reading. Digitized media can learn valuable details about the anonymous individuals that visit their site. In addition, websites with subscribers may have detailed information on registered users which they can also use for advertising. Print, radio and television media generally do not know this level of information for individual users. Advertisers and their intermediaries have no way of knowing whether an individual can hear or see their advertisements in the analogic world. For example, readers may not necessarily look at particular newspaper or

magazine page with advertising. On the other hand, online they can register with great confidence what content a consumer is viewing at a particular point in time. Advertisements can thus be targeted with a higher precision. Moreover, technology allows for making real time decisions on the ad to insert in a particular space. These and other features make online advertising a more efficient matchmaking vehicle for advertisers and viewers than offline advertising. From this reasoning, the author observes that there are economic incentives for advertising and viewing to move online.

From a supply side, there are three main sources of supply of online advertising inventory, each of which results in different methods for selling advertising. (1) Search engines: on these sites advertisers bid on a cost-per-click for slots on search results page and the search provider allocates the slots on the basis of expected revenues it will receive (cost-per-click times expected clicks). (2) Online media sites: they provide content that is broadly similar to what consumers get from traditional media. These sites allocate portions of their pages to advertisements much like newspaper pages do . They generally sell the ads on a cost-per-mille basis—that is, based on how many eyeballs see their pages—through their own sales team and through advertising networks. (3) Social Networks: these sites and on-line advertising businesses are still looking for advertising methods that work more effectively with the types of interactions occurring on social networking communities. Whether social networking sites can achieve cost-per-mille payments for their viewers that are comparable to other types of on-line advertising remains to be seen, as it has been clear with the case of Facebook IPO, which was locate to the stock exchange at a price embedding future revenues that are subject to this uncertainty. Following the author, however, it appears likely that online advertising will provide two potentially significant economic efficiencies. First, online advertising allows the economy to reduce the amount of resources devoted to creating content for aggregating and sorting potential buyers. Second, online advertising likely increases the accuracy of the match between the buyer and the seller. In both cases there are some drawbacks that also need to be considered, the most evident being freeriding risk and privacy concerns. Traditional advertising sustains a complex ecosystem of businesses. A wide range of media entities earn significant portions of their revenues from the sale of advertising inventory. In turn, these businesses support a variety of content generation businesses. Moreover, diverse other businesses or agencies work around

advertisers. Online advertising methods pose a serious threat to traditional methods; they increase the efficiency of matching buyers and sellers and delivering advertising messages to the buyers, this way reducing the economic importance of traditional intermediaries in the long term. Moreover, they increase the supply of advertising inventory significantly, putting pressure on margins. Finally, online advertising increases the supply of online content which provides a substitute for traditional content. In the author's view, The industrial structure of the online advertising industry could evolve either with a highly concentrated set of intermediaries at its center, with many content providers around this core or with many intermediaries at its centre, with some intermediaries focusing on mass advertising and others focusing on niches. The ultimate structure depends on the relative importance of several factors: the strength of indirect network effects and scale economies on one side, the possible benefits of specialization of knowledge in certain areas on the other side. The most controversial issue about online advertising is the use of personal data for targeted advertising. If people had ownership over information about themselves, and there was a competitive market for it, they could decide whether to sell it to an online advertising business. However, consumers have limited control over their private information on the digitized networks. For example a user can choose not to use websites that insert "cookies" that collect data on her machine, but most of internet users are not sufficiently web-savvy to discern among websites. Web browsers have increasingly provided mechanisms for consumers to control the retention of information on their browsing history and manage their cookies, but even the most sophisticated one is still largely insufficient to protect a user's privacy effectively. Another crucial issue is that consumers may agree to provide private information without anticipating that this information would be sold to other vendors who might combine it with other information about them. Solving the privacy problem should be one of the priorities of policy makers to set up a level playground for advertisers and consumers in the digital era. In order to do that, the complex social issues associated should be analysed thoroughly.

Kirchoff (2009)

Kirchoff presents the issues emerging for policymakers as the advertising industry face structural shifts, caused by consumers relying on the Internet and other digital platforms for news, entertainment, and socializing. Regulation in advertising follows the

principles of ensuring fair competition, shielding consumers from unfair or misleading messages, limiting the exposure of children, and restricting promotion of products such as tobacco and liquor deemed morally or physically harmful. Federal oversight of the advertising industry is intensifying as regulators and lawmakers try to keep pace with shifting technology and consumer habits, but recently the key issue has been the state of the newspaper industry, which is in financial distress due to eroding ad revenues. One emerging problem is that the online market is compressed. Under “search” business model, an advertiser bids, via an on-going auction process, to have his or her ad displayed when a consumer types a query into a search engine using a given keyword. The search market is dominated by Google and Yahoo. At the same time, the proliferation of ad-supported websites, online videos, blogs, and other offerings has created more supply, lowering advertising rates in both online and in conventional media markets. Media companies are struggling to craft new business strategies; they are investing in developing extensive online operations as customers move to the web. Some media firms now have online properties that pull in millions of consumers each month, but revenues have not grown in proportion to the digital audience, reducing the margins. One of the reasons is that many publishers chose to offer content for free online, under the theory they would generate higher advertising revenues by increasing their consumer base. Another factor is proliferation of websites, which has pushed down the price for some types of ads . On the other hand, media companies are taking on some of the functions of marketing and advertising firms as they reposition themselves. In this scenario, regulators and lawmakers are trying to keep up with an emerging world in which advertising is becoming both more pervasive and more difficult to distinguish from other content. On the other hand, the advertising industry is trying to ward off new regulation, saying it has moved aggressively with self-regulation, including its recent guidelines on behavioural advertising and that digital commerce is vital to the nation’s overall well-being. Whatever the outcome of the current initiatives, dramatic changes in the delivery of news, entertainment, and advertising are likely to continue, creating complex questions for lawmakers and regulators regarding consumer privacy, competition, and free speech. Media and cultural critic Marshall McLuhan in the 1960s argued that each new medium has its own intrinsic effect, changing the nature of society and commerce. Four decades later, technological advances are forcing media companies and advertisers to refine and reshape their messages to reach consumers in new venues,

from mobile phones to handheld readers to online gaming networks. The developing forms of communication are, in turn, influencing the content of advertising as companies attempt to become part of the conversation on social networks or part of the landscape by embedding products in news and entertainment programming. Consumers must figure out how to determine the value and veracity of advertising and media, as regulators determine how to craft a workable oversight system that stretches beyond advertising on traditional media, to the rapidly expanding digital world.

de' Grassi (2011)

The switch from “traditional publishing” to a “digital publishing”, which separates the concepts of meaningful expression from the support allowing for publishing, has been accelerated by the introduction on the market of new supports, technologic innovations allowing for comfortable exploitation of digitized contents. The emerging trends have imposed a rethinking of media industries’ business models. In this article I have analysed the key economic issues emerging for magazine publishers facing digitization. Then I outline the key strategic trade-offs and set a simulation model, embedding the peculiarities of digital media market and testing the available strategies on the distribution side of the supply chain. Digitization relaxes traditional constraints of the media industry such as space, copying and logistic issues and multiplies strategic options available to publishers through enhanced discrimination tools: (1) New versioning and bundling opportunities and (2) new avenues for conducting business, including the possibility of directly distributing contents. The model considers five strategies available to publishers and analyses how different publishing brands should choose among them. The pure strategies available are: (1) Not entering digital market, (2) Outsourcing digital distribution through licensing, (3) Setting up a directly owned digital retailing network. The latter option allow for a further decision on which marketing mix to offer through the new channel. This produces two more strategies: (4) distribute through digital retailer only a bundle composed of the paper version plus one or more digital versions. (5) Distribute both the bundle and the single versions independently. Publishing brands are heterogeneous in term of size and type of content; however, the attractiveness of digitized versions for each of them depends on three key variables: (1) the actual attractiveness of digital versions in terms of marginal costs, which result from the trade-off between savings on production and transport costs and

additional costs, such as digital distributor's fees, differences in taxation and lower willingness to pay of consumers and advertisers. (2) The digital market share, which depends mainly on the diffusion of digital e-readers, on marketing investments and on the structure and regulation of the new competitive environment which will result from the confusion of audiences, temporalities and media products. (3) The last factor is the algebraic sum of positive and negative externalities introduced in the industry by digitization. This factor will depend mainly on the degree of substitutability (cannibalization) of products and on the structure of intellectual property rights in the new framework. All the above factors must then be confronted with the specific characteristics of a media brand in terms of brand awareness, cost allocation in the traditional value chain, type of product, financial and organizational resources, etc. Choosing the most adapted strategy for serving the digital market is a matter of survival for many publishing brands and is an extremely complex decision. This article provides strategic guidelines for a firm to optimize his efforts toward digitization.

Conclusions

From the analysis of recent studies the first conclusion is that the continuous and rapid evolution of technologies, competitive scenarios and digital strategies, which characterize the development of the digital market for media, require more research to provide solutions for the various complex issues that are still under discussion. The first objective should be a regulation creating a level playground for the digital media market. In order to achieve this ambitious objective, research should provide solid economic evidence in support of the many policy initiatives which are emerging in the field of copyright, digital distribution or advertising. Moreover, research should focus not only on economic effects which are related to technologic innovations; on the other hand it should systematically include socio-economic questions that are rising since digitization affects also the core of media works, such as their meaning and their publishing protocols. The first question that needs to be addressed is the nature of digitized media. As today, in Europe, an e-book is comparable to an electronic licence for software; it is not considered a cultural good. This poses different economic

problems, such as whether the exhaustion principle applies or which level of VAT should be applied to them. A second relevant question is how to reengineer the mechanisms of remuneration for content creators. Despite lawmakers' efforts, copyright by definition is not adapted to a market in which copies cannot be physically accounted for. This question cannot be properly answered without an in depth analysis of how digitization affect the creation and distribution of intellectual property rights. For example, who is the right's owner of a Tweet? Is it the author or the platform or is it just common knowledge? How do we trace the new line dividing correspondence from publishing? The third and probably most debated question is the organization of digital distribution, the extent of the responsibility of intermediaries and their interaction with the physical distribution of the same contents. The fourth question is how to coordinate efficiently the policy objectives in the area of digital agenda and culture. In the last decade the objective of developing digital infrastructures has prevailed and the availability of a large amount of copyrighted goods for free has resulted in an indirect subsidy that has favoured this deployment. On the drawbacks, media industry as a whole has suffered from these policies while only specific sectors have been able to benefit from the larger potential market created with these subsidies. In particular, the language basins have been critical. While digitized media in English have gained larger market shares, others haven't, since their potential market was capped by the dimension of their linguistic basin. In order to survive, media companies have concentrated their efforts on the most profitable products, but this may have a negative impact on cultural development and diversity, which may result in a long-term serious issue for Europe. Summing-up, it seems that Digital Agenda objectives have gone in contrast with Cultural objectives in the digital market. Positive externalities created by the deployment of new networks have compensated for this cultural slow-down until now but they are quickly reaching saturation and the negative impact on welfare of cultural pauperisation is becoming predominant. A new field of research is open on which strategies should be implemented in order to align these two objectives.

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Chapter 2

Subsidising Network Technology Adoption. The Case of Publishers and E-readers: is there a Need for Vertical Agreements?

Abstract

To market a new network technology effectively, manufacturers need to understand the structure and size of network effects associated with the product. If consumers' surplus from adoption depends positively on the number of interconnections in the network, early adopters may need to be subsidized until a critical mass is reached. Moreover, in a two-sided market where platforms and complementary contents are constrained to non-negative prices, subsidies can be provided both by platform manufacturers and by producers of complementary contents. The article presents a model to analyse adoption dynamics with different subsidies and different stand-alone values for technology. The model shows that if the stand-alone value of technology is limited, subsidies from complementary contents producers may be pivotal to reach the critical mass. Moreover, under given conditions, this type of subsidies can lead to a more efficient adoption, increasing social welfare. In this case, assuming a monopolist platform manufacturer of the technology, complete contracts are needed to reach the Pareto optimal equilibrium.

Keywords: two-sided markets, network effects, technology adoption, copyright, vertical relations, media economics, publishing, e-books.

Introduction

A network technology can be defined as a platform (of tools, machines, techniques, crafts, systems, methods of organization or environmental rearrangements) giving access to a number of interconnections embedding externalities (usually positive). Starting with the initial work of Rohlfs (1974), the literature has emphasized the role of externalities and the value of network interaction as determinants of technology adoption. Rohlfs' model of interdependent demand defines consistent equilibrium user sets and finds multiple equilibria at any given price. He concludes that, if the initial disequilibrium is the null user set, early adopters need to be subsidized in order to reach a critical mass compatible with the start-up problem of the technology. Katz and Shapiro (1986) analyse the case of a new technology competing with an incumbent technology, they find that the determinant for adoption is the willingness from the manufacturer to make investments and promote the new technology. In the absence of subsidies, the incumbent technology has a competitive advantage due to his installed base of users. Many markets deriving from network technologies are two-sided; platform court two or more sides that use the technology to interact with each other. The value of the network technology depends on the two (or more) user sets, in a dynamic of indirect network externalities: it is the case of industries such as Media, software or credit cards. In these cases, as studied by Rochet and Tirole (2003), since demand in the two sides is interdependent, platforms can cross-subsidize between agents which take part in the transactions and producers of complementary contents can provide subsidies to technology adoption.

Moreover, network technologies can slightly differ in their stand-alone value, which is defined here as the utility they bring to a given consumer when the set of interconnections available in the network is the null set. For example, a single telephone cannot provide any utility to any user without an associated set of interconnections. On the other hand, a technology such as PC started providing utility to many users before the associated network (the internet) was deployed. The recent introduction on the market of e-readers, the most known of which being I-Pad from Apple and Kindle from Amazon, is a case of particular interest. These devices are specially conceived to exploit

digitized written and visual media, increasing comfort, accessibility and portability of the e-books and other Medias. Many users may thus be interested in e-readers only if they can have access to their favourite Medias through the platform. Nevertheless, other users may allocate a positive stand-alone value to the technology: it is the case of “geeks”, which by definition have a high willingness to pay for every new information technology. It can be also the case for specific segments of the population which can be interested in some of the particular characteristics of these technologic devices (light weight, possibility of editing texts, touch screen, design, brand, etc.).

The paper develops a theoretical model to investigate the dynamics of technology adoption with different stand-alone values. While there exists a wealth of literature that examine the role of stand-alone value and network value in technology adoption⁴, this paper focuses on efficient subsidy schemes and coordination problems arising from different type of network technologies and different installed bases. The model moves from the start-up problem described by Rohlfs (1974) in which a unit mass of consumers with interdependent demand needs to choose whether to adopt a new technology, marketed by a monopolistic manufacturer. In the next session, we thus formulate a simple model in which the incremental utility of the service to an individual depends only on the number of adopters on the two sides of the market and not on who these adopters are. While the abovementioned models do not consider stand-alone value, following Tucker (2008) we consider that a group of user may adopt the technology because of utilities arising from local usage of the new technology. In her paper, as an example, she estimates the weight of stand-alone value in the adoption decision for a service of video messaging. Nevertheless, different technologies may lead do very different estimations. In our example, we could assume that I-Pad, providing a much broader range of utility, may have a positive stand-alone value for a larger share of the population while Kindle, which is conceived almost exclusively to read books, will have a lower one.

In the paper, we thus consider the general case in which a given share of the population has a positive valuation for stand-alone technology, while the residual part of the population has a null valuation. Given this assumption, there exists a non-negative demand right after the introduction of the technology, before the network is deployed.

⁴ See for example Farrel and Saloner (1985) or Tucker (2008)

This demand determines an installed base for a given technology and modifies the start-up problem for a network technology. In some cases, the installed base can be sufficient to solve the start-up problem, leading to a high level of adoption equilibrium without any subsidy. Nevertheless, in many cases the installed base is limited and a subsidy scheme is needed to reach a more efficient equilibrium. In the model, two types of subsidies are considered: a penetration pricing scheme and an investment boosting the awareness or characteristics of the product. Moreover, both the manufacturer and the producers of complementary contents can provide these subsidies. The case of publishers and e-readers is again a good example. A manufacturer such as Apple or Amazon can provide subsidies by reducing the price of the platform or by investing to enhance product characteristics. While the first is a non-discriminatory subsidy, the second one may push more technophiles or brand fans towards adoption but it is not likely to impact the decision process of a consumer which is only interested in exploiting Media contents through his e-reader. On the other hand, a subsidy from a publishing company is likely to impact those consumers that are interested in the network of Medias connected to the platform.

The model shows that when the stand-alone value is small, subsidies from complementary contents can be more efficient to solve the start-up problem. In these cases, a coordination problem emerges in the market. Assuming that platform manufacturer has a market power and other firms don't, the manufacturer can adopt an opportunistic behaviour to free-ride on complementary contents subsidies and internalize all positive externalities. Anticipating this behaviour, companies will not invest to subsidize. Their optimal strategy is to wait until the technology is adopted by a sufficiently large share of the population, eventually free-riding on other firms' investment. If this type of subsidies is pivotal to a successful start-up, the network technology may reach a suboptimal equilibrium due to underinvestment: not only consumers will obtain a lower surplus, since their utility increase with the size of the network, but they will pay a higher price for the technology.

In such cases, vertical agreements leading to a complete contract between manufacturers and complementary contents producer can increase total welfare. This result, which may seem very controversial in the light of recent investigations from U.S. and E.U. Courts against Apple and many important publishers, was the basic principle leading to the

promotion of universal service adopted by these same institutions for other network technologies. As an example, subsidies to broadband diffusion (digital divide agenda) have been provided to telecom operators' and internet service providers' (ISP), which were in charge of the deployment of the network, both with financial aids and with a favourable regulation (ex. safe harbour). These distortions, which are now under discussion as well, introduced the problem of piracy and free-riding on media brands, but they did increase the value of broadband network for consumers, accelerating the adoption of the technology. The video game and DVD markets are further examples of successful start-ups of network technologies subsidized by publishers of complementary contents. Economists have shown that the availability of titles on this type of platform is crucial in determining the adopted standard among competitive platforms (Inceoglu, Park, 2009). The key difference in these cases is that the platforms are the only existing distribution channel for the complementary contents. Conversely, in our example books and Medias in general have alternative distribution channels they can exploit. Publishers may thus not accept to sell their products or subsidize technology adoption if they are not able to internalize sufficient externalities.

The paper is structured as follows: in Section 2 we set up a monopolistic network technology adoption framework. We then study the equilibrium users set with different stand-alone values. Section 3 introduces the subsidy schemes outlining the trade-off effects of different types of subsidies and the coordination problem. Section 4 concludes discussing results of the model and eventual policy insights.

A Model for Network Technology Start-up Dynamics

1. Interdependent Demand for a Network Technology

Consider a population consisting of n individuals. As in Artle and Averous' and Rohlfs' work, we define a set of binary variables:

$$(1) \left. \begin{array}{l} \{q_j = 0 \text{ if individual } j \text{ does not adopt the network technology}\} \\ \{q_j = 1 \text{ if the individual } j \text{ does adopt the network technology}\} \end{array} \right\} \text{for } = 1, \dots, N$$

We assume there are M potential goods accessible in the network and P other goods in the economy, where good P is the platform giving access to the network. Since we are in a two sided market, we establish a linear relation between the fraction $f = \frac{\sum_j q_j}{N}$ of users adopting the network technology and the share m of network goods available through adoption:

$$(2) m(f) = af$$

Where:

$$(3) \left. \begin{array}{l} \{m_i = 0 \text{ if good } i \text{ is not available through the network}\} \\ \{m_i = 1 \text{ if the good } i \text{ is available through the network}\} \end{array} \right\} \text{for } i = 1, \dots, M$$

$$(4) m = \frac{\sum_i m_i}{M}$$

To model interdependent demand, we specify a pair of additive utility functions for each individual:

$$(5) U_j^0 = f(r_{j1}, \dots, r_{jP-1})$$

$$(6) U_j^1 = f(r_{j1}, \dots, r_{jP-1}) + r_{jP} + \sum_{h \neq j} v_{jh}(m)q_j$$

Where:

- U_j^0 is the utility of individual j if he does not subscribe to the network technology,
- U_j^1 is the Utility of individual j if he does subscribe to network technology,
- r_{jp} represents the consumption of good p by individual j ,
- $v_{jh} \ h \neq j$ is the incremental utility to individual j of the additional user j , which is dependent on the effect of the new user on the number of goods available in the network.

Equations (5) and (6) implicitly assume independent utilities with respect to all goods in the economy other than:

1. The platform,
2. The goods accessible through the network.

In addition, we make the usual monotonicity assumptions:

$$(7) \frac{\partial U_j^k}{\partial r_{jp}} \geq 0 \quad \forall p \text{ and } > 0$$

$$(8) U_j^0 \leq U_j^1 \quad \forall j, k, q_1, \dots, q_{j-1}, q_{j+1}, \dots, q_n, r_{j1}, \dots, r_{jP-1}, r_{jP}$$

We also make two specialized assumptions, the first applicable to network technologies and the second applicable to two-sided markets:

$$(9) \frac{\partial U_j^1}{\partial m_i} \geq 0 \quad \forall i$$

$$(10) \frac{\partial m_i}{\partial q_j} \geq 0 \quad \forall j, q_1, \dots, q_{j-1}, q_{j+1}, \dots, q_n, r_{j1}, \dots, r_{jP-1}, r_{jP}$$

That is, a subscriber's utility never decreases as additional media goods become available in the network (and none drop out). In the same way, the number of media goods never decreases as additional users adopt technology (and none drop out). This is the logic usually defined as indirect network effect and seems like a sustainable assumption. In fact, it is hard to find an example of a network whose value would decrease if additional goods or services become available through it, or a market in which a higher demand leads to a reduction in the number of firms. It is maybe easier to think of a network technology becoming less valuable for a consumer as more users join it: it is the case for example of premium credit cards or exclusive clubs, in which the quality of service cannot be guaranteed beyond the optimal size of the set of users. However, as a rule, the increase of interconnections (user to goods or good to users) in a network technology is not detrimental to any party involved in the transactions.

Since we have assumed (9) and (10), the adoption of technology from user j will not be detrimental for any user $h \neq j$ thus $v_{jh} \geq 0 \quad \forall j, h$. The additive model assumes that these incremental utilities do not depend on consumption of other goods outside the

network. This is a reasonable assumption for the purposes of this article although the deployment of a new network may certainly have an impact both on social and individual behaviour. To go back to our example, the adoption of e-readers has an effect on the consumption of books or other Medias through other distribution networks. This effect, which is of particular interest for the publishing industry, is not discussed in this article for the sake of simplicity but most of all because it is so complex that it needs a specific article on the subject.

Every user is a rational consumer aiming at the maximization of his utility. The maxima U_j^0 are defined by the *ceteris paribus* conditions and do not depend on the adoption of network technology. Maximizing equation (6) with respect to $r_{j1}, \dots, r_{jP-1}, r_{jP}$, subject to individual i's budget constraint, we have:

$$(11) \widehat{U}_j^1 = \widehat{U}_j^0 + r_{jP} + \sum_{h \neq j} v_{jh} q_j - c_j(p)$$

Where $c_j(p)$ is the generic cost function for user j and $c_j(0) = 0$, $c_j(p) > 0 \forall j$. The condition for adoption will thus be:

$$(12) q_j = \begin{cases} 1 & \text{if } r_{jP} + \sum_{h \neq j} v_{jh} q_j \geq c_j(p) \\ 0 & \text{if } r_{jP} + \sum_{h \neq j} v_{jh} q_j < c_j(p) \end{cases}$$

Assuming a linear cost function $c_j(p) = b_j p$, we can reformulate (12) as:

$$(13) q_j = \begin{cases} 1 & \text{if } \theta_{jP} + \sum_{h \neq j} \theta_{jhN} q_j \geq p \\ 0 & \text{if } \theta_{jP} + \sum_{h \neq j} \theta_{jhN} q_j < p \end{cases}$$

Where $\theta_{jP} = \frac{r_{jP}}{b_j}$ and $\theta_{jhN} = \frac{v_{jh}}{b_j} \forall h \neq j$. To solve the model we need two more assumptions. The first one is that only a part of the population has a positive evaluation for the platform itself, what we defined in the introduction as the stand alone-value. The rest of the population derives utility only from the network accessible through the technology. We can write:

$$(14) \theta_{jP} = \begin{cases} \theta_{jP} \sim [0, \widehat{\theta}_{jP}] & \text{if } j \in g \\ 0 & \text{if } j \notin g \end{cases}$$

Where $g = \beta f$ with $\beta \in [0,1]$, and represents the share of “geeks” in the population. This assumption is reasonable in the light of the discussion developed in the

introduction and allows us to extend Rohlfs investigations by modelling different network technologies. Following this assumption, we can define different adoption conditions for the two types of consumer.

$$(15) q_j \forall j \in g = \begin{cases} 1 & \text{if } \widehat{\theta}_{jP} \geq p_d \text{ or } \sum_{h \neq j} \theta_{jhN} q_j \geq p \\ 0 & \text{if } \widehat{\theta}_{jP} < p_d \text{ and } \sum_{h \neq j} \theta_{jhN} q_j < p \end{cases}$$

Where p_d is the price of the platform and p_m is the price of goods in the network, thus p_d is given by $p_d = p - p_m$. For all the other users, the adoption condition is:

$$(16) q_j \forall j \notin g = \begin{cases} 1 & \text{if } \sum_{h \neq j} \theta_{jhN} q_j \geq p \\ 0 & \text{if } \sum_{h \neq j} \theta_{jhN} q_j < p \end{cases}$$

The second assumption, following Artle and Averous and Rohlfs, is that only the size of the network, in term of users and goods, affects an individual's demand. This is a contestable approximation, since the quality of goods in the network does have an impact on demand, just like the relationships among users does affect the utility of each of them for a communication service. Nevertheless, some interesting results can be derived even considering the simple case in which all goods and all users affect the network in the same way. From now on, we thus assume uniform calling pattern, acknowledging that the relaxation of this hypothesis would be a very interesting field for further research.

Let's start analysing demand for "non-geeks" in the first place. Thank to uniform calling assumption, we can re-write equation (16) for the unit mass representing our total population:

$$(17) q_j = \begin{cases} 1 & \text{if } f \theta_{jN} \geq p \\ 0 & \text{if } f \theta_{jN} < p \end{cases}$$

Where $\theta_{jN}(m) = \sum_{h \neq j} \theta_{jhN}$ and $f = \frac{\sum_j q_j}{N}$ is the fraction of users adopting the technology that we have introduced at the beginning of the section. This allows ordering individuals in term of their demand for the service, since if $\theta_{hN}(m) \geq \theta_{jN}$, user h will be an adopter in any equilibrium for which j is an adopter. Consider a technology where valuation θ_{jN} of the j^{th} consumer associated to the complete network is distributed uniformly over the population $\theta_{jN} \sim U[0,100]$. For the marginal consumer we have:

$$(18) \theta_{jN} = 100(1 - m(f))$$

The reserve price a “*non-geek*” consumer will be willing to pay to join the network when the latter is incomplete is proportional to the fraction of population which has subscribed to the network, since this determines the quantity of goods available in the network. We have denoted this fraction f , with $f \in [0,1]$. The utility U_j of the j^{th} consumer can thus be rewritten as:

$$(19) U_j = \begin{cases} \theta_{jN}m(f) - p & \text{if he adopts technology} \\ 0 & \text{if he does not adopt} \end{cases}$$

The j^{th} consumer will buy the service if and only if his utility is higher than 0, the condition for adoption becomes:

$$(20) p \leq \theta_{jN}m(f)$$

The fraction of subscribers for a given price p will be equivalent to a scalar multiplied by the fraction f of consumers with an utility from adoption equal or higher than p . To simplify we will start assuming that in (29, coefficient $a = 1$, so that we can substitute $m(f) = f$ as in Rohlfs. If U_j is the utility of the consumer for which $p = \theta_{jN}f$ (indifferent consumer), since utility is uniformly distributed we have:

$$(21) U_j \geq 0 \rightarrow \theta_{jN} \geq \frac{p}{f}$$

Substituting we have that demand is the locus of points where:

$$(22) p = 100f(1 - f)$$

The combination of the hypothesis on uniform distribution and the proportionality between utility and the fraction of subscribers allows showing the fraction of the population that may adopt technology for any given price.

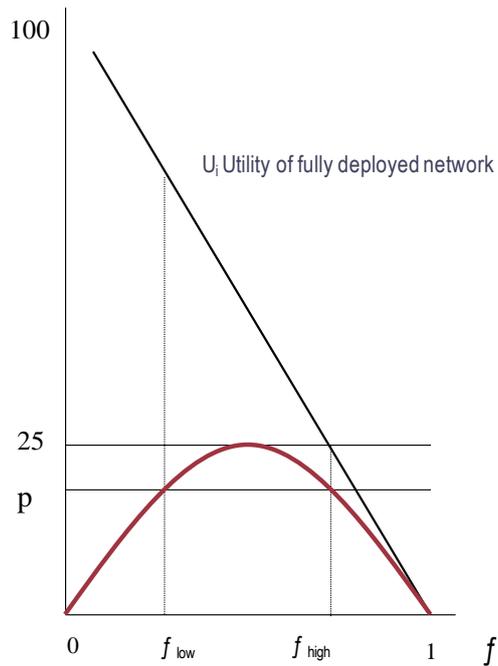


Fig.1 Demand for “non-geeks” users, as in Rohlfs’s Model (1974)

The graph above visually shows the demand of “non-geeks” consumers. The black curve represent the valuation of consumers for the complete network, namely a network in which all consumers are connected and all goods are available in the network. The red parabola represents demand for the incomplete network. The intersections (if any) of the red curve with price identifies possible equilibria. Solving for f we have:

$$(23) f \in [0.5 - \delta, 0.5 + \delta]$$

$$(24) \delta = \frac{1}{2} \sqrt{\left(1 - \frac{4p}{100}\right)}$$

We thus have three possible outputs:

- For $p > 25$, we have a single equilibrium in $f = 0$, the user set is null,
- For $p = 0$, we have multiple equilibria $f = 0, f = 1$, depending on the starting disequilibrium, we end up either with a null user set or a user set including the entire population

- For $0 < p \leq 25$ multiple equilibria, $f = 0$, $f = f_{low}$, $f = f_{high}$, with the equilibrium on the right-end side of the parabola (f_{high}) which is always pareto-superior to the ones on the left-end side.

If p is higher than the reserve price for the incomplete network, “non-geeks” consumers will not adopt technology in any case. If the price is below this threshold there will always be two possible outputs for non-geeks demand. The left-end equilibrium (f_{low}), beside behind suboptimal, is an instable equilibrium: if a single consumer chooses to drop from the network, the utility of others consumers will progressively become lower than p bringing back the equilibrium to the null user set. On the other hand, if the level of deployment is higher than f_{low} , the utility for a newcomer will be higher than p and the roll-out will proceed further and will reach the point of equilibrium defined as f_{high} .

This model shows the existence of a threshold, a critical mass of consumers which is necessary to solve the start-up problem of a network technology and generate the positive externalities.

Proposition 1: If the starting disequilibrium for a network technology is the null user set and all consumers are non-geeks, for any maximizing price $p^* > 0$, in order to reach the critical mass and solve the start-up problem, early adopters have to be subsidized.

Proof: if $p^* > 25$, $\forall j 0 \geq \theta_{jN}f - p^*$, thus nobody is interested in adopting the technology, unless subsidies are provided. If $0 < p \leq 25$, we have that $\theta_{jN}f - p^* > 0$ for $f \in [f_{low}, f_{high}]$ but $\theta_{jN}f - p^* < 0$ for $f \in [0, f_{low}] \cup [f_{high}, 1]$, thus if the starting disequilibrium is $f = 0$, nobody will be interested in adopting technology. The share of population that needs subsidies to adopt technology, which we call $\lambda = f_{low}$, while the amount of needed subsidies can be calculated as the area under the parabola:

$$(25) \Lambda(p) = \int_0^{f_{low}} p(f)df$$

2. Stand-alone Value and Geeks Demand

To learn more about adoption dynamics for network technologies we have to include in our model the demand from “geeks” users. We have assumed that a group of users has a positive valuation for the good defined as platform or device, which is essential to access the network technology. This category of consumers has two options to adopt, as described in (15). When the network user set is null, in the moment in which the technology is launched on the market ($t = 1$), he adopts if his valuation of the device is higher than the price of the device, namely $\widehat{\theta}_{jP} \geq p_d$. If this is not the case, he can still adopt at a later stage ($t = 2$) following the dynamics of adoption of “non-geeks” consumers. To simplify the strategic problem for “geeks” consumers, we further assume that a manufacturer cannot change the price of the device discriminating on the different groups of consumers. Moreover, we assume that demand for the device from geeks is less elastic than demand of “non-geeks” consumers. This seems a reasonable assumption since “geeks” users do not suffer any risk by adopting the technology, while for a “non-geeks” it exists the risk of receiving only the local utility from the device, for which he has a null valuation, or finding only a limited number of goods in the network, if a suboptimal equilibrium is reached.

The demand curve of “geeks” (from now on referred to as f_g) is defined as function of the share of “geeks” in the population (g), the price of device d (p_d) and of a parameter (α) which models the investment which can be allocated by a manufacturer to enhance the technologic characteristics or the awareness of the new device.

$$(26) f_g(g, p_d, \alpha) = f_g \in [0, g]$$

Where:

$$\frac{\partial f_g}{\partial g} \geq 0, \frac{\partial^2 f_g}{\partial g^2} = 0, \frac{\partial f_g}{\partial p_d} \leq 0,$$

And

$$(27) \frac{\partial f_g}{\partial \alpha} \geq 0, \frac{\partial^2 f_g}{\partial \alpha^2} \leq 0 \text{ if } j \in g, \quad \frac{\partial U_j}{\partial \alpha} = 0 \text{ if } j \notin g$$

An additional investment has a positive effect on the demand of geeks, but this effect decrease progressively since the share of “*geek*” in the population is not affected and thus the investment increase the utility of a progressively smaller share of the population. Moreover, investment in technology does not have any effect on “non-geeks” consumers. This property can be observed in most new technologies, a typical example being the PC’s market. Many manufacturers kept investing in technology to increase the performances of their devices, but only a few consumers, the more technophiles, were actually impacted in their decision to adopt a new model or not. Most people decision to adopt a new model was driven by the appearance on the market of new programs, which required more advanced technology to run. In the same way, when Apple invested to enhance the external aspect of their devices, which can be assimilated to a complementary content, the valuation of a large share of consumers was impacted, but not the one of “*geeks*”.

Consider as an example a demand curve for “geeks” with a linear dependence on parameter α and a logarithmic dependence on parameter p_d . The choice of the function derives from the assumed lower elasticity to price of the “geeks”:

$$(28) f_g(g, p_d, \alpha) = g - \left(\frac{1}{\alpha+1}\right) \times \log(1 + p_d)$$

With $\alpha \in R^+$. This archetypal demand has two advantages: first of all we can visually depict it on the same graph that we used for “non-geeks” demand. Moreover its particular shape is helpful to visually show the effect of additional investment α on adoption dynamics.

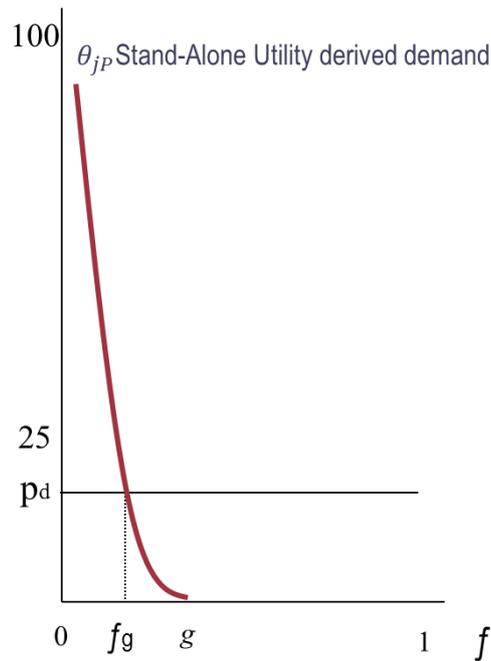


Fig.2 demand curve for “the Geeks”

Fig.2 introduces the demand function of “geeks”. If the share of “geeks” in the market increases, the curve will shift to the right, if the quantity of “geeks” decreases, it will shift to the left. An increase of parameter α , on the other hand, will change the shape of the curve, reducing elasticity to price of geeks and leading to higher demand for the technology. The existence of “geeks”, under given conditions, allow for a positive demand even starting with a null user set and with no subsidies available. To complete the definition of the problem, we need to define the dynamics of the technology adoption and to analyse the supply side.

3. Maximization Problem for a Monopolistic Manufacturer

i. Timeline with no subsidies

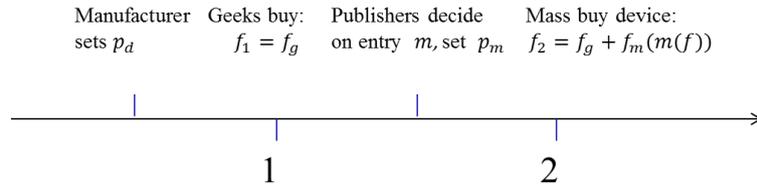


Fig.3 Timeline for network technology adoption with no subsidies

The simplest timeline of the game starts with the manufacturer setting p_d , which is fixed for the two periods. Then at time $t = 1$ the geeks for which $\widehat{\theta}_{JP} \geq p_d$ adopt the technology, creating an installed-base of early adopters of size $f_1 = f_g$. Publishers will observe f_1 and decide on entry and set their optimal price p_m , determining m . Then at $t = 2$ “non-geeks” decide on adoption. Fig.3 visually shows the timeline for adoption.

ii. Manufacturer Profit function

The manufacturer’s problem is to maximize his profits, which are given by the sum of profits in period 1 and discounted profits in period 2 which are a function of the installed base at $t = 1$. The profit function can be written as:

$$(29) \max_{p_d} \pi_d = \pi_1 + \delta \pi_2(f_1, p_d)$$

Where δ is the discount factor and profits are given by:

$$(30) \pi_1 = p_d f_1 - C(f_1)$$

$$(31) \pi_2 = p_d (f_2 - f_1) - C(f_2)$$

The associated cost functions are simply:

$$(32) C(f_1) = c(f_1) - (1 + \alpha)FC$$

$$(33) C(f_2) = c(f_2 - f_1)$$

$$(34) c = MC_d$$

Where c is the marginal cost of the device and FC represents all fixed cost of the technology, which can be increased with further investment (α) if subsidies are allowed. To complete the manufacturers market we have to set two conditions: the first one is a budget constraint, so that a manufacturer cannot keep increasing investment without a limit. We write this as $\pi_d \geq -K$, where K is the initial endowment of the firm. The second is a regularity condition:

$$(35) \max \pi_1 \leq \max (\pi_1 + \delta \pi_2(f_1, p_d))$$

This means assuming that a successful adoption of technology by “non-geeks” users is always more profitable for a manufacturer than the simple maximization of profits on the “geeks” market. This assumption is reasonable in most cases, since positive externalities increase with the size of the network, nevertheless there may be some counterfactual examples, in which raising the price to prevent “*non-geeks*” users from adoption can be the optimal strategy. An example can be a premium credit card: in this case, a limited size of the network is essential to provide exclusive utilities to the adopters and thus a raise in price can lead to higher profits with respect to an increase in the number of adopters. The First Order Condition for the manufacturer is:

$$(36) 0 = \frac{\partial \pi_d}{\partial p_d} = \frac{\partial \pi_1}{\partial p_d} + \delta \frac{\partial \pi_2}{\partial f_1} + \frac{\partial f_1}{\partial p_d}$$

Therefore, if (35) holds, at $t = 1$ the manufacturer charges a lower price or sets a higher quantity than would maximize short-run profits, in order to raise its customer base and hence its future profits, whenever a successful adoption is feasible.

iii. Equilibrium User Sets with Geeks in the Market

In the absence of subsidies, the equilibrium user set at $t = 2$ is determined exclusively by the installed base of geeks obtained at $t = 1$. Equilibria for a given price p is given by:

$$(37) f_2 = \begin{cases} f_g & \text{if } f_1 \leq f_{low} \\ f_{high} & \text{if } f_1 > f_{low} \end{cases}$$

If $f_1 \leq f_{low}$ the installed base is lower than the critical mass, thus for every consumer $j \in [f_1, f_{low}]$, we have that $0 \geq \theta_{jN}f - p$, thus no more consumers are interested in adopting the technology and we end up in a stable equilibrium in which only “geeks” adopt the technology. If $f_1 > f_{low}$ the critical mass is reached and more users adopt technology until the stable equilibrium in f_{high} is reached, where $0 \geq \theta_{jN}f = p$ as described at the beginning of this session. Fig 4 illustrates this situation. The disequilibrium point f_1 is located underneath the parabola. This implies that for some non-geek users j the network valuation is higher than is willingness to pay. User j thus adopts the technology further increasing the value of the network. Other users successively adopt technology until the stable equilibrium f_{high} is reached.

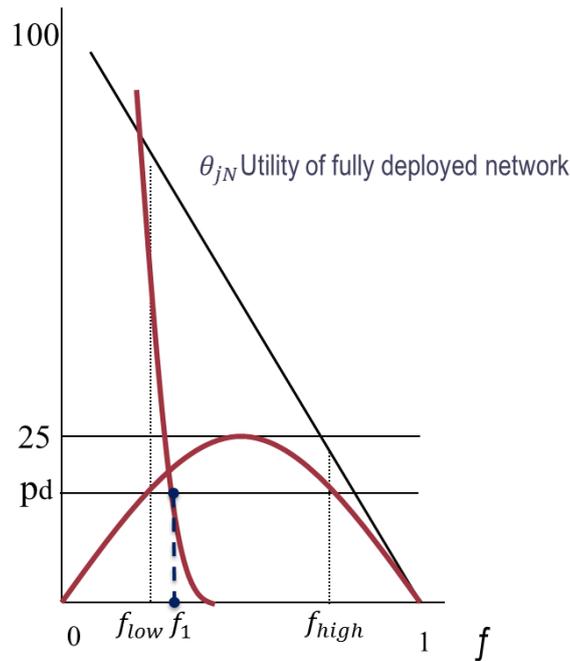


Fig.4 Technology Adoption dynamics with high Stand-Alone Value

Proposition 2: if $f_g(p_d) = f_1 > f_{low}$, for a given network technology, the start-up problem is solved and there is one and only one stable equilibrium user set at $t = 2$. Such equilibrium user set implies that a share f_{high} of the economy adopts the network technology and a share $(1 - f_{high})$ does not adopt.

Proof: if $f_1 > f_{low}$, f_1 is not a stable equilibrium. $\forall j \in [f_1, 1 - f_{high}]$ we have that: $u_j = \theta_j f_1 - p_d \geq 0$. Thus all users in this set adopt the technology at $t = 2$.

This situation captures a scenario in which the network technology has a very high Stand-Alone value and thus the population of “geeks” is predominant in the economy. This output is a first best solution both for the manufacturers, who maximize his profits and for consumers, since “geeks” will pay a lower price and “non-geeks” will obtain a larger surplus than in f_{low} or f_g .

The necessary but not sufficient condition to obtain $f_1 > f_{low}$ at $t = 2$, is to have a sufficient share of “geeks” in the economy, namely $g \geq f_{low}$. If this condition does not hold, meaning that $g < f_{low}$ and no subsidies can be provided except lowering the price, optimal strategy for manufacturer may be to choose p_d in order to maximize π_1 , since non-geeks will not adopt the technology unless the price is consistently reduced to $p_d \leq p_i$, as depicted in Fig5. The equilibrium user set will then depend on other variables such as the marginal cost of production c . If the price cannot be reduced below p_i the final equilibrium user set is in $f_1 = f_g(p_d)$. This captures the situation of a technology with low stand-alone value and underinvestment to subsidize early adopters or a technology for which the valuation of the device from “geeks” is very high while the valuation of the access to the network for “non-geeks” is low (Examples can be: Satellite phones or minidisc).

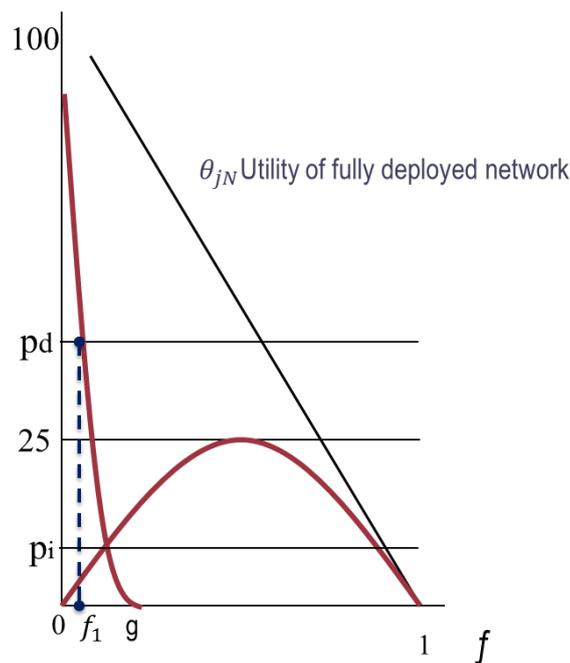


Fig.5 Technology Adoption dynamics with low Stand-Alone Value

Proposition 3: for any given g , in the absence of subsidies, the maximum price compatible with the start-up problem, is p_i , defined as the price for which $f_g(p_i) = f_{low}(p_i)$, $p_i = 100f_g(1 - f_g)$.

Proof: for any $p_d \leq p_i$, $f_1 \geq f_{low}$, thus $\forall j \in [f_1, 1 - f_{high}]$ we have that: $u_j = \theta_j f_1 - p_d \geq 0$. Thus all users in this set adopt the technology at $t = 2$. Conversely, for any $p_d > p_i$, $f_1 < f_{low}$, thus $\forall j \in [f_1, 1 - f_{low}]$, $u_j = \theta_j f_1 - p_d < 0$, non-geeks users do not adopt at $t = 2$.

Dynamics of Network Technology Adoption with subsidies

In this session we allow for additional types of subsidies from both the manufacturer and the producers of complementary contents and we analyse their effect on the adoption problem. First of all, let's formulate the general scheme of needed subsidies.

Proposition 5: Consider $p = p_d + p_m$, and assume that for “non-geeks” consumers the two good are perfect complements. For any p_d^* compatible with adoption, the share of population needing subsidies is at most $\lambda = f_{low}(p)$, decreasing with the installed based. Moreover, for any $f_g > 0$, the quantity of needed subsidies is lower than:

$$\int_0^{f_{low}} f(p) - p df^5.$$

Proof: if $g - \left(\frac{1}{\alpha+1}\right) \times \log(1 + p_d) \leq 0$ then the share of population to subsidize is: $\lambda = f_{low}(p)$. If $g - \left(\frac{1}{\alpha+1}\right) \times \log(1 + p_d) \geq f_{low}$, $\lambda = 0$ and no subsidies are needed. If $0 < g - \left(\frac{1}{\alpha+1}\right) \times \log(1 + p_d) < f_{low}$, $0 < \lambda < f_{low}$. Quantity of subsidies needed is given by:

$$(38) \int_{f_g}^{f_{low}} f(p) - p_i df$$

For any p_i , we thus have:

⁵ Quantity of subsidies calculated using Rohlfs (1974) model, starting from the null user set disequilibrium.

$$\int_{f_g}^{f_{low}} f(p) - p_i df \leq \int_{f_g}^{f_{low}} f(p) df \leq \int_0^{f_{low}} f(p) df \quad \forall p_i, f_g$$

1. Subsidies from Manufacturer

i. Timeline with Subsidies from Manufacturer

In this section, we allow the manufacturer to provide subsidies not only by reducing price p_d but also by increasing investment α .

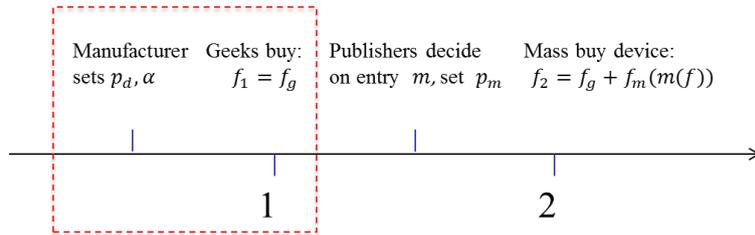


Fig.6 Timeline of Adoption dynamics with manufacturer subsidies

ii. Adoption Dynamics with Subsidies from Manufacturer

Manufacturer can invest α at $t = 1$ in order to enhance technical characteristics or awareness of their technology. We have described this subsidy in the previous session. Recall that we assumed α is “device related”, it affects $\widehat{\theta}_{jP}$, thus it does not have significant impact on “non-geeks”, since they have $\widehat{\theta}_{jP} = 0$. On the other hand, subsidies from complementary contents’ producers are “Network related”, they will impacts θ_{jN} . This working assumption reflects the actuality of the launch of e-readers, characterized by two distinct marketing channels (device, device + Media) from the very beginning. Although scope economies may exist among the two channels, we consider that they have second order effects.

Manufacturers can provide subsidies also by reducing the price of device, as introduced above. A reduction in p_d will affect the whole market, since price is fixed in the two periods, it is an indiscriminate subsidy. The intuition is that an overinvestment effort in technology, by pushing more geeks towards the adoption of the new technology at $t = 1$, can be more profitable than reducing p_d , since it is a discriminated subsidy. The condition for this strategy to be effective is that subsidy α is sufficient to solve the start-up problem. The effect of an increase in investment is shown in Fig 7. Higher investment leads to an increase in the demand from geeks. f_1 grows, nevertheless the share of “geeks” g in the population is not affected, nor is the utility of “non-geeks”. Recall also that the marginal effect of an overinvestment in technology of the hardware is decreasing as α increases. In our example, the problem for the manufacturer becomes:

$$(39) \max \pi_d(p_d, \alpha)$$

$$(40) \frac{\partial f}{\partial \alpha} = \frac{1}{(\alpha+1)^2} \times \log(1 + p_d), \frac{\partial^2 f}{\partial \alpha^2} = -\frac{2 \log(1+p_d)}{(\alpha+1)^3}$$

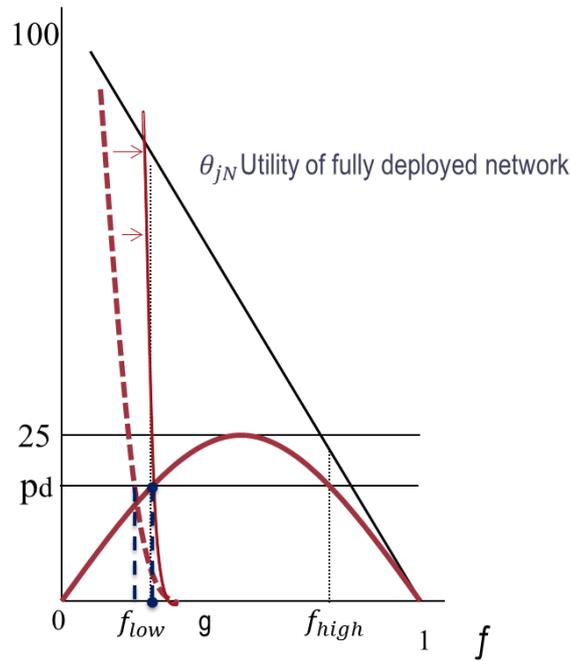


Fig.7 The effect of an increase in the investment effort

The First order condition becomes:

$$(41) \frac{\partial \pi_d}{\partial \alpha} = \frac{\partial \pi_d}{\partial p_d} = 0$$

Proposition 6: Consider a technology for which $g > f_{low}$ for the optimal price p_d^* . If manufacturer is allowed to provide infinite subsidies ($K = \infty$), then the start-up problem can always be solved without reducing optimal price p_d^* . The Pareto-superior equilibrium in f_{high} can be reached thank to subsidy α . We say that α can be “pivotal” when $g > f_{low}$.

Proof: If $g > f_{low}$, for every optimal $p_d^* < 25$, we can have either $f_g > f_{low}$ or $f_g \leq f_{low}$. If $f_g > f_{low}$ holds, the start-up problem is solved and no subsidies are needed. If $f_g \leq f_{low}$ the manufacturer can always set α^* such that $f_1(\alpha^*) > f_{low}$. This solves the start-up problem and it is always feasible if ($K = \infty$). In fact, for $\alpha \rightarrow \infty$, $f_g \rightarrow g \forall p_d^* < 25$, thus if $g > f_{low}$, the start-up problem can always be solved.

This choice may also be Pareto-superior for the economy if from the maximization problem we have that $\pi(f_{high}(p_d^*)) - \alpha^* \geq \pi(f_g(p^*))$. Otherwise, the manufacturer will have an incentive in non-investing. Technologic investment is progressively more costly and has an impact on a small share of consumers. Nevertheless, over-investing in technology can be justified if “geeks” consumers can be pivotal for adoption. By providing this type of subsidy, the manufacturer can fix a higher price and recover the cost of investment at $t = 2$. Manufacturer thus arbitrates between the two types of subsidies, choosing the combination that maximizes his profits.

2. Subsidies from Complementary Contents Producers (CCP)

In this section we first describe the CCP market, then we define the subsidies they can provide and we analyse their effect on adoption dynamics.

i. CCP market

Recall that the utility for a “non-geek” user is given by:

$$(42) U_j = \theta_j m(f_2) - (p_d + p_m)$$

Where p_m is the price and m is the fraction of complementary contents in the market as defined in (4). CCP market is composed by a large number (N) of identical companies (i) facing monopolistic competitions. Each company produces a single good which can be sold in the network associated with the new technology. There is free entry in the network, nevertheless in order to market a product the company suffers a positive cost of entry (which is technology specific and thus sunk), marginal costs are null:

$$(43) FC_i > 0, MC_i = 0 \quad \forall i$$

Each company maximizes profit in his share of the market:

$$(44) \max_{p_{m,i}} \pi_{i,2} = p_{m,i} f_{i,2}(f_1, p_m) - FC_i$$

Since companies are identical and there is free entry in the market for every observed p_d we can define m_i as a Boolean variable taking value 1 if the company enters the market. We thus have:

$$(45) m = \frac{M}{N} \text{ where } M = \sum_i m_i \forall i$$

And:

$$(46) m: \pi_i = p_m f_2(f_1, p_m) - m NFC_i = 0$$

$$(47) m = \frac{p_m * f_2(f_1, p_m)}{NFC_i}$$

For every manufacturer's choice, CCP market can end up in two alternative stable equilibria:

$$(48) m_{1,2} = \left\{ \begin{array}{ll} \frac{p_{m1} * f_1}{NFC_i} & \text{"non-geeks" don't adopt, low } m \\ \frac{p_{m2} * f_2}{NFC_i} & \text{"non-geeks" adopt, high } m \end{array} \right\}$$

ii. Timeline with Subsidies from CCP – reduction of p_m

Let's allow CCP to provide subsidies. For example they can reduce p_m . Subsidies from manufacturer occur after manufacturer has fixed his price. Non-geek users observe global price p and then decide on adoption.

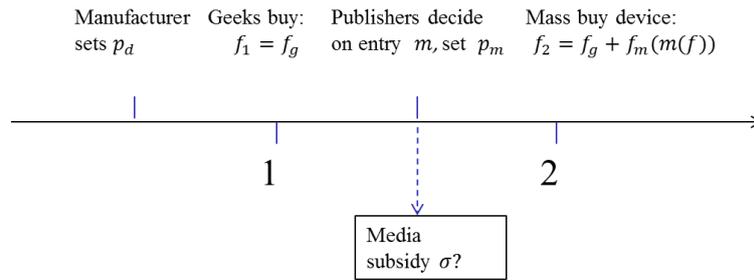


Fig.8 Timeline of Adoption dynamics with CCP subsidies

iii. Adoption Dynamics with Price Reduction from CCP

In this session we assume $g < f_{low}$ and $p_d^* \geq p_i$. This situation can arise from many different set-ups. For example, assuming $c > p_i$, the manufacturer cannot reduce the price of the device to p_i or he will have negative profits in both periods. Under these conditions, at $t = 1$ we have:

$$(49) \lambda(p) = f_{low}(p) - f_g(p_d^*) > 0 \text{ and } \Lambda(p) = \int_{f_g}^{f_{low}} f(p) - p_i df > 0$$

Additional subsidies are needed to solve the start-up problem. Fig.9 visually shows this situation through our example. The blue dotted line depicts $\lambda(p)$ while the red area represents $\Lambda(p)$.

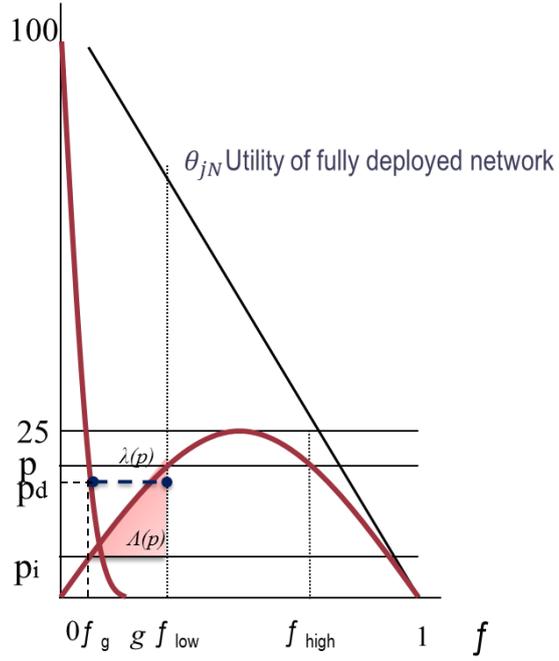


Fig.9 Additional Subsidies needed if $g < f_{low}$ and $p_d^* \geq p_i$

Having identified the needed subsidies, let's examine the impact CCP can have on adoption. Suppose that each CCP can make an investment σ_i to subsidize adoption. In our case study of Publishers and e-readers, it can be an investment to create a more comfortable version rather than the PDF standard for written contents or to implement additional features to the existing Media (interactive links, archives, commentaries, etc.). We have assumed that this type of subsidy will only impact the valuation of the network. We can make a further assumption that this investment is not detrimental for any consumer, thus $\frac{\partial \theta_{jN}}{\partial \sigma_i} \geq 0$.

Let's start analyzing CCP subsidies assuming $\frac{\partial \theta_{jN}}{\partial \sigma_i} = 0$, thus complementary contents don't increase the value of the network and CCP can provide subsidies only by reducing price of their goods.

Proposition 8: if device and complementary contents are perfect complement, meaning "non-geeks" consumers only considering $p = p_d + p_m$ making their adoption decision, then even assuming $\frac{\partial \theta_{jN}}{\partial \sigma_i} = 0$ CCP can provide subsidies to adoption. Moreover, these subsidies can be pivotal if

$$f_{low}(p_d) \leq f_g \leq f_{low}(p)$$

Proof: for any optimal couple $(p_d^*, p_m^* > 0)$ we have:

$$(50) \Lambda(p) = \int_{f_g}^{f_{low}} f(p) - p_i df \geq \int_{f_g}^{f_{low}} f(p_d^*) - p_i df$$

Thus CCP can reduce $p_m' < p_m^*$ and reduce the amount of needed subsidies. In fact:

$$(51) \Lambda(p(p_m')) = \int_{f_g}^{f_{low}} f(p(p_m')) - p_i df < \Lambda(p(p_m^*))$$

The maximum subsidy in this case is given by:

$$(52) \int_{f_g}^{f_{low}} f(p) - p_i df - \int_{f_g}^{f_{low}} f(p_d^*) - p_i df = \int_{f_{low}(p_d^*)}^{f_{low}(p)} f(p) df$$

If $f_{low}(p_d) \leq f_g \leq f_{low}(p)$, then the quantity of needed subsidies is:

$$(53) 0 \leq \Lambda(p) \leq \int_{f_{low}(p_d^*)}^{f_{low}(p)} f(p) df$$

But then $\forall f_g \in [f_{low}(p_d), f_{low}(p)]$ CCP can set opportunely p_m' such that $\Lambda(p(p_m')) = \Lambda(p)$, thus solving the start-up problem.

Now let's assume $\frac{\partial \theta_{jN}}{\partial \sigma_i} > 0$. CCP can increase valuation θ_{jN} by investing σ_i . Each company can choose to invest or not: if they do, they suffer extra costs. In our example we treat σ_i as a Boolean variable:

$$(54) \begin{cases} \sigma_i = 0, & \text{company does not invest} \\ \sigma_i = 1, & \text{company invests} \end{cases}$$

The extra fixed costs can then be introduced in the profit function as follows:

$$(55) \pi_{i,2} = p_{m,i} * (f_{i,2}(f_1, p_m)) - (1 + \sigma_i)FC_i$$

The effect of the subsidy is modeled as a linear increase in utility, depending on CCP decision. The new utility function can be written as:

$$(56) U_j = 100(1 + \sigma) \times (1 - m(f))$$

$$(57) \sigma = \sum_{i=1}^M \frac{\sigma_i}{N}$$

Proposition 9: if $\frac{\partial \theta_{jN}}{\partial \sigma_i} > 0$, the range in which CCP subsidies can be “pivotal” to network technology adoption is extended to $f'_{low}(p_d) \leq f_{low}(p_d) \leq f_g < f_{low}(p)$, where:

$$(58) f'_{low}(p_d) = 0.5 - \delta' \leq f_{low}(p_d)$$

$$(59) \delta' = \frac{1}{2} \sqrt{\left(1 - \frac{4p}{100(1+\sigma)}\right)} \geq \delta$$

Proof: the maximum achievable subsidy is obtained for $\sigma = m$, namely all companies that enter in the market invest to provide subsidy. Since all companies are identical, this is also the only positive subsidy reachable at equilibrium, the other possible equilibrium being $\sigma = 0$. If a positive subsidy is deployed, since $\frac{\partial \delta}{\partial \sigma} > 0$, $\frac{\partial f_{low}(p_d)}{\partial \sigma} \leq 0$, $f_{low}(p_d)$ will shift to the left as depicted in Fig.10 to reach $f'_{low}(p_d)$. Moreover, p_i increase to $p'_i = 100(1 + \sigma)f_g(1 - f_g) > p_i$. As a result, the needed subsidy is reduced from the blue area to the red area. Analytically:

$$(60) \Lambda'(p) \leq \int_{f_g(p_d^*)}^{f'_{low}(p_d)} f(p) - p'_i df < \int_{f_g(p_d^*)}^{f_{low}(p_d)} f(p) - p_i df$$

For every $\forall f_g \in [f'_{low}(p_d), f_{low}(p)]$ we can thus find the minimum value of σ that guarantees a successful deployment by setting:

$$(61) f'_{low}(p) = f_g$$

$$(62) g - \left(\frac{1}{\alpha}\right) \times \ln(1 + p_d) = 0,5 - \frac{1}{2} \sqrt{\left(1 - \frac{4p}{100(1+\sigma)}\right)}$$

And solving for σ .

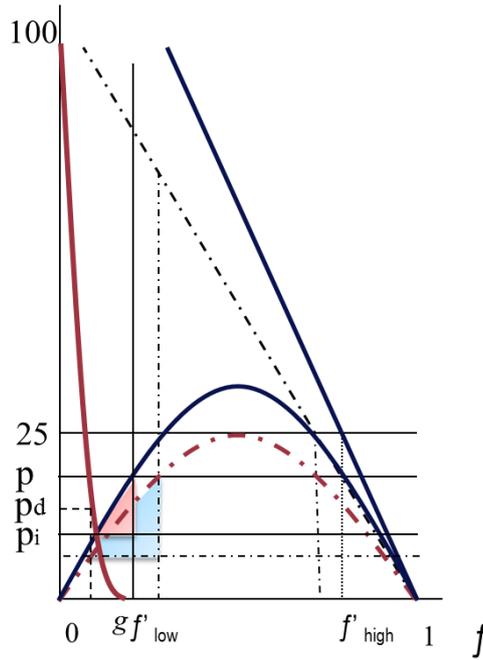


Fig.10 Additional Subsidies needed if $\frac{\partial \theta_{jN}}{\partial \sigma_i} > 0$

This type of subsidy, besides extending the set-ups in which it is possible to solve the start-up problem, can lead to a Pareto-superior final equilibrium where a larger share of consumers adopt the network technology and receive a higher surplus, while manufacturer obtains higher profits from the solution of the start-up problem (from the regularity condition).

3. Hold-up, Free-riding and Coordination Problems

CCP can provide subsidy only if they are compensated so that non negative profits constraint is satisfied. In fact, in the absence of coordination, investing is risky for CCP both because of horizontal and vertical information asymmetries. Each CCP controls a fraction $\frac{\sigma_i}{M}$ of the investment, so they do not have *a priori* guarantees that the need optimal investment σ^* would be reached. Moreover, if manufacturer cannot commit on fixing the price for the device, they suffer a hold-up risk (recall that we assumed investment FC is technology specific). For a CCP the profit function becomes:

$$(63) \max_{p_m, \sigma_i} \pi'_{i,2} = p_m \cdot f'_{i,2}(f_1, p_m, \sigma_i) - (1 + \sigma_i)FC_i$$

Thus for the company to be able to invest the condition becomes:

$$(64) \Delta\pi(\sigma) = (\pi'_{i,2} - \pi_{i,2}) = p_m * (f'_{i,2} - f_{i,2}) \geq \sigma_i FC_i$$

The intuition is that this condition can be fulfilled only if the manufacturer commits on keeping a fixed price for the device and remunerates CCP willing to invest for their subsidies. We can thus examine two possible scenarios:

- i. Manufacturer can establish complete contracts with CCP
- ii. Incomplete contracts: hold-up and free-riding risk emerge for CCP

i. Timeline with complete contracts

The possibility of structuring complete contracts can be modelled similarly to vertical integration. After signing the contract, the monopolist manufacturer can solve the start-up problem efficiently, since he can count on CCP subsidies. At the end of the game, he has to remunerate CCP according with their investment. This situation is shown in Fig.11.

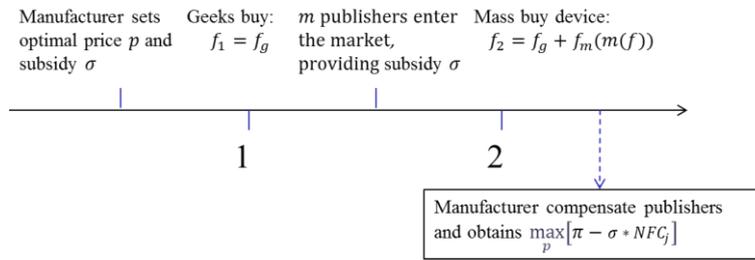


Fig.11 Timeline of Adoption dynamics with CCP subsidies and complete contracts

If $g \leq f_{low}$ and $f'_{low} < f_g < f_{low}$, thus only “network related” subsidies are pivotal the problem for the manufacturer becomes:

$$(65) \max_p \pi_d = \pi_2 - \sigma * NFC_i$$

$$\text{s. t. } f_1 \geq f_{low} \text{ or } \sigma * NFC_i \geq \int_{f_g}^{f_{low}} f(p) - p_i df$$

If $g > f_{low}$ and $f_g < f_{low}$, thus both “device related” and “network related” subsidies can be pivotal the problem for the manufacturer becomes:

$$\max_p [\pi(f'_{high}, p) - \sigma * NFC_i, \pi(f_{high}, p) - \alpha * FC]$$

$$\text{s. t. } \sigma * NFC_i \geq \int_{f_g}^{f_{low}} f(p) - p_i df \text{ or } \alpha * FC \geq \int_{f_g}^{f_{low}} f(p) - p_i df$$

Where the constraints represent the condition to solve the start-up problem with CCP subsidies or technologic subsidies.

Proposition 10: If $g \leq f_{low}$ and $f'_{low} < f_g < f_{low}$ or if $g > f_{low}$ and $f_g < f_{low}$, establishing complete contracts can lead to a Pareto-superior equilibrium, with respect to the situation in which both firms act opportunistically

Proof: If $g \leq f_{low}$ and $f'_{low} < f_g < f_{low}$, subsidies from CCP are a necessary condition to adoption from “non-geeks”. In this case complete contracts allow to end up in $f'_{high} > f_g$ thus consumers are better off. Moreover, manufacturer is better off since he does not provide subsidies and obtains $\max \pi_2 \geq \max \pi_1$ for the regularity assumption. CCP obtains zero profit in both cases but at f'_{high} more firms enter the market. if $g > f_{low}$ and $f_g < f_{low}$, then we can set two conditions:

$$(66) \alpha * FC \geq \sigma * NFC_i - (f'_{high} - f_{high}) * (p' - p - c) \text{ and}$$

$$(67) f'_{high} - f_{high} \geq 0$$

Where the first term in (66) represents the additional costs if manufacturer provides “device related” subsidies while the second term is composed by the remuneration of CCP for their subsidies and delta profits with respect to the case in which the companies act separately. This condition, if respected, indicates that the manufacturer is better off coordinating with CCPs. Thus if only (66) holds, in the new equilibrium manufacturer and CCPs are better off but not consumers. On the other hand, if only (67) holds but not (66), then consumers are better off in the new equilibrium but manufacturer has an

Anticipating this behavior, CCPs will not invest. Thus we will end up with a suboptimal equilibrium with a lower share of adopters f_g , and lower profits for the manufacturer as shown in table 1.

CCP \ Manufacturer	Investing	Wait and see
Keeping p_d	$\pi_2(f'_{high}) - \sigma * NFC_i; 0$	$\pi_1(f_g(p_d)); 0$
Changing p_d before $t = 2$	$\pi_2(f'_{high}); -(1 + \sigma) * NFC_i$	$\pi_1(f_g(p_d)); 0$

Table.1: Coordination problem with incomplete contracts

If we drop the assumption that CCP are identical, we will also have a coordination problem in the CCP market. When the start-up problem is not solved, each company will have an incentive to wait and see, eventually free-riding on the investment of other Media companies, once $f > f'_{low}$.

Going back to our case study of Publishing companies and e-readers, we observe the following: investment from Publishers seem to increase consumers' valuation of e-readers and their associated network. Their cooperation may be pivotal for non-geeks to adopt this new technology. In order to invest in the new distribution network, Media companies need to be granted sufficient returns from their investment. Under current market conditions, publishing companies suffer considerable risks by investing in the new distribution networks: first of all, they suffer hold-up risk from manufacturers. In fact, each manufacturer has a dominant position and control distribution through his platform, thus can impact profitability of publishing companies in many ways. Moreover, they suffer a cannibalization risk on their traditional distribution network; this risk increases if they are forced to reduce prices in one distributive channel. Finally, if they subsidize the new network and there is free-entrance, they suffer a free-riding risk from other Media companies, which can wait and enter the market at a later stage without suffering the costs of subsidies. If complete contracts are available, the positive network externalities generated can be distributed efficiently to bring both sides of the market on-board and increase social welfare.

Conclusions

In this paper we show that in a two-sided market with network externalities, cooperation of complementary contents producers can be pivotal to reach the critical mass of adopters needed to solve the start-up problem of a new technology. Moreover, in case of cooperation, under given conditions a Pareto-superior final equilibrium can be reached. Nevertheless, when the technology giving access to the network is proprietary, complete contracts with the producers of complementary contents might be necessary to reach this equilibrium. We also show that for some technologies, overinvesting to enhance technologic characteristics might be profit maximizing, even if only a few consumers are actually valuating positively these technologic innovations. In fact, those few customers can sometimes be essential to constitute an installed customers base large enough to solve the start-up problem.

These results allow for a reflection over recent investigations U.S. Court vs. Apple Inc. and al. or EU Antitrust formal proceedings to investigate sales of e-books. The main claim of these investigations is that recent contracts established by a group of publishers with the leader of tablets' manufacturer constitute a case of vertical restraint (they are basically MRP – minimum retail price – agreements). While MRP can be often considered as negative distortions, in the light of our analysis of the case of Tablets and Media, we could question whether these contracts are the main distortion in this emerging market or a consequence of current regulation and market structure. In fact, profitability of digitized versions sold through e-readers' network is very low for publishers. On the one side, the actual diffusion of e-readers does not guarantee a sufficient market for complementary contents. On the other side, the margins for publisher are lower than in the physical distribution network. This may be counter-intuitive since digitized versions are costless to reproduce. Nevertheless considering the lower willingness to pay of consumers, the unfavourable fiscal regimes (ex. VAT in France is 5% for physical books and 21% for digitized books), and the high distribution fees that publishers have to reverse to manufacturers (since they often act as distributors of digitized contents as well), the algebraic sum can be already negative. Moreover,

publishers need to consider the possible negative externalities introduced by the new distribution channel. Overall, the cost of subsidizing early-adopters of the new network is being sustained by Media industry consistently. In order to recover for these costs, publishers would need to control their distribution channels strategically or at least establishing a complete contract with the digital distributors of their contents. Otherwise, they risk suffering negative profits, due to the dominant position of the manufacturer/distributors in this market and they will stop providing subsidies. If the intention of the regulator is to enhance competition and to favour universal access to new networks, maybe the first distortion to address should be the regulation of digital distributors, which has been acknowledge but not solved with the Block exemption regulation by EU, which allows for instance fashion brands to restraint distribution of their goods in order to prevent their strong investments in the brand from free-riding.

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Chapter 3

Pricing Copyrighted Contents in the Digital Era: The case of Magazines' Industry

Abstract

This paper moves from the economic issues raised by digitization and by the roll-out of an innovative support such as Reading Tablets on Press Magazine's market. By separating the concepts of meaningful expression from the traditional supports allowing for publishing, digitization imposes a rethinking of media industries' business models and copyright frameworks. Each digital reader represents in fact a new medium allowing for the diffusion of copyrighted contents in digitized formats and their penetration rate will impact the share of the industry turnover that will be generated online and the cannibalization rate with respect to physical channels. This paper analyzes these issues through a pricing model for copyrighted contents in a two-sided market with multi-channel distribution. We analyze both the case of a firm producing only on one market (digital or physical) and of a firm producing the same content in different versions in the two markets. We find that: (i) in the digital market the "free dailies" business model is sustainable only if the number of publishers is limited. (ii) Publishers that are active already in the traditional channel with relevant market shares should "defend" their market share setting higher prices for the digital versions of their products. (iii) Unless both the advertising revenues per copy and the total sales in the digital markets grow larger than the traditional market, a traditional publisher should keep operating in the traditional market. (iv) If the total cannibalization grows to be more than proportional the optimal strategy for a publisher can be not to produce the digital version of a given product.

Introduction

The economic issues raised by digitization of information goods have been largely studied by economists. Digitization (Shapiro 1998) of copyrighted goods have had a growing impact on Media industries since it allows for a much cheaper and faster circulation of contents, the main drawbacks being the cannibalization of traditional industries and the creation of new challenges for legal institutions such as massive piracy and Creative Commons. Varian, H. (1995) introduces the problem of pricing goods with heterogeneous evaluations and a cost structure with high fixed costs – or costs of the first copy – and negligible marginal costs. He shows how engaging in price discrimination and bundling techniques in these cases lead to a situation in which both the industry and consumers are better off. By differentiating the product the market can be segmented and revenues can be recovered also from user with low willingness to pay without destroying the value from segments of consumers with high-willingness. Deneckere and McAfee (1994) show that even the conscious use of product degradation can make all parties strictly better off under specific circumstances. In addition to differentiation, bundling is a price discrimination technique which is particularly important when dealing with information goods and experience goods (Nelson 1970), since a utility evaluation can be made only after the consumption of the good and the heterogeneity in evaluations can be important. Bundling consist in offering distinct products for sale as one package. Nalebuff, B. (1999) shows how this tool is effective in auto-sorting consumers into different groups according to their willingness to pay. Bundling could be effective, under specific circumstances, even if products are partial substitutes, as it is in the case of thematic channels in pay TV, or as it is likely to be the case with different versions of the same media⁶. The effectiveness of multi-form⁷ bundling has been studied by Koukova, N., Kannan, P.K. and Ratchford, B. (2008). They show that complementarities exist between different formats and consumers tend to value them positively proportionally to the awareness they have about the differences between formats. Bakos and Brynjolfsson (2000) show that the optimal strategy for information goods (with low marginal cost) is pure bundling, while Venkatesh, R. and

⁶ See Gentzkow, M. (2005) on complementarities between physical and online newspapers

⁷ A package composed of the same product declined in physical and digitized versions

Chatterjee (2006) have analyzed the magazine markets the magazine market finding that it is always profit-enhancing for publishers to offer digitized versions although the domain of optimality of pure bundling is more limited.

Despite all these contributions showing the good opportunities brought by new media, publishing companies have been struggling to define their optimal pricing and marketing mixes in a context of increasing digitization. In the case of magazine publishing, the complexity of the profit maximization problem is substantially increased when digital versions are offered: the multiplication of substitutable versions and distribution channels sums up with the incertitude on the future evolution and on the competitive and legal framework of the digital market. The originality of the problem is that it combines a large number of economic issues which have hardly been tackled all together in one model. Magazine publishing is a two-sided market, since advertisers and consumers both concur to the sustainability of a publication business model. Magazines are differentiated goods, since they are subject to copyright but they compete for the leisure time of consumers. The digital market represent an opportunity to better discriminate between consumers, but producing a digitized version of the physical magazine means introducing a substitutable product in the market, thus cannibalization effects must be taken into consideration. Finally, digitized versions are produced at negligible marginal costs through a different retailing network, introducing multi-channel distribution problem such as free-riding in the business model.

For almost a decade, while the digital market was limited to PC as a support and to “free dailies business model, magazines’ publishers did not engage to much effort to enter the digital market, perceiving it as an unprofitable niche and a limited treat, especially due to the low compatibility of digital supports with the exploitation of magazines’ utility. Innovations such as smartphones and tablets have increased the utility of consumers for digitized written contents and attracted more advertising revenues in the market, making it more attractive for magazine publishers. Nevertheless, the optimal strategy to exploit digitization in the magazine industry has not yet been identified. The prevailing business models used by publishing brands to approach the digital market have been “*free dailies*”⁸ or “*freemium*”⁹ models, but are these models

⁸ Publishers using this model give acces to the contents for free, in order to maximize diffusion and consequent advertising revenues.

⁹ Publishers using this model give limited access to their contents for free, to build brand loyalty and attract premium paying subscribers.

really sustainable in a context of increased competition and reduced historical market power? Moreover, the introduction on the market of new version with higher degrees of substitutability has increased the concerns about the future of the whole traditional value chain.

The objective of this paper is to identify the optimal pricing strategy for an agent who is producing physical goods which can be offered also in digitized versions. The exploration of this complex question can be helpful to publishers and can be extended to other markets with similar characteristics in order to answer common questions such as: Under what product-market conditions would be profitable to offer a digital version of a product? How effective can versioning and bundling tools in a context of multi-channel distribution? Would digitization “kill” the traditional distribution channels in the long run?

In order to answer these questions the paper analyzes, through a simplified model, the pricing problem of a publisher who is assumed to operate in monopolistic competition, selling a single differentiated (copyrighted) product which can be available to consumers in multiple versions (physical or digitized). First we specify the different sustainable business models in the publishing industry. Then we show that the “free dailies” is hardly sustainable as the offer on the digital market grows and if a publisher has a positive pricing model in the traditional market. Moreover, we find out that traditional publishers with relevant shares of the market should try to defend the value of their product by applying a higher positive price when they enter the digital market. Finally, we analyze the market conditions that will eventually lead to a complete cannibalization of the traditional market.

The remainder of this paper is structured as follows: the next section introduces the standard model of publisher in the traditional physical market. Then we set some hypotheses about the digital market and we define the model of a publisher producing a digital differentiated product. In the fourth section, we establish a link between the markets to study the pricing strategy of a magazine publisher producing both a paper and a digitized version of his product. Section five concludes outlining the results of our model and tackling the related policy issues as well as future research developments.

A traditional economic model for publishing firms

The magazines' market has been traditionally characterized by a large number of small firms and few companies holding large portfolios of brands summing up to relevant market shares. The market is traditionally considered as concentrated in the top tier and more competitive in the lower tiers. A publisher is a firm selling edited pieces of information under a brand or a portfolio of brands. Each brand identifies a product referred as a magazine, which is assumed to be differentiated from the other goods in the market. The hypothesis that magazines are differentiated despite the fact that they often rely on the same sources of information, is based on two elements: first of all magazines are bundles of copyrighted contents, which by definition cannot be replicated exactly without incurring in a violation of intellectual property. The second element is the brand, which is common differentiating tool discussed in previous literature.

We assume that the physical global market is composed of n firms indexed by $j = 0, \dots, n$ each producing, for simplicity, a single differentiated good. We also assume that the consumer's market is composed of a mass of consumers denotes S with a strictly quasi-concave utility function. Each firm j starts with a given endowment derived from past investment in differentiation, which is represented by her initial share of the global market and is denoted \bar{s}_j . We further assume that the firm faces a down-sloping demand that depends on the deviation from the algebraic mean of the vector of magazines' prices available in the market, which is denoted \bar{p} . This parameter is assumed to be exogenous when the firm takes her pricing decision, thus firm j can disregard the effect of their single magazine pricing strategy on the actions of their competitors in the short term. The demand for the firm can be written:

$$(1) \quad q_j = f_j(p_j, \bar{s}_j, \bar{p})$$

Furthermore we can explicit this demand function assuming a linear relation and writing:

$$(2) \quad Q_j(p_j) = S(\bar{s}_j - b(p_j - \bar{p}))$$

Normalizing the S mass of consumers to one we can simplify the demand faced by the publisher to:

$$(3) \quad Q_j(p_j) = \bar{s}_j - b(p_j - \bar{p})$$

The cost function faced by the publisher is composed of a fixed part (F) and a variable part (c_j). The former represents all the costs which are needed to produce the first copy of a copyrighted content, such as authors' wages, editors and support services provided by the publisher. The variable cost includes the production of each additional copy, transport and distribution cost. We can write:

$$(4) \quad C_j(q_j) = c_j q_j + F$$

The revenues of the publishers are composed by the selling price and by advertising revenues, which are a function of the diffusion of the magazine and are defined as follow:

$$(5) \quad A_j = g(q_j)$$

In order to keep the model simple we can assume a linear form for the advertising revenues as we did for the demand function. The previous equation becomes then:

$$(6) \quad A_j(q_j) = \bar{\gamma} q_j T$$

The problem for the firm is to set the non-negative price that maximizes his profit function in the paper market, which can be written:

$$(7) \quad \max_{p_j \geq 0} \pi_j(q_j, p_j, C_j, A_j)$$

or explicitly

$$(8) \quad \max_{p_j \geq 0} \pi_j = D(q_j)q_j + A_j(q_j) - C_j(q_j)$$

To solve the problem we can apply the first order condition for a monopolist that will simply read:

$$(9) \quad F.O.C. \quad \frac{\Delta D(q_j)q_j}{\Delta q_j} + \frac{\Delta A_j(q_j)}{\Delta q_j} = \frac{\Delta C_j(q_j)}{\Delta q_j}$$

$$(10) D(q_j) = \frac{\bar{s}_j - q_j}{b} + \bar{p}$$

$$(11) \frac{\Delta D(q_j) q_j}{\Delta q_j} = \frac{\bar{s}_j - 2q_j}{b} + \bar{p}$$

Using equation 3, 4 and 6, we can solve to find the optimal price for firm j .

$$(12) \frac{\bar{s}_j - 2q_j}{b} + \bar{p} + \bar{\gamma} = c_j$$

$$(13) q_j^* = \frac{\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j)}{2}$$

$$(14) p_j^* \left\{ \begin{array}{ll} 0 & \text{if } \bar{\gamma} \geq \frac{\bar{s}_j}{b} + \bar{p} + c_j \\ \frac{\bar{s}_j}{2b} + \frac{\bar{p} - \bar{\gamma} + c_j}{2} & \text{otherwise} \end{array} \right\}$$

The resulting profit is:

$$(15) \pi_j^* = (p_j^* + \bar{\gamma} - c_j) * \left(\frac{\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j)}{2} \right) - F$$

$$(16) \pi_j^* = \frac{1}{4b} (\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j))^2 - F$$

Analyzing this result in terms of the parameter γ allows us to specify different categories of media goods in the publishing industry, corresponding to different business models. First of all, we can establish the necessary conditions for a publisher who relies exclusively on advertising revenues (i.e. free dailies). In fact if the coefficient of advertising revenues is sufficiently high, namely:

$$(17) \bar{\gamma} \geq \frac{\bar{s}_j}{b} + \bar{p} + c_j$$

The strategy of setting $p_j = 0$ is optimal for firm j . This strategy corresponds to maximizing diffusion of the goods to reach:

$$(18) q_j^{max} = \bar{s}_j + b\bar{p}$$

And a profit of:

$$(19) \pi_j = (\bar{s}_j + b\bar{p}) * (\bar{\gamma} - c_j) - F$$

The other extreme case is when $\bar{\gamma} = 0$, which is the case of products which cannot rely on advertising (i.e. can be the case for books, which usually do not include advertising pages). In this case we have the traditional monopoly solution which in this case reads:

$$(20) q_j^* = \frac{\bar{s}_j + b(\bar{p} - c_j)}{2}$$

$$(21) p_j^* = \frac{\bar{s}_j}{2b} + \frac{\bar{p} + c_j}{2}$$

$$(22) \pi_j = \left(\frac{\bar{s}_j}{2b} + \frac{\bar{p} - c_j}{2} \right) * \left(\frac{\bar{s}_j + b(\bar{p} - c_j)}{2} \right) = \frac{1}{4b} \left(\bar{s}_j + b(\bar{p} - c_j) \right)^2 - F$$

The above reasoning can be summarized as follows:

Proposition 1: if the economy is composed by a single market for the differentiated good, under the hypotheses set above, we have that $p_j^* \in \left[0; \frac{\bar{s}_j}{2b} + \frac{\bar{p} + c_j}{2} \right] \forall j$. The optimal price p_j^* of a specific differentiated good depends on the coefficient $\bar{\gamma}$, which can be interpreted as the relative weight of advertising revenues for firm j .

Based on coefficient $\bar{\gamma}$, we can identify three categories of products with different business models:

- If $\bar{\gamma} \geq \frac{\bar{s}_j}{b} + \bar{p} + c_j$, the firm's strategy is to maximize diffusion, setting $p_j^* = 0$. In the publishing industry this may represent the business model of *free dailies*, which rely exclusively on advertising revenues.
- If $0 < \bar{\gamma} < \frac{\bar{s}_j}{b} + \bar{p} + c_j$, the firm's strategy is to find the optimal balance between a good margin on kiosk sales and a sufficient diffusion to capture advertisers interest. This is the case of the majority of *magazines and newspapers*
- If $\bar{\gamma} = 0$, the firm's strategy is to maximize profits from stall sales revenues. In publishing this represents the business model for *books*.

In this paragraph we have outlined that pricing strategy in the presence of linear advertising revenues, may vary consistently from one differentiated good to another. We have then identified three categories of products based on the relative weight of advertising revenues in the business model. Moving from this setup, we will now assume that in addition to the *physical market*, there is the opportunity to exploit an emerging market, namely the *digital market*. Each publisher should decide whether to offer a digitized version and to establish a new pricing strategy for his good. In the next section we first discuss a number of hypotheses related to the new market and then we proceed to complete the pricing model for a publisher facing a new emerging market.

Pricing differentiated goods in the digital market

The advents of the internet, bit-encoding techniques and platform innovations such as the creation of smartphone and tablets have created new ways of conducting business in many fields of economy. In some industries such as in the media markets, digitization has brought a revolution in the business model of traditional firms. They allow for the creation of new products with specific cost functions and distribution channels and for the creation of new markets, characterized by specific competitive environments and regulations. On the supply side, digitization of press magazines relaxes the traditional constraints of the industry such as physical dimensions, costs of producing a copy and limitations to diffusion. The increased flexibility on the cost side in turn results in enhanced discrimination opportunities for the firms. On the drawbacks, the digital revolution complicates the pricing problem, introducing cannibalization and coordination problems among physical and digital value chains.

In order to keep the model simple, we focus on the strategic pricing decisions of a single firm j producing two different versions of the same product: the traditional physical product and a digital version characterized by the same content but different support and format. In reality, we observe that the pricing decisions depend also on the interactions of each media firm with physical and digital distributors, which may have different

strategies, different competitive environments and different market power. In this paper we will disregard these interactions, leaving their treatment to a separate paper.

In order to adapt the basic model to the digital context, that we generally identify with a subscript d , we need to introduce a number of hypotheses in addition to those discussed in the previous section. First of all, one of the positive impacts of digitization is the consistent reduction of the marginal cost of reproduction of copyrighted contents. For the sake of simplicity we will thus assume that marginal cost c_j is null when the unit of the good sold is in digital format. We use the notation $c_{j,d} = 0$. On the other hand, producing and selling the additional product involves emerging costs F_d which are assumed to be fixed.

$$(23) C_{j,d} = F_{j,d}$$

These costs include all the investment needed for the firm to conceive, produce and market the new product. This time we assume that the digital global market is composed of m potential firms indexed by $j = 0, \dots, m$ each producing, for simplicity, a single differentiated good. Some of these m firms are already active in the physical market while some others start operating exclusively in the digital market. Anyway we start by considering the markets as unrelated. We also assume that this time the consumer's market is composed of a share $\bar{\beta}$ of the total mass of consumers S . This assumption derives from the fact that in order to have access to the digital version of a product j , a consumer needs to be equipped with a specific device. Coefficient $\bar{\beta}$ represents the percentage of the total population which is capable of accessing the digital market. Moreover we assume that in the new market each firm starts with a null endowment, meaning that market power derived from past investment in differentiation in the physical market is not automatically transferred in the digital market. Resuming we have that:

$$(24) \bar{s}_{j,d} = \frac{\bar{\beta}S}{m} \quad \forall j = 0, \dots, m$$

Finally we keep the assumption that the firm faces a down-sloping demand and that there is free entry in the new market. The demand function for the firm depends on the number of firms entering the market and on price

$$(25) q_{j,d} = f_j(p_{j,d}, m)$$

We can explicit this demand function assuming a linear relation and writing:

$$(26) Q_{j,d}(p_{j,d}, m) = \bar{\beta} S \left(\frac{1}{m} - b_d(p_{j,d} - \bar{p}_d) \right)$$

Normalizing the S mass of consumers to one we can simplify the demand faced by the firm to:

$$(27) Q_{j,d}(p_{j,d}, m) = \bar{\beta} \left(\frac{1}{m} - b_d(p_{j,d} - \bar{p}_d) \right)$$

The revenues of the publishers in the digital market are composed by the selling price and by advertising revenues as in the physical market:

$$(28) A_{j,d} = g(q_{j,d})$$

Or explicitly:

$$(29) A_j(q_{j,d}) = \bar{\gamma}_d q_{j,d} T$$

We can now repeat the reasoning that we did for the physical market to find the price that maximizes the firm's profit function in the digital market. The maximization problem can be written:

$$(30) \max_{p_{j,d} \geq 0} \pi_{j,d}(q_{j,d}, p_{j,d}, C_{j,d}, A_{j,d})$$

The F.O.C. reads:

$$(31) \frac{\frac{1}{m} - 2\frac{q_{j,d}}{\bar{\beta}}}{b_d} + \bar{p}_d + \bar{\gamma}_d = 0$$

Solving for $q_{j,d}$ we obtain:

$$(32) q_{j,d}^* = \frac{\bar{\beta}}{2} \left(\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}_d) \right)$$

$$(33) p_{j,d}^* = \left\{ \begin{array}{ll} 0 & \text{if } \bar{\gamma}_d \geq \frac{1}{b_d m} + \bar{p}_d \\ \frac{1}{2b_d} \left(\frac{1}{m} + b_d(\bar{p}_d - \bar{\gamma}_d) \right) & \text{otherwise} \end{array} \right\}$$

And the resulting profit is

$$(34) \pi_{j,d}^* = \frac{1}{2b_d} \left(\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}_d) \right) * \frac{\bar{\beta}}{2} \left(\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}_d) \right) - F_{j,d}$$

$$(35) \pi_{j,d}^* = \frac{\bar{\beta}}{4b_d} \left(\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}_d) \right)^2 - F_{j,d}$$

As we did for the physical market, we can establish the necessary conditions for a publisher who relies exclusively on advertising revenues (i.e. free web-sites). If

$$(36) \bar{\gamma}_d \geq \frac{1}{b_d m} + \bar{p}_d$$

It is optimal for publisher j to set $p_{j,d} = 0$. The maximum share of the market that firm j is able to reach is:

$$(37) Q_{j,d}^{max}(0, m) = \bar{\beta} \left(\frac{1}{m} + b_d \bar{p}_d \right)$$

And the resulting profit is:

$$(38) \pi_{j,d} = \bar{\beta} \left(\frac{1}{m} + b_d \bar{p}_d \right) \bar{\gamma}_d - F_{j,d}$$

On the other hand, when $\bar{\gamma}_d = 0$ or very close to zero, which could be the case of many digital publications such as websites or blogs in the start-up phase, the solution of the maximization problem gives:

$$(39) q_{j,d}^* = \frac{\bar{\beta}}{2} \left(\frac{1}{m} + b_d \bar{p}_d \right)$$

$$(40) p_{j,d}^* = \frac{1}{2b_d} \left(\frac{1}{m} + b_d \bar{p}_d \right)$$

This gives us the range of optimal price for a digital differentiated product depending on his capability of generating advertising revenues.

$$(41) p_{j,d}^*(\bar{v}_d) \in \left[0; \frac{1}{2} \left(\frac{1}{b_d m} + \bar{p}_d \right) \right]$$

If we assume that this market is unrelated with the physical one, when the market starts we have no historic average price $\bar{p}_d = 0$, the m firms become then symmetric and at equilibrium they will all behave in the same way:

$$(42) Q_{j,d}(p_{j,d}, m) = \bar{\beta} \left(\frac{1}{m} - b_d p_{j,d} \right)$$

$$(43) D(q_{j,d}) = \frac{1}{m b_d} - \frac{q_{j,d}}{\beta b_d}$$

And we have that:

$$(44) q_{j,d}^* = \frac{\bar{\beta}}{2} \left(\frac{1}{m} + b_d \bar{v}_d \right)$$

$$(45) p_{j,d} = \bar{p}_d = \begin{cases} 0 & \text{if } \bar{v}_d \geq \frac{1}{b_d m} \\ \frac{1}{2b_d} \left(\frac{1}{m} - b_d \bar{v}_d \right) & \text{otherwise} \end{cases}$$

Finally, since we have free entry in the market, we have either:

$$(46) \pi_{j,d} = \frac{\bar{\beta}}{m} * \bar{v}_d - F_{j,d} = 0$$

From which we get:

$$(47) m^* = \frac{\bar{\beta} \bar{v}_d}{F_{j,d}}$$

Or

$$(48) \pi_{j,d} = \frac{\bar{\beta}}{2} \left(\frac{1}{m} + b_d \bar{v}_d \right) * \frac{1}{2b_d} \left(\frac{1}{m} + b_d \bar{v}_d \right) - F_{j,d} = \frac{\bar{\beta}}{4b_d} * \left(\frac{1}{m} + b_d \bar{v}_d \right)^2 - F_{j,d} = 0$$

$$(49) m^*_{1,2} = \frac{-\bar{\gamma}_d \pm 2\sqrt{\frac{F}{\bar{\beta}b_d}}}{b_d\bar{\gamma}_d^2 - 4\frac{F}{\bar{\beta}}}$$

Finally if the firms in the market cannot rely on advertising, the equilibrium number of firms is given by:

$$(50) q_{j,d}^* = \frac{\bar{\beta}}{2m}; p_{j,d}^* = \frac{1}{2mb_d}$$

$$(51) \pi_{j,d} = \frac{\bar{\beta}}{2m} * \frac{1}{2mb_d} - F_{j,d} = 0$$

$$(52) m^* = \frac{1}{2} \sqrt{\frac{\bar{\beta}}{b_d F_{j,d}}}$$

Proposition 2: If the digital market is totally unrelated with the physical one, under the

hypotheses set above, we have that $p_{j,d}^* \in \left[0; \frac{1}{\sqrt{\frac{\bar{\beta}b_d}{F_{j,d}}}} \right] \forall j$. The optimal price $p_{j,d}^*$ of a

specific differentiated good depends on the coefficient $\bar{\gamma}_d$, and it is common to every firm $j \in [1 \dots m^*]$. If

- If $\bar{\gamma}_d \geq \frac{1}{b_d m}$ the optimal strategy for every firm is to maximize diffusion, setting $p_{j,d}^* = 0$. If the advertising revenues are sufficiently attractive, since there are no marginal costs and no historical average price, every firm that can enter in the market has an incentive to maximize diffusion.
- If $0 \leq \bar{\gamma}_d < \frac{1}{b_d m}$, the firms strategy is to charge the share of the average cost of production that is not covered by advertising.

Proposition 3: as $m \rightarrow \infty$, (i.e. the available offer of contents grows infinitely large) the strategy of offering digital products for free is not sustainable for any firm j operating only in the digital market, if investment are needed for the production of the differentiated product (i.e. $F_d > 0$). The maximum number of firms that could operate in the market with the strategy $p_{j,d}^* = 0$ is we can solve 43 for m , imposing $\bar{p}_d = 0$:

$$(53) m^* = \frac{\bar{\beta}\bar{\gamma}_d}{F_{j,d}}$$

This number increases with the diffusion of digital market and advertising revenues and decreases with the costs needed to set up the differentiated product.

Pricing differentiated goods available in substitutable versions

The introduction of digitized versions allows for increased versioning and bundling opportunities for those firms already active in the physical market. The same written content, thanks to bit-encoding techniques, can be offered to consumers in many more ways: through a website, in Portable Document Format¹⁰, through smartphone and tablets specific application, through content aggregators or social networks, etc. Moreover, different versions can be digitally combined (bundled) in virtually infinite ways, thanks to the relaxation of physical constraints. In fact, the traditional bundles offered in the publishing industry, subscriptions (bundle of editions) and bundle of titles can be significantly expanded while a new bundling option, the coupling of different versions of the same contents, emerge.

Nevertheless, a digitized version is a substitute product for the hardcopy sharing the same contents; we may argue about the degree of substitutability of digital versions not being perfect, but overall the economic literature has shown a clear cannibalization effect between physical and digital copies of the same product. To model this effect we introduce in the traditional model introduced in section 1, an exogenous parameter $\bar{\alpha}$ which we assume as representative of the reduction of physical sales due to cannibalization effect of new market. If a firm j decides to sell a digital version of her physical product, the quantity of physical goods sold will thus depend also on the quantity of digital units of the goods that are sold.

$$(54) q_j' = f_j(p_j, q_{j,d})$$

The relation between digital sales and physical sales is once again assumed to be linear for simplicity, we can thus write:

¹⁰ Commonly called PDF, it is a digitized fac-simile of a document

$$(55) Q_j'(p_j) = S(\bar{s}_j - b(p_j - \bar{p})) - \bar{\alpha}q_{j,d}^*$$

The total demand faced by a firm j in the two markets can be written

$$(56) Q_j^{tot}(p_j, p_{j,d}) = S(\bar{s}_j - b(p_j - \bar{p})) + (1 - \bar{\alpha})\bar{\beta}S\left(\frac{1}{m} - b_d(p_{j,d} - \bar{p}_d)\right)$$

The total cost function for a firm j which is selling both physical and digital version of his product becomes:

$$(57) C_j^{tot}(q_j, q_{j,d}) = c_jq_j + F^{tot}$$

Where $F^{tot} = F + F_d$ is the sum of the investment needed to operate in the two markets? For simplicity, we assume that each firm can produce a single digital version of her differentiated physical good. If a firm is already active in the physical market, he can use his market power and the extra profits in the physical market to develop the digital one. We will also assume that firm j has total control of both his traditional and his digital retailing network. This hypothesis limits our model to a particular model of digital distribution, which may not be suitable for all firms. In reality, firms going digital have a number of available strategies, each of which involves complex economic tradeoffs which deserve an in depth discussion which is not in the purpose of this paper.

We can thus proceed solving the maximization problem as we did in the previous sections. First of all we normalize the S mass of consumers to one we can simplify the demand faced by the firm to:

$$(58) Q_j^{tot}(p_j, p_{j,d}) = Q_j(p_j, p_{j,d}) + Q_{j,d}(p_{j,d})$$

$$(59) Q_j(p_j, p_{j,d}) = (\bar{s}_j - b(p_j - \bar{p})) - \bar{\alpha}Q_{j,d}(p_{j,d})$$

$$(60) Q_{j,d}(p_{j,d}) = \bar{\beta}\left(\frac{1}{m} - b_d(p_{j,d} - \bar{p}_d)\right)$$

The total revenues from the advertising sector will be the sum of the two incomes:

$$(61) A_j^{tot} = g(q_j, q_{j,d})$$

Or explicitly:

$$(62) A_j^{tot}(q_j, q_{j,d}) = \bar{\gamma}q_j + \bar{\gamma}_d q_{j,d}T$$

Since advertising rates depends on the potential audience and on the actual sales, we can further simplify by assuming that the coefficient $\bar{\beta}$ is a good proxy of the relative value of $\bar{\gamma}_d$ with respect to $\bar{\gamma}$, so that

$$(63) \bar{\gamma}_d = \bar{\beta}\bar{\gamma}$$

Holds and we can write:

$$(64) A_j^{tot}(q_j, q_{j,d}) = \bar{\gamma}(q_j + \bar{\beta}q_{j,d})$$

Moreover, if the traditional publishing firms enter the digital market, they will introduce in the market their historical average price, which will participate in forming \bar{p}_d , so in this case $\bar{p}_d > 0$. We could assume for example that \bar{p}_d would depend positively on the historical average price \bar{p} and on the share of firms that are active in both markets $f = \frac{n}{m}$, so $\bar{p}_d(\bar{p}, \frac{n}{m})$.

The problem for the firm is to set the couple of prices that maximizes his global profit function. The maximization problem can be written:

$$(65) \max_{p_j \geq 0, p_{j,d} \geq 0} \pi_j^{tot}(q_j, q_{j,d}, p_j, p_{j,d}, d, C_j^{tot}, A_j^{tot})$$

or explicitly

$$(66) \max_{p_j \geq 0, p_{j,d} \geq 0} \pi_{j,d} = p_j(q_j, q_{j,d})q_j + p_{j,d}(q_{j,d})q_{j,d} + A_j^{tot}(q_j, q_{j,d}) - C_j^{tot}(q_j, q_{j,d})$$

To solve the problem we need to apply the first order conditions that read:

$$(67) F.O.C.1 \quad \frac{\Delta D_j(q_j, q_{j,d})q_j}{\Delta q_j} + \frac{\Delta A(q_j, q_{j,d})}{\Delta q_j} = \frac{\Delta C(q_j, q_{j,d})}{\Delta q_j}$$

This is the standard condition for the physical market, and

$$(68) F.O.C.2 \quad \frac{\Delta D_{j,d}(q_j, q_{j,d})q_{j,d}}{\Delta q_{j,d}} + \frac{\Delta A(q_{j,d})}{\Delta q_{j,d}} - \frac{\Delta C(q_{j,d})}{\Delta q_{j,d}} = - \frac{\Delta D_j(q_j, q_{j,d})q_j}{\Delta q_{j,d}}$$

This condition implies that the marginal profit obtained by producing one unit of digital output should equalize the marginal cost of cannibalization in the physical market. We first solve for the first condition to find:

$$(69) D_j(q_j, q_{j,d}) = \frac{\bar{s}_j - q_j - \bar{\alpha} q_{j,d}}{b} + \bar{p}$$

$$(70) \frac{\Delta D_j(q_j, q_{j,d}) q_j}{\Delta q_j} = \frac{\bar{s}_j - 2q_j - \bar{\alpha} q_{j,d}}{b} + \bar{p}$$

$$(71) \frac{\Delta A(q_j, q_{j,d})}{\Delta q_j} = \bar{\gamma}$$

$$(72) \frac{\Delta C(q_j, q_{j,d})}{\Delta q_j} = c_j$$

$$(73) \frac{\bar{s}_j - 2q_j - \bar{\alpha} q_{j,d}}{b} + \bar{p} + \bar{\gamma} = c_j$$

$$(74) q_j^* = \frac{\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) - \bar{\alpha} q_{j,d}}{2}$$

From the second condition we get:

$$(75) D_{j,d}(q_{j,d}) = \frac{1}{mb_d} + \bar{p}_d - \frac{q_{j,d}}{\beta b_d}$$

$$(76) \frac{\Delta D_{j,d}(q_{j,d}) q_{j,d}}{\Delta q_{j,d}} = \frac{1}{mb_d} + \bar{p}_d - \frac{2q_{j,d}}{\beta b_d}$$

$$(77) \frac{\Delta D_j(q_j, q_{j,d}) q_j}{\Delta q_{j,d}} = \frac{-\bar{\alpha} q_j}{b}$$

$$(78) \frac{\Delta A(q_j, q_{j,d})}{\Delta q_{j,d}} = \bar{\beta} \bar{\gamma}$$

$$(79) \frac{\Delta C(q_j, q_{j,d})}{\Delta q_j} = 0$$

$$(80) \frac{1}{mb_d} + \bar{p}_d - \frac{2q_{j,d}}{\bar{\beta}b_d} + \bar{\beta}\bar{\gamma} = \bar{\alpha} \frac{q_j}{b}$$

Solving 80 for $q_{j,d}$ we have:

$$(81) q_{j,d}^* = \frac{\bar{\beta}}{2} \left[\frac{1}{m} + b_d \left(\bar{p}_d + \bar{\beta}\bar{\gamma} - \bar{\alpha} \frac{q_j}{b} \right) \right]$$

$$(82) p_{j,d}^* = \frac{1}{2b_d} \left[\frac{1}{m} + b_d \left(\bar{p}_d - \bar{\beta}\bar{\gamma} + \bar{\alpha} \frac{q_j}{b} \right) \right]$$

Substituting 81 in 74 we can find the expression for q_j^* and p_j^* :

$$(83) q_j^{*'} = \frac{1}{\left(2 - \frac{\bar{\alpha}^2 \bar{\beta} b_d}{2b}\right)} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) - \frac{\bar{\alpha} \bar{\beta}}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\beta}\bar{\gamma}) \right] \right]$$

$$(84) p_j^{*'} = \left(\frac{\bar{s}_j}{b} + \bar{p} \right) - \frac{2b - \bar{\alpha}^2 \bar{\beta}}{2b^2} q_j^{*'} - \frac{\bar{\alpha} \bar{\beta}}{2b} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\beta}\bar{\gamma}) \right]$$

And by calling:

$$(85) \frac{2b - \bar{\alpha}^2 \bar{\beta}}{b^2(\bar{\alpha}^2 \bar{\beta} b_d - 4)} = \ddot{\theta}$$

$$(86) p_j^{*'} = \left(\frac{1}{b} + \ddot{\theta} \right) \left(\bar{s}_j + b\bar{p} - \left(\frac{\bar{\alpha} \bar{\beta}}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\beta}\bar{\gamma}) \right] \right) \right) + \ddot{\theta} b(\bar{\gamma} - c_j)$$

To get an understanding of the economic implications we observe the variation of prices as the digital market develops and as the cannibalization effect increases. First of all let's analyze the start-up phase of the new market, in which $\bar{\alpha} \in [0; 1]$ and $\bar{\beta} \in [0; 1]$.

If $\bar{\beta} = 0$ or $\bar{\alpha} = 0$, we have $\ddot{\theta} = -\frac{1}{2b}$ and we get back to the results of the initial situation in which either the only existing market is the traditional one ($\bar{\beta} = 0$) or the products are non-substitutable and the markets are independent ($\bar{\alpha} = 0$). On the other

hand, if both $\bar{\beta} = 1$, meaning that the digital market has reached the same level of development (i.e. same global demand) and produces the same advertising revenues and $\bar{\alpha} = 1$, so the products are perfect substitutes, we have that:

$$(87) q_{j,d}^* = \frac{1}{2} \left[\frac{1}{m} + b_d \left(\bar{p}_d + \bar{\gamma} - \frac{q_j}{b} \right) \right]$$

$$(88) p_{j,d}^* = \frac{1}{2b_d} \left[\frac{1}{m} + b_d \left(\bar{p}_d - \bar{\gamma} + \frac{q_j}{b} \right) \right]$$

$$(89) q_j^{*'} = \frac{1}{\left(2 - \frac{b_d}{2b}\right)} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) - \frac{1}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}) \right] \right]$$

$$(90) p_j^{*'} = \frac{\left(1 - \frac{b_d}{2b}\right)}{\left(2 - \frac{b_d}{2b}\right)} \left(\frac{\bar{s}_j}{b} + \bar{p} \right) - \frac{1}{\left(2 - \frac{b_d}{2b}\right)} (\bar{\gamma} - c_j) + \frac{\left(\frac{b_d}{2b} - 1\right)}{\left(2 - \frac{b_d}{2b}\right)} \frac{1}{2b} \left[\frac{1}{m} + b_d(\bar{p}_d + c_j) \right]$$

To complete the analysis we can now look at two other extreme cases. The first case is the case of a completely developed digital market ($\bar{\beta} = 1$) with no cannibalization ($\bar{\alpha} = 0$). This would be of course a first best solution for the firm, which would be able to exploit the segmentation of the markets. The optimal strategy in this case will be:

$$(91) q_{j,d}^* = \frac{1}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}) \right]$$

$$(92) p_{j,d}^* = \frac{1}{2b_d} \left[\frac{1}{m} + b_d(\bar{p}_d - \bar{\gamma}) \right]$$

$$(93) q_j^{*'} = \frac{1}{2} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) \right]$$

$$(94) p_j^{*'} = \frac{1}{2b} \left[\bar{s}_j + b(\bar{p} - \bar{\gamma} + c_j) \right]$$

The last extreme case is when the digital market is not yet developed ($\bar{\beta} = 0$) and the products are substitutable. In this case the solution is very simple since there will be no production in the digital market and the production in the physical market does not vary.

$$(95) q_{j,d}^* = 0$$

$$(96) p_{j,d}^* = \frac{1}{2b_d} \left[\frac{1}{m} + b_d(\bar{p}_d - \bar{\gamma}) \right]$$

$$(97) q_j^{*'} = \frac{1}{2} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) \right]$$

$$(98) p_j^{*'} = \frac{1}{2b} [\bar{s}_j + b(\bar{p} - \bar{\gamma} + c_j)]$$

From these equations we can set the following results.

Proposition 3: in a context in which a firm operates in two equally fully developed markets (same S and $\bar{\gamma}$ and $\bar{\beta} = 1$) with different structure and substitutability between the products, and the firm is free to set his pricing policy, the optimal price for the new version is in the range:

$$(99) p_{j,d}^* \in \left[\frac{1}{2} \left(\frac{1}{mb_d} + \bar{p}_d - \bar{\gamma} \right); \frac{1}{2b_d} \left[\frac{1}{m} + b_d(\bar{p}_d - \bar{\gamma}) \right] + \frac{1}{(4b-b_d)} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) - \frac{1}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\gamma}) \right] \right] \right] \forall \bar{\alpha} \in [0; 1]$$

Depending on the cannibalization rate among the two distribution channels. As the degree of substitutability grows ($\bar{\alpha} \rightarrow 1$), the optimal pricing strategy for the digital version depends positively on the share of the physical market and negatively on marginal costs. These effects are amplified if the price elasticity in the digital market is higher than in the traditional market ($b_d \geq b$). As an example, if $b_d = b$, we have that:

$$(100) \quad p_{j,d}^* \in \left[\frac{1}{2} \left(\frac{1}{mb_d} + \bar{p}_d - \bar{\gamma} \right); \frac{1}{3b_d} \left(\frac{1}{m} + b_d \bar{p}_d \right) - \frac{2}{3b_d} \bar{\gamma} + \frac{1}{3b_d} \left[\bar{s}_j + b_d(\bar{p} + \bar{\gamma} - c_j) \right] \right] \forall \bar{\alpha} \in [0; 1]$$

if $b_d = 2b$, we obtain

$$(101) \quad p_{j,d}^* \in \left[\frac{1}{2} \left(\frac{1}{mb_d} + \bar{p}_d - \bar{\gamma} \right); \frac{1}{2b} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) \right] - \frac{1}{2b} \bar{\gamma} \right] \forall \bar{\alpha} \in [0; 1]$$

The result that the higher is the marginal cost of producing the traditional good the higher should be the differential with the digital good is straightforward. The other results deserve some reflections. The intuition is that a firm with a high share of the market in the traditional market has an incentive to protect that market, relatively to a firm with an irrelevant share, which has an incentive to maximize his diffusion in the new market. Both effects become more important if the cannibalization between the two

products is higher. This effect is then mitigated or increased by the differential in price elasticity in the two markets.

Let's analyze now the cases in which the new market exceeds the size of the traditional one $\bar{\beta} \in [1; \infty]$ or the cannibalization effect is more than proportional $\bar{\alpha} \in [1; \infty]$, or both these effects combined.

- **Case $\bar{\beta} \in [1; \infty]$ and $(\bar{\alpha} = 1)$**

Proposition 4: In case of perfect substitutability, the conditions for a complete cannibalization of the traditional market are:

$$(102) \quad \bar{\beta} > \frac{\frac{1}{4}\left(\frac{1}{m} + b_d \bar{p}_d\right) + \sqrt{\frac{1}{4}\left(\frac{1}{m} + b_d \bar{p}_d\right)^2 + \frac{b_d \bar{v}}{2} [\bar{s}_j + b(\bar{p} + \bar{v} - c_j)]}}{\frac{b_d \bar{v}}{2}}$$

And

$$(103) \quad \bar{\beta} < \frac{4b}{b_d}$$

Or

$$(104) \quad \bar{\beta} < \frac{\frac{1}{4}\left(\frac{1}{m} + b_d \bar{p}_d\right) - \sqrt{\frac{1}{4}\left(\frac{1}{m} + b_d \bar{p}_d\right)^2 + \frac{b_d \bar{v}}{2} [\bar{s}_j + b(\bar{p} + \bar{v} - c_j)]}}{\frac{b_d \bar{v}}{2}}$$

And

$$(105) \quad \bar{\beta} > \frac{4b}{b_d}$$

If these conditions are respected, then the optimal strategy is to shut down the traditional market and concentrate on the digital one. Once again, these conditions are harder to be verified if the historical share of the market of the firm is higher.

Proof: From 83 we have that:

$$(106) \quad q_j^{*'} = \frac{1}{\left(2 - \frac{\bar{\beta} b_d}{2b}\right)} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) - \frac{\bar{\beta}}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\beta} \bar{\gamma}) \right] \right]$$

We can calculate the level of development of the digital market that becomes incompatible with the production of traditional products for a firm that operates in both markets (i.e. recall that we assume perfect substitutability in this case)

$$q_j^{*'} = 0, \text{ for}$$

$$(107) \quad -\bar{\beta}^2 \left(\frac{b_d \bar{\gamma}}{2} \right) - \bar{\beta} \left[\frac{1}{2} \left(\frac{1}{m} + b_d \bar{p}_d \right) \right] + \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) \right] = 0$$

Which solves for:

$$(108) \quad \bar{\beta}_{1,2} = \frac{\frac{1}{4} \left(\frac{1}{m} + b_d \bar{p}_d \right) \pm \sqrt{\frac{1}{4} \left(\frac{1}{m} + b_d \bar{p}_d \right)^2 + \frac{b_d \bar{\gamma}}{2} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) \right]}}{\frac{b_d \bar{\gamma}}{2}}$$

Since the $\Delta > 0$ for this equation there are two real and distinct solutions. Moreover since $\bar{\beta} \geq 0$, we are interested only in the positive solution:

$$(109) \quad \bar{\beta} = \frac{\frac{1}{4} \left(\frac{1}{m} + b_d \bar{p}_d \right) + \sqrt{\frac{1}{4} \left(\frac{1}{m} + b_d \bar{p}_d \right)^2 + \frac{b_d \bar{\gamma}}{2} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) \right]}}{\frac{b_d \bar{\gamma}}{2}}$$

Moreover, we have to check for the domain of $\bar{\beta}$. From 102 we have that $q_j^{*'}$ is well defined for $\bar{\beta} \in \mathbb{R}^+ - \frac{4b}{b_d}$, moreover if $\bar{\beta} > \frac{4b}{b_d}$ and 104 hold, or if $\bar{\beta} < \frac{4b}{b_d}$ and 102 holds, then we have $q_j^{*' < 0$, so we can define the conditions for which a firm should shut down the traditional market and start operating only in the digital market.

- **Case $\bar{\alpha} \in [1; \infty]$ and $(\bar{\beta} = 1)$**

Proposition 5: If the markets are equally developed and for a given firm we have that the level of cannibalization grows to reach:

$$(110) \quad \bar{\alpha} \geq \frac{2b \left(\frac{1}{m b_d} + \bar{p}_d + \bar{\gamma} \right)}{\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j)}$$

then the optimal strategy for the firm is not to produce the digital version of the product.

Proof: From the F.O.C. (80) we have that:

$$(111) \quad \frac{1}{mb_d} + \bar{p}_d - \frac{2q_{j,d}}{b_d} + \bar{\gamma} = \bar{\alpha} \frac{q_j}{b}$$

So if the cannibalization effect is more than proportional, producing the digital version becomes less attractive for a firm which is already active in the traditional market. We can thus find the condition for which, even if the digital market is fully developed, it is not convenient to produce a digital substitute.

$$(112) \quad \bar{\alpha} \geq \frac{b}{q_j} \left(\frac{1}{mb_d} + \bar{p}_d + \bar{\gamma} \right)$$

Substituting for q_j we have:

$$(113) \quad \bar{\alpha} \geq \frac{2b \left(\frac{1}{mb_d} + \bar{p}_d + \bar{\gamma} \right)}{\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j)}$$

If the cannibalization effect is more than proportional, even if the digital market is developed, a firm's optimal solution could be not to produce the digital version of his physical differentiated good. This can be the case for example if the cannibalization of advertising revenues is more than proportional due to free-riding in the digital value chain (i.e. news aggregators extracting value from digital versions of copyrighted products) or if the presence of a digital version on the market generates increasing copyright infringements through circulation of pirated copies that do not generate any revenue for the firm but still contribute to cannibalize physical sales.

- **Case $\bar{\alpha} \in [1; \infty]$ and $\bar{\beta} \in [1; \infty]$**

Proposition 6: If the development of the digital market is very large but at the same time the cannibalization grows more than proportionally, the effect on the traditional distributive channel is undetermined.

Proof: Taking the limit from the general expression, we see that the results is an undetermined formula.

$$(114) \quad q_j^{*'} = \frac{1}{\left(2 - \frac{\bar{\alpha}^2 \bar{\beta} b_d}{2b}\right)} \left[\bar{s}_j + b(\bar{p} + \bar{\gamma} - c_j) - \frac{\bar{\alpha} \bar{\beta}}{2} \left[\frac{1}{m} + b_d(\bar{p}_d + \bar{\beta} \bar{\gamma}) \right] \right]$$

$$(115) \quad \lim_{\alpha \rightarrow \infty, \beta \rightarrow \infty} q_j^{*'} = \frac{-\infty}{-\infty} = \text{undetermined}$$

Conclusions

In this paper we have studied the pricing issues raised by the development of a digital market in the magazine publishing industry. The originality of the problem is that it combines a large number of economic issues which have hardly been tackled all together in one model. Magazine publishing is a two-sided market, since advertisers and consumers both concur to the sustainability of a publication business model. Magazines are differentiated goods, since they are subject to copyright but they compete for the leisure time of consumers. The digital market represent an opportunity to better discriminate between consumers, but producing a digitized version of the physical magazine means introducing a substitutable product in the market, thus cannibalization effects must be taken into consideration. Finally, digitized versions are produced at negligible marginal costs through a different retailing network, introducing multi-channel distribution problem such as free-riding in the business model.

We have thus studied the pricing problems for publishers operating in one single market and for publishers operating in both the traditional and the digital market. We set up a simple model based on the hypothesis that while traditional market has a history due to the investments of different publishing brands, the firms that start their activity in the digital market face the same market conditions. Among the results, we find that in the digital market the “free dailies” business model is sustainable only if the number of publishers is limited. Moreover, we find that publishers that are active in the traditional channel with relevant market shares should “defend” their market share by setting higher prices for the digital versions of their products, in order not to devalue them and to reduce cannibalization between the two markets. On the other hand, publishers

which starts operating directly in the digital market or publishers with irrelevant market shares may have an interest in offering their products for free to maximize their diffusion and their share of advertising revenues. As for the general market trends, we find that unless both the advertising revenues per copy and the total sales in the digital markets grow larger than the traditional market, a traditional publisher should keep operating in the traditional market. In addition, if the total cannibalization grows to be more than proportional, namely if for each digital copy sold we lose more than one in the traditional market due to substitutability and copyright infringements, then the optimal strategy for a publisher can be not to produce the digital version of a given product. In this case, the publisher could choose a digital strategy with less negative externalities such as marketing a new digital product or a multi-support bundle.

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