E C O N O M I C S B U L L E T I N

Information goods and endogenous pricing strategies: the case of academic journals

Mark McCabe
Georgia Institute of Technology

Abstract

I model journal pricing behavior in a portfolio demand environment and consider how the ongoing transition from print to digital distribution has lead to endogenous changes in pricing behavior. Specifically, when choosing whether or not to price discriminate, publishers compare the benefits of selling more content to each set of buyers against the associated additional costs. As the distribution costs decline, price discrimination becomes more attractive. However, since this cost decline also creates new entry opportunities, incumbent firms may also need to bundle their journals to avoid displacement of individual titles.

I would like to thank Ted Bergstrom, Aaron Edlin, Scott Fay, Jeffrey Mackie−Mason, Steve Martin, Aviv Nevo, Dan O'Brien, Dan Rubinfeld, Chris Snyder, Huseyin Yildirim, and the Associate Editor of Economics Bulletin, Patrick Legros, for their helpful comments, as well as participants at the meetings of the American Economic Association, the Southern Economics Association and the Kiel Workshop on Information Economics and Network Industries. Partial financial support was provided by the Andrew W. Mellon Foundation.
Citation: McCabe, Mark, (2004) "Information goods and endogenous pricing strategies: the case of academic journals." *Economics Bulletin*, Vol. 12, No. 10 pp. 1−11
Submitted: March 5, 2004. **Accepted:** October 28, 2004.
URL: http://www.economicsbulletin.com/2004/volume12/EB−04L00003A.pdf

1. **Introduction**

The principal buyers of academic journals – research libraries – attempt to assemble broadly-defined journal collections. Although this portfolio approach to journal acquisition allows a community of scholars to share copies and reduce transaction costs, it also suggests that demand substitution between journals is constrained. For example, rather than choosing a handful of the available economics journals, most research libraries try to purchase dozens, and sometime hundreds of these titles (since from a user's perspective articles in one title are, at best, very imperfect substitutes for those appearing in other journals). The purpose of this note is to model journal pricing behavior in this demand environment and to consider how the ongoing transition from print to digital distribution has lead to endogenous changes in pricing behavior. Specifically, when choosing whether or not to price discriminate, publishers compare the benefits of selling more content to each set of buyers against the associated additional costs. As the distribution costs decline, price discrimination becomes more attractive. However, since this cost decline also creates new entry opportunities, incumbent firms may also need to bundle their journals to avoid displacement of individual titles. In recent years, this shift in strategy has been implemented by major commercial journal publishers (see Frazier 2001).

The scholarly journals market has received modest attention in the economics literature. Ordover and Willig (1978), Phillips and Phillips (2002), and Issman-Weit and Shy (2003) model the pricing of a single print journal to institutional and individual subscribers. Bergstrom (2001) discusses how the demand aggregation facilitated by libraries increases the profitability of an individual title and reduces user surplus. Chuang and Sirbu (1999) also consider the case of a single journal but in a digital environment. Given the lower transaction costs associated with this new environment, they demonstrate that mixed bundling (sales of individual articles as well as the "bundled" journal) can be a profit-maximizing strategy. Fay and Mackie-Mason (1999) extend Chuang and Sirbu's demand framework to allow for competition between bundles of information goods.[1] They compare the profitability and welfare properties of bundling in the monopoly and duopoly cases. In both of these papers, the analytical difficulties posed by the "N-good" bundling problem lead to simplifying assumptions, e.g. firms sell either one bundle containing all N goods and/or each of the individual goods, there is no price discrimination (and bundle components share a common price if sold separately), and the use of numerical methods is necessary to generate results. The two papers that are closest in spirit to the approach adopted here are McCabe (2003) and Jeon and Menicucci (2003). Like this paper, McCabe examines the impact of a decline in distribution costs on publisher pricing strategies. However, since library preferences are assumed to be lexicographic, no unique equilibria can be identified. Jeon and

---

[1] Both Chuang and Sirbu and Fay and Mackie-Mason (FMM) model *final* consumer demand for an N-good bundle(s) of articles or information goods. They assume that users rank each article in decreasing order of preference, and in the case of FMM, that articles sold by different firms are imperfect substitutes. Then given prices, consumers maximize their surplus. In this paper I specifically model the demand behavior of *libraries*. Although libraries do rank *journals* according to value/cost ratios, my approach incorporates additional elements: a library budget constraint and an outside good, i.e. monographs.

Menicucci (JM) focus on the digital environment and assume that libraries allocate their budgets across both journals and monographs. This latter assumption generates unique equilibria. However, when JM compare the profitability of unbundled and bundled journals sales the underlying equilibria are based on different decision criteria. When journals are sold separately, JM assume that libraries compare the "surplus-price ratio" of each journal, i.e. they purchase those titles with the highest use value per dollar. In contrast, when each publisher sells a single journal bundle, JM assume that libraries compare the net surplus associated with each bundle, i.e. use value minus the bundle price. This latter assumption is inconsistent with the library science literature and my own discussions with librarians (See McCabe, 2002). It implies that libraries are willing to pay more per unit of use value for a journal bundle whose overall value is relatively large.

In contrast, this paper relies exclusively on the use value per dollar approach for modeling the behavior of libraries. Given this demand framework, I demonstrate that the desirability of price discrimination depends on the magnitude of the distribution costs. In particular, when these costs are relatively high, a monopoly publisher prefers *not* to price discriminate (the "print regime"); when these costs are low, price discrimination is more desirable (the "digital regime").[2] In my model, bundling is important only as an entry foreclosure device.[3] When marginal costs are low, entry by new, lower quality titles may be profitable. Bundling by the incumbent firm can foreclose entry in these circumstances. For example, if entry would displace an incumbent's title, then bundling can be an effective defense if the publisher's journal portfolio is sufficiently valuable.

This note is organized as follows. I first describe the basic journal pricing model and then use it to analyze each of the two distribution regimes. I then compare the two regimes and identify the cost conditions under which each is observed. Next, I allow for entry. I conclude with a brief discussion of the results and their relationship to developments in the market for scientific journals. In the appendix I construct a numerical example which further illuminates the results.

---

[2] Mixed bundling is not considered here for two reasons. First, because I assume that libraries' valuations for journals are positively correlated, the standard motivation for mixed bundling – negative correlation in consumer valuations – is absent. Second, the ability to price discriminate in this paper satisfies the same objective as mixed bundling does in Chuang and Sirbu (1999), and Fay and Mackie-Mason (1999). That is, in both of those papers, mixed bundling permits firms to set different prices for high and low demand buyers. Here, price discrimination allows publishers to set prices based on library budgets.

[3] In JM's model, bundling may result in the foreclosure of incumbent titles as well. This difference arises from their assumption that libraries compare the net surplus of various bundles in making acquisition decisions.

2. The Basic Model

I consider two journal distribution regimes: 1. No price discrimination (the "print regime"), and 2. (Perfect) Price discrimination (the "digital regime"). In each case, given price and quality information for some set of journals, I assume that libraries allocate their fixed budgets between journals and monographs. In the print regime, libraries maximize the following objective function:

$$\sum_{j=1}^{N}\sum_{i=1}^{n_j} u_{ij}x_{ij} + v(m) \qquad (1)$$

subject to the constraint $\sum_{j=1}^{N}\sum_{i=1}^{n_j} p_{ij}x_{ij} + m \le M_z$, where u_{ij} is the (monetary) utility that library k obtains from journal i that is sold by publisher j, x_{ij} is a continuous variable in the interval [0,1] that represents the fraction of journal ij purchased by library z [4]; $v(m)$ is the utility from spending m on monographs, $v(0) = 0$, $v'(m) > 0 > v''(m)$; M_z is library z's total budget for journals and p_{ij} is journal ij's price. I assume that $v'(m) > 1$ for all $m \le M_z$. Thus, libraries prefer exhausting their budgets. Initially, I assume that M_z can take just one value; this is later relaxed. The number of libraries equals N_z. In the digital case, (1) changes slightly. Since each firm sells a single bundle, the i subscript is suppressed and thus, for example, u_j, corresponds to the utility obtained from firm j's entire journal bundle ($\sum_i^{n_j} u_{ij} = u_j$).

To simplify the presentation, I assume that two journals are potentially active and that a single monopolist controls both titles. Initially, I assume that entry is blocked. The production costs for each title include a fixed cost, F (the "first copy cost"), and a constant distribution cost, c, per subscription. A journal is active if its owner decides to invest F. Let N denotes the number of publishers with active titles, and n_j the number of active journals for firm j ($j = 1...N$). Thus, in the base model, $N=1$ and $n_j=2$.

The game played by market participants consists of four periods. In the first period, the monopolist decides, for each of its two titles, whether to expend F, the first copy cost. In the second period, subscription prices are selected for the active titles. Libraries then make their purchase decisions and, finally, the monopolist publishes its titles. Since sales can be forecast perfectly at the end of the second period, I focus on the first two periods of the game. JM's proposition 1 describes a unique SPNE for a similar game involving unbundled journals. In their setup, publishers first decide whether to enter or not, and then determine prices for their respective titles; finally, libraries maximize (1) subject to their budget constraint.

Let $U = \sum_j^N u_j$. Under the assumption of zero fixed and marginal costs, JM show (in their prop 1) that a unique *NE* exists in prices in the second period of their model: $p^*_{ij} = \alpha^* u_{ij}$,

---

[4] To derive an analytic result for the libraries' problem, it is necessary to make this assumption. Nonetheless, in equilibrium, all active titles, except possibly one lowest-quality title, are fully purchased, i.e. $x_{ij} = 1$. In reality, though most library journal purchases are for complete subscriptions, it is common practice for libraries to purchase individual articles from publishers when scholars request research from journals not otherwise available in their institution's library. I consider this issue further in the Appendix.

where α^* is the unique solution to

$$1/\alpha = v'(M_z - \alpha U). \qquad (2)$$

Note that the general form of (2) reflects the familiar Kuhn-Tucker solution to the maximization problem described by (1). This result is quite intuitive. Journal prices are linearly related to their underlying use value or utility. And the ratio of a journal's use value to price is determined by the marginal utility of the last dollar spent on monographs. In other words, libraries compare the "cost" of each unit of journal use value and spend their budget on the cheapest units available. This result constitutes an equilibrium because, on one hand, cutting a journal's price does not increase sales (only one copy of each journal is purchased), and, on the other hand, increasing its price results in more spending on monographs and less on the deviating title.

However, since JM assume that both fixed and marginal publishing costs are zero their approach cannot account for the changes in price strategies that have been observed during the transition from print to digital distribution, i.e. the shift to price discrimination. Their assumption of zero costs implies that a multi-journal publisher will always prefer to sell its entire portfolio (bundled or not) to every customer. If library budgets vary, this can be accomplished via perfect price discrimination (see footnote 7 for why 1st degree price discrimination is feasible). The intuition is that a publisher can maximize its share of a given customer's budget by offering as much content as possible. And since costs are zero, this strategy is profit maximizing.

3. The Print Regime (no price discrimination)

Suppose now that M_z can now take one of two values: small ($z=S$) or large ($z=L$), and that the numbers of libraries with budgets equal to M_S and M_L are N_S and N_L, respectively, with $N_S > N_L$. I show in section (5) that price discrimination is not profit maximizing for values of c greater than some c^* (>0) where c^* is determined by $v(m)$, M_Z, and the u_i. The intuition is that although selling more titles to a given set of libraries increases the journals' share of the libraries' budgets it also increases the total distribution costs. When c exceeds c^*, profits are greater when each title has a single price, and these prices are set so that one title is purchased by all libraries, and the other is bought by a subset of libraries, i.e. the large budget libraries (note that this "diversified" equilibrium corresponds to observed practice in the pre-digital era.). The second title is purchased by only a subset of libraries because the cost of both titles exceeds M_S and/or the addition of more monographs produces greater utility.

Suppose that $c > c^*$, and that $u_{11} = u_{21}$.[5] For the title sold by the firm to all libraries, profits are

$$\Pi_{11}^{All} = [(p_{11} - c)\cdot(N_S + N_L)] - F, \qquad (3)$$

[5] If $u_{11} \neq u_{21}$, then the publisher needs to consider which pricing strategy maximizes profits, i.e. should the high quality title be sold to all libraries, etc. The optimal strategy depends on the model parameters. See the numerical example in the appendix.

$p_{11} = \alpha_S^* \cdot u_{11}$, and α_S^* is defined by (2) when $M = M_S$ and $U = u_{11}$. Similarly, for the title sold only to large budget libraries profits are

$$\Pi_{21}^{Large} = [(p_{21} - c) \cdot N_L] - F, \qquad (4)$$

$p_{21} = \alpha_L^* \cdot u_{21}$, and α_L^* is defined by (2) when $m = M_L - p_{11} - \alpha_L U$ and $U = u_{21}$.[6]

Finally, note that with high distribution costs, bundling offers no advantages. Since the monopolist's revenue is proportional to *U*, bundling is helpful only if entry is deterred (in (2), note that α is declining in *U*). But by assumption, entry is not possible.

4. Digital Regime Case (perfect price discrimination)

If $c < c^*$ and price discrimination is preferred by firms, condition (2) can be applied directly to both classes of libraries. In the price discrimination, no bundling case ("PD"), since each journal is sold to each type of library, each set of customers can be analyzed separately. For each value of *M*, a unique α can be determined, and thus prices will differ across the two types of libraries (in the numerical example contained in the appendix , $d\alpha/dM > 0$, and so prices are higher for larger budget libraries).[7] The monopolist's profits can be expressed as $\Pi_1^{PD} = \Pi_{11}^{PD} + \Pi_{21}^{PD}$ where

$$\Pi_{i1}^{PD} = [(p_{i1}^{Small} - c) \cdot N_S] + [(p_{i1}^{Large} - c) \cdot N_L] - F \qquad (5)$$

$p_{i1}^{Small} = \alpha_S^* \cdot u_{i1}$, and α_S^* is defined by (2) when $M = M_S$ and $U = u_{11} + u_{21}$; p_{i1}^{Large} is defined similarly but note that, unlike the print-regime case, $M = M_L$.

In the price discrimination, bundling case ("B"), prices are defined in a similar fashion. Because each firm sells a single product, profits for firm j can be expressed more compactly as

---

[6] Note that a necessary condition for existence of this equilibrium is $\alpha_L^* \geq \alpha_S^*$, i.e. large budget libraries pay (weakly) more for the titles that they alone purchase.

[7] In the digital regime publishers use IP addresses to prevent arbitrage. Furthermore, to discriminate publishers do not need to rely on self-selection (and thus incentive compatibility constraints). Library budgets are public information (See footnote 10 in the Appendix). Note that if individual library data was not available, publishers might engage in 2nd degree price discrimination. To do so, publishers could create a set of distinct bundles with varying content. In the current case, there would be two bundles: one would be purchased by all libraries and consist of a single title, and the second would contain both titles. The prices for the first and second bundle would correspond to those defined earlier in section 3: p_{11}, and $p_{11} + p_{21}$, respectively. Alternatively, publishers could sell unbundled titles and use the pricing strategy described in section 3.

$$\Pi_1^B = [(p_1^{Small} - 2c)\cdot N_S] + [(p_1^{Large} - 2c)\cdot N_L] - 2F \qquad (6)$$

where $p_1^{Small} = \alpha_S^* \cdot u_1$, $u_1 = u_{11} + u_{21}$, and α_S^* is defined by (2) when $M = M_S$, and $U = u_1$; p_1^{Large} is defined similarly. Note that the monopolist's profit is the same under both schemes (since $p_1^{Small} = p_{11}^{Small} + p_{21}^{Small}$ and $p_1^{Large} = p_{11}^{Large} + p_{21}^{Large}$). However, this claim is not necessarily true if entry is permitted.

5. **Comparing the Two Regimes**

Do publishers prefer to price discriminate or not? All else equal, this decision is influenced by the magnitude of marginal costs. This can be seen by comparing profits for our monopolist under the two regimes (in the digital case, to simplify the analysis, I assume that the titles are bundled). If profits in the digital case exceed the corresponding profits in the print case, i.e., $\Pi_1^B \geq \Pi_{11}^{All} + \Pi_{21}^{Large}$, then using (3), (4), and (6), I can solve for the critical marginal cost, c^*, below the monopolist prefers to price discriminate and bundle:

$$c^* = \tfrac{1}{N_S}[(p_1^{Small} - p_{11})N_S + (p_1^{Large} - p_{11} - p_{21})N_L] \qquad (7)$$

The intuition for why lower values of *c* improve the relative attractiveness of the digital regime is that price discrimination increases the customer base for journal 2. Under the print regime it is sold only to large budget libraries; in the digital case all libraries purchase it. If *c* is too large, according to (7), the marginal revenue generated by price discrimination is exceeded by the additional costs. To check whether the print case is actually profitable for values of c in the interval $(p_{1j}, c^*]$, note that the first term inside the brackets on the right hand side of (7) is likely to be much larger than the second term. [8] Thus, $c^* \approx p_1^{Small} - p_{11} > 0$. And since I assume that $v''(m) < 0$, this implies that $p_1^{Small} < 2\,p_{11}$, or $c^* < p_{11}$ ($< p_{21}$). This latter inequality insures that the print case is profitable, provided that *F* is not too large.

6. Entry

Now consider the same basic setup with the possibility of entry. Each entrant title is assumed to exhibit *lower* quality than one of the monopolist's titles. There are *n* potential entrants, each with quality u_E ($< u_{i1}$).

Suppose $c > c^*$. Average costs are "high" and I assume that entry is not profitable for one or more entrants when the monopolist's titles are active. That is, given $v(m)$, M_z and *U* for either set of libraries, the price determined by (2) for any entrant title is insufficient to cover its average

---

[8] It is reasonable to assume that N_S is several times larger than N_L (see footnote 10). Also, in the numerical example presented in the appendix, the functional form chosen for *v(m)* implies that $p_1^{Small} - p_{11} > p_1^{Large} - p_{11} - p_{21}$.

costs. Thus, the level of *U* observed in equilibrium is necessarily less than or equal to the level observed when costs are zero. Only the highest quality titles are published.

Suppose $0 < c < c^*$. I assume that entry is profitable for values of *c* below some threshold level within this interval, and that the actual value of *c* is below this threshold. Furthermore, assume that entry is not profitable for any title unless one of the incumbent titles is displaced (this assumption simplifies the analysis; if entry is otherwise profitable for one or more titles, then bundling does not always increase profits). Suppose that titles are not bundled and that the aggregate quality of the potential entrants exceeds that of one of the incumbent's titles, i.e. $u_{11} + u_{21} > \sum_1^n u_E \geq u_{i1}$. Then entry will be successful and a (lower) value incumbent title will exit. As a consequence, each library enjoys a higher level of utility (increasing *U* always raises utility if prices satisfy (2)). However, if the monopolist bundles its titles, then displacement of the its bundle lowers utility since the entrant set is less valuable than the monopolist's bundle. Entry is blocked.

7. Final Remarks

The note models the pricing behavior of journal publishers in a portfolio demand environment. I show that a decline in distribution costs can result in an endogenous change in pricing strategies, namely a shift from non- discriminatory pricing (the "print regime") to price discrimination and possibly bundling (the "digital regime"). As described in the Appendix, this shift can improve aggregate consumer welfare since small budget libraries can afford to purchase more titles. However, in the digital environment, incumbent publishers may choose to bundle to deter entry and thus limit the welfare gains.

There are a variety of directions for future research. For example, I have assumed here that journal publishers cover their costs by collecting revenue from libraries. In response to the opportunities offered by the internet (and the entry-deterring effect of bundling by major publishers), new entrants have begun to adopt an "open access" business model in which online access is free, and revenues are generated by author fees and advertising.[9] It would be useful to endogenize pricing along these several dimensions of the journal market, and explore the implications for market evolution and welfare, e.g. should we expect both of these "business models" to coexist, or is it more likely that one will prove dominant? Which outcome is best , from the perspective of publishers, the scientific community, etc.? See McCabe and Snyder (2004) for an examination of some of these questions.

[9] In addition to the *Economics Bulletin*, other examples of this phenomenon include the Public Library of Science (plos.org), and Biomed Central (biomedcentral.com).

References

Bergstrom, T. C. (2001) "Free Labor for Costly Journals" *Journal of Economic Perspectives*, Fall.

Chuang, J., and M. Sirbu (1999) "Optimal Bundling Strategy for Digital Information Goods: Network Delivery of Articles and Subscriptions" *Information Economics and Policy* **11**, 147-176.

Fay, S., and J. K. Mackie-Mason (1999) "Competition Between Firms that Bundle Information Goods" University of Michigan working Paper.

Frazier, K. (2001) "The Librarians' Dilemma: Contemplating the Costs of the 'Big Deal' " *D-Lib Magazine* **7**(3), March.

Issman-Weit, E., and O. Shy (2002) "Pricing of Library Subscriptions with Applications to Scientific Journals" *Journal of Economics and Business*, **55**, 197-218.

Jeon, D. S., and D. Menicucci (2003) "Bundling Electronic Journals and Competition among Publishers" Universitat Pompeu Fabra working paper.

McCabe, M. J.(2002) "Journal Pricing and Mergers: A Portfolio Approach" *American Economic Review*, **92**(1), March, 259-269.

McCabe, M. J.(2003) "A Portfolio Model of Journal Pricing: Print v. Digital." Georgia Institute of Technology working paper.

McCabe, M. J., and C. Snyder (2004) "The Economics of Open Access Journals" Georgia Institute of Technology working paper.

Ordover, J. A., and R.D. Willig (1978) "On the Optimal Provision of Journals qua Sometimes Shared Goods" *American Economic Review, 68* (3), June, 324-338.

Phillips, O.R., and L .J. Phillips (2002) "The Market for Academic Journals" *Applied Economics* **34**, 39-48.

Appendix

A. Fractional Journal Purchases

JM are able to demonstrate that (2) is a unique equilibrium by allowing for the possibility of fractional journal purchases. This assumption is used in two ways. First, JM show that each publisher's profits are maximized if all of its titles exhibit the same u/p ratio. In some cases, this may require partial purchases of the lowest-quality title in the population (lemmas 2 and 3 in JM's proposition 1); note that full subscriptions are purchased for all other titles, i.e. $x_{ij} = 1$. Second, since (2) requires that *all* titles exhibit the same u/p ratio, if "high" prices are observed for one or more titles, libraries must be able to spend less on the deviating titles while increasing their purchases of monographs (lemma 4).

As I indicated in footnote 4, libraries do have the option to purchase individual journal articles. Typically, the corresponding prices are higher than implied by the journal subscription price. Although this fact is closest in spirit to JM's second use of the fractional assumption, there is nothing in their proposition 1 that rules out a high price in the first case. In the current application, it is easy to see that use of the fractional assumption in the print case introduces no complications. Any article prices higher than implied by the journal subscription price satisfy the requirements of JM's proposition. However, in the digital, bundled case, the threat of entry requires an additional condition. Specifically, prices for digital articles must be set so that, *in equilibrium*, libraries prefer to purchase a publisher's bundle rather than substituting the entrant titles and a subset of the bundle's articles.

B. A Numerical Example

Consider the following numerical example, in which a monopoly publisher sells two titles to small and large budget libraries. Let N_S=1000, N_L=250, M_S=10, M_L=25, F=\$600, c = \$2 or 0, v(m) = $M_Z \cdot \ln(m)$, and $u_{11} = 20$ and $u_{21} = 10$.[10] Initially, entry is not feasible. With these parameter values, the monopolist's profit-maximizing strategy, subject to the constraint of no price discrimination, involves setting prices so that title 1($u_{11} = 20$) is purchased by all libraries and title 2 ($u_{21} = 10$) is bought only by the largest budget libraries. The cost threshold defined by (7) equals \$1.27. Suppose c=\$2. In the unbundled, non-discriminatory print equilibrium, the prices (profits) for titles 1 and 2 are \$6.67 (\$5233) and \$5.24 (\$210), respectively. In the corresponding digital case (with price discrimination and bundling), the monopolist total profits are less (\$4709). Bundle prices for the small and large budget libraries equal \$7.5 and \$13.64, respectively. If c is

[10] The relative size of the budgets and the numbers of small and large budget libraries were chosen to resemble the distribution of the world's largest research libraries (the absolute size of the budgets are much smaller due to the small number of titles in the example). For example, using 1998 the U.S. National Center for Education Statistics' data on library budgets for serial titles, I calculated the mean value of the 50 largest budgets (\$4.5 million), and of the next 200 largest budgets (\$1.7 million). In 1998, these 250 libraries spent more than twice as much on serials (\$568 million) as the remaining 2500 libraries that reported spending more than \$1000 on serials (a total of \$254 million).

lowered to zero, duopolist profits for the digital case equals $9709, and $8443 in the print regime. Thus, the drop in marginal costs leads to a switch in the preferred pricing strategy. This switch also increases aggregate library utility. Despite their fixed budgets, (gross) utility for each small budget library increases about 53% because they now purchase all active titles; utility for the larger libraries declines about 3% because their cost of purchasing all titles increases about 14%; monograph expenditures decline by 25% and 13%, respectively, for the small and large libraries.

Now suppose that entry is feasible and that the set of entrants consists of 5 titles, each with a utility value of $2+\epsilon$ where $1 >> \epsilon > 0$. Given these parameter values, entry is not profitable in the scenarios described above; however, when c=0, if the incumbents did not bundle in the digital regime, then title 2 would be displaced (since the aggregate utility value of the entrants exceeds the value of this title).