Information Gatekeepers, Product Markets and Vertical Merger*

Jihui Chen†
University of North Dakota

Qihong Liu‡
University of Oklahoma

February 27, 2007

Abstract

This paper examines the welfare effects of vertical integration by an "information gatekeeper" into the product market it serves. We consider a homogeneous product market where n homogeneous product price-setting firms can broaden their market reach by advertising at a price comparison site, which is controlled by a profit-maximizing gatekeeper. We show that vertical integration into the product market alters the timing of the game in which the integrated entities now act as a price leader and charge the monopoly price to soften the competition. Post-merger, the independent firms' profits remain the same. In contrast, the integrated gatekeeper and its subsidiaries in the product market earn weakly higher profits. Consumer surplus and social welfare decline after the merger with linear demand.

1 Introduction

Recent advances in technology have dramatically changed the manner in which consumers and businesses gather and transmit information about product and prices. A recent comScore Media Matrix monthly analysis reports that more than 31 million unique users visited CNET Networks site in December 2006.[1] Baye and Morgan (2001) show that

*We are grateful to the editor Yeon-Koo Che and two anonymous referees for many helpful suggestions and comments that greatly improved this paper. We would also like to thank session participants at the 2004 Southern Economic Conference for comments on an earlier version of this paper. We are indebted to Michael R. Baye for his invaluable comments, suggestions, and advice.

†Department of Economics, University of North Dakota, Grand Forks, ND 58202. E-mail: susan.chen@mail.business.und.edu. Tel: (701) 777-2798. Fax: (701) 777-3365.

‡Department of Economics, University of Oklahoma, 729 Elm Ave, Norman, Ok 73019. E-mail: qliu@ou.edu. Phone: (405) 325-5846. Fax: (405) 325-5842.

[1]Source: "Holiday Fever Drives Traffic to Shopping Sites in December" (http://www.comscore.com/press/release.asp?press=1177).

a profit–maximizing gatekeeper has an incentive to distort the fees it charges firms to list prices at its site in order to create the profit-maximizing level of price dispersion. As a consequence, even though price comparison sites provide information to consumers that would seem to enhance competition, their presence does not result in marginal-cost pricing in the product markets they serve. Both the gatekeeper and firms in the product market charge prices above marginal cost and earn positive profits.

An important question — left unanswered by the Baye-Morgan analysis — is whether vertical integration between an information gatekeeper and one or more firms in the product market would enhance or reduce overall social welfare. In light of the positive margins earned by the gatekeeper and firms in the product market, standard reasoning might lead one to speculate that vertical integration would increase social welfare, due to the potential reduction in the degree of "double marginalization." But these results are generally sensitive to upstream market structure and nature of competition.[2] Other conclusions heavily rely on specific contractual agreements.[3] However, these existing results are not relevant for mergers between information markets and the product markets they serve.

The present paper addresses this issue. Our analysis is motivated by the fact that, in a number of markets, information gatekeepers are vertically integrated into the product markets they serve. For instance, in the summer of 2001, five major airlines (American, Continental, Delta, Northwest, and United Airlines) established Orbitz—an information gatekeeper in the market for air travel price information. Similarly, in November 2001, Warner Brothers, Paramount Pictures, Universal Pictures, Sony Pictures Entertainment, and Metro-Goldwyn-Mayer entered a joint venture establishing Movielink—an information gatekeeper that distributes movies online. Major record labels created information gatekeepers (Vivendi and Sony's Pressplay and Warner, EMI and Bertelsmann's Music-

[2]While backward integration by a downstream monopsonist is pro-competitive (see Perry, 1978), Riordan (1998) develops a simple model of anticompetitive "backward vertical integration by a dominant firm into an upstream competitive industry," in the presence of competing fringe firms.

[3]For instance, Heavner (2004) shows that enclosure costs of vertical integration can reduce social welfare. Also, see Grossman and Hart (1986) for related discussion.

Net) servicing the market for digital music. In the spring of 2003, the five largest hotel chains launched their jointly-owned information gatekeeper (TravelWeb).[4]

As these examples illustrate, firms in a variety of new economy markets derive profits from operations in information markets as well as the product markets they serve. In terms of public policy, vertical links between information and product markets (be it through vertical integration or joint ventures) raise potential antitrust concerns. Indeed, the U.S. government has held numerous hearings to investigate the potential anti-competitive effects of these sorts of vertical links in industries that include air travel, music, cosmetics, bond trading, and foreign-currency trading.[5]

The present paper offers a stylized but useful framework for examining the welfare effects of vertical integration and/or joint ventures that link certain product and information markets. We consider a homogeneous product market where price-setting oligopolists can broaden their market reach by advertising at a price comparison site, which is controlled by a profit-maximizing gatekeeper. In our model, we consider various types of consumers: some actively conduct comparison shopping both at and beyond the gatekeeper prior to reaching a purchase decision, some rely solely on the gatekeeper for product information, while the rest never use the information gatekeeper. We show that vertical integration into the product market alters the timing of the game in which the integrated entities now act as a price leader and charge the monopoly price to soften the competition. This, in turn, induces the gatekeeper to increase the fees it charges firms to advertise their prices at its price comparison site. While the increase in fee reduces the independent firms' incentives to advertise prices, the merged firms' withdrawal from the competition increases the incentive to advertise at the gatekeeper as their chances

[4]Subsequently, some of aforementioned joint ventures spun off from parent companies through acquisitions or initial public offerings (IPOs). For instance, Cendant Corporation completed its acquisition of Orbitz in November 2004, Sony and Vivendi sold Pressplay to Roxio Inc. in May, 2003, and Priceline acquired Travelweb in May 2004.

[5]See, for instance, "Are All Online Travel Sites Good for the Consumer: An Examination of Supplier-Owned Online Travel Sites," *Hearing Before the Subcommittee on Commerce, Trade, and Consumer Protection of the Committee on Energy and Commerce*, House of Representatives One Hundred Seventh Congress, Second Session, July 18, 2002, Serial No. 107-120.

of getting price-sensitive consumers rise. However, these two effects exactly offset each other. As a result, the independent firms' profits remain the same following the merger. In contrast, the integrated gatekeeper and its subsidiaries in the product market earn weakly higher profits. Finally, depending on the demand function, consumer surplus and social welfare may or may not decline after the merger. For example, both decrease with linear demand.

Our analysis provides a framework for evaluating the welfare effects of past efforts by the Civil Aeronautics Board (CAB) and the Department of Justice (DOJ) to force American Airlines to divest its Sabre computer reservation system (CRS) (as American ultimately did "voluntarily" in 1996). It also offers insights into the recent policy debate regarding the welfare effects of a move by a handful of airlines to create TRUEconnect – a new information gatekeeper in the market for air-travel information.

Viewed more broadly, concerns regarding the competitiveness of vertical integration led to the consent decree signed by AOL-Time Warner.[6] Among other petitioners, Internet Service Providers (ISPs) including Earthlink which had competed head-to-head with AOL were concerned that the vertically integrated cable division (i.e., Time Warner) would favor its affiliated broadband ISP service (i.e., AOL). To ensure competition, FTC ordered the merged entity to "open its cable system to competitor ISPs", among others terms. Those provisions were very similar to those in the American-Sabre case.[7] Similar issues also arose in Newscorp/Telepiu case concerning the merger between two Italian pay-TV platforms Stream and Telepiu in 2002 and the Vivendi/Seagram/Canal Plus merger in 2000.[8]

[6] We thank an anonymous referee for pointing this out.

[7] Source: "FTC Approves AOL/Time Warner Merger with Conditions," December 14, 2000 (http://www.ftc.gov/opa/2000/12/aol.htm).

[8] Source: "Vertical and horizontal integration in themedia sector and EU competition law" by Miguel Mendes Pereira, "The ICT and Media Sectors within the EU Policy Framework", Brussels, 7 April 2003 (http://ec.europa.eu/comm/competition/speeches/text/sp2003_009_en.pdf).

2 Model

Following Baye-Morgan, we consider a homogeneous product market where n identical price-setting firms produce at a marginal cost of $c \geqslant 0$. The firms can broaden their market reach by advertising at a price comparison site, which is controlled by a profit-maximizing gatekeeper. Our analysis extends the Baye-Morgan model by (1) allowing one or more firms in the product market to control (through vertical integration or joint ventures) the market for price information and (2) introducing various consumer types including loyals.

A unit mass of consumers, each with demand $D(p)$ enjoy surplus $S(p) > 0$ by purchasing at a price $p \leqslant r$ where r denote the monopoly price ($r < \infty$). To closely depict various types of consumers, we assume a fraction β of them always visit all individual firms' own sites but never the gatekeeper, while the remaining fraction $(1 - \beta)$ only visit the gatekeeper but never individual firms' own sites. For simplicity of discussion, we refer to the former as "non-visitors" (to the gatekeeper) and the latter "visitors". We further assume that both groups consist of a fraction γ of loyals who only purchase from a favorite store and the remaining $(1 - \gamma)$ of switchers who always purchase at the lowest listed price. In the event of tied prices, switchers will be split among firms charging the same lowest price. We assume that γ is sufficiently large so that the gatekeeper has no incentive to charge a very high advertising fee with only one firm advertising and foreclose the rest.

An alternative way to interpret our assumption of consumer types is as follows: (1) some consumers $(1 - \beta)$ have high search costs and they rely solely on the gatekeeper for product and price information. As in Deneckere et al. (1992) and Baye and Morgan (2005), there are both loyals and switchers among these consumers. (2) some consumers $(\beta\gamma)$ are extremely loyal and they directly visit a favorite store for purchase. (3) the remaining $(\beta(1 - \gamma))$ have low search costs and they visit the gatekeeper as well as all stores' own sites. Essentially, these consumers are aware of all price information regardless of firms' advertising decisions. We may also interpret the last group as "cross-channel" shoppers, who use the gatekeeper to obtain additional product review information, online coupons, and many other resources, but ultimately purchase from the lowest-price firm's own site. A casual observation reveals that retails indeed encourage seamless "cross-channel" shopping. Leading retailers including Best Buy and Circuit City allow customers to order online and pick the products up in-store.

Note that visitors' purchase decisions are contingent on the availability of price information at the gatekeeper. Firms have the option to advertise at the gatekeeper in exchange for a fee ϕ, and advertising is the only way that firms can reach visitors.[9] Table 1 summarizes the four consumer types.

Table 1. Four Consumer Types in the Model

Consumer Type	Fraction	Purchase Choice
Visitor Loyals	$(1-\beta)\gamma$	advertising favorite store
Visitor Switchers	$(1-\beta)(1-\gamma)$	lowest-priced advertising store
Non-Visitor Loyals	$\beta\gamma$	favorite store
Non-Visitor Switchers	$\beta(1-\gamma)$	lowest-priced store

3 Analysis

In this section, we analyze equilibria arising in the game with an independent information gatekeeper (pre-merger) and the one with an integrated gatekeeper into the product market (post-merger). We focus on symmetric equilibrium given symmetry of firms.[10] Next, we in turn consider both pre- and post-merger equilibrium results.

[9] We assume that firms cannot price discriminate between consumers who use the gatekeeper and those who do not. For example, price information listed at Shopper.com for a product sold by Circuitcity is identical to that listed at Circuiticty.com. Baye and Morgan (2002), in constrast, allows firms to price discriminate between consumers who do and do not use the information gatekeeper.

[10] There also exist an infinite number of asymmetric equilbria in our model, but the symmetric equilibrium first-order stochastically dominates the asymmetric ones. Interested readers, refer to Baye et al. (1992) for detailed discussion.

3.1 Before Merger

We start with the pre-merger game. The timing and nature of the game is as follows. First, the gatekeeper announces the fee ($\phi > 0$) it charges firms to list their prices at its site. Second, firms simultaneously and independently decide whether to list their prices at the gatekeeper's site and make their pricing decisions. Finally, consumers shop.

Let α denote a firm's propensity to advertise its prices at the gatekeeper's site, and p the advertised prices. Let $\pi(p) = \frac{(p-c)D(p)}{n}$, so that $\pi(r)$ denotes monopoly profits. Each firm chooses prices according to a cumulative density function (CDF) $F(p)$ when it advertises and $G(p)$ when it does not.

The gatekeeper's problem is given by

$$\max_{\phi} \quad \pi_g = n \cdot \alpha(\phi) \cdot \phi.$$

Proposition 1 *In a symmetric equilibrium, each firm chooses to advertise at the gatekeeper's site with probability* $\alpha(\phi) = 1 - \left[\frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}$*, the distribution of advertised prices is given by* $F(p) = \frac{1-\left[\frac{\frac{\phi}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}}{1-\left[\frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}}$ *for* $p \in [p_0, r]$*, where* $p_0 = \pi^{-1}\left(\frac{\phi}{\frac{(1-\beta)\gamma}{n} + (1-\beta)(1-\gamma)}\right)$.
The distribution of non-advertised prices is given by

$$G(p) = \frac{A^{\frac{1}{n-1}} - B^{\frac{1}{n-1}}}{C^{\frac{1}{n-1}}},$$

for $p \in [\underline{p}, r]$*, where* $\underline{p}$ *satisfies* $\frac{\gamma}{n}\left(\pi(\underline{p})\right)^2 - \frac{\gamma}{n}\pi(\underline{p}) + \frac{\phi}{1-\beta} = 0$ *and* $A = \frac{\frac{\phi}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$, $B = \frac{\gamma}{(1-\gamma)n}(\pi(r) - \pi(p))$, $C = \frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$.

See Appendix for the proof of this proposition.

3.2 After Merger

Next, suppose that the gatekeeper and firm m in the product market are vertically integrated. The merged firm now advertise at the gatekeeper for free, since it's simply an internal transfer.[11]

The timing of the game becomes: First, the integrated gatekeeper announces the fee ($\phi > 0$) it charges independent firms to list their prices at its site. Meanwhile, the integrated firm decides whether to advertise at the gatekeeper. Second, upon observing the merged firms' advertising decisions, the independent firms in the product market make advertising and pricing decisions. The merged firm has the option to announce prices before other firms do.[12] Finally, consumers shop.

Notice that consumers' optimal decisions remain unchanged. Next, consider firm m's problem in which it decides whether to advertise and whether to adopt a pure or mixed pricing strategy. Table 2 summarizes firm m's available strategies.

Table 2. The Integrated Firm m's Strategy Space

	Pure Strategy ($p = r$)	Mixed Strategy ($H_j(p)$)
Advertise	Strategy 1	Strategy 3
Not Advertise	Strategy 4	Strategy 2

To proceed, we define the following three advertising and pricing strategies that may be adopted by firm m:[13]

[11]Ex ante, it is unclear whether it is optimal for the merged firm m to always advertise at the gatekeeper. If it always advertises, its rivals may advertise less frequently, which would in turn reduce the merged entities' joint profits.

[12]For simplicity, we assume that if firm m adopts a mixed pricing strategy, the game proceeds as in the pre-merger game – all firms simultanously announce prices; if it adopts a pure strategy (e.g., charges r), it announces its price first and then other firms simultanously make their advertising and pricing decisions. Knowing other firms will always undercut, firm m focuses on its loyals only and charges the monopoly price r. We assume that the merged firm is unable to get any visitor switchers even if the independent firms charge r at the gatekeeper because of undercutting.

[13]Strategy 4 – firm m decides not to advertise and charges at $p = r$ – is clearly dominated by Strategy 1. Firm m always gets its share of non-visitor loyals whether or not it advertises, but it gets additional visitor loyals only if it advertises.

Strategy 1: Firm m decides to advertise at price $p_m = r$, and other firms subsequently make advertising and pricing decisions;

Strategy 2: Firm m decides not to advertise, and choosing prices from a CDF $H_2(p)$ simultaneously with other independent firms;

Strategy 3: Firm m decides to advertise and choose prices from a CDF $H_3(p)$ simultaneously with other firms, and it does not put all the mass on $p = r$.

We focus on the equilibrium results in which all $n - 1$ independent firms behave symmetrically. Suppose that each independent firm chooses prices according to a CDF $F_j(p)$ when it advertises with probability α_j and $G_j(p)$ when it does not with probability $(1 - \alpha_j)$ where $j = 1, 2,$or 3.[14]

Our results are summarized in Proposition 2.

Proposition 2 *When the gatekeeper and one of the firms in the product market are vertically integrated, in equilibrium, the integrated gatekeeper allows its own subsidiary to advertise at no charge and the integrated firm m's optimal strategy is to advertise with probability one, and choose price* $p_m = r$.

See Appendix for the proof of this proposition.

The intuition for this result is as follows. The merged firm earns the highest possible expected profits from its captive loyal customers both at and outside the gatekeeper. Moreover, by setting $p_m = r$, it avoids competing with other firms for the price-sensitive switchers both at and beyond the gatekeeper. Essentially, the merged entity softens the competition in the product market by giving up the switchers. As a result, the expected profits (excluding the fee payment) of independent firms' rise. However, the merged entities can completely reap any increased profits in the product market by setting a higher ϕ, since the independent firms' outside option is the same before and after the merger.[15] Meanwhile, the higher advertising fees increase the vertically integrated

[14] Subscript j denotes different strategies by firm m.

[15] Obviously the above result holds when the gatekeeper enjoys the monopoly power. In the case of multiple gatekeepers, the above finding will still hold as long as demands of visitor loyals at different gatekeepers are independent of each other, i.e., no leakage among gatekeepers. However, it will not hold if gatekeepers compete against each other.

gatekeeper's profits from operations in the information market, while its subsidiary earns higher profits in the product market.[16] Overall, the merged entities' profits increase in the post-merger game.

Generally, consider a merger between an information gatekeeper and $k \in \{1, 2, 3, ..., n-1\}$ firms in the product market. In equilibrium, all merged firms advertise at the gatekeeper with probability one and choose price $p_k = r$. The joint profits of the integrated entities are given by

$$\begin{aligned}\pi_g &= \pi_{g\phi} + k\pi_{gk} \\ &= (n-k) \cdot \alpha \cdot \phi \\ &\quad + \left[\frac{\gamma k}{n} + (1-\beta)(1-\gamma)(1-\alpha)^{n-1-k}\right]\pi(r),\end{aligned}$$

where $\alpha = \left[1 - \left(\frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right)^{\frac{1}{n-1-k}}\right]$.

3.3 Welfare Considerations

In this section, we consider the changes in welfare before and after the merger. In addition, we compare these two equilibrium results (Case 1: pre-merger and Case 2: post-merger) with the following three benchmark cases:

Case 3: the absence of the information gatekeeper;[17]

Case 4: a benevolent social planner operates the gatekeeper and decides the socially optimal ϕ and then firms make advertising and pricing decisions – this is the second best scenario;

Case 5: a benevolent social planner operates both the gatekeeper and firms in the product market, i.e., deciding both advertising fee ϕ and product prices – this is the first best scenario.

[16] In the event of no listings in the post-merger game, the merged firm earn the monopoly profits from all visitors and its own non-visitor loyals. In contrast, in the pre-merger game, if it charges r, it fails to get any visitor switchers if at least one firm advertises.

[17] Firms only have access to non-visitors.

Comparison of case 1 with case 2

We start with firms' profits. In each case, (independent) firms advertise with probability $\alpha_i > 0$, and earn the same expected profit as when they do not advertise. Furthermore, when they do not advertise, they chooses prices from a lower bound p_1 or p_2 through the monopoly price r. Since they adopt a mixed pricing strategy, their expected profits must be the same as when they adopt a pure strategy – charge r. Last note that when an independent firm does not advertise and charges r, it earns the same profit in both Cases 1 and 2, i.e., $\pi(r, NA) = \frac{\beta\gamma}{n}\pi(r)$. Meanwhile, the merged firm m has the option to adopt its pre-merger advertising and pricing strategies to obtain the pre-merger profits. Thus, firm m's post-merger expected profits weakly dominates its pre-merger profits. Finally, the gatekeeper's profits are simply a transfer between firms and itself and would not affect the overall social welfare. Taken together, producer surplus in Case 1 weakly dominates that in Case 2.

Next consider consumer surplus. In Case $i = 1, 2$, the gatekeeper charges a fee ϕ_i. Each (independent) firm observes this fee and choosing an advertising strategy α_i. Their pricing strategies follow the CDF $F_i(p)$ with $p \in [p_{iA}, r]$ when they advertise and $G_i(p)$ with $p \in [p_{iNA}, r]$ when they don't, both of which are lengthy, as we show in the previous section. Moreover, it can be shown that p_{iA} and p_{iNA} are also different. To calculate the consumer surplus, we need to derive the distribution of the minimum price at and beyond the gatekeeper, when there are j firms ($j = 0, .., n$) advertising at the gatekeeper. However, if firms advertise with probability 1 ($\alpha_i = 1$), then $G_i(p)$ disappears and the analysis is greatly simplified.

Further note that when $\gamma = 1$, there are only loyal customers at and beyond the gatekeeper, then the gatekeeper's optimal strategy is to charge the highest possible fee and each firm always advertises with probability 1 and sets prices at r. Therefore, throughout this section, we assert the following:

Assumption: γ is sufficiently large.[18]

[18] Although relaxing the assumption of γ would make the model more realistic, it renders the present

Under the assumption, all firms advertise with probability $\alpha_i = 1$.[19] Now Case 1 and Case 2 have the same advertising probability $\alpha_1 = \alpha_2 = 1$, the same fee $\phi_1 = \phi_2$ and the same lower support of price range $p_{1A} = p_{2A} = p_0$. Let $S(p)$ denote each consumer's surplus when the price paid is p. Then the consumer surplus in Case 1 is,

$$CS_1 = \gamma \int_{p=p_0}^{r} S(p)dF_1(p) + (1-\gamma) \int_{p=p_0}^{r} S(p)dH_1(p). \tag{1}$$

The first term of equation (1) is the loyals' consumer surplus, and the second term is from the switchers, and $H_1(p)$ is the CDF of the minimum prices charged by all n firms.

Similarly, consumer surplus in Case 2 is given by

$$CS_2 = \frac{\gamma}{n}(n-1) \int_{p=p_0}^{r} S(p)dF_2(p) + \frac{\gamma}{n} S(r) + (1-\gamma) \int_{p=p_0}^{r} S(p)dH_2(p), \tag{2}$$

where $H_2(p)$ is the CDF of the minimum prices charged by all $n-1$ firms (except for the merged firm).

The difference between equations (1) and (2) is

$$\begin{aligned} CS_2 - CS_1 &= \frac{\gamma}{n}(n-1)\left[\int_{p=p_0}^{r} S(p)dF_2(p) - \int_{p=p_0}^{r} S(p)dF_1(p)\right] \\ &\quad + \frac{\gamma}{n}\left(S(r) - \int_{p=p_0}^{r} S(p)dF_1(p)\right) \\ &\quad + (1-\gamma)\left[\int_{p=p_0}^{r} S(p)dH_2(p) - \int_{p=p_0}^{r} S(p)dH_1(p)\right]. \end{aligned}$$

The above equation consists of three terms. The first term refers to the difference in consumer surplus of loyals for $n-1$ independent firms between the two cases, the second term the difference of firm m's loyals, and the third term the difference of all switchers. It can be shown that F_1 first-order stochastically dominates F_2, i.e., $F_1(p) \leq F_2(p)$ for all

model tractable. One can view the results in the present paper as the solution to an interesting limiting case.

[19] Our numerical analysis shows that when γ is sufficiently larger, setting ϕ so that $\alpha_1 = 1$ is optimal for the gatekeeper. Note that we also need to make sure that the gatekeeper has no incentive to charge a high ϕ and foreclose all but one firm. We find that foreclosure is not optimal when γ is large.

p. Our numerical analysis also suggests that H_1 first-order stochastically dominates H_2. So the first and third terms of the above equation are both positive, while the second term is negative.[20] More information is needed (e.g., the shape of $S(p)$) to determine the sign of $CS_2 - CS_1$.[21] In summary, a merger between an information gatekeeper and one or more firms in the product market may or may not be welfare-enhancing, depending on the demand function.

Other Cases

In Case 3, the gatekeeper is absent. Firms' behavior are exactly the same as in Case 1 except that the market size reduces to only β instead of 1. Firms' profits are the same as in Case 1, since the incremental profits from sales at the gatekeeper exactly offset the increase in fee. However, the gatekeeper's profits are now lost. It is straightforward to show that both consumer surplus and social welfare in Case 3 are lower than those in Cases 1 and 2, given $\beta < 1$.

The creation of a market for information by an independent gatekeeper (i.e., Case 1) or by $k < n$ firms in the product market (through a unilateral or joint venture with a gatekeeper, or Case 2) may be welfare enhancing.[22] Absent a market for information, some consumers may fail to access the product market and thus deadweight loss results. The presence of such a market for information results in broader market reach and improved efficiency. Provided the fixed costs of creating the market for information are sufficiently small (c.f., Baye-Morgan, Proposition 7), social welfare may increase as a result of the creation of a market for information — provided that at least one firm in the product market remains independent.

In Case 4, a social planner sets the socially optimal fee $\phi \in [0, \phi_{low}]$ so that all firms advertise. But this results in exactly the same market equilibria as in Cases 1&2,

[20] Details are available upon request.

[21] For example, our numerical analysis indicates that using the linear demand function $D(p) = a - b * p$ where $a, b = 5, 2, 1, 1/2$, or $1/5$, post-merger always leads to a lower consumer surplus.

[22] Proposition 7 of Baye-Morgan shows that "the establishment of a market for information" can be welfare-enhancing.

depending on whether or not a merger takes place.

In Case 5, a social planner chooses any fee $\phi \in [0, \phi_{low}]$. All firms advertise with probability one and price at marginal cost. Thus, market is most efficient among all cases. Social welfare and consumer surplus are both maximized in this "first-best" case.

4 Extensions

To check the robustness of our results, we extend our model in the following directions:

1. Asymmetric firms

One way to extend our model is to allow for firm asymmetry.[23] Firm asymmetry may originate from either the demand or the cost or both. In the presence of demand asymmetry, some firms might have larger customer bases (loyal and/or switcher) than others, or the demand function $D(p)$ might vary across firms. Firm asymmetry can also arise simply due to differential costs (e.g., Southwest is a low-cost carrier compared to major airlines). In this section, we introduce cost asymmetry into the model and assume two types of firms, k firms with a low constant marginal cost $c_l > 0$, and $n-k$ firms with a high constant marginal cost c_h $(c_h > c_l)$. We assume that $\min\{k, n-k\} \geq 2$, so that there are at least two firms of each type. The consumer types and their demands remain the same as in the main model.

We allow the gatekeeper to charge ϕ_l for the low-cost and ϕ_h for the high-cost firms. Upon observing the fees, all firms make advertising and pricing decisions. To keep the results tractable, we assume that the cost difference $(c_h - c_l)$ is sufficiently large so that the high cost firm will never get any non-visitor switchers. As a result, the low-cost firms' advertising and pricing strategies are independent of the high-cost type's.

The results we find are qualitatively the same as the symmetric case, except that now the low-cost firms pay a higher fee than the high-cost $(\phi_l > \phi_h)$, and different advertising propensities, and price distributions across firm types. Foreclosure may occur

[23] We thank an anonymous referee for pointing this out.

both before and after a merger between the information gatekeeper and one or more firms in the product market, provided that β and γ are small – most consumers are visitor switchers. However, the high-cost type is more likely to opt out of the gatekeeper in the pre-merger game while the low-cost is more likely to opt out in the post-merger game if the gatekeeper acquires one or more of the high-cost firms.

In the pre-merger case, the gatekeeper may set a high universal advertising ϕ such that only the low-cost firms would advertise and the high-cost firms choose to opt out of the market for information, or an even higher ϕ such that only one of the low-cost advertises with probability one and foreclose the rest. As a result, the high-cost firms are more likely to be foreclosed.

In the post-merger case, the gatekeeper allows its own subsidiaries to advertise for free while charges a high ϕ to foreclose all high-cost firms (retaining the low-cost) or foreclose all independent firms.[24] When the gatekeeper merges with one (e.g., American's Sabre) or more (e.g., Orbitz) of the high-cost firms, foreclosure may occur, given that the cost difference between the two types is not too large.

The low-cost firms (e.g., Southwest and JetBlue airlines) may choose to pull the price listings out of the information market permanently, if (i) they are unwilling to pay a higher ϕ and cannot subsequently negotiate successfully with the gatekeeper(s);[25] or (ii) the gatekeeper has an incentive to foreclose the low-cost firm. For instance, when the gatekeeper merges with some of the high-cost firms and charging differential advertising fees is not an option (e.g. due to antitrust concerns), the merged gatekeeper may degrade its service quality to competing low-cost firms (as Southwest claimed), and force the low-cost to opt-out completely.

2. Multiple gatekeepers

[24] For example, when there are sufficiently many visitor switchers or $(1-\beta)(1-\gamma)$ is large.

[25] Recent incidents in the online market for air-travel information illustrated the existence of fee discrimination. In December 2003, US Airways temporarily withdrew its price information from Expedia due to a dispute over a unilateral substantial increase in ticketing fee by the online travel agent. This issue was soon resolved upon a successful negotiation between the two parties. Northwest also briefly stopped advertising on Expedia in 2002 due to a similar contract dispute with the online travel agent.

In the present paper, we assume a monopoly information gatekeeper. This is clearly not the case in many of the aforementioned information markets. Thus, another way to extend our model is to allow for multiple gatekeepers and potentially competition among them.[26] This could be done within our framework by assigning the profit functions $E\pi(p, I_1, .., I_g)$ – a representative firm's expected profit when it sets price p, and $I_i = \{NA, A\}$ implies whether it advertises at the gatekeeper $i = 1, ..g$.[27] If there is no leakage of visitors among various gatekeepers so that each gatekeeper is a constrained monopolist, then the previous results still hold, only that the visitors to a single gatekeeper and non-visitors will sum up to less than 1. The other extreme is that the gatekeepers are homogeneous. Then Bertrand competition will drive the ϕ down to the marginal cost of providing the information service.

If the gatekeepers are imperfect substitutes for each other, obviously merger will still increase the merged entity's expected profit. However, a complete analysis of competing gatekeepers is beyond the scope of this paper. We conjecture that the integrated firm has incentives to raise its price after the merger. This is because, when it raises price, it gains from its loyals but potentially loses from the switchers. The integrated firm's withdrawal from competing for the switchers makes the gatekeeper more attractive to the independent firms. Such benefit enters the merged entities' post-merger objective function but not the pre-merger one. Thus, the gatekeeper benefits from joining alliance with the firms in the product market. Since the merged firm m raises its price (closer to the monopoly price), both consumer surplus and social welfare are likely to decline. As for the independent firms, the increase in their expected profits from the switchers may be well offset by the increase in a higher fee ϕ, and thus remain unchanged.

[26] Note that the coordination issue may arise in the case of competing gatekeepers (See Baye and Morgan, 2001, p.469-470).

[27] Note that here we again assume symmetric firms.

5 Conclusion

This paper examines a simple theoretical model of vertical integration between an "information gatekeeper" and the product markets it serves. We consider a homogeneous product market where n homogeneous product price-setting firms can broaden their market reach by advertising at a price comparison site, which is controlled by a profit-maximizing gatekeeper. We show that vertical integration into the product market induces the gatekeeper to increase the fees it charges firms to advertise their prices at its price comparison site. The integration also alters the timing of the game in which the integrated firms now act as price leaders and opt out of the competition for price sensitive switchers at the gatekeeper. While the increased fee reduces the propensity with which firms advertise their prices, they compete more aggressively at the gatekeeper as their chances of getting the switchers rise. However, these two effects exactly offset each other and the independent firms receive the same profits as in the pre-merger game. Yet, both the integrated gatekeeper and its subsidiaries in the product market earn weakly higher post-merger profits, but social welfare (defined as the sum of expected consumer and producer surplus) may or may not decline. Furthermore, we extend the model by introducing cost asymmetry and competing information gatekeepers.

Our analysis provides a framework for evaluating the merit of efforts by the CAB and the DOJ to force American Airlines to spin off its Sabre computer reservation system. In addition, our work sheds some light on the current policy debate regarding the welfare effects of AOL-Time Warner and other mergers in the ISP market.

For future research, we may consider more complex fee schedules adopted by the gatekeeper. For example, the gatekeeper may charge per unit advertising fee (depending on actual sales) instead of a fixed fee. This leads to an important difference in the case of asymmetric firms. In addition, we may consider a dynamics game in which firms are concerned about their market shares and long-term prospects instead of simply focusing on single-period profits.

6 Appendix

This Appendix provides proofs of Propositions 1 and 2.

Proof of Proposition 1:

A representative firm's expected profits when it does not advertise are

$$E\pi(p, NA) = \frac{\beta\gamma}{n}\pi(p) + \beta(1-\gamma)\left[1-\alpha F(p) - (1-\alpha)\,G(p)\right]^{n-1}\pi(p). \tag{3}$$

The firm's expected profits when it advertises are

$$E\pi(p, A) = E\pi(p, NA) + \frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha F(p))^{n-1}\pi(p) - \phi.$$

Note that the optimal fee must be such that $\alpha \in (0, 1]$. Then, it follows that $E\pi(p, A) = E\pi(p, NA)$, i.e.,

$$\frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha F(p))^{n-1}\pi(p) - \phi = 0. \tag{4}$$

Set $p = r$, then $F(r) = 1$. Thus, equation (4) becomes

$$\frac{(1-\beta)\gamma}{n}\pi(r) + (1-\beta)(1-\gamma)(1-\alpha)^{n-1}\pi(r) = \phi$$

$$\Rightarrow (1-\beta)(1-\gamma)(1-\alpha)^{n-1} = \frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}$$

$$\Rightarrow (1-\alpha)^{n-1} = \frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}.$$

In equilibrium, each firm chooses to advertise its price at the gatekeeper's site with probability

$$\alpha(\phi) = 1 - \left[\frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}. \tag{5}$$

Given $\alpha \in (0, 1]$, it follows that $\phi \in [\phi_{low}, \phi_{high})$ where $\phi_{low} = \frac{(1-\beta)\gamma}{n}\pi(r)$ and $\phi_{high} =$

$\left((1-\beta)(1-\gamma)+\frac{(1-\beta)\gamma}{n}\right)\pi(r)$.

Next, from equation (4),

$$\frac{(1-\beta)\gamma}{n}\pi(p)+(1-\beta)(1-\gamma)(1-\alpha F(p))^{n-1}\pi(p)-\phi=0$$

$$\Rightarrow (1-\alpha F(p))^{n-1}=\frac{\frac{\phi}{\pi(p)}-\frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$$

$$\Rightarrow 1-\alpha F(p)=\left[\frac{\frac{\phi}{\pi(p)}-\frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}$$

$$\Rightarrow \alpha F(p)=1-\left[\frac{\frac{\phi}{\pi(p)}-\frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}.$$

Using α from equation (5), we obtain the distribution of advertised prices, or

$$F(p)=\frac{1-\left[\frac{\frac{\phi}{\pi(p)}-\frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}}{1-\left[\frac{\frac{\phi}{\pi(r)}-\frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-1}}} \tag{6}$$

for $p\in[p_0,r]$, where p_0 is defined by

$$F(p_0)=0\Rightarrow \frac{\frac{\phi}{\pi(p_0)}-\frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}=1$$

$$\Rightarrow \pi(p_0)=\frac{\phi}{\frac{(1-\beta)\gamma}{n}+(1-\beta)(1-\gamma)}.$$

$G_1(p)$ can be solved by equating a non-advertising firm's profits when it charges prices at p and r, i.e., $E\pi(p,NA)=E\pi(r,NA)$. Using equations (3), (5) and (6), we derive the distribution of non-advertised prices, or

$$G(p)=\frac{A^{\frac{1}{n-1}}-B^{\frac{1}{n-1}}}{C^{\frac{1}{n-1}}}, \tag{7}$$

where $A = \frac{\frac{\phi}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$, $B = \frac{\gamma}{(1-\gamma)n}(\pi(r) - \pi(p))$, $C = \frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$.

Finally, the gatekeeper's problem is given by

$$\max_{\phi} \quad \pi_g = n \cdot \alpha \cdot \phi = n \left[1 - \left(\frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)} \right)^{\frac{1}{n-1}} \right] \cdot \phi$$

There is no general closed-form solution of ϕ^*.

Proof of Proposition 2:

Lemmas 1 and 2 are used in the proof of Proposition 2. We consider three different strategies that may be adopted by the merged firm m in the proof.

Lemma 1 *It is optimal for the merged firm m to always advertise at the gatekeeper.*

Lemma 2 *If firm m* always advertises, *it is optimal for it to charge r than choose prices according to a CDF $H(p)$.*

Strategy 1 We begin with Strategy 1 in which the integrated firm m always advertises and sets its price at r and other firms act as second-movers.

Firm i's expected profits when it does not advertise are given by[28]

$$E\pi_1(p, NA) = \frac{\beta\gamma}{n}\pi(p) + \beta(1-\gamma)\left[1 - \alpha_1 F_1(p) - (1-\alpha_1)G_1(p)\right]^{n-2}\pi(p).$$

Firm i's expected profits when it advertises are given by

$$E\pi_1(p, A) = E\pi_1(p, NA) + \frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_1 F_1(p))^{n-2}\pi(p) - \phi_1.$$

Since $\alpha \in (0, 1]$, $E\pi_1(p, A) = E\pi_1(p, NA)$ must hold, i.e.,

$$\frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_1 F_1(p))^{n-2}\pi(p) - \phi_1 = 0 \tag{8}$$

[28] Again, subcript denotes different strategies by firm m.

When $p = r$, $F(r) = 1$. It follows that in equation (8)

$$\frac{(1-\beta)\gamma}{n}\pi(r) + (1-\beta)(1-\gamma)(1-\alpha)^{n-2}\pi(r) = \phi$$

$$\Rightarrow (1-\beta)(1-\gamma)(1-\alpha)^{n-2} = \frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}$$

$$\Rightarrow (1-\alpha)^{n-2} = \frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$$

In equilibrium, each independent firm chooses to advertise its price at the gatekeeper's site with probability

$$\alpha_1 = 1 - \left[\frac{\frac{\phi}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-2}} \tag{9}$$

Given $\alpha_1 \in (0,1]$, it follows that $\phi_1 \in [\frac{(1-\beta)\gamma}{n}\pi(r), \left((1-\beta)(1-\gamma) + \frac{(1-\beta)\gamma}{n}\right)\pi(r))$.

Now go back to equation (8),

$$\frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_1 F_1(p))^{n-2}\pi(p) - \phi = 0$$

$$\Rightarrow (1-\alpha_1 F_1(p))^{n-2} = \frac{\frac{\phi}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}$$

$$\Rightarrow 1 - \alpha_1 F_1(p) = \left[\frac{\frac{\phi}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-2}}$$

$$\Rightarrow \alpha_1 F_1(p) = 1 - \left[\frac{\frac{\phi}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-2}}.$$

Next, from equations (8) and (9), we derive the distribution of advertised prices

$$F_1(p) = \frac{1 - \left[\frac{\frac{\phi_1}{\pi(p)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-2}}}{1 - \left[\frac{\frac{\phi_1}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)}\right]^{\frac{1}{n-2}}} \tag{10}$$

for $p \in [p_1, r]$, where p_1 is defined by

$$F(p_1) = 0 \Rightarrow \frac{\frac{\phi}{\pi(p_1)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)} = 1$$

$$\Rightarrow \pi(p_1) = \frac{\phi}{\frac{(1-\beta)\gamma}{n} + (1-\beta)(1-\gamma)}.$$

The gatekeeper's expected profits from the advertising fees are

$$\pi_{1g\phi} = (n-1) \cdot \alpha_1 \cdot \phi_1 = (n-1) \left[1 - \left(\frac{\frac{\phi_1}{\pi(r)} - \frac{(1-\beta)\gamma}{n}}{(1-\beta)(1-\gamma)} \right)^{\frac{1}{n-2}} \right] \cdot \phi_1$$

and firm m's expected profits are

$$\begin{aligned} \pi_{1gm} &= \frac{\beta\gamma}{n}\pi(r) + \frac{(1-\beta)\gamma}{n}\pi(r) + (1-\beta)(1-\gamma)(1-\alpha_1)^{n-2}\pi(r) \\ &= \left[\frac{\gamma}{n} + (1-\beta)(1-\gamma)(1-\alpha_1)^{n-2} \right] \pi(r). \end{aligned}$$

Thus, the merged entity's joint profits are given by[29]

$$\pi_{1g} = \pi_{1g\phi} + \pi_{1gm}.$$

Strategy 2 Next, we consider the equilibrium results under Strategy 2 in which firm m does not advertise and chooses prices from a CDF $H_2(p)$.

Firm i's expected profits when it does not advertise are

$$E\pi_2(p, NA) = \frac{\beta\gamma}{n}\pi(p) + \beta(1-\gamma) \left[1 - \alpha_2 F_2(p) - (1-\alpha_2) G_2(p) \right]^{n-2} (1 - H_2(p))\pi(p).$$

[29] Since we do not have closed-form solution for the optimal ϕ, we do not have an analytical form of the joint profits. However, our numerical analysis shows that foreclosure is not optimal when the fraction of loyal customers γ is sufficiently large.

Firm i's expected profits when it advertises are

$$E\pi_2(p, A) = E\pi_2(p, NA) + \frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_2 F_2(p))^{n-2}\pi(p) - \phi_2.$$

Since $\alpha_2 \in (0, 1]$, it must hold that $E\pi_2(p, A) = E\pi_2(p, NA)$, i.e.,

$$\frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_2 F_2(p))^{n-2}\pi(p) - \phi_2 = 0.$$

Note that the above equation is identical to equation (8) in Strategy 1. Therefore, the integrated gatekeeper's expected profits from the advertising fees are exactly the same as in Strategy 1, i.e., $\pi_{1g\phi} = \pi_{2g\phi}$ if $\phi_1 = \phi_2$.

Since firm m chooses prices from a CDF $H_2(p)$ for $p \in [p_2, r]$, its expected profits must be the same at any price in its support. For example, at $p = r$, it only gets non-visitor loyals in Strategy 2, whereas it also acquires additional visitor loyals under Strategy 1.[30] Therefore, firm m's expected profits under Strategy 2 is strictly lower than those under Strategy 1, i.e., $\pi_{1gm} > \pi_{2gm}$.

Taken together, it must hold that $\pi_{1g} = \pi_{1g\phi} + \pi_{1gm} > \pi_{2g} = \pi_{2g\phi} + \pi_{2gm}$.

Now that we have shown that it is optimal for the merged entity to always advertise at the gatekeeper (i.e., Lemma 1), next is to show whether it's optimal to always charge r, or whether Strategy 1 dominates Strategy 3 (i.e., Lemma 2).

Strategy 3 If firm m adopts Strategy 3, firm i ($i \neq m$)'s expected profits when it does not advertise are

$$E\pi_3(p, NA) = \frac{\beta\gamma}{n}\pi(p) + \beta(1-\gamma)\left[1 - \alpha_3 F_3(p) - (1-\alpha_3)G_3(p)\right]^{n-2}(1 - H_3(p))\pi(p).$$

[30] Note that we assume a positive fraction of visitor loyals at the gatekeeper.

Firm i's expected profits when it advertises are

$$E\pi_3(p,A) = E\pi_3(p,NA) + \frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_3 F_3(p))^{n-2}(1-H_3(p))\pi(p) - \phi_3.$$

Since $\alpha_3 \in (0,1]$, it must hold that $E\pi_3(p,A) = E\pi_3(p,NA)$, i.e.,

$$\frac{(1-\beta)\gamma}{n}\pi(p) + (1-\beta)(1-\gamma)(1-\alpha_3 F_3(p))^{n-2}(1-H_3(p))\pi(p) - \phi_3 = 0. \quad (11)$$

Next we consider the merged firm m's expected profits. Since it chooses prices from a CDF $H_3(p)$ for $p \in [p_3, r]$, it must earn the same expected profits at any price in its support, including r. However, note that at $p_m = r$, its expected profits take the same form as that under Strategy 1 (only with a different α), i.e.,

$$\pi_{3gm} = \left[\frac{\gamma}{n} + (1-\beta)(1-\gamma)(1-\alpha_3)^{n-2}\right]\pi(r).$$

In fact, under Strategy 1, the merged entity's expected profits are given by

$$\pi_{1g} = (n-1)\alpha_1\phi_1 + \left[\frac{\gamma}{n} + (1-\beta)(1-\gamma)(1-\alpha_1)^{n-2}\right]\pi(r),$$

which is exactly the same as that for π_{3g}, only with different α, ϕ and the CDFs.

Let ϕ_3^* denote the optimal choice of ϕ, and α_3^* the resulting α under Strategy 3. Note that under Strategy 1, the gatekeeper can always choose a ϕ_1 such that $\alpha_1 = \alpha_3^*$. Comparing equations (11) with (8), the difference is that the second component of the LHS of equation (11) is multiplied by $1 - H(p) \leq 1$, in addition to the difference in $F_j(p)$ where $j = 1$ or 3. Setting $p = r$ in both equations, the second term becomes zero in (11), but remains non-negative (positive if $\alpha < 1$) in (8). Therefore, $\phi_1 \geqslant \phi_3^*$ holds for the same α^*, and the merged entity's joint profits are greater under Strategy 1 than under Strategy 3, i.e., $\pi_{1g} \geqslant \pi_{3g}$.

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