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Competition in the news industry: fighting aggregators with versions and links*

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Abstract

We analyze the linking and versioning strategies of a media firm when facing competition from blogs, search engines and news aggregators. First, we show that when the publisher competes against a blog it is less likely to release a “fighting version” if this generates significant spillovers for its rival. Second, we analyze in which situations a publisher will accept to offer part of its contents to a news aggregator in exchange for financial compensation. We explain that an agreement is possible when the aggregator is not overly dependent on the firm’s contents. Finally, we show that when the firm competes against a search engine, its linking and versioning strategies depend on the amount of traffic it receives from its competitor. The firm can use the search engine as its own low quality version and as a mechanism to expand its market since it gives access to many contents.

Keywords: Product segmentation, versioning, linking, media market, search engines, news aggregators, Internet.

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1 Introduction

The newspaper industry is undergoing a major transformation.¹ Internet has significantly reduced the costs of accessing information and of distributing the contents globally and, as a result, many news services have emerged intensifying competition for consumers and advertisers. In this new scenario, traditional publishers are forced to seek out new competitive strategies and business models. This paper analyzes how these changes are modifying the linking and versioning strategies of media firms.

Some of the most successful new players in the media market are search engines and news aggregators, which have risen to occupy the top positions in audience rankings (Table 1). Search engines provide links to news articles on other news sites and display them in a single site accompanied by a title or an excerpt. This represents a considerable saving to consumers in terms of time and effort as they can conveniently check several information sources for updates.² Search engines use algorithms that index and group stories according to diverse criteria including the originality of information, their immediate interest for readers and their “contagious” capacity. News search engines such as Google News, Bing News, and Summify (the last of these sites indexes the most read articles in Twitter and Facebook) neither hang advertisements nor set user charges. Their commercial objective is essentially to bring visitors to other Internet services on the same platform, such as common searches that sell advertising space.

News aggregators, by contrast, provide news articles that are created with information obtained from newspapers, press agencies or even blogs, and they do not usually include links to the original sources. Some of the best known are Yahoo! News, Drudge Report, and The Huffington Post. Aggregators enter into licensing agreements with information suppliers to

¹In the final decades of the 20th century competition in the industry was strong as scale economies were overbalanced by the heterogeneity of consumer preferences (Reddaway, 1963; Rosse, 1967; Dertouzos and Trautman, 1990). As late as 2010 there were about 1,400 daily newspapers and thousands of community papers in the US being published weekly or biweekly, while figures for 2002 show that the industry, including printers, reporters, advertising salespeople and other personnel, amounted to around \$50 billion business employing around 400,000 people. However, today the industry is facing a severe crisis in part due to the migration of readers from printed to on-line newspapers and the creation of hundreds of news sites (PEJ, 2011).

²Taking into account this argument, U.S. legislation considers that these entrants make a “transformative” use of contents and, as a consequence, do not infringe copyright law (Isbell, 2010).

avoid copyright infringements. Some of them, such as Yahoo! News, rely exclusively on the press agencies, thus avoiding conflicts with other news sites.

Table 1. Top News Sites, 2011, Nielsen

Average Monthly Unique Visitors (Site)	Unique Audience (000)
Yahoo News	39,042
CNN Digital Network	34,617
MNSBC Digital Network	29,438
Huffington Post	22,578
ABC News Digital Network	18,199
Fox News Digital Network	17,846
NYTimes.com	16,647
BBC	13,878
CBS News Network	12,665
Google News	11,757
Washingtonpost.com	11,201
LA Times	10,864
Bing News	10,741
The Wall Street Journal	10,593
USAToday.com	9,239

The emergence of both search engines and news aggregators has created a trade-off for traditional newspapers, who must decide between fighting the entrants or accommodating them. On the one hand, entrants create a business-stealing effect since they compete for the same consumers as the traditional newspapers, by using the latter’s contents.³ On the other hand, they create a market expansion effect because they reduce consumer search costs

³Some traditional newspapers consider search engines and aggregators to be free-riders reselling and profiting from the factual information they have gathered at vast expense (Frijters and Velamuri, 2010). Rupert Murdoch, chairman and CEO of News Corporation, has declared: “Producing journalism is expensive; we invest tremendous sources in our project from technology to our salaries. To aggregate stories is not fair use. To be impolite, it is theft”. The Guardian (2009), Rupert Murdoch: “There’s no such thing as a free news story”, 1/12/2009. Available at <http://www.guardian.co.uk/media/2009/dec/01/ruPERT-murdoch-no-free-news>.

and make a great variety of contents widely available. This situation benefits traditional firms, which receive payments when they negotiate with aggregators, and indirect traffic when they accept search engine links. With this in mind, determining the amount of traffic that entrants actually send to their information sources becomes an essential question in the debate. Available information suggests that a very large proportion of search engine visitors merely scan the link headlines without clicking through to the newspapers and, as a result, do not generate advertising revenue for the newspapers.⁴

The relationship between search engines and news agencies is even more complex, because the main activity of agencies is precisely that of feeding newspapers with their content. In order to deal with this situation, in 2004 Google News reached an agreement with the Associated Press (AP), permitting Google to host AP contents in exchange for compensation.⁵ Similarly, in 2005 Agence France Press (AFP) filed a lawsuit against Google News for removal of copyright management information and “hot news” misappropriation. After two years of litigation, AFP and Google News settled the case by signing a licensing agreement, according to which Google was granted the right to post AFP content. In spite of this, other press associations are still pressing public authorities to protect their content,⁶ and some regulatory bodies such as the Federal Trade Commission have suggested various solutions, which range from extending copyright legislation to diverse antitrust exemptions for news organizations (FTC, 2010).⁷

Traditional newspapers are also modifying their commercial strategies to defend themselves against competitors. Some publishers believe that they still have a significant demand from

⁴For instance, 44% of Google News users in 2010 scanned the headlines without clicking through to the original articles on the newspapers’ web sites. See R. Wauters, TechCrunch, 19/1/2010, available at <http://techcrunch.com/2010/01/19/outsell-google-news/>.

⁵At the end of 2009, this agreement was broken and the search engine stopped offering AP’s links. In spite of this, in early 2010, AP reached a new agreement with Google and another with Yahoo! News. See “Associated Press Returns to Google News”, <http://mashable.com/2010/02/09/ap-google-news>.

⁶In 2009, the Federazione Italiana Editori Giornali brought a lawsuit against Google for its indexing system. In the same year, the Federation of German Newspaper Publishers called for a new ancillary copyright with lump-sum payments as compensation for the revenues third parties make with their content. In 2010, the Newspaper Licensing Agency won a copyright ruling in the UK High Court that involved the main newspapers and news aggregators. See also the “Hamburg Declaration on Intellectual Property Rights”, signed in 2009 by the World Association of Newspapers and News Publishers.

⁷Proposals include new legislation for “hot news”, statutory limits to fair use, licensing the news or allowing firms to agree jointly to erect paywalls.

readers who prize high quality journalism, editorial guidance and the opinions of experts. In keeping with this belief, The Times launched a paywall in 2010. The Wall Street Journal has recently launched “freemium”, by which general news remains free but premium content and the blogs of some experts are locked behind a paywall. Similarly, the Financial Times offers subscriptions to premium and standard articles at different prices.⁸ Some publishers have even opted for more dramatic strategies. In 2010, Gannett, the New York Times Company and the Washington Post Company created Ongo, a news aggregator that brought together more than 50 other publications, including the Los Angeles Times, the Chicago Tribune and Reuters. The participants in this initiative sought to offer a high quality news aggregator that had an editor in charge of organizing and choosing the articles obtained from the associated newspapers.⁹ In spite of this, the startup was not successful and closed in 2012 after first seeking to modify its pricing policy on several occasions.¹⁰

The objective of this paper is to analyze how new business models in the media market are modifying the commercial strategy of traditional publishers. We present a model that examines the linking and versioning strategies of newspaper managers in the face of competition from bloggers, search engines and news aggregators. By so doing, we show that on some occasions owners prefer to fight entrants by releasing low quality versions, while on other occasions they prefer to accommodate entrants by negotiating compensations or by allowing them to introduce links. Interestingly, the linking strategy can be interpreted as a mechanism by which the publisher uses the entrant to create a version of its own newspaper.

A number of recent studies have examined the effects of news aggregators in the media market focusing on different research questions to the ones specifically addressed here. Chiou

⁸Following these examples, the New York Times is planning to erect a paywall and News Limited has announced that it will charge for online access to The Australian and for certain parts of the Daily Telegraph and the Herald Sun. The Conversation, 8/6/2011. Available at <http://theconversation.edu.au/news-ltd-announces-pay-wall-plan-as-newspapers-struggle-nline-1743>.

⁹Previously, in 2009, Rupert Murdoch’s News Corporation had launched the Project Alesia, which offered readers a bundle of newspapers and magazines. This project did not attract the interest of other firms. On the other hand, some newspaper associations have created a platform behind a paywall (e.g. Orbyt and “KiosKo y Mas” in Spain). But many of these aggregators simply offer the pdf version of the printed newspapers.

¹⁰A. LaFrance, “Ongo, an attempt at a pan-media paywalled aggregator, is closing”; Nieman Journalism Lab, 8/5/2012. Available at <http://www.niemanlab.org/2012/05/ongo-an-attempt-at-a-pan-media-paywalled-aggregator-is-closing/>.

and Tucker (2010) investigate the effects of the breakdown of the agreement between Google News and AP in 2009, and show that the event was correlated with a decline in the demand for content from AP sources. Athey and Mobius (2012) analyze the effect of introducing a “local news” feature in the French version of Google News in 2009, whereby users were able to see news from local outlets prominently presented on the web site. They report that the adopters of this feature increase their visits to Google News, which in turn generated additional consumption of local news. Moreover, some users, having discovered this, started navigating directly to the local news site.

Katona and Sarvary (2008) were the first to theoretically analyze strategic linking between web sites in a market for advertising links. Dellarocas et al. (2010) analyze competition among news sites that generate revenue from user visits and who compete with each other as well as with alternative media (e.g. TV, blogs, Twitter feeds) for user attention. News sites decide how much to invest in original content and how many links to include. The authors show that linking has different implications depending on the level of differentiation of the web sites. They also show that the presence of an outside alternative may benefit incumbent content sites, since they increase the total traffic that flows in the content ecosystem and divert most of it to the best content sites. Content sites can even compete to attract aggregators when the latter selectively place links to a subset of available sites. George and Hogendorn (2012) adapt a two-sided market model to digital media markets to analyze how search technology and aggregators can alter both market participation and the number of sites visited. They explain that both aggregators and improved search technology tend to increase viewer multi-homing. But unlike search, aggregators may not expand the market. Jeon and Nasr (2012) show how the presence of a news aggregator affects competition among newspapers. They find that competition with a news aggregator can lead to the specialization of newspapers when their advertising revenue increases substantially with an increase in quality. With specialization, the presence of the aggregator increases the average quality of newspapers, which in turn increases consumer surplus. Rutt (2012) considers how aggregators affect the pricing decisions of firms and the quality of their articles. He assumes that firms randomize between providing the article for free and charging a price for it, and shows that this behavior creates a mixture of advertiser and subscription business models and also a quality dispersion across firms.

Our paper also contributes to the literature on versioning. The seminal papers of Mussa and Rosen (1978) and Moorthy (1984) showed that the introduction of a new version by a monopolist might be profitable when the benefits of expanding the market overcome the cannibalization effect on the original product. Stokey (1979) and Salant (1989) later showed that versioning essentially depends on the form of the cost function. In particular, versioning is optimal when the marginal cost function of improving the quality is sufficiently convex.

More recently, a number of papers have sought to clarify the circumstances under which versioning is convenient for a monopolist. Bhargava and Choudhary (2008) find that versioning depends on the relation between the optimal market share of the low and high quality versions of one product when they are offered alone. Anderson and Dana (2009) show that versioning requires that the relative change in overall surplus associated with a product quality improvement is increasing in consumers' willingness to pay. Calzada and Valletti (2012) show that versioning might arise when consumers are allowed to buy two versions of the same product. They examine the particular case of the movie industry and explain that versioning is optimal when the theater and the DVD versions are not merely substitutes. In this case, while some consumers buy both versions, others only use the theater or the DVD version. This situation is quite closely related to that discussed in this paper, since the main characteristic of news aggregators is precisely that of offering consumers the possibility of reading the news articles from several newspapers.

Other studies have analyzed versioning in the presence of competition. Wu, Chen and Anandalingam (2003) show that versioning can be a very effective and profitable instrument in the fight against piracy. Valletti and Szymanski (2006) analyze parallel trade for products protected by intellectual property rights such as the export of pharmaceuticals. They show that monopolist pharmaceutical firms will never find it optimal to release a lower quality version. However, when a laboratory is competing with a generic product it will introduce a second brand to protect its profits. Our study has points in common with this research, since we analyze the versioning strategy of a publisher who faces competition from a news site. In spite of this, a particular characteristic of the media market is that when a new piece of information is distributed through the Internet it can be immediately used by other news sites and it can be linked. This possibility can alter significantly the versioning strategy of the publisher.

Our study makes several changes to the previous models of versioning. We consider a publisher that can commercialize two versions of its contents. For example, it can offer high and low quality news articles that cover one event (as in the freemium model) or it can offer different news web sites of different qualities and with different approaches (as is the case of the News Corporation or The New York Times Company). Taking this into account, we first analyze the entry of a blog (or a news site) that uses the contents of the existing publisher to generate its articles, but which does not link to the original sources of information. We show that a competitor of this type reduces the publisher's incentives to release a second version. While Valletti and Szymanski (2006) argue that incumbents have incentives to release a "fighting brand" to defend themselves against competitors, in our model the fighting version generates positive spillovers that improves the quality of the competitor. As a result, the publisher accommodates the blog when it considers that a new version (i.e. a new newspaper or a blog) will in fact reinforce the blog significantly.

Subsequently, we analyze the case in which the publisher negotiates the use of its contents with a news aggregator. This situation reflects the agreements that Yahoo! News and other news aggregators have reached with various newspapers and news agencies. We show that this type of agreement is possible when the quality of the aggregator is sufficiently high and it offers the publisher an economic compensation. Therefore, we show that even when the publisher can exclude its rivals from the use of its contents, it can still reach an agreement with them.

The last part of this paper analyzes the case of a publisher that competes against a search engine. This benefits from the publishers' contents, but instead of offering an economic compensation to them, they set links to their contents. In this context, we show that a publisher receives sufficient traffic from a low quality search engine it will accept these links, and the search engine will become its low quality version. We also explain that if the number of users that click through to the newspaper's contents is sufficiently high the publisher can release a second version. This occurs because the profits generated by the new version compensate the cannibalization effect suffered by the existing version. In fact, the second version improves the quality of the search engine and generates a market expansion effect. Finally, we analyze the case where the spillovers generated by the publisher's second version are so great that the search engine offers more utility than a single newspaper, and we show that in this case linking

and versioning are more likely. These results show that the disputes in the market between traditional newspapers and search engines essentially depend on the amount of traffic that the search engine sends to the newspaper and on the complementarity of the contents that are aggregated.

The rest of the paper is structured as follows. Section 2 introduces the model. Section 3 analyzes the versioning strategy of a publisher that competes with a blog that can't be excluded for using its contents. Section 4 considers the negotiations between a publisher and a news aggregator when the aggregator can be excluded for using the publisher's contents. Section 5 examines the linking and versioning strategies of a publisher that competes with a search engine. Section 6 concludes.

2 The Model

We analyze the versioning strategy of a publisher that faces competition from a blog, a search engine and a news aggregator. The publisher can offer one or two versions of its product to the consumers (two news articles about the same subject; two newspapers with different editorial approaches). It always offers version H of quality $u_H = u$ and it might also release version L of a quality $u_L = \alpha u$, where $\alpha < 1$. The quality of the two versions is exogenously determined and their contents can be related. For example, L may simply be a degraded version of newspaper H , and consumers might not obtain any utility from it after having visited H . Alternatively, H and L can be complementary newspapers. For example, H can be a general on-line newspaper and L a site with blogs of the experts that write for the newspaper, or a site specializing in sports coverage.

The competitor offers a product A , which can include contents obtained from H and L , or links to these products. When the publisher only releases H the quality of A is $u_A = \beta u$, with $\beta \in (0, \alpha)$. And when it releases H and L , the quality of A is $u_A = u[\beta + \alpha(1 - s)]$, where $0 \leq s \leq 1$ measures how L increases consumer utility when they are already consuming H . Notice that the quality of A can be larger than the quality of H when $s < (\beta + \alpha - 1)/\alpha$. This reflects the case where consumers enjoy more contrasting the editorial approaches of different newspapers (or reading complementary sources of information) than visiting just one particular newspaper.

In order to simplify the model and to make it more realistic we assume that consumer search costs are so high that they only visit one news site. This implies that consumers can only access the two newspapers if they visit the competitor. With this restriction we reflect the most important feature of search engines and news aggregators, which is to group the contents of different sources on a single web site, thereby reducing consumer search costs significantly.

Consumers are characterized by the intensity of their preferences for news sites. Imagine that they are uniformly distributed in the segment $[0, 1]$ and define as θ the consumers' willingness to pay. Taking this into account, the consumers' net utility when they visit the publisher's version i is $\theta u_i - p_i$, with $i \in \{H, L\}$, where p_i is the subscription fee paid for the newspaper. On the other hand, consumers' net utility when they visit the competitor is $\theta u_A - c$, where c is the cost incurred by the consumer. An alternative way of interpreting the model is to imagine that p_i is the number of advertisements inserted on the web site i and that the price of the advertisements is exogenously set. Under this interpretation the publisher would choose the number of advertisements that maximizes its profits.

Finally, in order to focus our attention on the firm's versioning strategy, we assume that the costs associated with producing each version are sunk, and that the marginal costs of the versions are zero. This assumption means that it could be very expensive to generate news articles, but that they can be distributed at no cost.

3 Competing with blogs: no exclusion option

This section analyzes the commercial strategy of a publisher competing with a blog (or with another newspaper) that creates its contents by gathering information directly from the publisher's web sites. The absence of any distribution costs on the Internet allows many bloggers and news sites to publish opinions and news articles that are largely based on articles produced by traditional newspapers and on the opinions expressed in the blogs of experts. This implies that when a publisher increases the quality of its products or releases a new version (e.g., a specialized newspaper or a blog) this immediately generates positive spillovers on other news sites.

We also assume that the blog is a non-lucrative activity, and so it neither charges consumers a fee nor hangs advertisements on its site. However, we assume that consumers use the

publisher's newspapers as their anchor site, so they incur a search cost $c \geq 0$ when they visit the blog.

Taking the above into account, the following set of indifferent consumers describes the market segmentation. If the publisher only releases H the consumer indifferent to visiting the newspaper and the blog is $\theta_{HA} = (p_H - p_A)/u(1 - \beta)$, while the consumer indifferent to visiting the blog and not visiting any site is $\theta_{A0} = c/\beta u$. In this case, the publisher's profit is $\pi_{HA} = p_H(1 - \theta_{HA})$. On the other hand, if the publisher releases L and H there are three indifferent consumers: the consumer indifferent to visiting H and L is $\theta_{HL} = (p_H - p_L)/u(1 - \alpha)$, the consumer indifferent to visiting L and A is $\theta_{LA} = (p_L - c)/[u(\alpha - (\beta + \alpha(1 - s)))]$, and the consumer indifferent to visiting A and not reading the news is $\theta_{A0} = c/[u(\beta + \alpha(1 - s))]$. In this case, the publisher's profit is $\pi_{HLA} = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{LA})$.

The following proposition describes in which cases the publisher accommodates the blog and only releases one version, and in which cases the publisher defends itself by releasing a fighting version. The timing of the game is as follows: first, the publisher decides how many versions it will offer. Second, it releases its products and sets the prices in order to maximize profits. Finally, consumers choose their preferred product.

Proposition 1. *In the presence of a blog the publisher reacts as follows:*

1) *If $\beta < \beta_1$ the optimal versioning strategy of the firm is:*

- *When $0 \leq s \leq \hat{s}$, the firm only offers H , and the blog is active;*
- *When $\hat{s} < s \leq 1$, the firm supplies H and L , and the blog is active;*

2) *If $\beta \geq \beta_1$ the optimal versioning strategy of the firm is:*

- *When $0 \leq s \leq s_2$, the firm only supplies H , and the blog is active;*
- *When $s_2 < s \leq s_1$, the firm supplies H and L , but the blog is not active;*
- *When $s_1 < s \leq 1$, the firm supplies H and L , and the blog is active;*

Proof. *See the Appendix.*

The first part of this proposition presents the strategy of the publisher when the quality of A is low in comparison with that of L ($\beta < \beta_1$). In this case, the firm releases L if the

spillovers generated on A are sufficiently small ($s > \hat{s}$). When this occurs, the increase in profits obtained with L offsets the cannibalization effect that L generates on H . However, when the spillovers are larger the release of L is not sufficiently profitable and the publisher decides to accommodate their blog.

Figure 1: Competition with a blog ($\beta = 0.5$, $\alpha = 0.75$, $u = 1$, $c = 0.12$). The figure shows the consumers' segmentation as a function of s . For $s < s_2$ the publisher only offers H . Low type consumers don't visit any web site, intermediate consumers visit A , and high type consumers visit H . For $s_2 < s \leq 1$ the publisher offers two versions and intermediate consumers visit L : If $s_2 < s \leq s_1$, p_L is low and the blog is not active; if $s_1 < s \leq 1$, p_L is higher and some consumers visit A .

The second part of the proposition can be similarly interpreted and considers the case where A and L are of similar quality ($\beta \geq \beta_1$). In this case, when s is sufficiently high ($s_2 < s \leq s_1$) the publisher sets a low p_L and the blog fails to attract any consumers (region B in Figure 1). If s becomes even larger the spillovers are smaller ($s_1 < s \leq 1$), the publisher sets a higher p_L , and some consumers visit A . In this case, it is possible to identify four types of consumer: those with a high type visit H , those with an intermediate type visit L , and those with a low type are less interested in the newspaper or do not visit any news sites at all (see this segmentation in region C in Figure 1).

Our results reveal that the publisher's versioning strategy depends on the spillovers generated by its versions on the competitor. In a related model, Valletti and Szymanski (2006)

show that the presence of a competitor incentivizes the incumbent to release a fighting brand to retain part of its profits. Proposition 1 reaches a similar conclusion when s is close to 1, that is, when the blog gains few spillovers if the fighting brand is released. However, when the new version improves the competitive capacity of the blog, the publisher prefers to release only H .

4 Competing with news aggregators: exclusion option

The previous section has analyzed the versioning strategy of a publisher unable to avoid its contents being used by other news sites. In the media market, however, news aggregators typically negotiate with newspapers and news agencies the right to use their contents in exchange for compensation. This is, for example, the case of Yahoo! News, which creates many of its articles from information gathered from other news services such as Reuters, BBC News, or USA Today. Here, we seek to determine in which cases in spite of the exclusion option newspapers and news aggregators will be able to reach an agreement. The only difference with the previous section is that now the publisher can break off negotiations, in which case the competitor is left with lower quality contents.

To analyze this situation, imagine that when the publisher and the aggregator reach an agreement the publisher receives a share w of the aggregator's revenues. As before, the publisher can release newspapers H and L , which have a quality u and αu , respectively. The quality of the aggregator depends on the result of the negotiations. If there is an agreement, the publisher only releases H and the quality of A is βu , where $\beta < \alpha$. If there is no agreement, the quality of A is $u\beta(1 - r)$, where $r \leq 1$ reflects the possibilities of the aggregator of substituting the publisher's contents with other contents.

The consumption decision of readers depends on the quality of the products. If there is an agreement, consumers can choose between H and A . In this case, the consumer indifferent to visiting H and A is $\theta_{HA} = (p_H - p_A)/(u - \beta u)$, and the consumer indifferent to A and not visiting any site is $\theta_{A0} = p_A/\beta u$. Notice that p_H is the firm's price and p_A the aggregator's price, which we assume is determined exogenously. To ensure that A is a version "from below" we consider that the aggregator is non-strategic and p_A is a parameter. Aggregators buy their contents from other news sites and free entry implies that the price will be set at the marginal

production cost.¹¹ On the other hand, if there is no agreement, the publisher can release a fighting version to protect its revenues.¹² In this case, consumers choose between H , L and A . The consumer indifferent to H and L is $\theta_{HL} = (p_H - p_L)/u(1 - \alpha)$, the consumer indifferent to L and A is $\theta_{LA} = (p_L - p_A)/u[\alpha - \beta(1 - r)]$, and the consumer indifferent to A and not visiting any site is $\theta_{L0} = p_A/u\beta(1 - r)$.

The publisher and the news aggregator play the following game. At time t_{-2} , they negotiate the revenue share w that the publisher is to receive. At time t_{-1} , based on the outcome of the negotiations, the publisher decides how many versions to release. And at time t_0 , the publisher sets p_H and p_L and releases its newspapers. The following proposition describes the firm's versioning strategy.

Proposition 2. *Imagine that the publisher and the news aggregator negotiate over w :*

1) *When $p_A < p_A^*$:*

- *If $0 \leq r \leq r_1$ both the publisher and the aggregator agree to negotiate;*
- *If $r_1 < r \leq 1$ there is no agreement, H and L are released, and A is active;*

2) *When $p_A \geq p_A^*$:*

- *If $0 \leq r \leq r_2$ both the publisher and the aggregator agree to negotiate;*
- *If $r_2 < r \leq 1$, there is no agreement, H and L are released, and A is not active.*

Proof. *See the Appendix.*

The first part of the proposition shows the outcome of the negotiation when the price of the aggregator is not too high ($p_A < p_A^*$). In this case, the publisher agrees to negotiate with the aggregator if it is not especially dependent on H ($0 \leq r \leq r_1$). The publisher obtains more profits by offering part of its contents to the aggregator and negotiating a share w of the aggregator's benefits than releasing a fighting version. However, when the aggregator is more

¹¹ p_A can also be interpreted as a search cost when the aggregator is not the consumers' anchor site, or the number of advertisements inserted in the aggregator's web site.

¹² The possibility that the publisher releases a fighting version has been analyzed by Johnson and Myatt (2003), Wu, Chen and Anandalingam (2003), and Valletti and Szymanski (2006). We show this result more formally in the proof of Prop. 4.

dependent on H ($r_1 < r \leq 1$) the increase in profits obtained cooperating with the aggregator is small and there is no agreement.

The second part of the proposition has a similar interpretation. In this case, however, if the aggregator's price is high ($p_A > p_A^*$) and the negotiations break down the aggregator is unable to attract any consumers. As a consequence, an agreement between the two firms is more likely (it occurs for a higher value r) and the aggregator agrees to pay a larger share of its revenues as compensation.

In order to examine the possibility of an agreement, Figure 4 shows the maximum compensation that the aggregator agrees to pay ($\bar{w}$) to the publisher. It can be seen that for a large r the aggregator offers a larger share of its revenues. The figure also shows the minimum compensation that the publisher is prepared to accept for offering its contents to the aggregator ($\underline{w}$), which increases with r . Notice that only when $\underline{w} < \bar{w}$ can the two firms reach an agreement and this occurs when r is sufficiently low (the aggregator is not very dependent on the publisher).

Figure 2: Negotiation between the publisher and the news aggregator. $\underline{w}$ is the minimum compensation that the publisher accepts for selling its contents to the aggregator, and $\bar{w}$ is the maximum compensation that the aggregator accepts to pay.

To sum up, the proposition shows that when the aggregator is highly dependent on the publisher, this denies the aggregator access to its contents and releases the two versions. A similar result can be found in Valletti and Szymanski (2006), where there are no spillovers, and in Proposition 1 above, when spillovers are small. However, if the aggregator is a strong

competitor the publisher prefers to reach a cooperative agreement so as to increase its quality and gain part of the rents generated. This cooperation is based on the idea that aggregators can include in just one site many complementary contents originated in different news sites.

5 Competing with search engines: spillovers and links

In this section we modify our model to examine the effects of a search engine that provides links to the publisher's contents. As before, the entrant benefits from the publisher's contents, but in this case it also sends traffic to it. When consumers visit the search engine, they read the headlines of the news articles (or excerpts of it) and then click through to the newspaper with a probability δ , which we assume is determined exogenously. In our model the search engine's consumers only incur a cost when they click through to the newspaper. For example, when $\delta = 1$ the search engine's users click through to all the newspapers' articles and pay the entire price of the newspapers, and when $\delta = 0$ they do not click through to any news article, they pay nothing for reading the articles, and they do not generate any revenue for the publisher. Indeed, this situation actually reflects what occurs in practice with a number of different search engines, since their visitors pay no charges and they do not include any advertisements in their sites. However, search engine visitors generate revenues for the publisher when they click through to the news articles.

The publisher and the search engine negotiate the inclusion of links. The publisher allows links to be included if this increases its profits, and the search engine includes the links if this increases its audience. When there is not agreement the quality of the search engine is $u_A = u\beta(1 - r)$, where $r \in (0, 1)$ reflects the deterioration in its quality. On the other hand, when the negotiation succeeds its quality is $u_A = u\beta$ if the publisher releases H and $u_A = u[\beta + \alpha(1 - s)]$ if the publisher releases both H and L . This occurs because, when the publisher releases two versions, the search engine includes links to both, and its users click through to both H and L with a probability δ .

We assume that search costs are very high and as a result the search engine is the only available mechanism for accessing the two web sites simultaneously. In fact, the main advantage of search engines from the consumers' perspective is that they offer more product variety with lower search costs. Taking this into account, if the publisher offers two versions, the net utility

of consumers that directly visit H is $\theta u - p_H$, if they directly visit L they receive $\theta \alpha u - p_L$, and if they visit A they obtain $\theta u[\beta + \alpha(1 - s)] - \delta(p_H + p_L)$.¹³

Search engines do not modify the contents of H and L , but consumers can obtain more utility by visiting both versions simultaneously if they like product variety. To account for this possibility, below we first consider the case of a low quality search engine ($u_H > u_L > u_A$) and then examine the case of a high quality search engine ($u_A > u_H > u_L$).

The following proposition describes the linking and versioning strategies of a publisher when $u_H > u_L > u_A$ (i.e. $\beta < s\alpha$). This reflects the situation in which users derive greater utility from directly accessing the newspapers (e.g. they like the editorial policy and the reputation of traditional newspapers) than from accessing several newspapers through the search engine. The timing of the game is as follows: first, the publisher and the search engine observe the market and decide upon a linking strategy. Second, the publisher decides how many versions to offer. Third, the publisher releases its products and sets the price for each version. Finally, consumers choose their preferred products from among those offered by the publisher and the search engine.

Proposition 3. *The linking and versioning strategy when the publisher competes against a low quality search engine ($\beta < s\alpha$) is:*

- 1) If $0 \leq \delta \leq \delta_3$ the firm doesn't accept the links and releases H and L ;
- 2) If $\delta_3 < \delta \leq \delta_2$ the firm accepts the links and only releases H ;
- 3) If $\delta_2 < \delta \leq \delta_1$ the firm accepts the links and releases H and L ;
- 4) If $\delta_1 < \delta \leq 1$ the firm would accept the links but the search engine is not interested.

The firm releases H and L ;

Proof. *See the Appendix.*

The first part of the proposition shows that the publisher does not accept the links when it only receives a small amount of traffic from the search engine ($0 \leq \delta < \delta_3$). Without any links, the search engine cannot benefit from any spillovers, and so the publisher always releases two versions (region A in the Panels of Figure 2). As a result, there is complete market segmentation: low type consumers visit the search engine, intermediate type consumers visit

¹³We are working in an extension of the model in which the publisher offers low and high quality articles at a single web site and might allow the search engine to link to just one of them.

Figure 3: Competition with a search engine ($\beta = 0.5$, $\alpha = 0.75$, $u = 1$, $r = 0.1$, $p_A = 0.05$). The figures show the consumers' segmentation as a function of δ . Each panel considers a different level of spillovers and is divided in regions according to the parts of Proposition 2. In region A the firm doesn't want to be linked. In region B the publisher is linked and it releases H . In regions C the publisher is linked and it releases H and L . Finally, in region D the search engine doesn't want to link the publisher and there is a complete segmentation of consumers.

the low quality newspaper, and high type consumers visit the high quality newspaper. Notice that δ_3 is increasing in c , which means that when the search engine becomes unattractive to consumers the publisher is less interested in reaching an agreement with it.

The second part shows that when the publisher receives a larger amount of the search engine's traffic ($\delta_3 \leq \delta \leq \delta_2$) it accepts the links, but only releases H . Two main reasons justify this result. First, as in Proposition 1, if L generates positive spillovers on A , the publisher may not consider it optimal to release a second version because this will not compensate the cannibalization over H . Notice that when L does not generate any spillovers ($s = 1$) the publisher always releases L and regions A and B vanish (see Panel I in Figure 2). The second reason for only releasing H is that the links transform the search engine in a low quality version of the publisher. Indeed, if δ is large the publisher can use linking as an alternative for versioning.

The third part examines the situation in which the percentage of consumers that click through to the publisher's links is large ($\delta_2 < \delta \leq \delta_1$) and spillovers are important (s takes low values). In this case, the firm accepts the links and releases both H and L . Specifically,

it segments the market in such a way that a group of consumers visits H (those that have a greater appreciation of the newspaper's editorial policy) and another group visits H and L indirectly through the search engine. As p_L is high nobody buys L alone (see regions C in Figure 2). This implies that when δ is large the publisher, instead of using L as a fighting version, uses it to increase the quality of A , since the search engine's consumers click through to both H and L .

The last part of the proposition shows that the search engine can also decide not to include links to the publisher's contents. If its visitors have to pay a high price when clicking through to the publisher's links ($\delta_1 < \delta \leq 1$), it obtains a small audience and might prefer to renounce to the links of H and L . As a result, consumers are segmented in four groups as in the first part of the proposition (See region D in Figure 2).

The strategy of the publisher changes significantly when the quality of the search engine is greater than the quality of H and L commercialized separately, $u_A > u_H > u_L$.¹⁴ This situation reflects the case where consumers prefer product variety to limiting themselves to one high quality newspaper. As mentioned above, this case is relevant when the search engine is the only option for consuming both versions simultaneously. The following proposition describes the commercial strategy of firms in this situation.

Proposition 4. *The linking and versioning strategy when the publisher competes against a high quality search engine ($\beta > 1 - \alpha(1 - s)$) is:*

1) *If $0 < \delta \leq \delta_2$ the firm accepts the links and releases H and L , but only A receives direct visits;*

2) *If $\delta_2 < \delta \leq \delta_1$ the firm accepts the links and releases H and L , and all news sites receive direct visits;*

3) *If $\delta_1 < \delta \leq 1$ the firm would accept the links, but the search engine is not interested. The firm releases H and L ;*

Proof. *See the Appendix.*

The first part of the proposition focuses on the case in which δ is small ($0 \leq \delta \leq \delta_2$). In such a situation, the publisher releases H and L and allows the search engine to include links

¹⁴For sake of clarity, we do not include in our analysis the intermediate case where $u_H > u_A > u_L$.

to them. As δ is low and $u_A \geq u_H$ only A receives direct visitors. In spite of this, the publisher maximizes profits by setting high prices.

The second part of the proposition shows that when the search engine's users make more visits to the newspapers ($\delta_2 \leq \delta < \delta_1$) prices become too high for all consumers to visit the two versions simultaneously. As a result, intermediate type consumers visit one of the two versions and only high type consumers visit A . Notice that in this scenario, the release of L cannibalizes H in two ways. First, some low type readers who could consume H actually visit L . And second, some high type consumers who could visit H now visit A . In spite of this, as δ is high the cannibalization effect is offset by the direct and indirect visits to L .

The last part of the proposition presents the case where δ is very large ($\delta_1 < \delta \leq 1$). In this case, if spillovers are not sufficiently high the quality of A is not sufficient to offset the high price that consumers have to pay for H and L . As a result, the search engine is better not including links to the publisher's products.

To illustrate this situation with an example, imagine that $u_A = u_H$. In this case, if consumers access H directly they pay p_H , but if they use the search engine and click through to the two newspapers they pay $\delta(p_H + p_L)$. Therefore, if $\delta > p_H/(p_H + p_L)$ consumers are better off buying only H and the search engine does not receive visits.

Finally, notice that the size of the three regions identified in the proposition crucially depends on the values taken by s . For example, when $u_A = u_H$ then $\delta_1 = \delta_2 = 1/(1 + \alpha)$, and region $\delta_2 \leq \delta < \delta_1$ vanishes (see Panel I of Figure 3). When $u_A > u_H$ (i.e. $s < (\beta + \alpha - 1)/\alpha$) the size of regions $0 \leq \delta < \delta_2$ and $\delta_2 \leq \delta < \delta_1$ increase, and region $\delta_1 < \delta < 1$ shrinks.

To sum up, in this section we have shown that the linking and versioning strategies of the publisher and the search engine crucially depend on the amount of traffic that the search engine is able to generate. Proposition 2 shows that when $u_A < u_L$, the publisher might be interested in reaching an agreement with the search engine if this generates sufficient traffic for its newspapers. In this case, the publisher uses the search engine as its low quality version. The publisher can even release its second version to reinforce the quality of the search engine.

Proposition 3 examines the case where the spillovers generated by L imply that $u_A > u_H$. In this case, if most of the search engine's traffic is redirected to the publisher, the search engine will have only a small audience because its users have to pay a high price. As a result,

Figure 4: Consumers' segmentation when the publisher competes with a high quality search engine ($\beta=0.5$, $\alpha=0.75$, $u=1$, $r=0.1$, $p_A=0.05$). Each panel considers a different level of spillovers s and is divided in regions according to the parts of Proposition 3. In region A the firm releases two versions, but only the search engine is active. In region B the firm releases version H and the search engine is not active. In region C the firm releases two versions and the three products are active.

the search engine does not include links to the publisher. However, if smaller volumes of traffic are redirected to the publisher both firms are interested in linking and versioning because the publisher can set high prices and the search engine obtains a larger audience. This result is in line with Calzada and Valletti (2012), who show that a monopolist might consider it optimal to release a second version when some of the consumers can buy both versions. Interestingly, in this model it is precisely the search engine that permits this possibility.

6 Conclusions

In recent years, blogs, search engines, and news aggregators have reached the top positions in audience rankings of news sites. While traditional publishers accuse these news sites of “stealing” their contents and revenues, entrants argue that they are in fact “expanding the market” by improving accessibility to newspapers and their contents. The reason for this is that they reduce consumer search costs by offering links to many news sites and by editing the contents originated by other firms. In this paper we have examined the product line response of publishers to entrants of this type. We show that on some occasions publishers prefer to fight

entrants by releasing new versions while on others they accommodate entrants by negotiating compensation or by allowing links to their site.

Our first contribution has been to analyze the versioning strategy of a publisher when its competitor can use its contents for free or in exchange for compensation. We have shown that when the publisher cannot avoid its contents being used for free by the entrant (a blog or a news site), versioning is less likely than was previously considered in the literature. The reason for this is that a fighting version might not be profitable if it improves the quality of the entrant. On the other hand, when the publisher can avoid the appropriation of its contents by others, it might still want to reach a cooperative agreement with the entrant (news aggregator). The intuition for this finding is that in the media market the information generated by news sites can easily be integrated into the contents of competitors and the publisher can take advantage of this. Taking this into account, the publisher's product line strategy becomes heavily dependent on the spillovers generated by its contents and on the possibilities it has of excluding competitors.

Our second contribution has been to analyze the linking and versioning strategies of a publisher in competition with a search engine. Search engines provide links to the publisher's contents, and although they pay nothing to the publishers for it some of their visitors click through to the publisher's articles. In this situation, we show that if the publisher receives sufficient traffic from the search engine, it agrees to be linked and, as a result, the search engine becomes a version of the publisher. To the best of our knowledge, this represents a novel finding in the literature on versioning, which hitherto has not considered the possibility of links substituting fighting versions. We have also analyzed the case where the publisher's spillovers are such that the search engine offers greater utility than a single newspaper. In this situation, linking and versioning are more likely to occur because they generate a market expansion effect.

All in all, our results show that the disputes between digital newspapers and search engines are essentially dependent on the amount of traffic that search engines send to the newspaper and on the complementarity of the aggregated contents. It is therefore an empirical question to examine whether publishers obtain sufficient traffic from the search engines to justify their links, and whether search engines maximize their audience with their linking policies.

Our analysis can be extended in several directions in order to understand recent developments in the media market. Here, we have focused on the optimal versioning strategy of a publisher that can release newspapers of different qualities; however, we might also consider the case of a single newspaper that offers several news articles, some of them for free and others behind a paywall (freemium model). Such an extension will be useful in understanding how firms use search engines to attract visitors to their web sites and to promote their premium articles.

In this paper we have restricted our attention to the case in which a publisher is the sole producer of contents. However, news agencies play an essential role in the media market, providing fundamental information to traditional newspapers as well as to search engines and news aggregators. As such, the analysis of the role of new agencies in the linking strategy of newspapers would constitute an interesting issue for future research.

7 Appendix

Proof of Proposition 1. When the publisher only offers H the indifferent types are $\theta_{HA} = (p_H - c)/(1 - \beta)u$ and $\theta_{A0} = c/\beta u$. The firm sets p_H to maximize $\pi_{HA} = p_H(1 - \theta_{HA})$ and as a result the price and the profits are:

$$p_H = \frac{c + u(1 - \beta)}{2}; \quad (1)$$

$$\pi_{HA} = \frac{u(1 - \beta)}{4} + \frac{c}{4}\left(2 + \frac{c}{u(1 - \beta)}\right). \quad (2)$$

With this price, it is verified that $\theta_{HA} = \frac{1}{2}\left(1 - \frac{c}{u(1 - \beta)}\right) > \theta_{A0} = \frac{c}{\beta u}$ as long as $c < \frac{\beta u(1 - \beta)}{2 - \beta}$.

To ensure the participation of the blog we consider that this condition is always satisfied.

Imagine now that the publisher releases H and L . The quality of L is αu , where $\beta < \alpha < 1$. In this case, the indifferent types are $\theta_{HL} = (p_H - p_L)/u(1 - \alpha)$; $\theta_{LA} = (p_L - c)/[u(\alpha - (\beta + \alpha(1 - s)))]$; and $\theta_{A0} = c/[u(\beta + \alpha(1 - s))]$. The firm sets p_H and p_L to maximize $\pi_{HLA} = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{LA})$. Solving the firm's problem we obtain:

$$p_H = \frac{1}{2}[c + u(1 - \beta - \alpha(1 - s))]; \quad p_L = \frac{1}{2}[c + u(\alpha s - \beta)]; \quad (3)$$

$$\pi_{HLA} = \frac{u}{4}[1 - \beta - (1 - s)\alpha] + \frac{c}{4}\left[2 + \frac{c}{(\alpha s - \beta)u}\right]; \quad (4)$$

To ensure the participation of the blog now we need that $s > s_1$, where $s_1 = \frac{(\alpha+2\beta)u-c-\sqrt{c^2-6\alpha cu+\alpha^2 u^2}}{2\alpha u}$.¹⁵ In this case, it is verified that $\theta_{HL} = \frac{1}{2} > \theta_{LA} = \frac{1}{2} \left(1 - \frac{c}{(\alpha s - \beta)u}\right) > \theta_{A0} = \frac{c}{(\beta + \alpha(1-s))u}$. On the other hand, when $s \leq s_1$ this ranking is not preserved and the firm sets $p_L = \frac{\alpha c}{\beta + \alpha(1-s)}$ to ensure that $\theta_{LA} = \theta_{A0} = \theta_{L0}$. As a consequence, the publisher sets p_H to maximize $\pi_{HL} = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{L0})$. The prices and the associated profit are:

$$p_H = \frac{1}{2}[(1 - \alpha)u + \frac{2\alpha c}{\beta + \alpha(1-s)}]; \quad p_L = \frac{\alpha c}{\beta + \alpha(1-s)}; \quad (5)$$

$$\pi_{HL} = \frac{u}{4} - \frac{\alpha[(\alpha(1-s) + \beta)u - 2c]^2}{4u(\alpha(1-s) + \beta)^2}. \quad (6)$$

Moreover, the indifferent types are: $\theta_{HL} = \frac{1}{2} > \theta_{L0} = \frac{c}{(\beta + \alpha(1-s))u}$.

Next, we examine the publisher's optimal versioning policy. Consider first that $s > s_1$ (the competitor is active). In this case, it is satisfied that $\pi_{HLA} > \pi_{HA}$ for $s > \hat{s}$, where

$$\hat{s} = \frac{\alpha c^2 + \alpha(1 - \beta)(\alpha + \beta)u^2 + \sqrt{\alpha^2 \left(c^4 + 2(1 - \beta)c^2 u^2(\alpha + \beta - 2) + (\alpha - \beta)^2(\beta - 1)^2 u^4\right)}}{2\alpha^2(1 - \beta)u^2}. \quad (7)$$

Therefore, the publisher releases H and L for $\hat{s} < s \leq 1$ and only H for $s \leq \hat{s}$. Notice that this result is only valid when $\hat{s} > s_1$, which occurs when $\beta < \beta_1$, where β_1 is the value that satisfies $\hat{s} = s_1$ (the expression for both β_1 is long and we don't report it for simplicity). For $\beta > \beta_1$ (α and β take close values) the publisher offers H and L for $s_1 \leq s \leq 1$ and the blog is active. For $s < s_1$ if the firm offers the two versions and sets the prices in (5), A is not active. For this reason, the relevant profit function in order to analyze the publisher's strategy is π_{HL} . In particular, we obtain that $\pi_{HL} > \pi_{HA}$ for $s > s_2$, where

$$s_2 = \frac{2\sqrt{\alpha^2(\beta - 1)c^2(c^2 - 2(\beta - 1)cu + (\beta - 1)\beta u^2)} + \alpha(-(\alpha + \beta)c^2 - 2(1 - \beta)\beta cu - (\alpha - \beta)(1 - \beta)(\alpha + \beta)u^2)}{\alpha^2[2(\beta - 1)cu - c^2 + (\alpha - \beta)(\beta - 1)u^2]}. \quad (8)$$

Hence, for $s_2 < s < s_1$ the publisher offers the two versions at the prices in (5) and the blog is not active. And for $s < s_2$ it only releases H and the blog is active. **Q.E.D.**

¹⁵Notice that when c is sufficiently high $\theta_{LA} < \theta_{A0}$ for $s^* = \frac{(\alpha+2\beta)u-c+\sqrt{c^2-6\alpha cu+\alpha^2 u^2}}{2\alpha u} < 1$. In this case, the publisher only offers H for low values of β . In order to simplify the presentation we discard this case.

Proof of Proposition 2. When the publisher reaches an agreement with the aggregator it only releases one version. In this case, the indifferent types are $\theta_{HA} = (p_H - p_A)/[u(1 - \beta)]$ and $\theta_{A0} = p_A/\beta u$. The firm sets p_H to maximize $\bar{\pi}_{HA} = p_H(1 - \theta_{HA}) + p_A w(\theta_{HA} - \theta_{A0})$ while the aggregator obtains $\bar{\pi}_{HA}^a = p_A(1 - w)(\theta_{HA} - \theta_{A0})$. The solution yields:

$$p_H = \frac{p_A(1 + w) + u(1 - \beta)}{2}; \quad (9)$$

$$\bar{\pi}_{HA} = \frac{\beta^2 u[\beta u - 2u(u + p_A(1 + w))] - 4p_A^3 w + \beta(u + p_A(1 + w))^2}{4\beta u(1 - \beta)}; \quad (10)$$

$$\bar{\pi}_{HA}^a = \frac{p_A(1 - w)[p_A(\beta(1 + w) - 2) + \beta u(1 - \beta)]}{2\beta u(1 - \beta)}. \quad (11)$$

With the price in (9) the indifferent types satisfy $\theta_{HA} = \frac{1}{2} \left(1 - \frac{p_A(1 - w)}{u(1 - \beta)}\right) > \theta_{A0} = \frac{p_A}{\beta u}$ for $p_A < \hat{p}_A = \frac{\beta u(1 - \beta)}{2 - \beta(1 + w)}$. We assume this condition is satisfied to ensure the participation of the aggregator.

Next, consider the case where the negotiation between the firm and the aggregator breaks down. Imagine first that the firm releases both H and L . The indifferent types are $\theta_{HL} = (p_H - p_L)/u(1 - \alpha)$, $\theta_{LA} = (p_L - p_A)/u[\alpha - \beta(1 - r)]$ and $\theta_{A0} = p_A/u\beta(1 - r)$. The firm sets p_H and p_L to maximize $\pi_{HLA} = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{LA})$ and the aggregator's profits are $\pi_{HLA}^a = p_A(\theta_{LA} - \theta_{A0})$. Solving the problem we obtain:

$$p_H = \frac{p_A}{2} + \frac{u(1 - \beta(1 - r))}{2}; \quad p_L = \frac{p_A}{2} + \frac{u(\alpha - \beta(1 - r))}{2}; \quad (12)$$

$$\pi_{HLA} = \frac{1}{4} \left[u(1 - \beta(1 - r)) + p_A \left(2 + \frac{p_A}{u(\alpha - \beta(1 - r))} \right) \right]; \quad (13)$$

$$\pi_{HLA}^a = \frac{p_A}{2} \left[1 + \frac{p_A(2\alpha - \beta(1 - r))}{\beta(\alpha - \beta(1 - r))(r - 1)u} \right]. \quad (14)$$

Notice that with these prices the ranking $\theta_{HL} = \frac{1}{2} > \theta_{LA} = \frac{1}{2} \left(1 - \frac{p_A}{(\alpha - \beta(1 - r))u}\right) > \theta_{A0} = \frac{p_A}{\beta(1 - r)u}$ is preserved as long as $p_A < p_A^* = \frac{\beta[\alpha - \beta(1 - r)](1 - r)u}{2\alpha - \beta(1 - r)}$. For $p_A > p_A^*$ the publisher sets

$p_L = \frac{\alpha p_A}{\beta(1 - r)}$ to guarantee that $\theta_{LA} = \theta_{A0}$. Taking this into account, it sets p_H to maximize $\pi_{HL}^n = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{LA})$. The resulting prices and associated profits are:

$$p_H = \frac{2\alpha p_A + u\beta[1 - \alpha(1 - \beta) - r]}{2\beta(1 - r)}; \quad (15)$$

$$\pi_{HL} = \frac{1}{4} \left[u - \frac{\alpha(2p_A - \beta(1 - r)u)^2}{\beta^2(r - 1)^2 u} \right]; \quad \pi_{HL}^a = 0. \quad (16)$$

With the price in (15) the indifferent types are $\theta_{HL} = \frac{1}{2}$ and $\theta_{L0} = \frac{p_A}{\beta u(1 - r)}$. Moreover, as p_A is high the aggregator is not active in the market.

We can also consider the case where there is no agreement but the publisher only releases H . The indifferent costumers are $\theta_{HA} = (p_H - p_A) / [u(1 - \beta(1 - r))]$ and $\theta_{A0} = p_A / (u\beta(1 - r))$, and the profit are $\hat{\pi}_{HA}^n = p_H(1 - \theta_{HA})$ and $\hat{\pi}_{HA}^a = p_A(\theta_{HA} - \theta_{A0})$. In this situation, the price and the profits of the publisher are:

$$p_H = \frac{p_A}{2} + \frac{u(1 - \beta(1 - r))}{2}; \quad (17)$$

$$\hat{\pi}_{HA} = \frac{[p_A + u(1 - \beta(1 - r))]^2}{4(1 - \beta(1 - r))u}. \quad (18)$$

It can be shown that $\pi_{HLA} > \hat{\pi}_{HA}$ as long as $p_A > 0$. Hence, the publisher always prefers to release two versions. As L don't create spillovers on A the publisher always releases a fighting version.

Finally, once defined the profits of the publisher and the aggregator in each of the possible scenarios, we analyze when they will reach an agreement. First, notice that the publisher accepts to negotiate as long as $\pi_{HA} > \bar{\pi}_{HLA}$, which is satisfied for $w > \underline{w}$, where:

$$\underline{w} = 1 + \frac{A(1 - \beta)p_A(2p_A - \beta u) + \sqrt{A(1 - \beta)p_A^2[(4A + \beta)p_A^2 - 2A(2 - \beta)\beta p_A u + A\beta^2(1 - \beta(1 - r))u^2]}}{A\beta p_A^2};$$

where $A = k + r - 1$ and $\alpha = \beta k$. And second, the aggregator accepts to negotiate as long as $\bar{\pi}_{HA}^a > \pi_{HLA}^a$, which is satisfied for $w < \bar{w}$, where:

$$\bar{w} = 1 + \frac{A(1 - \beta)(2p_A - \beta u)(r - 1) - \sqrt{A(1 - \beta)(1 - r)[4p_A^2(\beta(1 - r) + A(1 + \beta - (1 - \beta)r)) - 4A\beta p_A(1 - r)u + A(1 - \beta)\beta^2(1 - r)u^2]}}{2A\beta p_A(r - 1)} \quad (19)$$

Taking this into account, the firms reach an agreement as long as $\underline{w} < \bar{w}$, which is satisfied for $r < r_1$. Here r_1 is the maximum value of the spillover for which the agreement is possible.

Now consider that $p_A > p_A^*$. In this case $\pi_{HLA}^a = 0$, so the aggregator will accept any agreement with the firm. In this context, the publisher negotiates with the aggregator as long as $\bar{\pi}_{HA} > \pi_{HLA}$, which is satisfied for $w > \underline{w}^*$, where:

$$\underline{w}^* = \frac{2}{\beta} - \frac{u(1-\beta) + p_A}{p_A} + \frac{\sqrt{(\beta-1)\beta^2 p_A^2 (r-1)^2 [4p_A^2 (\alpha - (r-1)^2) + 4\beta p_A (r-1)(r+\alpha-1)u + (\alpha-1)\beta^2 (r-1)^2 u^2]}}{\beta^2 p_A^2 (r-1)^2}. \quad (20)$$

Finally, note that the publisher and the aggregator reach an agreement as long as $\underline{w}^* < \bar{w}^* = 1$. This occurs when $r < r^2$, where:

$$r^2 = \frac{2\sqrt{k p_A^2 (\beta u - 2p_A)^2 + (2p_A - \beta u)[2p_A - \beta(1-k)u]}}{4p_A^2 - 4\beta p_A u + \beta^2 (1-k)u^2}. \quad (21)$$

For $r^2 < r \leq 1$ there is no agreement and the publisher releases a fighting version. **Q.E.D.**

Proof of Proposition 3. Imagine first that the publisher releases both H and L and doesn't allow the links of the search engine. In this case, the consumer indifferent to H and L is $\theta_{HL} = (p_H - p_L)/(u(1-\alpha))$, the consumer indifferent to L and A is $\theta_{LA} = (p_H - c)/(u(\alpha - \beta(1-r)))$ and the consumer indifferent to visiting the search engine and not reading the news is $\theta_{A0} = c/(u\beta(1-r))$. Taking this into account, the firm sets both p_H and p_L to maximize $\pi_{HLA}^{nolinks} = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{LA})$, which yields the following prices and profits:

$$p_H = \frac{1}{2}[c + u(1 - \beta(1-r))]; \quad p_L = \frac{1}{2}[c + u(\alpha - \beta(1-r))].$$

$$\pi_{HLA}^{nolinks} = \frac{1}{4} \left[2c + u(1 - \beta(1-r)) + \frac{c^2}{u(\alpha - \beta(1-r))} \right] < \frac{u}{4}. \quad (22)$$

Moreover, the audience for the search engine is $A_{HLA}^{nolinks} = \theta_{LA} - \theta_{A0} = \frac{1}{2} + \frac{c[2\alpha - \beta(1-r)]}{2\beta u(1-r)[\beta(1-r) - \alpha]}$.

Notice that publisher always releases L because it don't create spillovers on A .¹⁶ On the

¹⁶When the publisher only releases H and links are not allowed we obtain:

$$p_H = \frac{c + (1 - \beta(1-r))u}{2}; \quad \pi_{HLA}^{nolinks} = \frac{[c + (1 - \beta(1-r))u]^2}{4u(1 - \beta(1-r))}. \quad (23)$$

It can be verified that $\pi_{HLA}^{nolinks} > \pi_{HA}^{nolinks}$ for $c > 0$.

other hand, with the above prices it is satisfied that $\theta_{HL} = \frac{1}{2} > \theta_{LA} = \left[\frac{1}{2} - \frac{c}{2u(\alpha - \beta(1-r))} \right] > \theta_{A0} = \frac{c}{u\beta(1-r)}$ as long as $c < \bar{c} = \frac{\beta u(\alpha - \beta(1-r))(1-r)}{2\alpha - \beta(1-r)}$, which it is assumed for simplicity.

Imagine next that the publisher accepts to be linked and commercializes H . In this case, the consumer indifferent to H and A is $\theta_{HA} = p_H(1 - \delta)/(u(1 - \beta))$, and the consumer indifferent to A and not visiting any site is $\theta_{HA} = \delta p_H/(u\beta)$. Taking this into account, the firm sets p_H to maximize $\pi_{HA} = p_H(1 - \theta_{HA}) + \delta p_H(\theta_{HA} - \theta_{A0})$. As a result, the price and the associated profits are:

$$p_H = \frac{\beta u(1 - \beta)}{2(\beta - 2\beta\delta + \delta^2)}; \quad \pi_{HA} = \frac{\beta u(1 - \beta)}{4(\beta - 2\beta\delta + \delta^2)}. \quad (24)$$

Moreover, the search engine's audience is $A_{HA} = \theta_{HA} - \theta_{A0} = \frac{\beta - \delta}{2(\beta - 2\beta\delta + \delta^2)}$, and it is satisfied that $\theta_{HA} = \frac{\beta(1 - \delta)}{2(\beta - 2\beta\delta + \delta^2)} > \theta_{A0} = \frac{\delta(1 - \beta)}{2(\beta - 2\beta\delta + \delta^2)}$ for $\delta < \beta$.

Next, consider that the firm accepts the links and releases H and L . In this case, $u_L = \alpha u$ and $u_A = \beta(u + \alpha(1 - s))$, where $\beta < \alpha < 1$. Moreover, since $\beta < s\alpha$ we obtain that $u_A < u_L$. Taking this into account, the consumer indifferent to H and L is $\theta_{HL} = (p_H - p_L)/u(1 - \alpha)$; the consumer indifferent to L and A is $\theta_{LA} = (p_L(1 - \delta) - \delta p_H)/u(\alpha s - \beta)$; and the consumer indifferent to A and not visiting any newspaper is $\theta_{A0} = \delta(p_H + p_L)/u[\beta + \alpha(1 - s)]$. The publisher sets p_H and p_L to maximize $\pi_{HLA} = p_H(1 - \theta_{HL}) + p_L(\theta_{HL} - \theta_{LA}) + (p_H + p_L)\delta(\theta_{LA} - \theta_{A0})$. The solution of this problem is:

$$p_H = \frac{[\alpha(1 - \delta)(2\beta - 1 + \delta) + \beta(\beta - 1 + 2\delta) + \alpha(1 - 2\beta - 2\delta)s + \alpha^2(\delta - 1 + s)^2]u}{2[4\beta\delta - \beta - \delta^2 - \alpha(1 - s + \delta(3\delta + 4(s - 1)))];}$$

$$p_L = \frac{[\beta(\beta - \delta) - \alpha^2(\delta^2 - \delta(1 - s) + s(1 - s)) + \alpha(\beta(1 + \delta - 2s) - \delta(1 - \delta - s))]u}{2[4\beta\delta - \beta - \delta^2 - \alpha(1 - s + \delta(3\delta + 4(s - 1)))].} \quad (25)$$

With these prices it is satisfied that $\theta_{HL} > \theta_{LA}$ if $\delta > \delta^* = [\beta + \alpha(1 - s)]/(1 + \alpha)$, and $\theta_{LA} > \theta_{A0}$ if $\delta < \delta^*$. This implies that the publisher can't get a positive market share for both versions. The publisher can instead set $p_L = \frac{p_H(\beta - (1 - \alpha)\delta - \alpha s)}{\beta - 1 + \delta + \alpha(1 - \delta - s)}$ to guarantee that $\theta_{HL} = \theta_{LA} = \theta_{HLA}$, where θ_{HLA} is the consumer indifferent to H and A when the publisher releases H and L . Taking this into account, it sets p_H to maximize $\pi_{HLA} = p_H(1 - \theta_{HA}) + \delta(p_H + p_L)(\theta_{HA} - \theta_{A0})$. The price and the associated profits are:

$$p_H = \frac{[\beta + \alpha(1 - s)][\beta - 1 + \delta + \alpha(1 - \delta - s)]^2 u}{2[\beta(1 - \beta) + 4(\beta - 1)\beta\delta + \delta^2 + \alpha(1 - 2\beta)(1 - s - 2\delta(2 - \delta - 2s)) + \alpha^2(\delta + s - 1)(1 - s + \delta(4s - 3))];}$$

$$\pi_{HLA} = \frac{[\beta + \alpha(1-s)][\beta - 1 + \delta + \alpha(1 - \delta - s)]^2 u}{4[\beta(1-\beta) + 4(\beta-1)\beta\delta + \delta^2 + \alpha(1-2\beta)(1-s-2\delta(2-\delta-2s)) + \alpha^2(\delta+s-1)(1-s+\delta(4s-3))]}; \quad (26)$$

The audience for the search engine is $A_{HLA} = \theta_{HLA} - \theta_{A0}$, where:

$$\theta_{HLA} = \frac{(2\delta-1)(\beta + \alpha(1-s))(\beta - 1 + \delta + \alpha(1 - \delta - s))}{2[\beta(1-\beta) + 4(\beta-1)\beta\delta + \delta^2 + \alpha(1-2\beta)(1-s-2\delta(2-\delta-2s)) + \alpha^2(\delta+s-1)(1-s+\delta(4s-3))]};$$

$$\theta_{A0} = \frac{\delta(1-\beta-\delta+\alpha(\delta+s-1))(1-2\beta+\alpha(2s-1))}{2[\beta(1-\beta) + 4(\beta-1)\beta\delta + \delta^2 + \alpha(1-2\beta)(1-s-2\delta(2-\delta-2s)) + \alpha^2(\delta+s-1)(1-s+\delta(4s-3))]}; \quad (27)$$

It can be checked that $\theta_{HA} > \theta_{A0}$ for $\delta < \delta^*$.

On the other hand, if firms agree to set the links when $\delta > \delta^*$ there is a region $\delta^* < \delta < \beta$ where the publisher sets $p_L = \frac{p_H(\beta+\alpha(1-\alpha)-\delta)}{\delta}$ to guarantee that $\theta_{HA} = \theta_{A0} = \theta_{H0}$. As a result, it maximizes $\pi_{HLA} = p_H(1 - \theta_{H0})$ by setting $p_H = u/2$ and obtains $\theta_{H0} = 1/2$ and $\pi_{HL} = u/4$. Finally, for $\delta > \beta$ any consumer wants to visit A . As a result, the publisher only releases H , sets $p_H = u/2$ and obtains $\pi_{H0} = u/4$.

Finally, taking into account the previous results we examine the linking and versioning policy of the publisher and the search engine. Consider the case of the publisher. When $\delta < \delta^*$ it can be shown that $\pi_{HLA}^{nolinks} > \pi_{HA}$ for $\delta < \delta_3$. Therefore, the publisher releases H and L and don't accepts links for $0 \leq \delta \leq \delta_3$, where:

$$\delta_3 = \frac{\beta - \sqrt{(\beta-1)\beta[p_A^2 + 2p_A(\alpha+\Phi)u + (1+\Phi)(\alpha+\Phi)u^2] + [p_A^2 + 2p_A(\alpha+\Phi)u + \beta(\alpha+\Phi)(r-1)u^2]}}{[p_A^2 + 2p_A(\alpha+\Phi)u + (1+\Phi)(\alpha+\Phi)u^2]}; \quad (28)$$

and where $\Phi = \beta(r-1)$. On the other hand, $\pi_{HLA} > \pi_{HA}$ for $\delta > \delta_2$ (the expression of δ_2 is long and we don't report it for simplicity). This implies that for $\delta_3 < \delta \leq \delta^*$ the publisher wants to be linked and if this happens for $\delta_3 < \delta \leq \delta_2$ it only offers H , and for $\delta_2 < \delta \leq \delta^*$ it releases H and L (although nobody directly visits L).¹⁷

¹⁷Notice that if s is sufficiently high $\delta_2 < \delta_3$. In this case, for $\delta < \hat{\delta}$ (we omit the expression of $\hat{\delta}$ for simplicity) it is verified that $\pi_{HLA}^{nolinks} > \pi_{HLA}$. As a result, the firms don't reach an agreement for $0 < \delta \leq \hat{\delta}$ and they reach an agreement and the publisher releases H and L for $\hat{\delta} < \delta \leq \delta_1$.

For $\delta^* < \delta \leq \beta$ the publisher releases H and L but the prices are so high that if there are links nobody chooses the search engine. Moreover, for $\beta < \delta \leq 1$ the publisher only releases H because consumers never choose the search engine at the equilibrium prices.

Finally, we examine the linking strategy of the search engine, which maximizes its audience. It can be show that $A_{HLA}^{nolinks} > A_{HLA}$ for $\delta > \delta_1$, where $\delta_1 > \delta_2$. This implies that for $\delta_2 < \delta \leq \delta_1$ the search engine and the publisher agree on setting the links and the publisher releases the two versions, and for $\delta > \delta_1$ although the publisher wants to be linked the search engine is not interested because this would reduce its audience. These two cases are represented in Panels I and II of Figure 2. On the other hand, notice that $A_{HLA}^{nolinks} > A_{HA}$ for $\delta > \delta_4$ and that $\delta_4 < \delta_2$ if s is sufficiently low. When this occurs, for $\delta_2 < \delta \leq \delta_4$ the search engine and the publisher agree to establish the links and the publisher only releases H , and for $\delta > \delta_4$ there is not agreement, the publisher releases H and L and the search engine offers its own contents. **Q.E.D.**

Proof of Proposition 4. When the publisher and the search engine don't reach an agreement, the publisher releases H and L and its prices and profits $\pi_{HLA}^{nolinks}$ are those in (22). On the other hand, if they reach an agreement and the publisher only releases H it is satisfied that $u_H > u_L > u_A$, and publisher's price and profits π_{HA} are those in (24).

Consider next that they reach an agreement and the publisher releases both H and L . As a result, $u_A > u_H$, since $u_A = u[\beta + \alpha(1 - s)]$ and $s < (\beta + \alpha - 1)/\alpha$. In this situation, the consumer indifferent to A and H is $\theta_{AH} = [\delta(p_H + p_L) - p_H]/u[\beta + \alpha(1 - s) - 1]$, the consumer indifferent to H and L is $\theta_{HL} = (p_H - p_L)/u(1 - \alpha)$; and the consumer indifferent to L and not visiting any newspaper is $\theta_{L0} = p_L/u\alpha$. The firm sets the prices p_H and p_L to maximize $\pi_{AHL} = \delta(p_H + p_L)(1 - \theta_{AH}) + p_H(\theta_{AH} - \theta_{HL}) + p_L(\theta_{HL} - \theta_{L0})$. Taking this into account, the prices and the associated profits are:

$$p_H = \frac{\delta[\beta - 1 + \alpha(\beta + \delta - s - \alpha(\delta + s - 1))]u}{2[\beta + \delta(\delta - 2) + \alpha(1 + \delta(3\delta - 2) - s)]}; p_L = \frac{\alpha\delta[2\beta - 1 - \delta + \alpha(1 + \delta - 2s)]u}{2[\beta + \delta(\delta - 2) + \alpha(1 + \delta(3\delta - 2) - s)]} \quad (29)$$

$$\pi_{AHL} = \frac{\delta^2[\beta - 1 + \alpha(3\beta - 1 - s - \alpha(3s - 2))]u}{4[\beta + \delta(\delta - 2) + \alpha(1 + \delta(3\delta - 2) - s)]}. \quad (30)$$

With these prices, the audience for the search engine is $A_{AHL} = 1 - \theta_{AH}$.

Moreover, it is guaranteed that $\theta_{AH} > \theta_{HL} > \theta_{L0}$ as long as $\delta > \delta_2 = (\beta + \alpha(1-s))/(1+\alpha)$, where:

$$\theta_{AH} = \frac{\delta[\delta - 1 + \alpha(3\delta - 1)]}{2[\beta + \delta(\delta - 2) + \alpha(1 + \delta(3\delta - 2) - s)]}; \quad (31)$$

$$\theta_{HL} = \frac{\delta[\beta - 1 + \alpha(2\delta - s)]}{2[\beta + \delta(\delta - 2) + \alpha(1 + \delta(3\delta - 2) - s)]}; \quad (32)$$

$$\theta_{L0} = \frac{\delta[2\beta - 1 - \delta + \alpha(1 + \delta - 2s)]}{2[\beta + \delta(\delta - 2) + \alpha(1 + \delta(3\delta - 2) - s)]}. \quad (33)$$

Note that for $\delta > \delta_2$ the publisher might consider if it prefers to release only H . If $\delta > \delta_2 > \beta$ and it only releases H nobody visits the aggregator and the publisher gets π_{H0} . Next, notice that $\pi_{AHL} > \pi_{H0}$ for $\delta < \delta^*$, where:

$$\delta^* = \frac{\beta + \alpha(1-s)}{1 + \alpha - \sqrt{(1 - \beta - \alpha(1-s))(1 - \beta + \alpha(1 - 3\beta + s + \alpha(3s - 2)))}}. \quad (34)$$

This implies that for $\delta^* \leq \delta \leq 1$ if there are links the publisher prefers to release H and the aggregator is not active, and for $\delta_2 \leq \delta \leq \delta^*$ it releases both versions at the prices in (16) and the aggregator is active.

Consider now that $\delta < \delta_2$, for which $\theta_{AH} < \theta_{L0}$.¹⁸ This is the case where all consumers visit the search engine in order to pay less, and only in some cases they click through to the newspapers. In this situation, the consumer indifferent to visiting A and not reading any newspaper is $\theta_{A0} = \frac{\delta(p_H + p_L)}{u(\beta + \alpha(1-s))}$. In order to ensure that $\theta_{A0} = \theta_{L0}$ the firm sets $p_L = p_H \frac{\alpha\delta}{\beta + \alpha(1-s-\delta)}$. Taking this into account, it sets p_H to maximize $\pi_{A0} = \delta p_H (1 - \theta_{A0}) + \delta p_L (1 - \theta_{A0})$. This yields:

$$p_H = \frac{\beta + \alpha(1-s-\delta)u}{2\delta}; \quad p_L = \frac{\alpha u}{2}; \quad (35)$$

$$\pi_{A0} = \frac{[\beta + \alpha(1-s)]u}{4} > \frac{u}{4}. \quad (36)$$

Notice that $\pi_{A0} > \frac{u}{4}$ because all visitors of the search engine access to the two versions. This also implies that $\pi_{A0} > \pi_{HLA}^{nolinks}$ (recall that the only option to visit the two version is through the search engine).

¹⁸Note that $\delta_2 > \delta_1$ for $s < (\beta + \alpha - 1)/\alpha$.

Finally, we examine the linking strategy of the search engine. It can be show that $A_{HLA}^{nolinks} > A_{AHL}$ for $\delta > \delta_1$, where $\delta_1 > \delta_2$. This implies that for $\delta_2 < \delta \leq \delta_1$ the search engine and the publisher agree to establish the links and the publisher releases the two versions, and for $\delta_1 < \delta \leq 1$ although the publisher wants to be linked the search engine prefers not to do it. **Q.E.D.**

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