The B.E. Journal of Economic Analysis & Policy

Topics

Volume 7, *Issue* 1 2007 *Article* 29

Understanding the Internet's Relevance to Media Ownership Policy: A Model of Too Many Choices

Matthew G. Nagler*

*Lehman College, City University of New York, matthew.nagler@lehman.cuny.edu

Recommended Citation
Matthew G. Nagler (2007) "Understanding the Internet's Relevance to Media Ownership Policy: A Model of Too Many Choices," *The B.E. Journal of Economic Analysis & Policy*: Vol. 7: Iss. 1 (Topics), Article 29.
Available at: http://www.bepress.com/bejeap/vol7/iss1/art29

Understanding the Internet's Relevance to Media Ownership Policy: A Model of Too Many Choices*

Matthew G. Nagler

Abstract

Does the Internet provide a failsafe against media consolidation in the wake of an easing of media ownership rules? This paper posits a model of news outlet selection on the Internet in which consumers experience cognitive costs that increase with the number of options faced. Consistent with psychological evidence, these costs may be reduced by constraining one's choice set to "safe bets" familiar from offline (e.g., CNN.com). It is shown that, as the number of outlets grows, dispersion of patronage across outlets inevitably declines. Consequently, independent Internet outlets may fail to mitigate lost outlet independence on other media.

KEYWORDS: choice framing, media ownership, Internet, differentiated products, location models

*I would like to thank Bill Dickens, David Gabel, Eszter Hargittai, Barry Schwartz, Steven Tepper, Thierry Verdier, Joel Waldfogel, and an anonymous referee for their valuable insights. Financial support from the PSC-CUNY Research Award Program of the City University of New York is also gratefully acknowledged. Contact: Matthew G. Nagler, Dept. of Economics, Accounting & Business Adm., Lehman College, 250 Bedford Park Blvd. West, Bronx, NY 10468-1589; email: matthew.nagler@lehman.cuny.edu

1. Introduction

On June 2, 2003, the Federal Communications Commission voted 3-2 to ease its local and national media ownership rules. The decision increases the number of television stations that a single owner may hold in a local market or nationwide in the United States and enables a single owner to hold outlets across different media under circumstances where cross-ownership had previously been prohibited. A summary of the rule changes is shown in Table 1. With most of the rules stayed by U.S. Court of Appeals for the Third Circuit pending revision or re-argumentation by the FCC, their fate and ultimate impact are not yet known.[1] Other countries with substantial private media ownership have regulations similar to those in the U.S.; as many of those countries are examining their policies in light of convergence (Wu, 2004), the FCC's rule changes have international significance.

Table 1
Summary of changes to FCC media ownership rules, June 2003

CATEGORY OF RULES	OLD RULE	NEW RULE
Local TV Ownership	A company can own two stations in a market if there are eight or more other stations and as long as one of the owned stations is not in the top four highest-rated stations.	A company can own three stations in a large market (18 or more stations); and two in a market with at least five stations. Any combination must not involve two or more top-four stations.
National TV Ownership	35% cap on ownership of TV stations by a single owner nationwide.	45% cap on ownership of TV stations by a single owner nationwide.
Cross-Media Limits: Newspaper-TV Newspaper-radio Radio-TV	A company cannot own both a broadcast and a print organization in the same market. Ownership of one TV and one radio station in a market permitted; ownership of multiple TV and multiple radio stations subject to a sliding scale based on market size.	Cross-ownership freely allowed in markets with more than nine television stations, limited to certain specific combinations in markets with between four and eight stations, and banned in markets with three or fewer stations.

Source: Hogan & Hartson, L.L.P. (2004).

[1] On June 21, 2006, the FCC released a Further Notice of Proposed Rulemaking seeking comment on how it should respond to the issues raised by the Third Circuit Court of Appeals. Though the formal comment period closed in January 2007, the FCC is continuing, as of this writing, to accept input through public hearings. Once this process concludes, a revised set of rules will presumably be issued.

In defending its decision, the FCC's majority bloc argued that the variety of publicly-accessible information sources had increased dramatically over the past few decades, mitigating the need for stringent restrictions on a few, regulated media. The Internet was referenced conspicuously as a part of this trend.[2] "We see the Internet itself becoming an essential source of important content," then-FCC Chairman Michael Powell said in a speech shortly before the commission's decision was handed down (McCullagh, 2003). As a component of the FCC's "diversity index" used to construct thresholds of allowable ownership in the new rules, the Internet played a direct, and not merely rhetorical, role in the development and rationalization of the rules.[3]

Was the FCC correct in apparently viewing the Internet as a source of new "voices" that could compete effectively with incumbent news sources? Clearly, there are new voices on the Internet – thousands of them. To quote Adam Thierer of the Progress & Freedom Foundation, "Today, the Internet gives every man, woman and child the ability to be a one-person publishing house or broadcasting station and communicate with the entire planet…. While the 1973 family could read the local newspaper together, today's families can view thousands of newspapers from communities across the planet." (McCullagh, 2003) However, as commissioner Michael J. Copps noted in his dissenting statement on the FCC's decision, "the dominating Internet news sources are controlled by the same media giants who control radio, TV, newspapers, and cable."[4] Consistent with this assertion, evidence from Internet traffic data indicates that a small number of websites account for the predominant portion of Internet traffic, demonstrating a "winner-take-all" pattern of consumer visitation (Adamic and Huberman, 2000).

One could argue that the reason that a small number of offline firms dominate Internet news space is simply that they provide better news coverage than the many independent news sites. However, this requires some strong assumptions. First, the offline firms' quality advantage would have to be the result of non-transferable specific assets or sunk cost investments.[5] Otherwise, it could be matched by anyone. Second, such investments would have to be capable of raising the level of quality to the point that, for the vast majority of consumers, it would trump the value of horizontally differentiated news content.[6] Third, the cost of raising quality to a preemptive level would have to be great enough that

---

[2] See, e.g., "Statement of Commissioner Kevin. J. Martin on Biennial Review of Broadcast Ownership Rules," June 2, 2003, p. 2.

[3] Details on the FCC's diversity index can be found at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-235047A1.doc

[4] "Statement of Commissioner Michael J. Copps, Dissenting," June 2, 2003, p. 3.

[5] Regarding endogenous sunk costs and market structure, see Sutton (1991).

[6] The appropriate framework for analyzing this possibility is one that considers both horizontal and vertical differentiation. See, e.g., Dos Santos Ferreira and Thisse (1996) and Lambertini (2001).

such an action could be duplicated profitably only by a small number of firms. Given the variety of content available or potentially available on the Internet, it seems incredible that consumers would gravitate overwhelmingly to such a small share of outlets on the basis of quality differences. Further, with wire services providing access to global reporting networks at low cost to any entrant, it is unclear what sort of sunk cost investments could have provided offline firms with a non-duplicable quality advantage.

This paper offers an alternative explanation. It hypothesizes that the distribution of consumers across websites is affected by the way in which consumers approach decisions involving large numbers of options. The ability of new Internet "voices" to compete with familiar voices on conventional media, it is argued, depends crucially on the consumer's ability to deal effectively with the massive array of options found on the Internet.[7]

According to recent psychological and consumer research, the greater the number of options an individual faces, the greater are the demands placed on the individual's cognitive resources, so in effect expanded options impose costs (Shugan, 1980; Malhotra, 1982; Loewenstein, 2000; Schwartz, 2000).[8] Cognitive overload caused by large numbers of choices has been shown to affect decision outcomes both for large purchases, such as houses (Malhotra, 1982); and for small and inconsequential purchases, such as a jar of jam or box of chocolates (Iyengar and Lepper, 2000). As the number of options increases and information about options increases, people seek ways of considering fewer options and processing a smaller percentage of overall information regarding their options (Hauser and Wernerfelt, 1990). A number of different specific response patterns have been observed, varying with the context. Sometimes individuals choose to forgo a decision entirely (Dhar, 1997; Iyengar and Lepper, 2000). In other cases, they may make the decision, but with the aid of a prejudicial approach that reduces demands on cognitive resources or the expected regret from a poor choice (see, e.g., Chernev, 2003, 2005). Most recently, Iyengar and Jiang (2005) demonstrated that decision makers facing large choice sets show a prejudicial

[7] Shopbots and other "infomediaries" offer consumers the option of framed and limited choices culled from the Internet. See Hagel and Singer (1999) and Smith, Bailey and Brynjolfsson (2000). However, that a consumer faces choices framed by an infomediary presumes (1) that the consumer is aware of an infomediary appropriate to her particular decision problem, and (2) that she chooses to use it in preference to other choice management methodologies. It seems appropriate to regard the baseline of choice as the "open" Internet, prior to selection of an infomediary or other choice management methodology.

[8] These are "psychic" costs of managing the cognition of choice, arising from the bounded rationality of individuals (Simon, 1955). They are distinct from "search costs" – chiefly, time costs – that individuals experience regardless of cognitive constraints, and they have been treated as distinct in previous analyses (e.g., Hauser and Wernerfelt, 1990). Regarding search costs, see Stigler (1961).

preference for options associated with reduced risk. In fact, as choice sets grow in size without one option emerging as dominant, people become increasingly likely to choose the option perceived to offer the fewest potential losses (i.e., a "sure bet" or "safe bet").

This paper posits a location model (see, e.g., Hotelling, 1929) in which consumers choose among differentiated news outlets on the Internet. Consistent with the psychological literature, consumers face choice-management costs that increase with the number of options faced.[9] They may make an optimal choice from among all news options or, alternatively, reduce their choice-management costs by constraining themselves to a subset of "safe bet" options familiar from offline media.[10] This set might include news sources that have companion outlets on offline media (e.g., CNN.com) and sources that are extensively marketed offline (e.g., the Drudge Report). The assumption is derived from Iyengar and Jiang's (2005) findings, as well as research suggesting that consumers consider web-based options riskier than offline options (Grabner-Kraeuter, 2002; Lee, Ang, and Dubelaar, 2005) and that they use offline representation as a key determinant of which websites to include in their choice set for visitation (Ilfeld and Winer, 2002).

The model shows that dispersion of consumers across outlets inevitably declines as the number of outlets grows. This pattern results independent of quality considerations or search costs and contradicts the conventional wisdom that the concentration of consumers will be strictly non-increasing in the number of options. A corollary to this finding, as regards the diversity of independent viewpoints, is that incremental independent outlets on the Internet cannot be counted on to take the place of familiar outlets on other media whose independence is lost through consolidation. Thus, the Internet's existence is a poor substitute for media ownership restrictions, at least given current attitudes toward the Internet.

There are several papers that, like the present analysis, examine media markets using location models. Gal-Or and Dukes (2003) and Gabszewicz et al. (2002, 2004) examine the equilibrium level of programming differentiation in media markets. In these papers, the degree of differentiation depends upon the

[9] "Clutter costs," described by MacKie-Mason et al. (1996), also increase with the number of options faced; they stem from the increased difficulty of locating desired content or of operating a user interface used to access content when more choices are available. Clutter costs are not directly related to an individual's mental capacities and are specific to the market for information. By contrast, cognition-based choice-management costs may arise in any environment involving choice among alternatives.

[10] Instead of making a binary decision between choosing among all available options or just safe bets, would it be more accurate to assume consumers optimally select a choice set size? Psychological evidence suggests not. Dhar (1997) and Iyengar and Lepper (2000) find that many consumers opt for no choice at all when presented with a set of options that is too large or too difficult to manage. If most people could reframe their choice sets optimally by sampling from the full set of options or by other methods, such results would not be observed.

relationship of the media outlet's location decision (i.e., in programming space) to the amount of revenue the outlet receives from advertisers, reflecting the nature of media markets as "two-sided markets" with both advertiser and consumer constituents (see, e.g., Rochet and Tirole, 2003, and Armstrong, 2007). Also using a location model, Anderson and Coate (2005) perform a welfare analysis of the market provision of broadcasting; they consider, among other things, the welfare effect of the concentration of media ownership.

In contrast with these papers, the present paper investigates the impact, via the cognitive costs of choice, of varying the number of outlets in the model, something that the above-referenced papers do not do. Following Berry and Waldfogel (2001), I abstract from the relationship between the media programming market and the advertising market. I assume that advertising levels are fixed and that prices paid by the advertiser per consumer-hour vary simply with the number of consumers that visit the site. In this context, the proportionality of hours attending the chosen outlet to the consumer's utility from that outlet gives rise to the maximum differentiation result of the traditional Hotelling framework (d'Aspermont et al., 1979). The effect of number of outlets on outlet locations, outlet profits, and the distribution of consumers are all examined with the differentiation issue thus accounted for. Unlike Anderson and Coate (2005), the model in the present paper does not analyze the welfare economics of media markets *per se*. It instead takes as given that greater consumer dispersion is socially desirable and examines the ability of a market with a massive number of options (e.g., the Internet) to deliver dispersion.

Another related area of literature, exemplified by Kaiser (2006) and Kaiser and Kongsted (2005), investigates the effect of companion websites on offline print media circulation. Kaiser (2006) finds that magazine websites on average have a negative effect on the circulation of their offline counterparts, but the effect varies over time and across consumer age groups. In contrast, Kaiser and Kongsted (2005) find positive effects running from website traffic to offline circulation. No investigation has yet been undertaken into the converse effect of offline media performance on companion website visitation, an issue that bears a close relationship to the present paper.

The next section presents the theoretical model. The final section discusses policy implications and extensions to the model.

2. A model

2.1 Introduction to the model

Consumers select an outlet to visit from among a set of differentiated news outlets. Outlets serve consumers at a zero price and earn profit by "selling" the consumer-hours they accrue to advertisers. There are two stages to the market. In the first stage, a set of independent, symmetrically-spaced outlets serves consumers. Following this stage, additional independent outlets enter the market so that incumbent and entrant outlets compete together in the second stage. The first stage may be thought of as a market for television (or other broadcast or print) news, whereas the second stage consists of Internet news websites. The incumbent second-stage outlets are websites that mirror the positioning of first-stage news networks (e.g., companion sites, such as CNN.com for CNN) and that are under the same ownership.[11]

Attention is focused on the second-stage, Internet news market. Consumers incur a cost associated with the load to cognitive resources imposed by the options faced in this market. The cost increases without bound with the number of options, consistent with previous treatments of the costs of thinking and evaluation (Shugan, 1980; Hauser and Wernerfelt, 1990). Bearing this cost in mind, a consumer may choose her preferred outlet from among all the options and incur the associated cost, or she may default to her preferred outlet from among the incumbent options and incur no cost.[12] Consumers select the outlet that maximizes utility net of choice-management costs and also choose a utility-maximizing number of hours to spend at that outlet.

The model's main result is that, while the incumbents' share of consumers in the second stage typically falls initially as the equilibrium number of outlets increases, it eventually rises with the number of outlets above some threshold number. A similar pattern is observed for the Herfindahl-Hirschman index (HHI), a widely-used measure of industry concentration.

2.2 Assumptions

In the first stage, $M \geq 1$ TV news outlets with zero marginal production costs serve consumers. These outlets are symmetrically spaced around a circle with unit circumference representing all possible news programming formats.[13] As a baseline for the calculation of concentration measures, I assume all incumbent outlets are independently owned.[14]

---

[11] Incumbent outlets also might include Internet outlets that have been extensively marketed offline, as discussed in the introduction. However, the probability of a given independent website "rising above the pack" through effective offline marketing and competing on equal footing with offline incumbents is probably extremely small.

[12] This dual decision process, whereby the consumer first chooses a cognitive attitude and then makes a consumption decision given this attitude, is similar to the process assumed by Nagler (1993) in modeling the effects of deceptive advertising.

[13] See Salop (1979).

[14] The size of M and the positioning of incumbent outlets may be presumed to have been determined in a simultaneous entry game by profit-maximizing independent firms, given per-outlet fixed costs

In the second stage, news websites replace the TV news outlets. They, too, operate with zero marginal costs of production. Internet news formats are assumed analogous to the TV news formats. The *M* incumbent outlets from TV news space serve this new market. Following Schmalensee (1978), I assume that incumbents cannot easily change their relative positioning, therefore they take the same positions in Internet news space as they held in TV news space.[15] In addition, new, independent outlets enter the market. Entry is presumed symmetric with respect to incumbents' positions, so the number of entrants is some multiple of *M*.[16] Define $N \equiv nM$, $n \geq 0$, as the number of entrants. Entrant outlets simultaneously choose positions to maximize profits, taking the positions of other outlets as given. Each outlet's decision to enter is conditioned on its being able to earn nonnegative profits post-entry.

News outlets are presumed to exhibit increasing returns to scale. Outlet profits at the second stage are given by

$$\pi = Q \cdot P(X) - F \qquad (1)$$

where X is the number of consumers served by the outlet, Q is the number of consumer-hours garnered by the outlet, P is the price paid by advertisers per consumer-hour, and $F > 0$ is a per-outlet fixed cost. F is assumed to be very small relative to first-stage per-outlet fixed costs, so $N >> M$, given free entry. The price of advertising is assumed to be a weakly increasing function of the number of consumers served by the outlet, that is, $P_X \geq 0$. The assumption is motivated by research which suggests that the effectiveness of advertising increases as messages become common knowledge within a culture or relevant subgroup (e.g., Chwe, 2001, pp. 37-49).

Consumers are distributed uniformly around the circle based on their preferences for news programming, with the total number of consumers normalized to one. They derive utility from visiting news outlets, and they may choose at most one outlet to visit.[17] The consumer's utility is a function of both the location of the outlet she visits relative to her own location and the amount of time she spends

---

and a requirement of nonnegative outlet profits.

[15] Regarding repositioning costs, see, e.g., Kotler (1976, pp. 168-169). Though incumbents might find it feasible to "translate" their brands in ways appropriate to the Internet (e.g., offer a less conservative viewpoint appropriate to an online consumer who is, on average, younger), repositioning *relative to competitors* in the new Internet product space would likely be costly (e.g., if CNN decided to make CNN.com exclusively a sports news website) as this would involve resetting consumer expectations about the brand's position as framed by other brands. In the concluding section, I consider the effects of relaxing this assumption and allowing incumbents to position their outlets strategically at the second stage.

[16] This is a static generalization of Grace's (1970) symmetry assumption.

[17] The effect of consumers instead visiting multiple outlets is discussed in the final section.

there.[18] To wit, let $U(s,x,\phi)$ be the gross utility for the consumer located at x who spends ϕ hours at the outlet located at s. Assume decreasing returns to the time spent at a given outlet, i.e., $U_\phi > 0$ but $U_{\phi\phi} < 0$, and a constant marginal opportunity cost of time, $\tau > 0$.

Let $\phi^*(s,x)$ be the consumer's maximizing choice of ϕ given τ and locations s and x, and define the envelope function $U(s,x) \equiv U(s,x,\phi^*(s))$. Assume $U(s,x) = \psi\phi^*(s,x)$, for some $\psi > 0$. Intuitively, one may view $U(s,x)$ as a satiation utility level that the consumer approaches with continued exposure to outlet s. The higher this satiation utility, the longer the consumer will choose to spend at the outlet in order to achieve satiation. With respect to the envelope function, I posit the specific form $U(s,x) = v - t|x-s|$. Thus, a consumer derives utility $v > 0$ when visiting an outlet whose positioning matches exactly her location on the circle. When she visits an outlet that does not exactly match her preferences, her utility declines in proportion to the distance of her chosen outlet from her ideal point. The proportionality parameter, $t > 0$, is the consumer's psychological "transportation cost" of visiting the non-ideal outlet.

In selecting from among all the options available at the second stage, consumers experience choice-management costs, $c(N)$, where $c' > 0$ and $c(.)$ is not bounded from above.[19] As an alternative, a consumer may constrain herself to choose from among incumbent outlets and incur no cost. Each consumer chooses the outlet s^* that maximizes her utility net of choice-management cost, subject to $U \geq 0$, and spends the number of hours there specified by $\phi^*(s^*,x) = \dfrac{v - t|x-s^*|}{\psi}$.

Attention shall be restricted to the case of $t \leq 2Mv$, in which all consumers consume at least some Internet news. (This assumption also guarantees that all consumers participate in the first-stage market.)

The sequence of events at the second stage may be summarized as follows: (i) entrant outlets choose positions to maximize profits; (ii) consumers choose their preferred outlet and number of hours to spend there, taking the positions of outlets as given; (iii) outlets earn profits and consumers receive utility.

---

[18] In the case of the Internet news market, one may think of the number of times the consumer "hits" a website as the relevant utility-affecting parameter rather than time spent at the site.

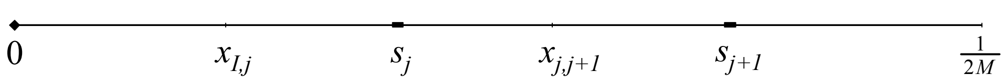
[19] Since the consumer already knows her preferred choice among the incumbent outlets, choice-management costs are assumed to depend only on the number of entrant outlets.

2.3 Equilibrium entrant locations

In the second-stage market, outlets are not only differentiated with respect to their distance from the consumer, but also the level of choice-management cost associated with choosing them. The choice between two entrants always favors the closer entrant, because entrants are equally affected by choice-management costs. However, a consumer might prefer an incumbent over an entrant even when the entrant is closer, given the lower choice-management costs associated with choosing an incumbent. Thus, the consumers that choose a given entrant are those that are closer to the entrant than to any adjacent entrants and that, considering both distance and choice management, prefer the entrant to the nearest incumbent.

Given this, and due to symmetry, equilibrium entrant locations around the circle may be determined by analyzing consumer choice on a representative segment extending from a given incumbent to the midpoint between it and the neighboring incumbent on its right side. The incumbent's location shall be referred to as the zero point, so other positions on the segment, such as the location of entrants, may be distinguished by their distance, $0 < s \leq \frac{1}{2M}$, from the incumbent. I adopt the convention of identifying entrants on the segment with numeric subscripts to indicate relative distance from the incumbent, with "1" being the closest (i.e., s_1, s_2, s_3, etc.). The location at which a consumer is indifferent between two adjacent entrants, s_j and s_{j+1}, shall be referred to as $x_{j,j+1}$, while the locus of indifference between entrant s_j and the incumbent shall be $x_{I,j}$. Figure 1 illustrates a possible arrangement of the representative segment showing two entrants.

Figure 1. Example of a representative segment
Two entrants (*j*=1)



Expressions for $x_{j,j+1}$ and $x_{I,j}$ are given by

$$x_{j,j+1} = \frac{s_j + s_{j+1}}{2} \; ; x_{I,j} = \frac{s_j}{2} + \frac{c(N)}{2t} \tag{2}$$

Given that preferences between entrants are based purely on distance, $x_{j,j+1}$ is the midpoint between s_j and s_{j+1}. Meanwhile, the expression for $x_{I,j}$ solves the asymmetric equation $U\left(0, x_{I,j}\right) = U\left(s_j, x_{I,j}\right) - c\left(N\right)$. Observe that as N grows from zero, $x_{I,j}$ moves rightward from the midpoint between the incumbent and entrant, growing closer to the entrant. Eventually, a level of N is reached, specified by $c\left(N\right) = s_j t$, at which $x_{I,j}$ is exactly at the entrant's location. When $c\left(N\right) > s_j t$, the incumbent dominates s_j with respect to the preferences of all consumers, even those on the far side of s_j relative to the incumbent.[20]

Now consider the number of consumers that visit entrant s_j. The visitors on s_j's left side consist of all the consumers between s_j and the closer of $x_{I,j}$ and $x_{j-1,j}$. All consumers to the left of these thresholds either prefer s_{j-1}, the nearest incumbent, or both, relative to s_j. Meanwhile, the visitors on s_j's right side consist of all the consumers between s_j and $x_{j,j+1}$, except in the special case in which no entrant has located between s_j and the nearest incumbent to its right side. In that case, s_j's territory stops at $x_{I',j}$, the locus of indifference between s_j and the right-side incumbent [I']. $x_{I',j}$ solves $U\left(\frac{1}{M}, x_{I',j}\right) = U\left(s_j, x_{I',j}\right) - c\left(N\right)$ and is given by

$$x_{I',j} = \tfrac{1}{2M} + \frac{s_j}{2} - \frac{c\left(N\right)}{2t} \tag{3}$$

In sum, the following cases pertain to the total number of consumers, $X\left(s_j\right)$, visiting s_j:

$$\left.\begin{array}{ll} x_{j,j+1} - x_{j-1,j} & \text{if } x_{j-1,j} > x_{I,j} \\ x_{j,j+1} - x_{I,j} & \text{if } x_{j-1,j} < x_{I,j} < s_j \\ 0 & \text{if } x_{I,j} > s_j \end{array}\right\} \text{ and } s_j \text{ is flanked by two entrants}$$

$$\left.\begin{array}{ll} x_{j,j+1} - x_{I,j} & \text{if } x_{I,j} < s_j \\ 0 & \text{if } x_{I,j} > s_j \end{array}\right\} \text{ and } s_j \text{ is flanked by an incumbent and an entrant } (j=1) \tag{4}$$

$$\left.\begin{array}{ll} x_{I',j} - x_{I,j} & \text{if } x_{I',j} > x_{I,j} \\ 0 & \text{if } x_{I',j} < x_{I,j} \end{array}\right\} \text{ and } s_j \text{ is flanked by two incumbents (i.e., } j=1)$$

---

[20] To confirm this, consider a consumer located at $x_R > s_j$. This consumer receives $v - tx_R$ from choosing the incumbent, versus $v - tx_R + ts_j - c\left(N\right) < v - tx_R$ from choosing s_j.

The expressions in (4) can be used to determine the consumer-hours accrued by s_j and, thus, profit for s_j as a function of location. One may then solve the first-order conditions for profit maximization with respect to location to obtain optimizing relative entrant locations.[21] These may be written:

$$\begin{aligned} s_1 &= \frac{s_2}{2} + \frac{c(N)}{2t} \\ s_2 &= \tfrac{1}{M} - s_1 - (n-2)(s_2 - s_1) \\ s_j &= s_2 + (s_2 - s_1)(j-2) \qquad j \geq 3 \end{aligned} \tag{5}$$

Solving these together yields reduced-form entrant locations,

$$s_j = \frac{j}{(n+1)M} + \frac{c(N)(n+1-2j)}{t(n+1)} \quad \text{for } c(N) < \tfrac{t}{2M} \tag{6}$$

In this expression, *n*, the number of entrants between each pair of adjacent incumbents, is endogenous. Given the assumption of free entry, it is the maximum number of entrants consistent with nonnegative profits. As shown in Appendix B, all entrants serve an identical number of consumers, $X^E(n,M,t)$, and accrue an identical quantity of consumer-hours, $Q^E(n,M,t,v,\psi)$. It follows from (1) that profits are also identical for all entrants, $\pi^E \equiv \pi^E(n,M,t,v,\psi,F)$. It can further be shown that $\pi_n^E < 0$ when $c(N) \leq t/2M$ and $t \leq 2Mv$.[22] Therefore, subject to these conditions and the zero-profit (free entry) condition, $\pi^E = 0$, one may express the equilibrium value of *n* as an implicitly-derived function of the other arguments of π^E, $n^* \equiv n(M,t,v,\psi,F)$.[23] While our focus is to demonstrate what happens to measures of consumer dispersion as n^* increases, one could alternatively express dispersion effects in terms of changes in the exogenous arguments of n^*. For example, one could analyze the effect of per-outlet fixed cost on the distribution of consumer choice across outlets. These effects could be derived using standard comparative static techniques.

Equilibrium entrant locations are obtained simply by substituting n^* for *n* in (6).

2.4 Incumbent market share and HHI

---

[21] See Appendix A.

[22] See Appendix B.

[23] See, e.g., Chiang (1984). Since it must be an integer, n^* does not actually satisfy $\pi^E = 0$ exactly; rather, as alluded to above, it is the largest integer satisfying $\pi^E \geq 0$. This represents only a slight modification of the implicit function result.

Now, let σ_I be a single incumbent's market share of consumers. Assuming $c(N) < \frac{t}{2M}$, then, as discussed in Appendix A, no entrant is dominated by the incumbent in equilibrium. This implies the incumbent will only serve consumers on the near side of its neighboring entrants. Thus, $\sigma_I = 2x_{I,1}$. Given symmetry, the market share of all incumbents taken together is $M\sigma_I = 2Mx_{I,1}$. Using (2) and (6),

$$M\sigma_I\left(n^*\right) = \frac{1}{n^*+1} + \frac{2Mc\left(n^*M\right)n^*}{\left(n^*+1\right)t} \tag{7}$$

Differentiating (7) with respect to n^* yields

$$M\sigma_I{}'\left(n^*\right) = \frac{1}{\left(n^*+1\right)^2}\left[\frac{2M\left\{n^*M\left(n^*+1\right)c'\left(n^*M\right)+c\left(n^*M\right)\right\}}{t} - 1\right] \tag{8}$$

Clearly, $M\sigma_I{}'(0) < 0$. If c' is small enough, $M\sigma_I{}'(.)$ will remain negative at low levels of n^*, thus the share of incumbents will decline over this range. As n^* grows, however, both terms in the numerator grow inexorably, given that $c(.)$ grows without bound. Inevitably, $M\sigma_I{}'(.)$ turns positive and remains so. Defining $N^* \equiv n^* \cdot M$, it can be stated that:

Proposition 1: *The market share of incumbents increases with the number of competing entrant news outlets in equilibrium [* N^* *] beyond a certain point.*

The result is fully general, requiring no specific assumptions about the functional form of $c(.)$.

An analogous result can be derived for the Herfindahl-Hirschman index, or HHI. Define the HHI as the sum of the squared consumer shares of all $L \le M + N$ outlet *owners,* or $HHI(n) \equiv \sum_{i=1}^{L} \sigma_i^2$.[24] Given the baseline assumption of independent owners for all outlets, one may write

[24] Note that this calculation bases the index on the share of consumers served by each owner, not the share of revenue generated. The index ranges between 0 and 1, not 0 to 10,000 as is sometimes used.

$$HHI(n) = \sum_{i=1}^{M+N} \left[\sigma_i(n)\right]^2 = M\left[\left[\sigma_I(n)\right]^2 + \sum_{j=1}^{n}\left[\sigma_j(n)\right]^2\right] \quad (9)$$

where the σ_j represent the entrants' market shares of consumers. σ_I is simply (7) divided by *M.* The entrant market shares are equal to the number of consumers served by each entrant, that is, $\sigma_j = X(s_j)$. As discussed above, all entrants garner the same number of consumers; this number, X^E, is specified in Appendix B by (A19). Therefore, substituting expressions from (7) and (A19) into (9) obtains, in equilibrium,

$$HHI(n^*) = \frac{1}{(n^*+1)M} + \frac{4n^*M\left[c(n^*M)\right]^2}{(n^*+1)t^2} \quad (10)$$

Differentiating (10) with respect to n^* yields

$$HHI'(n^*) = \frac{1}{(n^*+1)^2 M}\left(\frac{4M^2 c(n^*M)\left\{c(n^*M) + 2n^*(n^*+1)Mc'(n^*M)\right\}}{t^2} - 1\right) \quad (11)$$

Analysis proceeds along analogous lines to that of $M\sigma_I'(n^*)$. Thus:

Corollary 1: *HHI increases with the number of competing entrant news outlets in equilibrium [* N^* *] beyond a certain point.*

Proposition 1 and Corollary 1 can be explained by noting two effects of incrementally increasing the number of entrants when there are choice-management costs. First, an incremental entrant garners market share, reducing incumbent and existing entrant market shares and, therefore, the HHI. Second, the incremental entrant increases choice-management costs, causing other entrants to lose share to incumbents; this raises the HHI. When the total number of entrants is small, the first effect dominates. However, when the total number of entrants is large, the negative externality of increased choice-management cost outweighs the concentration-reducing impact of share claimed by the incremental entrant, and incumbent shares and the HHI rise.

A final result relates to the relative impact of an independent entrant outlet versus an independent incumbent outlet on the dispersion of consumers across outlet owners:

Corollary 2: *Consider a merger between two independent incumbent outlets, and a concurrent increase in the equilibrium number of entrant outlets [* N^* *] (due, say, to a decrease in F) such that the total number of independent outlet owners* *remains unchanged. There exists a number of entrant outlets, $\bar{N}$, such that for all $N^* > \bar{N}$, the merger and increase in entrants taken together would decrease consumer dispersion across outlet owners.*

To prove this, use *HHI* to measure dispersion. Given Corollary 1, there exists $\bar{n}$ such that for all $n^* > \bar{n}$, $HHI'(n^*) > 0$. Let $\bar{N} = \bar{n}M$, and consider the effect, for $N^* > \bar{N}$, of the proposed merger and increase in entrants. The merger increases *HHI* unambiguously. However, the increase in the equilibrium number of entrant outlets does not decrease *HHI*; it actually increases it as well.

In order for the Internet to offer a failsafe against media consolidation, new outlets on the Internet must be as effective at attracting consumers as old outlets on traditional media whose independence is lost through consolidation. Corollary 2 suggests that they are not, if, as seems likely, the number of outlets on the Internet is great relative to consumers' cognitive capacities for dealing with choice. This result has relevance for the design of effective media ownership policy, as I discuss below.

3. Discussion

This paper has presented a model of news outlet selection in which consumers could opt to choose from the full array of options available on the Internet or from a smaller set of "safe bet" news sources familiar from conventional media. Consumers in the model experience choice-management costs that increase with the number of options faced. It was demonstrated in this context that, as the equilibrium number of Internet outlets grows, consumers increasingly favor the "safe bets." Thus, both HHIs and the market shares of safe bets exhibit a U-shaped relationship with the equilibrium number of Internet outlets.

The remainder of this section is divided into two parts. In this first part, I discuss public policy implications of these results. In the second, I discuss extensions to the model.

3.1 Public policy

Changes to the FCC's media ownership rules appear to be governed by a standard that the Supreme Court articulated in *Red Lion Broadcasting Co. v. FCC*, in which it stated that "it is the purpose of the First Amendment to preserve an uninhibited marketplace of ideas in which truth will ultimately prevail, rather than to countenance monopolization of that market, whether it be by the Government itself or a private licensee."[25] One might reasonably approach the question of whether this standard has been met by asking whether opponents of a viewpoint espoused via a certain outlet, such as a television or radio station, can access an outlet for rebuttal that can reach an audience of the size reached by the initial viewpoint and do so as effectively.

Given this interpretation of *Red Lion*, the model's results suggest that the existence of the Internet is insufficient to establish that the media ownership rules may be safely relaxed. Recall from the introduction the arguments made by Michael Powell and Adam Thierer supporting relaxation of the rules. If consumers experience costs to managing large numbers of choices, then dispersion of consumers across websites may be limited even when, as Michael Powell suggests, sites offer high-quality content. Further, the large number of websites, referred to by Adam Thierer, rather than making it easier to rebut a message from a conventional channel, may actually inhibit this process by creating a muddle for consumers that induces them to stick with familiar channels. If consumers rally to the same sources online that they choose offline, then the Internet does little to mitigate the effects of media consolidation.

Beyond allowing comment on proposed changes to the current media ownership rules, the model's results offer hints as to how a more appropriate system of rules might deal with the variety of media found in today's marketplace. As previously noted, one outcome of the model is that a new Internet news source cannot attract consumers as effectively as a recognized source of equal quality from conventional media. To be valid, then, an accounting of the diversity of voices should consider not just the number of sources held by a single owner, but some measure of relative source effectiveness at attracting consumers. In short, there may be a role for market performance measures, rather than just the conventional structural standards for media ownership.

A multi-media HHI would offer such a measure. Perhaps Nielsen data on TV viewership and Arbitron data on radio listenership of appropriately defined programming could be combined with website visitation data to create an HHI based on consumer attendance across media. The statistic could be compared to a "cap" to determine whether a specific merger should be allowed. Alternatively, the FCC or the courts could use the HHI calculation to determine whether a set of structural ownership rules, such as the proposed new rules, is appropriate. The advantage of a multi-media HHI is that it would not prejudge the impact on the market of choice-management costs, number of voices, or any other structural indicator. Rather, it would allow market performance to be the deciding factor with respect to relevant policy decisions.

---

[25] *Red Lion Broadcasting Co. v. FCC,* 395 U.S. 367, 390 (1969). See also "Statement of Commissioner Michael J. Copps, Dissenting," June 2, 2003, p. 2.

3.2 Model extensions

3.2.1. Incumbent strategic behavior

The model assumed that incumbents could not change position at the second stage. Suppose, instead, that incumbent outlets are able to change position and that they act strategically with respect to entry; that is, they choose their positions recognizing the effect of their location decisions on entrant location decisions. Entrants meanwhile take the incumbents' positions as given, just as they did in the model, and incumbents take each other's positions as given.

Determining optimal incumbent positions in this context is complicated for two reasons. First, given increasing returns to each outlet, the incumbent's profit function is discontinuous in its location. Movement of the incumbent, say, from left to right, causes the profits of entrants on its right side to fall. Eventually, their profits fall to zero, and the number of entrants that would choose to locate to the right of the incumbent drops by one. The event will not necessarily coincide with an increase in the number of entrants on the incumbent's left side. Thus, incumbent profits rise abruptly, as the incumbent's consumer-hour accruals jump with the elimination of the right-side entrant. Since incumbent profit is discontinuous, it is not differentiable. This means profit-maximizing incumbent locations must be determined by evaluating profits in multiple cases rather than simply by solving first-order conditions.

The second complicating factor is that the profit earned by an incumbent that abuts two entrants depends upon the incumbent's distance from the entrants on either side. From (6), one can see that this distance falls with the number of entrants on either side, rises with the distance from the incumbent to the nearest neighboring incumbent on either side, and rises, all else being equal, with the total number of entrants on the circle. Changes in these factors may exert opposing influences on entrant proximity as the incumbent moves from its first-stage position. The relative size of these influences depends upon the specification of $P(Q)$; thus incumbent profits might increase, decrease, or remain the same as an incumbent moves from its first-stage position. Indeed, with respect to incumbent locations, multiple equilibria may be possible.

Nevertheless, without evaluating these equilibria it is still possible to show that the results derived in the model apply in the case of strategically-located incumbents. Consider (6) with an arbitrary distance $L \leq 1$ replacing M in the equation. At $c(N) = \frac{t}{2L} - \varepsilon$, for some arbitrarily small $\varepsilon > 0$, the profit-maximizing location for all entrants is arbitrarily close to $\frac{1}{2L}$. From equations (A19) and (A20) in the appendix, one can see that this positioning corresponds to an arbitrarily small $Q^E > 0$. Thus, zero entrant profits correspond, given (1) and a positive price for advertising, to an arbitrarily small level of fixed costs, $F_{\varepsilon} > 0$, and also some equilibrium number of entrants, n_{ε}^{*}. Let $n_{0}^{*} \equiv \lim_{\varepsilon \to 0} n_{\varepsilon}^{*}$. Clearly, $\sigma_{I}\left(n_{0}^{*}\right) = HHI\left(n_{0}^{*}\right) = 1$. But since, for $\varepsilon > 0$, each entrant serves some consumers, it must be that $\sigma_{I}\left(n_{\varepsilon}^{*}\right) < 1$ and $HHI\left(n_{\varepsilon}^{*}\right) < 1$. Thus, Proposition 1 and Corollary 1 hold in the general context. Corollary 2 may also be shown to hold, using an extension of this logic.

3.2.2. Consumers visit multiple outlets

The model assumed that consumers can choose only one outlet to visit. Suppose instead, as seems appropriate to the Internet, that consumers may allocate their time across multiple outlets, in effect mixing several goods.[26] In keeping with the model's approach, let us maintain the assumption of decreasing returns to the time spent at any one outlet, and assume that the utility of spending time at a given outlet is a decreasing function of the distance from one's location to the outlet. With the possibility of visiting multiple outlets, the amount of time spent at a given outlet might reasonably be expected to be a decreasing function of the total number of outlets. Consistent with this, the total amount of time spent across all outlets might be modeled as a concave increasing function of the number of outlets. Both these assumptions make sense given the limited number of hours in a day, if one assumes no complementarity across outlets. Finally, assume that a consumer visiting any number of entrants must pay $c\left(N\right)$ one time only.

In the context of this variant of the model, increasing the number of entrants, *N*, benefits the consumer by providing not only an increased variety of options, but also increased variety in the consumer's chosen mix. However, just as there are decreasing returns to increasing the proximity of the nearest entrant as *N* increases, so too are there decreasing returns to increasing mix variety. This is because of the concavity of the time spent at all outlets and, as assumed in the model, the constant ratio of utility to hours spent. Given that $c\left(N\right)$ increases without bound in *N*, all consumers will therefore prefer to visit *only* the incumbent if *N* is large enough. Thus, the main results from the model should still apply under a model extension in which consumers may divide their time among multiple outlets.

[26] For location models in which consumers mix different goods, see Anderson and Neven (1989), Gal-Or and Dukes (2003), Gabszewicz et al. (2004), and Hoernig and Valletti (2007).

3.2.3. Other extensions and potential future work

The model could be productively extended in additional ways. Future work might consider the effect of relaxing the simplifying assumptions concerning the advertising side of the market. The quantity and price of advertising could be modeled more explicitly. The effect of advertising as a nuisance to consumers could be accounted for, consistent with the approaches of Gal-Or and Dukes (2003) or Gabszewicz et al. (2004); this would allow consideration of how consumers trade off the nuisance of advertising and the nuisance of choice in their decision-making. More broadly, it would be worthwhile to extend analysis of the disutility of choice to the general product market context, explicitly modeling the interaction of choice-management cost with product price. Finally, a formal welfare analysis of choice-management costs should be considered, investigating consumption levels per consumer and gauging the welfare effect of consumers sometimes opting not to choose (Dhar, 1997).

Appendix A. Optimizing relative entrant locations

Using (4) in the text, an entrant s_j flanked by two entrants and subject to $x_{j-1,j} > x_{I,j}$ serves a number of consumers given by

$$X\left(s_j\right) = x_{j,j+1} - x_{j-1,j} = \frac{s_j + s_{j+1}}{2} - \frac{s_j + s_{j-1}}{2} = \frac{s_{j+1} - s_{j-1}}{2} \tag{A1}$$

and accrues consumer-hours given by

$$Q\left(s_j\right) = \int_{x_{j-1,j}}^{x_{j,j+1}} \phi^*\left(s_j, x\right) dx = \frac{1}{\psi} \int_{x_{j-1,j}}^{x_{j,j+1}} v - t\left|x - s_j\right| dx \tag{A2}$$

Similarly, an entrant flanked by two entrants and subject to $x_{j-1,j} < x_{I,j} < s_j$, or $x_{I,j} < s_j$ if flanked by an entrant and an incumbent, serves a number of consumers given by

$$X\left(s_j\right) = x_{j,j+1} - x_{I,j} = \frac{s_j + s_{j+1}}{2} - \frac{s_j}{2} - \frac{c\left(N\right)}{2t} = \frac{s_{j+1}}{2} - \frac{c\left(N\right)}{2t} \tag{A3}$$

and accrues consumer-hours given by

$$Q\left(s_j\right) = \int_{x_{I,j}}^{x_{j,j+1}} \phi^*\left(s_j, x\right) dx = \frac{1}{\psi} \int_{x_{I,j}}^{x_{j,j+1}} v - t\left|s_j - x\right| dx \tag{A4}$$

Integrating (A2) yields:

$$Q\left(s_j\right)=\frac{1}{\psi}\left[vx-\frac{tx^2}{2}+ts_jx\right]_{s_j}^{x_{j,j+1}}+\frac{1}{\psi}\left[vx+\frac{tx^2}{2}-ts_jx\right]_{x_{j-1,j}}^{s_j}$$

$$=\frac{1}{\psi}\left\{\left[vx_{j,j+1}-\frac{tx_{j,j+1}{}^2}{2}+ts_jx_{j,j+1}\right]+\left[ts_j{}^2-2ts_j{}^2\right]-\left[vx_{j-1,j}+\frac{tx_{j-1,j}{}^2}{2}-ts_jx_{j-1,j}\right]\right\} \quad \text{(A5)}$$

$$=\frac{1}{\psi}\left\{\left[v\left(x_{j,j+1}-x_{j-1,j}\right)\right]-\frac{t}{2}\left[x_{j-1,j}-s_j\right]^2-\frac{t}{2}\left[x_{j,j+1}-s_j\right]^2\right\}$$

Substituting from (2), (A5) may be rephrased in terms of entrant locations and exogenous parameters:

$$Q\left(s_j\right)=\frac{1}{\psi}\left\{\left[v\left(\frac{s_j+s_{j+1}}{2}-\frac{s_j+s_{j-1}}{2}\right)\right]-\frac{t}{2}\left[\frac{s_j+s_{j-1}}{2}-s_j\right]^2-\frac{t}{2}\left[\frac{s_j+s_{j+1}}{2}-s_j\right]^2\right\}$$

$$=\frac{1}{\psi}\left\{v\left(\frac{s_{j+1}-s_{j-1}}{2}\right)-\frac{t}{2}\left[\frac{s_{j-1}-s_j}{2}\right]^2-\frac{t}{2}\left[\frac{s_{j+1}-s_j}{2}\right]^2\right\} \quad \text{(A6)}$$

Similarly, integrating (A4) yields:

$$Q\left(s_j\right)=\frac{1}{\psi}\left\{v\left(x_{j,j+1}-x_{I,j}\right)-\frac{t}{2}\left(x_{j,j+1}-s_j\right)^2-\frac{t}{2}\left(x_{I,j}-s_j\right)^2\right\} \quad \text{(A7)}$$

Rephrasing (A7) in terms of entrant locations and exogenous parameters, using (2):

$$Q\left(s_j\right)=\frac{1}{\psi}\left\{v\left(\frac{s_{j+1}}{2}-\frac{c(N)}{2t}\right)-\frac{t}{2}\left(\frac{s_{j+1}-s_j}{2}\right)^2-\frac{t}{2}\left(\frac{c(N)}{2t}-\frac{s_j}{2}\right)^2\right\} \quad \text{(A8)}$$

Per (1), profits for s_j are given by $\pi\left(s_j\right)=Q\left(s_j\right)\cdot P\left(X\left(s_j\right)\right)-F$. The first-order condition for profit maximization with respect to s_j is

$$Q_{s_j}P\left(X\left(s_j\right)\right)+Q\left(s_j\right)\cdot P_X\cdot X_{s_j}=0 \quad \text{(A9)}$$

It is clear from (A1) and (A3) that $X_{s_j}=0$ for both relevant cases. Therefore, for a positive price interior solution, (A9) is satisfied only when $Q_{s_j}=0$. In the case of an entrant s_j flanked by two entrants and subject to $x_{j-1,j}>x_{I,j}$, this becomes

$$\frac{1}{\psi}\left\{t\left[\frac{s_{j-1}-s_j}{2}\right]\cdot\frac{1}{2}+t\left[\frac{s_{j+1}-s_j}{2}\right]\cdot\frac{1}{2}\right\}=0 \quad \text{(A10)}$$

Thus, $s_j=\frac{s_{j-1}+s_{j+1}}{2}$.

In the case of an entrant flanked by two entrants and subject to $x_{j-1,j} < x_{I,j} < s_j$, or an entrant flanked by an entrant and an incumbent and subject to $x_{I,j} < s_j$, $Q_{s_j} = 0$ becomes

$$\frac{1}{\psi}\left\{\frac{t}{2}\left(\frac{s_{j+1}-s_j}{2}\right)+\frac{t}{2}\left(\frac{c(N)}{2t}-\frac{s_j}{2}\right)\right\}=0 \tag{A11}$$

Thus, $s_j = \frac{s_{j+1}}{2} + \frac{c(N)}{2t}$.

Boundary conditions for the cases given in (4) may be re-phrased using (2); thus $x_{j-1,j} > x_{I,j}$ is re-written as $c(N) < s_{j-1}t$, and $s_j > x_{I,j}$ is re-written $c(N) < s_j t$. Substituting $c(N) = s_j t$ into $s_j = \frac{s_{j+1}}{2} + \frac{c(N)}{2t}$ yields $s_j = s_{j+1}$, so $c(N) < s_{j+1}t$ may be used in place of $c(N) < s_j t$. Thus the optimizing relative entrant locations may be written

$$\begin{aligned}
s_j &= \frac{s_{j-1}+s_{j+1}}{2} && \text{if } c(N) < s_{j-1}t \text{ and } s_j \text{ is flanked by two entrants}\\
s_j &= \frac{s_{j+1}}{2}+\frac{c(N)}{2t} && \text{if } \begin{cases} c(N) < s_{j+1}t \text{ and } s_j \text{ is flanked by an incumbent and an entrant } (j=1)\\ \text{OR } s_{j+1}t > c(N) \geq s_{j-1}t \text{ and } s_j \text{ is flanked by two entrants}\end{cases}\\
s_j &= \tfrac{1}{2M} && \text{if } s_j \text{ is flanked by two incumbents (i.e., } j=1)
\end{aligned} \tag{A12}$$

where the entrant's location decision is trivial due to symmetry in the sub-case of an entrant flanked by two incumbents.

It is possible to simplify (A12) for the case of two or more entrants between adjacent incumbents by noting that, when $c(N) < \frac{t}{2M}$, no entrant will locate where it is dominated by the incumbent in equilibrium. The logic goes as follows. When $c(N) < \frac{t}{2M}$, an entrant located at $\frac{1}{2M}$ is not dominated by the incumbent. Therefore, any dominated entrant could do better by moving farther from the incumbent until it is not dominated. Because all dominated entrants relocate in a similar fashion, and because any entrant not at $\frac{1}{2M}$ will move farther still from the incumbent as its near-side neighbor draws closer, no entrant will be dominated in equilibrium. Thus, (A12) may be revised to state that an entrant adjacent to an incumbent positions itself at $s_1 = \frac{s_2}{2} + \frac{c(N)}{2t}$, while all other entrants locate at the midpoint between their neighbors. This may, in turn, be rewritten as (5) in the text.

Appendix B. Consumer, consumer-hour, and profit functions for entrants

Given that no entrant is dominated in equilibrium, subject to $c(N) < \frac{t}{2M}$, the number of consumers served by entrants may be written, using (A3) and (A1), respectively,

$$X(s_1) = \frac{s_2}{2} - \frac{c(N)}{2t} \tag{A13}$$

$$X(s_j) = \frac{s_{j+1} - s_{j-1}}{2} \quad (j > 1) \tag{A14}$$

and entrant consumer-hour accruals may be written, using (A8) and (A6),

$$Q(s_1) = \frac{1}{\psi}\left\{ v\left(\frac{s_2}{2} - \frac{c(N)}{2t}\right) - \frac{t}{2}\left(\frac{s_2 - s_1}{2}\right)^2 - \frac{t}{2}\left(\frac{c(N)}{2t} - \frac{s_1}{2}\right)^2 \right\} \tag{A15}$$

$$Q(s_j) = \frac{1}{\psi}\left\{ v\left(\frac{s_{j+1} - s_{j-1}}{2}\right) - \frac{t}{2}\left[\frac{s_{j-1} - s_j}{2}\right]^2 - \frac{t}{2}\left[\frac{s_{j+1} - s_j}{2}\right]^2 \right\} \quad (j > 1) \tag{A16}$$

Using the reduced-form expression for entrant locations, (4) in the text, (A13) may be re-written

$$X(s_1) = \frac{1}{(n+1)M} - \frac{2c(N)}{(n+1)t} \tag{A17}$$

and (A15) becomes

$$\begin{aligned} Q(s_1) &= \frac{1}{\psi}\left\{ v\left(\frac{1}{(n+1)M} - \frac{2c(N)}{(n+1)t}\right) - \frac{t}{4}\left(\frac{1}{(n+1)M} - \frac{2c(N)}{t(n+1)}\right)^2 \right\} \\ &= \frac{1}{\psi}\left\{ vX(s_1) - \frac{t}{4}\left(X(s_1)\right)^2 \right\} \end{aligned} \tag{A18}$$

Similarly, (A14) may be re-written

$$X(s_j) = \frac{1}{(n+1)M} - \frac{2c(N)}{(n+1)t} = X(s_1) \equiv X^E(n, M, t) \ \ \forall j > 1 \tag{A19}$$

and (A16) becomes

$$\begin{aligned} Q(s_j) &= \frac{1}{\psi}\left\{ v\left(\frac{1}{(n+1)M} - \frac{2c(N)}{(n+1)t}\right) - \frac{t}{4}\left[\frac{1}{(n+1)M} - \frac{2c(N)}{(n+1)t}\right]^2 \right\} \\ &= \frac{1}{\psi}\left\{ v \cdot X^E(n) - \frac{t}{4}\left(X^E(n)\right)^2 \right\} = Q(s_1) \equiv Q^E(n, M, t, v, \psi) \ \ \forall j > 1 \end{aligned} \tag{A20}$$

Thus, the number of consumers served and the consumer-hours accrued are each the same across all entrants. It follows that profits are the same for all entrants and may be expressed as a function of exogenous parameters *n*, *M*, *t*, *v*, ψ, and *F*, to wit, $\pi^E(n,M,t,v,\psi,F)$. (In what follows, I suppress the arguments of functions *X, Q*, and π.)

Differentiating (A19) with respect to *n*, $X_n^E = \frac{-2(n+1)M^2c'(N)+2Mc(N)-t}{(n+1)^2 tM}$. Therefore, for $2Mc(N) \le t$, the case in which all entrants are not trivially dominated by the incumbent, $X_n^E < 0$. Using (A20), it follows that $Q_n^E = \frac{1}{\psi} X_n^E \left\{ v - \frac{t}{2} X^E \right\}$. Further, $t \le 2Mv$ implies $X^E \le \frac{2v}{t}$; therefore $Q_n^E < 0$.

Differentiating (1) with respect to *n* yields $\pi_n = Q_n P + Q \cdot P_X \cdot X_n$. Given this, $Q_n^E < 0$, and $X_n^E < 0$, it follows that $\pi_n^E < 0$ over the relevant range.

References

Adamic, L. A., Huberman, B. A., 2000. The nature of markets in the World Wide Web. Quarterly Journal of Electronic Commerce 1, pp. 5-12.

Anderson, S. P., Coate, S., 2005. Market provision of broadcasting: a welfare analysis. Review of Economic Studies 72, pp. 947-972.

___, Neven, D. J., 1989. Market efficiency with combinable products. European Economic Review 33, pp. 707-719.

Armstrong, M., 2007. Competition in two-sided markets. Rand Journal of Economics, forthcoming.

d'Aspermont, C., Gabszewicz, J., Thisse, J.-F., 1979. On Hotelling's 'Stability in competition.' Econometrica 47, pp. 1145-1150.

Berry, S. T., Waldfogel, J., 2001. Do mergers increase product variety? Evidence from radio broadcasting. Quarterly Journal of Economics 116, pp. 1009-1025.

Chernev, A., 2003. Product assortment and individual decision processes. Journal of Personality and Social Psychology 85, pp. 151-162.

___, 2005. Feature complementarity and assortment in choice. Journal of Consumer Research 31, pp. 748-759.

Chiang, A. C., 1984. Fundamental Methods of Mathematical Economics, Third Edition. McGraw-Hill, Singapore (International Edition).

Chwe, M. S.-Y., 2001. Rational Ritual: Culture, Coordination, and Common Knowledge. Princeton University Press, Princeton.

Dhar, R., 1997. Consumer preference for a no-choice option. Journal of Consumer Research 24, pp. 215-231.

Dos Santos Ferreira, R., Thisse, J.-F., 1996. Horizontal and vertical differentiation: the Launhardt model. International Journal of Industrial Organization 14, pp. 485-506.

Gabszewicz, J. J., Laussel, D., Sonnac, N., 2002. Press advertising and the political differentiation of newspapers. Journal of Public Economic Theory 4, pp. 317-334.

___, ___, ___, 2004. Programming and advertising competition in the broadcasting industry. Journal of Economics & Management Strategy 13, pp. 657-669.

Gal-Or, E., Dukes, A., 2003. Minimum differentiation in commercial media markets. Journal of Economics & Management Strategy 12, pp. 291-325.

Grabner-Kraeuter, S., 2002. The role of consumers' trust in online-shopping. Journal of Business Ethics 39, pp. 43-50.

Grace, S. H., 1970. Professor Samuelson on free enterprise and economic efficiency: a comment. Quarterly Journal of Economics 84, pp. 337-345.

Hagel, J., III, Singer, M., 1999. Net Worth: Shaping Markets When Customers Make the Rules. Harvard Business School Press, Boston.

Hauser, J. R., Wernerfelt, B., 1990. An evaluation cost model of consideration sets. Journal of Consumer Research 16, pp. 393-408.

Hoernig, S. H., Valletti, T. M., 2007. Mixing goods with two-part tariffs. European Economic Review, forthcoming.

Hogan & Hartson, L.L.P., 2004. FCC update: Third Circuit remands media ownership rules. Retrieved August 30, 2006, from http://www.hhlaw.com/newsStand/pubDetail.aspx?publication=1041.

Hotelling, H., 1929. Stability in competition. Economic Journal 39, 41-57.

Ilfeld, J. S., Winer, R. S., 2002. Generating website traffic. Journal of Advertising Research 42, pp. 49-61.

Iyengar, S. S., Jiang, W., 2005. The psychological costs of ever increasing choice: A fallback to the sure bet. Working Paper, Columbia University.

___, Lepper, M. R., 2000. When choice is demotivating: Can one desire too much of a good thing? Journal of Personality and Social Psychology 79, pp. 995-1006.

Kaiser, U., 2006. Magazines and their companion websites: Competing outlet channels? Review of Marketing Science 4, Issue 1, Article 3. Available at: http://www.bepress.com/romsjournal/vol4/iss1/art3.

___, Kongsted, H. C., 2005. Do magazines' 'companion websites' cannibalize the demand for the print version? Working Paper, Centre for Applied Microeconometrics, Institute for Economics, University of Copenhagen.

Kotler, P., 1976. Marketing Management, Third Edition. Prentice Hall, Englewood Cliffs, NJ.

Lambertini, L. Vertical differentiation in a generalized model of spatial competition. Annals of Regional Science 35, pp. 227-238.

Lee, B-C, Ang, L., Dubelaar, C., 2005. Lemons on the web: A signaling approach to the problem of trust in Internet commerce. Journal of Economic Psychology 26, pp. 607-623.

Loewenstein, G., 2000. Costs and benefits of health- and retirement-related choice. In: Burke, S., Kingson, E., Reinhardt, U. (Eds.), Social Security and Medicare: Individual vs. Collective Risk and Responsibility. Brookings Institution Press, Washington, D.C.

MacKie-Mason, Shenker, J. S., Varian, H. R., 1996. Service architecture and content provision: the network provider as editor. Telecommunications Policy 20, pp. 203-217.

Malhotra, N. K., 1982. Information load and consumer decision making. Journal of Consumer Research 8, pp. 419-430.

McCullagh, D., 2003. FCC debate: Is the Net enough? CNET News.com, May 31, 2003. Retrieved August 30, 2006, from http://news.com.com/2100-1028-1011850.html.

Nagler, M. G., 1993. Rather bait than switch: Deceptive advertising with bounded consumer rationality. Journal of Public Economics 51, pp. 359-378.

Rochet, J.-C., Tirole, J., 2003. Platform competition in two-sided markets. Journal of the European Economic Association 1 (4), pp. 990-1029.

Salop, S. C., 1979. Monopolistic competition with outside goods. Bell Journal of Economics 10, pp. 141-156.

Schmalensee, R., 1978. Entry deterrence in the ready-to-eat breakfast cereal industry. Bell Journal of Economics 9, pp. 305-327.

Schwartz, B., 2000. Self-determination: The tyranny of freedom. American Psychologist 55, pp. 79-88.

Shugan, S. M., 1980. The cost of thinking. Journal of Consumer Research 7, pp. 99-111.

Simon, H., 1955. A behavioral model of rational choice. Quarterly Journal of Economics 68, pp. 99-118.

Smith, M. D., Bailey, J., Brynjolfsson, E., 2000. Understanding digital markets. In: Brynjolfsson, E., Kahin, B. (Eds.), Understanding the Digital Economy. MIT Press, Cambridge, MA.

Stigler, G. J., 1961. The economics of information. Journal of Political Economy 69, pp. 213-225.

Sutton, J., 1991. Sunk Costs and Market Structure. MIT Press, Cambridge, MA.

Wu, I., 2004. Canada, South Korea, Netherlands and Sweden: Regulatory implications of the convergence of telecommunications, broadcasting and Internet services. Telecommunications Policy 28, pp. 79-96.