Competition in a Media Market:
The Case of Magazines[*]

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Abstract

This study investigates whether the Japanese magazine market in which resale price maintenance is a common marketing practice, is competitive or cooperative, explicitly incorporating the two-sidedness of the market into the analytical framework. First, the demand models on the reader side and the advertiser side are estimated using the unique panel data of the Japanese magazines from 1992 to 2007. Using the estimated parameters, the price-cost margins on reader and advertiser sides under alternative supply models, competition or cooperation on each side of the market, are computed. After that, we perform non-nested statistical tests to select the supply model which has the best fit to the data. The empirical results show that the model of cooperation on reader side and competition on advertiser side has a better fit to the data than other alternative supply models.

Keywords: indirect network effect; media industry; resale price maintenance; two-sided market.
JEL Classifications: L14; L42; L82.

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1. Introduction

Resale price maintenance (RPM) has been at the heart of the recent debates in competition policy.[1] According to theoretical studies, RPM has pro-competitive effects, such as eliminating double marginalization and free-riding, as is the case of other vertical restraints.[2] On the other hand, RPM may facilitate cooperation among firms. For example, Jullien and Rey (2007) theoretically show that, increasing price transparency among firms, RPM can facilitate collusion and reduce total welfare when firms adopt it. Rey and Vergé (2010) point out another effect of RPM facilitating cooperative behavior among manufactures. They develop the model in which rival manufactures distribute their products through the same competing retailers, and show that RPM limits the competition at both levels (that is, manufactures and retailers), and it can generate industry-wide monopoly pricing. Therefore, competitive effects of RPM in actual cases must be empirically examined on case-by-case basis. However, the number of empirical works is relatively small.[3]

This study investigates whether the Japanese magazine market in which RPM is a common marketing practice, is competitive or cooperative. The Japanese Antimonopoly Act (AMA) prohibits RPM in principle except for very special cases therefore RPM is nearly per-se-illegal in Japan.[4] However, the exceptions are copyrighted products, such as, books, magazines, newspapers, gramophone records, pre-recorded music cassette tapes, and pre-recorded music compact discs. RPM of these cultural products are exempted from the provisions of the AMA.[5] According to JFTC

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[1] In Leegin Creative Leather Products, Inc. v. PSKS, Inc. (127 S. Ct. 2705 (2007)), the US Supreme Court overturned the per-se-illegal rule in Dr. Mills Medical Co. v. John D. Park & Sons Co. (220 U.S. 373 (1911)) against the (minimum) resale price maintenance (RPM), and the Court declare that both of the pro- and anti-competitive effects of RPM must be evaluated under the rule-of-reason basis. For more details, see Graglia (2008), Komenda (2008), Doty (2008), and Warren (2008).

[2] See, for example, Motta (2004) and Rey and Vergé (2008).

[3] For example, Bonnet and Dubois (2010), Fishwick (2008), Gilligan (1986), Hersch (1994), Ippolito and Overstreet (1996), and Ornstein and Hanssens (1987).

[4] After the amendment of the Antimonopoly Act (AMA) in 2009, a surcharge duty is imposed on a company repeatedly engaged in RPM in Japan. For more detail discussions about the enforcement on RPM by the JFTC, please refer Inoume (2007).

[5] The Article 23-(4) of the AMA provides that the provisions of the AMA shall not apply to legitimate acts performed by an entrepreneur who publishes copyrighted works or an entrepreneur who sells such published copyrighted works, in order to fix and maintain the resale price thereof with another entrepreneur who purchases such works. The JFTC has publicly announced that copyrighted works of the Article 23-(4) are above six products (Inoue (2007)).

(2008), in practice, almost all publishers adopt RPM in transaction of magazines: the Japanese magazine market is an interesting case example for empirically investigating the effects of PRM on market competition.

This study also pays attention to the nature of the magazine market: two-sidedness. As pointed out by Evans (2003), the business model of magazine publication is a typical example of platform businesses, such as internet search engine (e.g. Google) and social networking services (e.g. Facebook), recently getting much attention from practitioners as well as scholars. As is the case of other medium, magazines internalize the indirect network effects between readers and advertisers: publishers sell readers' eye balls to advertisers. That is, advertisers prefer a magazine with large circulations. Kaiser and Song (2009), an empirical study on the German magazine market, reveal that readers in many magazine segments appreciate advertising, that is, they tend to prefer magazines with large advertisement, and they suggests that indirect network effects play important role in magazine markets. If the indirect network effects from the reader side to the advertiser side are sufficiently large, publishers have an incentive to lower cover prices. However, the vertical structure of the industry may cause similar inefficiency to double-marginalization because wholesalers and book stores do not internalize the indirect network effects in their optimization. Therefore, RPM may resolve inefficiency inherent in the magazine market.

The analytical framework of this study depends on the empirical literatures in two different fields: empirical studies of two-sided market and empirical studies of vertical structure between manufactures and retailers. First, because the magazine market is potentially two-sided, following Argentesi and Filistrucchi (2007), Filistrucchi, et al. (2011), Song (2011), and Rysman (2004), the demand models on both sides of the market (reader and advertiser) are estimated with the unique panel data of the Japanese magazines from 1992 to 2007, explicitly incorporating the indirect network effects.[6] Then, utilizing the empirical frameworks of Bonnet and Dubois (2010) and Villas-Boas (2007), we test whether the Japanese magazine market is competitive or cooperative, given the fact that most publishers apply RPM.[7] More concretely, using the estimated demand

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[6] Argentesi and Ivaldi (2007) for the Italian magazine market; Argentesi and Filistrucchi (2007) and Filistrucchi, et al. (2011) for the Italian news paper market; Clements and Ohashi (2005), and Corts and Lederman (2009) for the US video game market; Dubois, et al. (2007) for the French academic journal market; Kaiser and Wright (2006), Kaiser and Song (2009), and Song (2011) for the German magazine market; Ohashi (2003) for the US VCR market; Rysman (2004) for the US yellow page market; Wilbur (2008) for the US television market. Armstrong (2006) and Rochet and Tirole (2008) are theoretically studies the pricing behavior in the two-sided market.

[7] Bonnet and Dubois (2010) for the French bottled water market; Brenkers and Verboven (2006) for the European car market; Sudihir (2001) for in the yogurt and peanut butter market; and Villas-Boas

parameters, the sets of price-cost margins on both sides of the market under alternative supply models, competition or cooperation, are computed. After that, we perform non-nested statistical tests in order to select the supply model which has the best fit to the data.

The estimation results of reader demand reveals that the indirect network effects from the advertiser side to the reader side and the effects from the reader side to the advertiser side are positive and crucial in the magazine choice behavior of readers and advertisers. Moreover, the results of statistical tests of selecting supply models show that the model of cooperation on reader side and competition on advertiser side has a better fit to the data than other supply models. Therefore, in the Japanese magazine market, publishers were cooperative on reader side, that is, jointly maximized the total industry profit from magazine sales, but, on the advertiser side, they competed with each other. To the authors' knowledge, this study is the first empirical work directly testing the relationship between RPM and market competition in a media market by utilizing a structural approach.

The paper is organized as follows: the second section briefly describes the Japanese magazine market, paying special attentions to the distribution system. In the third and fourth sections, the models of demand and supply sides are explained, respectively. In the fifth section, the test of selecting alternative supply models is described. The sixth section describes the data and variable construction. The seventh section provides the empirical results. Finally, the concluding remarks are presented in the eighth section.

2. The Japanese magazine market

2.1 Overview

According to RIP (2009), the Japanese magazine market started to shrink after successful growth until the mid-90s (see Figure 1). The total circulation of magazines reached its peak in 1997. After then, the total circulation of magazines constantly decreased at the yearly rate of −2.6% on average (−1.9% for monthly magazines and −3.9% for weekly magazines, respectively). In the end, the total circulation in 2008 decreased to 71.67% of the peak (76.90% for monthly magazines and 62.47% for weekly magazines, respectively).

= Figure 1 =

RIP (2008) explains the decline of the market by several factors. The first one is the increasing competition with other medium, especially, the development of the Internet. The second is a decrease of points of sales due to the shutdown of small and medium size bookstores. The third

(2007) for the US yogurt market.

factor is the aging of the Japanese society: older people tend to not purchase magazines.[8]

Despite of the market contraction, the average price of magazines increased even after 1997. The average increasing rate is 1.1% annual basis (0.6% for monthly magazines and 1.8% for monthly magazines, respectively), and the average price of 2008 was 11.92% higher than the average price of 1997 (8.01% for monthly magazines and 20.91% for weekly magazines, respectively). RIP (2009) explains the price increase by the surge of material prices. In addition, the increase of publishing magazines with *Furoku*, supplemental items, was likely to be a source of the price increase.

Advertisement in magazines shared a very small part of advertisement in mass-medium, which accounted for about 60% of total advertisement expenditure in 2005, including medium other than mass-medium, such as direct mails, outdoor displays, the Internet, and so on. Generally, advertising agencies are said to charge about 10% to 20% commission of advertising prices.[9]

Figure 2 presents the several series of price indices: the solid line is the hedonic cover price index, and the dashed line is the hedonic advertising price index. As is the case of Figure 1, prices have been increasing even in the market contraction phase, that is, after 1998. On the other hand, interestingly, the input prices, such as papers or inks, decreased after the late 90s.

= Figure 2 =

2.2 Production

The production and distribution system of books and magazines in Japan consists of three vertically related different sectors, that is, publishing, wholesale, and retailing.[10] The number of new book title and the number of magazine titles are 77.417 and 3,644, respectively, in 2007. However, more than three quarters of firms published ten items or less. Table 1 reports the number of publishers. The number of publishers increased from 4,309 in 1990 to 4,612 in 1997. After that, along with the market evolution, the number gradually decreased and it was 4,055 in 2007. On the other hand, the

[8] For example, according to JMPA (2009), the ratios of people over 65 years old within readers of top 3 weekly general magazines, *Shukan Gendai*, *Shukan Shincho*, and *Shukan Bunshun*, are 3.3%, 12.6%, and 6.9%, respectively.

[9] The Japanese advertising industry consist of several large firms and many small firms. According to KIFA (2008), the number of establishments engaged in advertisement business is 9,370 in 2006. The ratio of the total revenue of the largest five advertising agencies to the total advertising expenditure of the Japanese companies in 2005 is 49%, and the ratio of the largest thirty firms is 65%, respectively.

[10] This subsection depends on JFTC (2008), JSPS (2010), KIFA (2008), RIP (1998-2009).

number of magazine publishers was somewhat stable compared to the total number of publishers, and the number of magazine titles increased during the period from 1997 to 2007.

Among them, 95 publishers were the members of the Japan Magazine Publishers Association (JMPA) in 2012. According to its website, JMPA is the only organization for magazine publishing companies in Japan and over 80% of magazines circulation and sales in Japan assumes the member companies.[11]

= Table 1 =

2.3 Distribution

There are various distribution channels of books and magazines to consumers, but publishers distribute about 70% of books and 80% of magazines using wholesalers. The wholesale sector is highly concentrated. The number of book and magazine wholesalers, who were the members of the Japan Publication Wholesalers Association (JPWA) in 2006, is about thirty. The market share of the largest two firms accounted for about 60%, and that of the largest three firms was 84% in 2006, respectively. The ratio shows an upward tendency. Especially, the large two wholesalers regularly have transacted with very large numbers of publishers and retailers: more than 2,500 publishers and more than 10,000 bookstores.

On the other hand, the retail sector was fragmented. The number of bookstores was 34,233 establishments in 2004, and the more than 80% of them had a selling floor space of 250m^2 or less. The large sixteen bookstore chains owned about 2,000 establishments in 2006, and their sales accounted for about 30% of the total sales of books and magazines. The convenience stores also sell books and magazines, and they shared about 22% of transactions through wholesalers. In addition, the shopping of books and magazines via the Internet had been increasing among the Japanese consumers: the estimated market size of online bookstores was about 72 billion JPY in 2006.

About 30% of books and the most of magazines (about 90%) were sold on consignment, that is, publishers distributed products to retailers through a wholesaler under the contracts that they must repurchase dead stocks after a specified period passes. Retailers generally sold books and magazines on RPM contracts with publishers. That is, RPM is a common marketing practice of publishers. The margin for distribution sector in cover price is said to be 30% to 34%: 8% to 10% for wholesalers and 22% to 24% for retailers, respectively.

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[11] The aim and role of JMPA are to progress and promote of culture through publishing enterprise, to contribute societal development, to ensure a free press and expression, and to help a sound development of magazine publication.

3. Demand

3.1 Reader

Following Argentesi and Filstrucchi (2007), Argentesi and Ivaldi (2007), Dubois, et al. (2007), and Rysman (2004), we utilize a nested logit framework in order to model the consumers' choice behavior of magazines.

Magazines are grouped into $G + 1$ exhaustive and exclusive magazine categories: category g (= 1, 2, …, G) consists of J_{gt} magazines in year t (= 1, 2, …, T), and category 0 only consists of not-purchasing any magazine (that is, one chooses an outside alternative media). It is assumed that consumer i (= 1, 2, …, N_t) in year t purchase one of magazines, or does not purchase any magazine: there are $\Sigma_g J_{gt} + 1$ alternative options for a consumer. The utility attained by consumer i in market t from purchasing magazine j is as follows:

(1) $$v_{ijt}^{x} = \alpha \ln(p_{jt}) + \beta \ln(a_{jt}) + z_{jt}^{x}\gamma + \xi_{jt}^{x} + \varsigma_{it|g}(\sigma) + (1-\sigma)\varepsilon_{ijt}^{x},$$

where p_{jt} and a_{jt} is the cover price of magazine j and the total amount of advertising in magazine j in year t, respectively. z^{x}_{jt} and ξ^{x}_{jt} are observable and unobservable magazine characteristics. We assume that ξ^{x}_{jt} is a random variable with zero mean.

On the other hand, the utility from not purchasing any magazine is as follows:

(2) $$v_{i0t}^{x} = \delta_{0t}^{x} + \varsigma_{it|0}(\sigma) + (1-\sigma)\varepsilon_{i0t}^{x},$$

where δ^{x}_{0t} is normalized to zero. $\zeta_{it|g}$ is an unobservable variable representing i's preference for all magazines, while ε^{x}_{ijt} is an unobservable random variable representing i's preference for specific magazine j. ε^{x}_{ijt} is assumed to be distributed the Type I extreme value and $\zeta_{it|g}$ is distributed such that the sum of the last two terms is also distributed the Type I extreme value.

The difference between the ordinary nested logit model and that of this study is that the total amount of advertising in each magazine may affects the reader demand of that magazine. If advertising in magazines is informative and attractive for readers, β should be positive. However, if not, β will be zero, or even negative.

Berry (1994) shows that under the nested logit assumption we can express the log of the odds ratio between the probability of purchasing magazine j and that of purchasing no magazine as a linear function of price, total advertising, observable and unobservable magazine characteristics and conditional market share of magazine j within consumers who purchase one of available magazines, as follows:

(3) $$\ln(s_{jt}^{x}) - \ln(s_{0t}^{x}) = \alpha \ln(p_{jt}) + \beta \ln(a_{jt}) + z_{jt}^{x}\gamma + \sigma \ln(s_{jt|g}^{x}) + \xi_{jt}^{x},$$

where $s_{jt|g}$ is the market share or choice probability of magazine j conditional on purchasing a magazine in group g. α, β, γ, and σ are parameters to be estimated.[12]

[12] The formulae of cover price and advertising elasticities of reader demand are presented in

3.2 Advertiser

We utilize a simple logit specification for advertising demand model. As Argentesi and Filistrucchi (2007) stated, this specification requires two somewhat restrictive assumptions. The first assumption is that potential advertisers have only single unit of demand for advertising. This assumption does not support multi-homing of advertisers. The second assumption is that there is no congestion among advertisers for purchasing an advertising slot of the same magazine. These are practical assumptions because we cannot observe advertisers' multi-homing behavior, and capacity constraints of respective magazines' advertising slot.

It is assumed that advertiser k chooses one of J_t (= $\Sigma_g J_{gt}$) magazines for an advertising outlet, or does not choose any magazine (that is, one chooses an outside alternative media): there are $J_t + 1$ alternative options for an advertiser. The utility attained by advertiser k (= 1, 2, …, K_t) in year t from purchasing advertising slot in magazine j is as follows:

(4) $$v^a_{jkt} = \rho \ln(q_{jt}) + \lambda \ln(x_{jt}) + z^a_{jt}\theta + \xi^a_{jt} + \varepsilon^a_{jkt},$$

where q_{jt} and x_{jt} is an price of advertising in magazine j and total circulation of magazine j in year t, respectively. z^a_{jt} and ξ^a_{jt} are observable and unobservable magazine characteristics. We assume that ξ^a_{jt} is a random variable with zero mean.

On the other hand, the utility from not purchasing any magazine is as follows:

(5) $$v^a_{i0t} = \delta^a_{0t} + \varepsilon^a_{i0t},$$

where δ^a_{0t} is normalized to zero. ε^a_{jkt} is an unobservable random variable representing i's preference for specific magazine j, and it is assumed to be distributed the Type I extreme value.

As is the case of the reader side, the difference between the ordinary logit model and that of this study is that the total circulation of each magazine may affects the advertising demand. If circulation of magazines is attractive for advertisers, γ should be positive. However, if not, γ will be zero, or even negative.

The log of the odds ratio between the probability of purchasing an advertising slot of magazine j and that of purchasing no advertising slot as a linear function of advertising price, observable and unobservable magazine characteristics, as follows:

(6) $$\ln(s^a_{jt}) - \ln(s^a_{0t}) = \eta \ln(q_{jt}) + \lambda \ln(x_{jt}) + z^a_{jt}\theta + \xi^a_{jt},$$

where η, β, and θ are parameters to be estimated.[13]

Appendix A.

[13] The formulae of advertising price and circulation elasticities of advertiser demand are reported in Appendix A.

4. Publisher

4.1 Reader side

Based on the fact that RPM is a lawful and common marketing practice on the reader side of the Japanese magazine market, following Bonnet and Dubois (2010) and Rey and Vergé (2010), this study considers the case of RPM with two-part tariff contract between publishers and retailers.

Publishers assumed to propose take-it-or-leave-it offers of two-part contracts to retailers. These contracts are public information and consist of franchise fees, wholesale prices, and retail prices. It is assumed that if any of those offers is rejected, all contracts are refused, and the magazine market breaks down. Otherwise, if all publishers' offers are accepted, retailers simultaneously set retail prices as imposed under RPM contracts for all the magazines, and payments made according to the contracts.

Let N_t is the potential market size on reader side, and write the reader demand as $x_{jt}(p_t, a_t) = s^x_{jt}(p_t, a_t)N_t$, where p_t and q_t are the vectors of cover price and advertising price. It is assumed that there are R retailers (r =1, 2, …, R), and the profit function of retailer r is expressed as follows:

(7) $$\pi_{rt} = \sum_{j \in J_{rt}} [(p_{jt} - w^x_{jt}) x^r_{jt}(p_t, q_t) - F^r_{jt}],$$

where w^x_{jt} is the wholesale price of magazine j, x^r_{jt} is the demand for magazine j at retailer r, and $x_{jt} = \Sigma_r x^r_{jt}$. F^r_{jt} is the franchise fee paid by the retailer to the publisher for selling magazine j. J_{rt} is the set of magazines sold by r. In this study, the retailers' marginal costs are assumed to be zero.

On the other hand, the profit of publisher f from the reader side is expressed as follows:

(8) $$\sum_{j \in J_{ft}} [(w^x_{jt} - c^x_{jt}) x_{jt}(p_t, q_t) + F^x_{jt}],$$

where F^x_{jt} is the total franchise fee received by the publisher for selling magazine j, and $F^x_{jt} = \Sigma_r F^r_{jt}$. c^x_{jt} represents the marginal cost of publishing magazine j on reader side.

Publishers maximize the (total) profits (from both sides of the market) subject to the retailers' participation constraints:

(9) $$\pi_{rt} \geq \underline{\pi}_{rt} = 0$$

that is, the retail profit must be greater than or equal to the value of outside option, which is normalized to zero: $\underline{\pi}_{rt} = 0$. As Bonnet and Dubois (2010), and Rey and Vergé (2010) stated, participation constraints are clearly binding because otherwise publishers could increase the franchise fees given those of other publishers. Then, the profit of publisher f from the reader side becomes as follows:

(10) $$\sum_{j \in J_{ft}} \pi^x_{jt}(p_t, q_t \mid c^x_{jt}) + \sum_{j \notin J_{ft}} (p_{jt} - w^x_{jt}) x_{jt}(p_t, q_t) - \sum_{j \notin J_{ft}} F^x_{jt}$$

where

(11) $$\pi^x_{jt}(p_t, q_t \mid c^x_{jt}) = (p_{jt} - c^x_{jt})x_{jt}(p_t, q_t),$$

that is, the total margin of the magazine *j* from the reader side. Thus, publisher *f* fully internalizes entire margins of own magazines, and partially internalizes the retailer's margins of rivals' magazines on the reader side. In addition, the last term of the right hand side is a constant for publisher *f*.

Bonnet and Dubois (2010), and Rey and Vergé (2010) shows that, if it is allowed, imposing cover prices is always a dominant strategy for publishers. Because wholesale prices have no direct effect on publishers' own profit but only on rivals' profits, wholesale prices a strategic role for each publisher. Therefore, this generates continuum of equilibria with one for each wholesale price vector that affects the rivals' strategic behaviors. In this study, we consider two polar cases: publishers make their wholesale and retail prices to be equal ($w^x_{jt} = p_{jt}$), that is, they squeeze retailers' margins, or publishers set their wholesale prices to their marginal costs on the reader side ($w^x_{jt} = c^x_{jt}$).

In the first case, that is, $w^x_{jt} = p_{jt}$, the second term of (10) equals zero, and the profit of publisher *f* from the reader side is the sum of the margins (on the reader side) of own magazines (J_{ft}) as follows:

(12) $$\sum_{j \in J_{ft}} \pi^x_{jt}(p_t, q_t \mid c^x_{jt})$$

Because of the retailers' participation constraints, $F^x_{jt} = F^r_{jt} = 0$, for all *j*. Therefore, this is the case of oligopolistic competition on the reader side.

On the other hand, in the second case, $w^x_{jt} = c^x_{jt}$, the profit from the reader side is the sum of the margins of all magazines in the market (J_t) as follows:

(13) $$\sum_{j \in J_t} \pi^x_{jt}(p_t, q_t \mid c^x_{jt}) - \sum_{j \notin J_{ft}} F^x_{jt}$$

Because the last term is a constant for publisher *f*, this is the industry-profit maximization, or the case of cooperation on the reader side. In this case, RPM eliminates the upstream and downstream competition on the reader side of the market.

4.2 Advertiser side

The advertiser side is assumed to be vertically integrated. Let K_t are the potential market size on the advertiser side, and write the advertising demand as $a_{jt}(q_t, x_t) = s^a_{jt}(q_t, x_t)K_t$. Then, the publisher's margin of magazine *j* on the advertiser side is a function of cover prices and advertising prices, as follows:

(14) $$\pi^a_{jt}(p_t, q_t \mid c^a_{jt}) = (q_{jt} - c^a_{jt})a_{jt}(p_t, q_t).$$

where c^a_{jt} represents the marginal cost of publishing *j* on the advertiser side.

We consider two different market configurations on the advertiser side. One in which the market is oligopolistically competitive, that is, the profit of publisher *f* from the advertiser side is the sum of the margins (on the advertiser side) of own magazines (J_{ft}):

(15) $$\sum_{j \in J_{ft}} \pi^{a}_{jt}(p_t, q_t \mid c^{a}_{jt})$$

and one in which the market is cooperative (joint profit maximization), and the profit of publisher *f* from the advertiser side is the sum of the margins of all magazines in the market (J_t):

(16) $$\sum_{j \in J_{t}} \pi^{a}_{jt}(p_t, q_t \mid c^{a}_{jt})$$

4.3 Supply scenarios

As explained above, we consider two different market configurations on both sides of the market, that is, competition and cooperation. In the end, we have the following four supply scenarios: (1) competition on both sides of the market, (2) competitive reader side and cooperative advertiser side, (3) cooperative reader side and competitive advertiser side, and (4) cooperation on both sides of the market.

= Table 2 =

Model 1: competition on both sides of the market

In this model, publishers oligopolistically compete on both sides of the market, and set their cover prices and advertising prices as solutions for the following optimization problem, as follows:

(17) $$(p_{jt}, q_{jt})_{j \in J_{ft}} = \arg\max \sum_{j \in J_{ft}} \pi^{x}_{jt}(p_t, q_t \mid c^{x}_{jt}) + \sum_{j \in J_{ft}} \pi^{a}_{jt}(p_t, q_t \mid c^{a}_{jt}),$$

Model 2: competitive reader side & cooperative advertiser side

In this model, publishers make their wholesale and retail prices to equal ($w^{x}_{jt} = p_{jt}$), that is, the reader side is competitive, but the advertiser side is cooperative. Thus, the program for publisher *f* is as follows:

(18) $$(p_{jt}, q_{jt})_{j \in J_{ft}} = \arg\max \sum_{j \in J_{ft}} \pi^{x}_{jt}(p_t, q_t \mid c^{x}_{jt}) + \sum_{j \in J_{t}} \pi^{a}_{jt}(p_t, q_t \mid c^{a}_{jt}).$$

Therefore, publishers set their cover prices and advertising prices so as to maximize the total industry-joint profits on the reader side, but the profit of their own magazines on the advertiser side.

Model 3: cooperative reader side & competitive advertiser side

In this model, publishers set their wholesale prices to their marginal costs ($w^{x}_{jt} = c^{x}_{jt}$), and the advertiser side is oligopolistically competitive. Then, the program for publisher *f* is:

(19) $$(p_{jt}, q_{jt})_{j \in J_{ft}} = \arg\max \sum_{j \in J_t} \pi^x_{jt}(p_t, q_t \mid c^x_{jt}) + \sum_{j \in J_{ft}} \pi^a_{jt}(p_t, q_t \mid c^a_{jt}).$$

Therefore, publishers set their cover prices and advertising prices so as to maximize the total industry-joint profits on the reader side, but the profit of their own magazines from the advertiser side.

Model 4: cooperation on both sides of the market

In this model, publishers jointly maximize the industry-joint profits, and set their cover prices and advertising prices as solutions for the following program:

(20) $$(p_{jt}, q_{jt})_{j \in J_{ft}} = \arg\max \sum_{j \in J_t} \pi^x_{jt}(p_t, q_t \mid c^x_{jt}) + \sum_{j \in J_t} \pi^a_{jt}(p_t, q_t \mid c^a_{jt}),$$

4.4 Pricing equations

Following Filistrucchi, et al. (2011) and Song (2011), we derive the pricing equation under the hypothesis that publishers are competing in a pricing game on both sides of the market. Under each assumption on the market configuration on respective sides of the market, we can derive the pricing equations and the corresponding formulae for the markups on each side of the market.

With given other publishers' behavior, each publisher sets the cover prices and the advertising prices which maximize its total profits. For each magazine *j*, there are two first-order conditions, that is, the pricing equations on both sides of the market under Model *h* (= 1, 2, 3, and 4), as follows:

(21) $$x_{jt} + \sum_k I^{xp(h)}_{jkt}(p_{kt} - c^{x(h)}_{kt})\frac{\partial x_{kt}}{\partial p_{jt}} + \sum_k I^{ap(h)}_{jkt}(q_{kt} - c^{a(h)}_{kt})\frac{\partial a_{kt}}{\partial p_{jt}} = 0$$

and,

(22) $$\sum_k I^{xq(h)}_{jkt}(p_{kt} - c^{x(h)}_{kt})\frac{\partial x_{kt}}{\partial q_{jt}} + a_j + \sum_k I^{aq(h)}_{jkt}(q_{kt} - c^{a(h)}_{kt})\frac{\partial a_{kt}}{\partial q_{jt}} = 0$$

where $I^{xp(h)}_{jkt}$ ($I^{xq(h)}_{jkt}$, $I^{ap(h)}_{jkt}$, and $I^{aq(h)}_{jkt}$) is an index which equals one if a publisher, under Model *h*, takes account the margin from the reader side (advertiser side, reader side, and advertiser side) of magazine *k* in the search of optimal cover price (advertising price, cover price, and advertising price) of magazine *j* in year *t*, otherwise zero.

The system of equations can be solved for the sets of price-cost margins ($pcm^{x(h)}_t = p_t - c^{x(h)}_t$ and $pcm^{a(h)}_t = p_t - c^{a(h)}_t$), in matrix form as follows:

(23) $$\begin{pmatrix} pcm^{x(h)}_t \\ pcm^{a(h)}_t \end{pmatrix} = \begin{pmatrix} p_t - c^{x(h)}_t \\ q_t - c^{a(h)}_t \end{pmatrix} = -\left[\begin{pmatrix} D^{xp}_t & D^{ap}_t \\ D^{xq}_t & D^{aq}_t \end{pmatrix} \circ \begin{pmatrix} I^{xp(h)}_t & I^{ap(h)}_t \\ I^{xq(h)}_t & I^{qa(h)}_t \end{pmatrix}\right]^{-1} \begin{pmatrix} x_t \\ a_t \end{pmatrix}$$

where the operator ○ denotes the element-by-element multiplication of two matrices. x_t and a_t are the vectors of magazine circulation and advertisement. The (j, k) element of D^{xp}_t (D^{xq}_t, D^{ap}_t, and D^{aq}_t) is the marginal effect of cover price of j on the magazine sales of k, $\partial x_{kt}/\partial p_{jt}$ (the marginal effect of advertising price on the magazine sales, $\partial x_{kt}/\partial q_{jt}$, the marginal effect of cover price on the advertisement, $\partial a_{kt}/\partial p_{jt}$, and the effect of advertising price on advertisement, $\partial a_{kt}/\partial q_{jt}$).

$I^{xp(h)}_t$ ($I^{xq(h)}_t$, $I^{ap(h)}_t$, and $I^{aq(h)}_t$) is a market configuration matrix, which (j, k) element equals $I^{xp(h)}_{jkt}$ ($I^{xq(h)}_{jkt}$, $I^{ap(h)}_{jkt}$, and $I^{aq(h)}_{jkt}$), respectively. As described above, we consider oligopolistic competition and cooperation on each side of the market. In the case of oligopolistic competition, the market configuration matrix is identical to the ownership matrix: the (j, k) element is one if magazines j and k are published by the same publisher, otherwise zero. One the other hand, in the case of cooperation, all publishers jointly maximize their total profit, therefore all elements of the configuration matrix equal one.

Following Filistrucchi (2011) and Song (2011), we estimate the marginal effects of cover prices and advertising prices on reader and advertiser demand using the implicit function theorem, as follows:

$$(24)\qquad \begin{pmatrix} D_t^{xp} & D_t^{ap} \\ D_t^{xq} & D_t^{aq} \end{pmatrix} = -\begin{pmatrix} \Delta_t & O \\ O & \Omega_t \end{pmatrix}\begin{pmatrix} -E & \mathrm{B}_t \\ \Gamma_t & -E \end{pmatrix}^{-1},$$

where E is an identity matrix and O is a null matrix, $\Delta_{jkt} = \partial x_{kt}/\partial p_{jt}$, $\Omega_{jkt} = \partial a_{kt}/\partial q_{jt}$, $\mathrm{B}_{jkt} = \partial a_{kt}/\partial x_{jt}$, and $\Gamma_{jkt} = \partial x_{kt}/\partial a_{jt}$, therefore, these values depend only on the estimable demand parameters.[14]

5. Test of alternative supply models

Following Bonnet and Dubois (2010) and Villas-Boas (2007), we test alternative models of the Japanese magazine market using the sets of our marginal cost estimates. For Model h, the marginal costs can be estimated as the differences between observed prices and the estimated price-cost margins. We specify the marginal cost functions as follows:

$$(25)\qquad \ln(p_{jt} - pcm_{jt}^{x(h)}) = \ln(c_{jt}^{x(h)}) = V_{jt}^{x}\kappa^{x(h)} + e_{jt}^{x(h)},$$

$$(26)\qquad \ln(q_{jt} - pcm_{jt}^{a(h)}) = \ln(c_{jt}^{a(h)}) = V_{jt}^{a}\kappa^{a(h)} + e_{jt}^{a(h)},$$

where $pcm^{x(h)}_{jt}$ and $pcm^{a(h)}_{jt}$ are the estimated price-cost margins for publishers on the reader side and the advertiser side under Model h. V^x_{jt} and V^a_{jt} are the matrices of exogenous cost shifters. In this study, we assume that cost shifters are identical on both sides, that is, $V^t_{jt} = V^a_{jt} = V_{jt}$, and, as cost shifters, we use magazine fixed effects, year dummies, and interactions of the wholesale price index (WPI) of paper, the WPI of ink, and the wage of print industry with the number of page multiplied by magazine size. $e^{x(h)}_{jt}$ and $e^{a(h)}_{jt}$ are the unobservable random shocks to the costs. With the

[14] For more detailed descriptions of these matrices under the demand model of this study, see Appendix B.

assumption that they have zero means, the parameters, $\kappa^{x(h)}$ and $\kappa^{a(h)}$, are consistently identified and estimated.[15]

The test is to infer which cost equations have the best statistical fit given the observed cost shifters. For any two models *h* and *h*', we test one model against the other. In order to simultaneously deal with both sides of the magazine market, we stack the two marginal cost equations. The OLS estimation of the stacked model is equivalent to the equation-by-equation OLS estimation of two marginal cost equations.[16] Therefore, we implement the following criterion function under Model *h*.

$$(27)\qquad \begin{aligned} \min_{\kappa^h} Q_n^h(\kappa^{x(h)}, \kappa^{a(h)}) &= \min_{\kappa^x} \frac{1}{n}\sum_t \sum_j [(e_{jt}^{x(h)})^2 + (e_{jt}^{a(h)})^2] \\ &= \min_{\kappa^x} \frac{1}{n}\sum_t \sum_j \{[\ln(c_{jt}^{x(h)}) - V_{jt}\kappa^{x(h)}]^2 + [\ln(c_{jt}^{a(h)}) - V_{jt}\kappa^{a(h)}]^2\} \end{aligned}$$

where *n* (= 2 * Σ_t J_t) is the sample size of the regression. Following Bonnet and Dubois (2010), we apply non-nested tests (Vuong (1989) and Rivers and Voung (2002)) in order to test which supply model statistically fits with observable cost shifters.

For any two competing models *h* and *h'*, the null hypothesis is that the two models are *asymptotically equivalent* when

$$(28)\qquad H_0: \lim_{n\to\infty} [Q_n^h(\overline{\kappa}^{x(h)}, \overline{\kappa}^{a(h)}) - Q_n^{h'}(\overline{\kappa}^{x(h')}, \overline{\kappa}^{a(h')})] = 0$$

where the criterion functions are evaluated at the estimated parameter values under each model. The first alternative hypothesis is that *h* is *asymptotically better* than *h'* when

$$(29)\qquad H_1: \lim_{n\to\infty} [Q_n^h(\overline{\kappa}^{x(h)}, \overline{\kappa}^{a(h)}) - Q_n^{h'}(\overline{\kappa}^{x(h')}, \overline{\kappa}^{a(h')})] < 0$$

The second alternative hypothesis is that *h'* is *asymptotically better* than *h* when

$$(30)\qquad H_2: \lim_{n\to\infty} [Q_n^h(\overline{\kappa}^{x(h)}, \overline{\kappa}^{a(h)}) - Q_n^{h'}(\overline{\kappa}^{x(h')}, \overline{\kappa}^{a(h')}))] > 0$$

The following test statistics proposed by Rivers and Vuong (2002) is defined as a difference of the sample lack-of-fit criteria (with normalization) between alternative models, *h* and *h*'.

$$(31)\qquad T_n = \frac{\sqrt{n}}{\sigma_n^{hh'}}[Q_n^h(\overline{\kappa}^{x(h)}, \overline{\kappa}^{a(h)}) - Q_n^{h'}(\overline{\kappa}^{x(h')}, \overline{\kappa}^{a(h')})]$$

Rivers and Vuong (2002) show that the asymptotic distribution of T_n statistic is a standard normal

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15 As Bonnet and Dubois (2010) pointed out, the estimation procedure, in which the demand model are separately estimated from the supply model, is efficient because it does not require the re-estimation of the demand model under different supply models.

16 With the assumption of identical cost shifters on both sides, the equation-by-equation OLS estimation of two marginal cost equations is as efficient as the SUR estimation.

distribution.[17] If α is the size of the test, and t_α and $t_{1-\alpha}$ denote the values of the inverse standard normal distribution evaluated at α and $1-\alpha$, H_0 is rejected in favor of H_1 if $T_n < t_\alpha$ and H_0 is rejected in favor of H_2 if $T_n > t_{1-\alpha}$.

6. Data and variables

6.1 Sources

Using the following data sources, we construct a panel data of the Japanese magazines from 1992 to 2007. The data about sales (average per issue), cover price, total page per issue, the frequency of publishing, and format (size) are obtained from JABC (1992−2007), which covers the period from January to December of each year. The data about advertising price and its advertisement size (whole page of the flip side of a cover) are taken from JMAA (1992−2007) surveyed in January of each year. Finally, the data about advertising shares in total pages by 13 categories from 1992 to 2007 are obtained from NARI (1993−2008).

The advantage of using JABC (1992−2007) is that its sales data does not include returned items from bookstores to publishers, while circulation does. That is, we can obtain the information about *true* sales volumes. On the other hand, the disadvantage is its small coverage. The total observations of this study are 1,875 magazines listed in JABC (1992−2007), but, the information about some of the magazines are not available in JMAA (1992−2007). In the end, the number of the observations is 1,543. Although the number of included magazines in the dataset ranges from 64 to 134 per year, and the coverage is somewhat small, popular magazines, such as, *Shukan Gendai*, *Shukan Shincho*, *Shukan Bunshun* (weekly general magazines), *Shukan Daiyamondo*, *Shukan Toyo-keizai* (weekly business/economic magazines), *shukan Josei*, *Josei Jishin*, *Josei sebun* (weekly women's magazines), *Can Cam*, *JJ*, *non no* (women's fashion magazines), are included in the samples.[18]

6.2 Variables

On the reader side, the potential market size of the reader side is set 100 million, and the dependent variable is the log of sales divided by the number of consumers who do not purchase any magazine, that is, the difference between the potential market size and the total sales of all magazines in each year. The dependent variable is regressed on conditional market share (log), cover price (log), advertising pages (log), contents pages (log), magazine fixed effects, and year dummies. The conditional market share of magazine j within genre g in year t is computed by dividing the sales by the total sales of genre g in year t.

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[17] $\sigma^{hh'}{}_j$ is the estimated value of the square root of the variance of the difference in lack-of-fit.

[18] For the details of the panel data structure, see Table 9 in Appendix C.

The advertising pages of magazine *j* within genre *g* are estimated by multiplying the total pages of *j* by the average advertising share in total pages of the genre *g*, obtained from NARI (1993−2008), and the contents pages are the difference between the total pages and the advertising pages.

On the advertiser side, the potential market size of the advertiser side is assumed to be 500 thousand pages. Because the total advertising pages of sample magazines is about 5,000 pages per year, this specification assumes that total advertisement in magazines account for 0.1 percent of total advertising market. The dependent variable is the log of the advertising pages divided by the difference between the potential market size and the total advertising pages of sample magazines in each year, which is an approximation to the size of advertisers who do not purchase any advertising slot in magazines. The dependent variable is regressed on the advertising price (log), sales (log), contents pages (log), the size of advertising, magazine fixed effects, and year dummies.

Finally, all price variables (cover price and price of advertising), the WPI of paper and ink and the wage of printing industry, which are used as instruments (explained below), are deflated by the general consumer price index (CPI: 2005 = 1.0).

6.3 Instruments

As is the case of previous related works, cover price and the conditional market share in the reader demand and the advertising price in the advertiser demand are endogenous and will be correlated with unobserved magazine qualities of both sides (ξ^x and ξ^a). In addition, the terms representing the indirect network effects between both sides of the market, that is, the number of advertising pages in the reader demand and sales in the advertiser demand, are also endogenous. Therefore, we need appropriate instruments. This study is in line with previous related works, and uses the function of observable characteristics of rivals and other cost sifters.

For the estimation of reader demand, the number of rival magazines, the average contents pages of rivals, the average number of issues per year among rivals, the average magazine size of rivals, the share of irregular size magazines in rivals within the same genre, are used as instruments. In addition, interactions of the WPI of paper and the WPI of ink, with the number of pages multiplied by magazine size, are also included. On the other hand, for the estimation of advertiser demand, we use the number of rivals within the same genre, interactions of the WPI of paper, the WPI of ink, and the wage of printing industry with the number of page multiplied by magazine size, as instruments.

Table 3 reports the descriptive statistics of regression variables for the expansion phase, 1992 to 1997, and the contraction phase, 1998 to 2007, as well as for the full sample. According to the table, although the advertising pages decreased from the expansion phase to contraction phase, the advertising price increased. Additionally, in the contraction phase, the magazines became smaller and be published less frequently, than the expansion phase. On the other hand, the size of advertising became larger.

= Table 3 =

7. Results

7.1 Reader demand

As is the case of Argentesi and Filistrucchi (2007), and Filistrucchi, et al. (2011), the reader demand and the advertiser demand are separately estimated. Table 4 reports the estimation results of reader demand function. The Hansen *J* statistics is 5.047 with the degree of freedom 4 (*p*-value = 0.283), and the null hypothesis of orthogonality is not rejected. Therefore, the endogeneity problem is not so serious in the present specification. The first stage regression results are also presented in the table, and the instruments work well.

The estimated coefficient of (log of) cover price is negative (−3.189) and the estimated coefficient of (log of) conditional market share is positive and less than unity (0.225), and both of them are statistically significant at 1% level, that is, these two parameters satisfy the conditions required by the consumer theory. In addition, the estimated coefficient of (log of) contents pages is positive (0.437) and statistically significant at 1% level too.

Finally, the estimated coefficient of (log of) advertising pages, that is, the indirect network effects from advertiser side to reader side is positive (0.332) and statistically significant at 1% level. This is same as the results of Kaiser and Song (2009) who show that, by analyzing the German magazine market, readers in many magazine segments appreciate advertising. Based on these results, the indirect network effects on the reader side from the advertiser side are important in the readers' choice of a magazine, and readers tend to prefer magazines with large advertisement.[19]

= Table 4 =

7.2 Advertiser demand

Table 5 reports the estimation results of advertiser demand function. The Hansen *J* statistics is 0.062 with the degree of freedom 1 (*p*-value = 0.805), and the null hypothesis of orthogonality is not rejected. Therefore, the endogeneity problem is not severe in this specification. The first stage regression results are also reported in the table, and the instruments work well.

The estimated coefficient of (log of) advertising price is negative (−5.319) and statistically

[19] In contrast to this result, Argentesi and Filistrucchi (2007) did not found any significant indirect network effects from advertiser side to reader side in the Italian newspaper market.

significant at 1% level, and it satisfies the theoretical requirement. In addition, the estimate for the size of advertising is positive (0.492) and significant at 1% level too. On the other hand, the coefficient of (log of) the contents pages is positive (0.159) but not significant. Therefore, contents pages are not important for advertisers.

Finally, the estimated coefficient of (log of) magazine sales, that is, the indirect network effects from reader side to advertiser side is positive (1.593) and statistically significant at 1% level. This is same as the results of related previous works: advertisers tend to prefer magazines with large sales volumes. Based on these results, the indirect network effects from the reader side to the advertiser side are crucial in the advertisers' choice of a magazine.

= Table 5 =

7.3 Marginal costs

Table 6 reports the median of estimated price cost margin ratio, and marginal cost on the reader side under different supply models by each year. Concerning the price cost margin ratio, the median price cost margin ratios are negative for Model 1 after 2004 and Model 3 after 1995. This means that, in those periods, more than half of the Japanese publishers run deficit on reader side by lowering cover prices, that is, the reader side was loss leader. For the marginal costs, the estimates are all positive in all models in whole sample period, and roughly speaking, the estimates under Model 3 are greater than other models: the estimated median values of 2007 are 768 JPY in Model 1, 614 JPY in Model 2, 1,031 JPY in Model 3, 691 JPY in Model 4, respectively.

= Table 6 =

Table 7 reports the median of estimated price cost margin ratio, and marginal cost on the advertiser side. The estimates of marginal cost are reported in thousand JPY. In contrast to the reader side, the median price cost margin ratios are positive. Therefore, more than half of the Japanese publishers made a profit on advertiser side, that is, the advertiser side was profit center. For the marginal costs, the estimates are all positive in all models for every year. The estimated marginal costs under Model 3 are greater than others: the estimated median values of 2007 are 2,322 thousand JPY in Model 1, 2,313 thousand JPY in Model 2, 2,330 thousand JPY in Model 3, and 2,315 thousand JPY, respectively.

= Table 7 =

7.4 Testing alternative supply models

The (log of) estimated marginal costs on both sides of the market under respective supply models are regressed on observable magazine cost shifters, that is, magazine fixed effects, year dummies, and interactions of the WPI of paper, the WPI of ink, and the wage of print industry with the number of page multiplied by magazine size.

The first panel of Table 8 reports the regression results of marginal costs on reader side under different supply models. The R squared of each estimated model is fairly high: about 0.945 in Model 1, 0.942 in Model 2, 0.943 in Model 3, and 0.946 in Model 4, respectively. The estimated coefficient of the WPI of paper is significant and positive, and the most of those of the WPI of ink and the wage of printing industry are significant, but negative. The latter results are somewhat difficult to understand: contrary to expected, the price of ink and wage were negatively correlated with marginal costs. The second panel of Table 8 is the results of marginal costs on advertiser side. The R squared of each model is also high: about 0.944 for all models. The estimated coefficient of the WPI of paper and the wage of printing industry is not statistically significant. On the other hand, that of the WPI of ink is statistically significant, but negative. The last result is also hard to interpret.

= Table 8 =

The first panel of Table 8 presents the Rivers and Vuong (2002) test statistics for pair wise comparisons of all alternative supply models. H_0: h is asymptotically equivalent to h', H_1: h is asymptotically better than h', and H_2: h' is asymptotically better than h. Again, for 5% level, H_0 is rejected in favor of H_1 if T_n is lower than −1.64 and that H_0 is rejected in favor of H_2 if T_n is greater than 1.64. To account for that each marginal cost estimates depend on the estimated demand parameters, the bootstrapped standard errors of test statistics with 500 replications are reported in parentheses.[20] The results show that, although the tests are not transitive, Model 3 of cooperation on reader side and competition on advertiser side has a better fit to the data than other alternative supply models: its column statistics are always positive and larger than 1.64, while the row statistics is negative and smaller than −1.64.

We perform the same tests for two subsamples: the market expansion phase from 1992 to 1997 and the contraction phase from 1998 and 2007. The test statistics are reported in the second and third panels of Table 9.[21] The results of these tests are almost same as those of the full sample: Model 3 has a better fit to the data than other alternative supply models.

[20] Following Bonnet and Dubois (2010), we bootstrapped the demand estimation step and computed the price cost margins and test statistics over replications.

[21] The regression results of marginal costs for subsamples are presented at Table 10 in Appendix D.

= Table 9 =

8. Concluding remarks

This study examines whether the Japanese magazine market in which resale price maintenance, suspected as a device facilitating collusion, is a common marketing practice, is competitive or cooperative, explicitly incorporating the two-sidedness of the market into the analytical framework. First, the demand models on the reader side and the advertiser side are estimated using the unique panel data of the Japanese magazines from 1992 to 2007. Using the estimated parameters, the sets of price-cost margins on both side of the market under alternative supply models, competition or cooperation, are computed. After that, we perform non-nested statistical tests in order to select the supply model which has the best fit to the data. The empirical results show that the model of cooperation on reader side and competition on advertiser side has a better fit to the data than other alternative supply models.

Therefore, in the Japanese magazine market, publishers were cooperative on reader side, that is, jointly maximized the total industry profit from magazine sales, but, on the advertiser side, they competed each other. Based on the fact that RPM is a common marketing practice in the Japanese magazine market, the empirical results may support the theoretical results of Rey and Vergé (2010), that is, RPM may facilitate cooperative behavior, that is, industry-joint profit maximization, among firms through common agencies.

Appendix A: Elasticities

The cover price and advertising elasticities of reader demand are computed as follows.

(a-1) $$Ex_{jkt}^{price} = \begin{cases} \dfrac{-\alpha}{1-\sigma}[\sigma s_{jt|g}^{x} + (1-\sigma)s_{jt}^{x}], & \text{if } j \neq k \in g, \\ -\alpha s_{jt}^{x}, & \text{if } j \in g, k \in g', g \neq g', \\ \dfrac{\alpha}{1-\sigma}[1-\sigma s_{jt|g}^{x} - (1-\sigma)s_{jt}^{x}], & \text{otherwise.} \end{cases}$$

(a-2) $$Ex_{jkt}^{ad} = \begin{cases} \dfrac{-\beta}{1-\sigma}[\sigma s_{jt|g}^{x} + (1-\sigma)s_{jt}^{x}], & \text{if } j \neq k \in g, \\ -\beta s_{jt}, & \text{if } j \in g, k \in g', g \neq g', \\ \dfrac{\beta}{1-\sigma}[1-\sigma s_{jt|g}^{x} - (1-\sigma)s_{jt}^{x}], & \text{otherwise.} \end{cases}$$

On the other hand, the advertising price and circulation elasticities of advertiser demand are computed as follows.

(a-3) $$Ea_{jkt}^{price} = \begin{cases} -\alpha s_{jt}^{a}, & \text{if } j \neq k \\ \alpha(1-s_{jt}^{a}), & \text{otherwise} \end{cases}$$

(a-4) $$Ea_{jkt}^{circulation} = \begin{cases} -\beta s_{jt}^{a}, & \text{if } j \neq k \\ \beta(1-s_{jt}^{a}), & \text{otherwise} \end{cases}$$

Appendix B: Matrices in pricing equations

The (j, k) elements of matrices, Δ, B, Ω, and Γ in the pricing equations are as follows:

(a-5) $$\Delta_{jkt} = \begin{cases} \frac{\alpha}{1-\sigma}[1-\sigma s_{jt|g}^{x} - (1-\sigma)s_{jt}^{x}]\frac{s_{jt}^{x}}{p_{jt}}N_t & \text{if } j = k, \\ -\frac{\alpha}{1-\sigma}[\sigma s_{jt|g}^{x} + (1-\sigma)s_{jt}^{x}]\frac{s_{kt}^{x}}{p_{jt}}N_t & \text{if } j \neq k,\ j \,\&\, k \in g \\ -\alpha s_{jt}^{x}\frac{s_{kt}^{x}}{p_{jt}}N_t & \text{otherwise} \end{cases}$$

(a-6) $$\mathrm{B}_{jkt} = \begin{cases} \lambda(1-s_{jt}^{a})\frac{s_{jt}^{a}}{x_{jt}}K_t & \text{if } j = k, \\ -\lambda s_{jt}^{a}\frac{s_{kt}^{a}}{x_{jt}}K_t & \text{otherwise} \end{cases}$$

(a-7) $$\Omega_{jkt} = \begin{cases} \rho(1-s_{jt}^{a})\frac{s_{jt}^{a}}{q_{jt}}K_t & \text{if } j = k, \\ -\rho s_{jt}^{a}\frac{s_{kt}^{a}}{q_{jt}}K_t & \text{otherwise} \end{cases}$$

and,

(a-8) $$\Gamma_{jkt} = \begin{cases} \frac{\beta}{1-\sigma}[1-\sigma s_{jt|g}^{x} - (1-\sigma)s_{jt}^{x}]\frac{s_{jt}^{x}}{a_{jt}}N_t & \text{if } j = k, \\ -\frac{\beta}{1-\sigma}[\sigma s_{jt|g}^{x} + (1-\sigma)s_{jt}^{x}]\frac{s_{kt}^{x}}{a_{jt}}N_t & \text{if } j \neq k,\ j \,\&\, k \in g \\ -\beta s_{jt}^{x}\frac{s_{kt}^{x}}{a_{jt}}N_t & \text{otherwise} \end{cases}$$

Appendix C: Panel data structure

= Table 10 =

Appendix D: Estimation results of marginal cost function for subsamples

= Table 11 =

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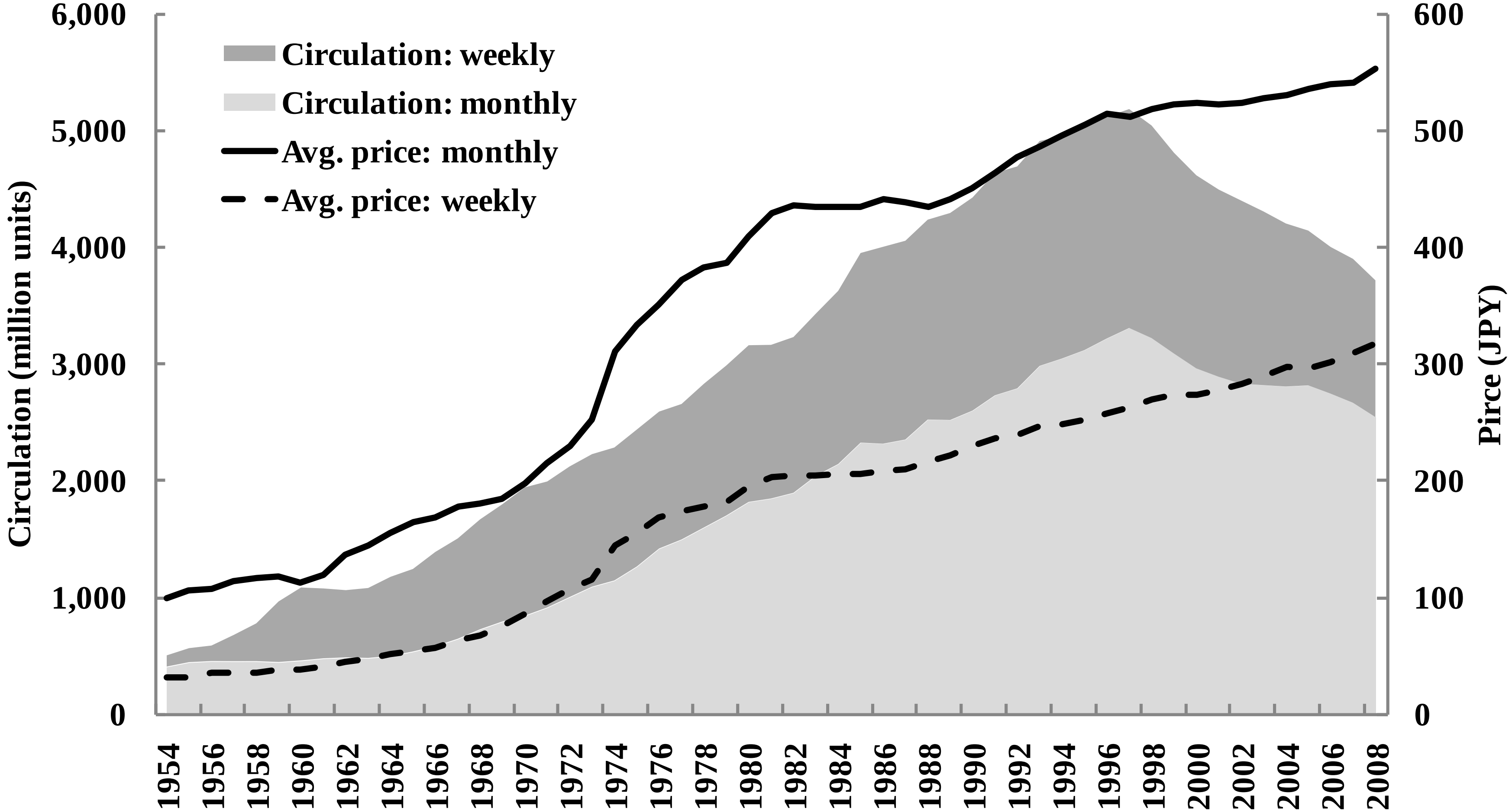
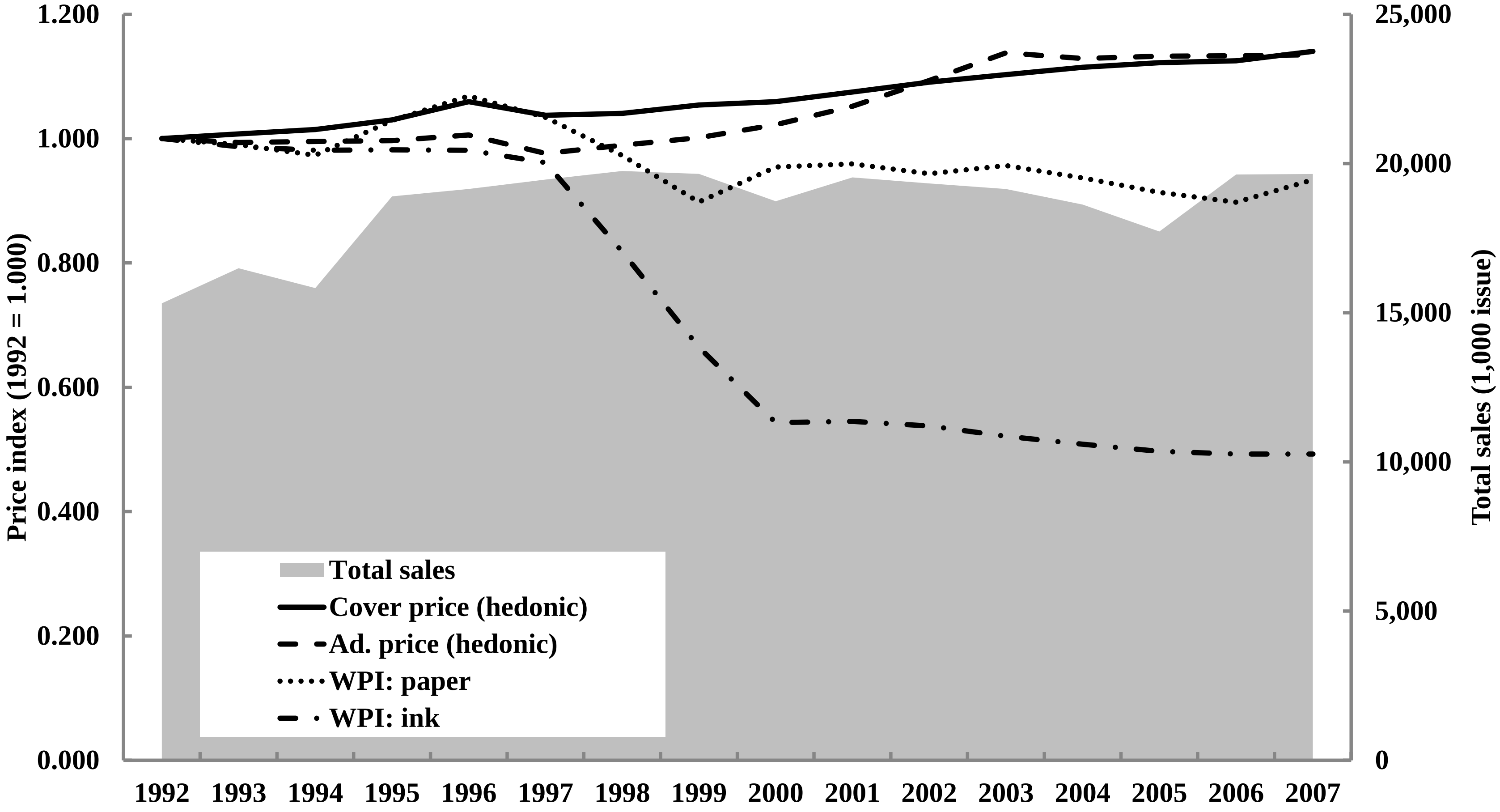
Figure 1: The Japanese magazine market: 1954−2008



Note: RIP (2009) is used as the original data source.

Figure 2: The cover price and advertising price indices



Note: The series of total sales, cover price (hedonic) and advertising price (hedonic) indices are calculated from the panel data used in this study.

Table 1: No. of publishers and magazines

	Publisher				Magazine	
	Total		of magazine			
	No.	%change	No.	%change	No.	%change
1990	4,309					
1991	4,320	0.26				
1992	4,284	−0.83				
1993	4,324	0.93				
1994	4,487	3.77				
1995	4,561	1.65				
1996	4,602	0.90				
1997	4,612	0.22	944		3,318	
1998	4,454	−3.43	938	−0.64	3,359	1.24
1999	4,406	−1.08	947	0.96	3,394	1.04
2000	4,391	−0.34	954	0.74	3,433	1.15
2001	4,424	0.75	929	−2.62	3,461	0.82
2002	4,361	−1.42	937	0.86	3,486	0.72
2003	4,311	−1.15	933	−0.43	3,554	1.95
2004	4,260	−1.18	925	−0.86	3,624	1.97
2005	4,229	−0.73	919	−0.65	3,642	0.50
2006	4,107	-2.88	958	4.24	3,652	0.27
2007	4,055	-1.27	950	-0.84	3,644	-0.22

Note: JSPS (2010) and RIP (1998-2009) are used as the original data source.

Table 2: Four Alterative supply models

	Reader side		Advertiser side	Market configuration matrix in pricing equations			
				Cover price		Advertising price	
		w^x		I^{xp}	I^{ap}	I^{xq}	I^{aq}
Model 1	Competition	c^x	Competition	Ownership	Ownership	Ownership	Ownership
Model 2	Competition	c^x	Cooperation	Ownership	Ones	Ownership	Ones
Model 3	Cooperation	p	Competition	Ones	Ownership	Ones	Ownership
Model 4	Cooperation	p	Cooperation	Ones	Ones	Ones	Ones

Note: This table summarizes the four market configuration matrixes in the pricing equations for cover prices and advertising prices under each supply scenario. The "Ownership" denotes the ownership matrix which (j, k) element equals one if magazines j and k are published by a same publisher, otherwise, zero. The "ones" represents the matrix whose size is same as the ownership matrix, but all its elements are one.

Table 3: Descriptive statistics

		Full sample No. = 1,543				Expansion: 1992-1997 No. = 433		Contraction: 1998-2007 No. = 1110	
		Mean	S.D.	Min	Max	Mean	S.D.	Mean	S.D.
Sales	Issues	192,298.500	207,164.700	6,566.000	1,063,167.000	242,807.400	253,657.300	172,595.400	182,278.600
Cover price	JPY	636.072	348.058	222.447	1,853.724	632.682	395.034	637.395	328.100
Advertising	Pages	59.420	32.199	7.803	225.320	63.549	33.611	57.810	31.501
Price of advertising	1,000 JPY	2,110.323	1,243.008	397.614	5,680.000	1,858.809	1,227.111	2,208.436	1,235.890
Contents	Pages	162.757	67.186	45.390	516.516	166.915	73.909	161.135	64.336
Magazine size	cm^2	582.589	72.251	310.800	623.700	559.912	83.809	591.435	65.140
No. of issues per year	Issues	21.729	14.082	4.000	48.000	24.841	15.306	20.515	13.388
Irregular size	Dummy	0.710	0.454	0.000	1.000	0.591	0.492	0.757	0.429
Size of advertising	cm^2	9.702	3.264	3.010	13.950	8.564	3.318	10.147	3.133

Note: price variables (cover price and price of advertising) are deflated by the general consumer price index (CPI: 2005 = 1.0).For the details, see text.

Table 4: Estimation results of reader demand

	Reader demand			First stage regression results								
				ln(w/i share)			ln(Price)			ln(Advertisement)		
ln(Share within genre)	0.225	(0.062)	***									
ln(Cover price)	−3.189	(0.746)	***									
ln(Advertisement)	0.332	(0.065)	***									
ln(Contents)	0.437	(0.083)	***	0.350	(0.173)	**	0.030	(0.045)		−0.622	(0.134)	***
Instruments:												
WPI: paper * pages * size				−0.218	(0.171)		0.049	(0.043)		1.255	(0.128)	***
WPI: ink * pages * size				0.208	(0.073)	***	−0.013	(0.019)		−0.249	(0.048)	***
Rivals' contents				0.001	(0.001)		0.000	(0.000)		−0.001	(0.000)	***
Rivals' no. of issues/year				−0.019	(0.004)	***	−0.004	(0.002)	*	0.006	(0.004)	
Rivals' magazine size				−0.047	(0.025)	*	0.006	(0.009)		−0.021	(0.013)	
Rivals' irregular dummy				−0.163	(0.085)	*	0.021	(0.023)		−0.026	(0.040)	
No. of rivals w/i genre				−0.041	(0.004)	***	−0.005	(0.002)	**	0.004	(0.003)	
Constant	10.317	(4.454)	**	−3.603	(0.803)	***	6.242	(0.278)	***	6.201	(0.568)	***
Magazine fixed effects	Yes			Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes			Yes		
Hansen *J* stat. (*df* = 4)	5.047											
R^2	0.951			0.920			0.975			0.930		
F(205, 1337)				1,578.360		***	5,728.860		***	801.800		***

Note: No. of observations = 1,543, ***, **, and * denotes statistically significant at 1%, 5%, and 10% level, respectively. The standard errors are in parentheses. The first stage regression results are also presented.

Table 5: Estimation results of advertiser demand

	Advertiser demand			First stage regression results					
				ln(Ad. price)			ln(Sales)		
ln(Advertising price)	−5.319	(1.403)	***						
ln(Sales)	1.593	(0.516)	***						
ln(Contents)	0.159	(0.377)		0.228	(0.063)	***	0.205	(0.157)	
Size of advertising	0.492	(0.131)	***	0.094	(0.004)	***	−0.002	(0.008)	
Instruments:									
WPI: paper * Pages * Size				−0.342	(0.102)	***	−0.455	(0.250)	*
WPI: ink * Pages * Size				0.078	(0.027)	***	0.097	(0.068)	
Wage: print * Pages * Size				0.039	(0.023)	*	0.173	(0.049)	***
Constant	41.499	(19.756)	**	12.212	(0.326)	***	10.194	(0.897)	***
Magazine fixed effects	Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes		
Hansen *J* stat. (*df* = 1)	0.061								
R^2	0.104			0.975			0.957		
$F(202, 1340)$				12,608.74		***	4,673.45		***

Note: No. of observations = 1,543, ***, **, and * denotes statistically significant at 1%, 5%, and 10% level, respectively. The standard errors are in parentheses. The first stage regression results are also presented.

Table 6: Estimated price cost margin ratio and marginal costs: Reader side

	Model 1 (Comp, Comp)		Model 2 (Comp, Coop)		Model 3 (Coop, Comp)		Model 4 (Coop, Coop)	
	PCM	MC	PCM	MC	PCM	MC	PCM	MC
1992	−0.109	601.010	−0.052	573.500	−0.194	689.280	−0.029	560.140
1993	−0.067	557.640	0.009	524.275	−0.120	595.045	0.045	508.360
1994	−0.084	556.285	−0.016	504.700	−0.119	606.250	0.027	497.085
1995	−0.148	593.620	−0.038	517.545	−0.314	703.400	−0.077	530.850
1996	−0.153	633.010	−0.034	547.910	−0.330	774.050	−0.014	562.630
1997	−0.162	602.440	−0.040	531.555	−0.353	721.450	−0.040	547.905
1998	−0.158	576.890	−0.027	489.150	−0.372	735.440	−0.049	504.180
1999	−0.137	614.500	−0.016	504.510	−0.323	749.580	−0.033	517.640
2000	−0.177	640.130	−0.064	557.535	−0.386	785.435	−0.088	576.025
2001	−0.239	695.310	−0.077	581.015	−0.494	848.785	−0.104	625.635
2002	−0.234	737.095	−0.070	642.140	−0.490	941.530	−0.123	681.130
2003	−0.226	746.940	−0.053	598.010	−0.527	988.340	−0.136	680.610
2004	−0.289	759.670	−0.053	636.840	−0.559	1003.600	−0.152	686.460
2005	−0.296	737.860	−0.084	614.250	−0.592	954.810	−0.173	680.050
2006	−0.308	734.170	−0.068	613.280	−0.745	1004.700	−0.208	669.800
2007	−0.297	767.780	−0.079	614.680	−0.675	1030.500	−0.176	691.395

Note: The median of the estimated total price cost margin ratio and marginal costs (MC) on reader side under respective supply models are reported: for example, Model 2 represents that the reader side is cooperative, but the advertiser side is oligopolistically competitive. The estimates of marginal costs are in JPY.

Table 7: Estimated price cost margin ratio and marginal cost: Advertiser side

	Model 1 (Comp, Comp)		Model 2 (Comp, Coop)		Model 3 (Coop, Comp)		Model 4 (Coop, Coop)	
	PCM	MC	PCM	MC	PCM	MC	PCM	MC
1992	0.108	1,148.000	0.111	1,146.100	0.106	1,149.000	0.111	1,145.800
1993	0.090	1,157.300	0.093	1,155.300	0.090	1,158.100	0.094	1,154.950
1994	0.095	1,410.350	0.098	1,408.050	0.095	1,411.350	0.098	1,407.750
1995	0.115	1,379.800	0.119	1,375.750	0.113	1,382.250	0.119	1,375.900
1996	0.112	1,458.850	0.115	1,454.250	0.110	1,461.850	0.115	1,454.650
1997	0.114	1,374.650	0.118	1,369.650	0.112	1,377.800	0.118	1,370.050
1998	0.116	1,461.000	0.120	1,456.200	0.114	1,464.200	0.119	1,456.700
1999	0.111	1,400.600	0.116	1,396.500	0.108	1,403.300	0.115	1,396.700
2000	0.118	1,360.850	0.123	1,355.750	0.116	1,364.200	0.123	1,356.350
2001	0.128	1,437.950	0.133	1,432.700	0.124	1,441.950	0.132	1,433.300
2002	0.127	1,484.300	0.132	1,478.250	0.124	1,488.850	0.132	1,479.050
2003	0.128	1,577.500	0.132	1,570.500	0.124	1,583.000	0.132	1,571.600
2004	0.132	1,796.300	0.137	1,788.700	0.129	1,802.300	0.136	1,790.200
2005	0.133	1,856.400	0.137	1,849.200	0.131	1,862.100	0.136	1,850.500
2006	0.137	2,263.800	0.141	2,255.400	0.133	2,271.000	0.140	2,257.200
2007	0.133	2,322.300	0.138	2,313.200	0.129	2,329.850	0.137	2,315.050

Note: The median of the estimated total price cost margin ratio and marginal costs (MC) on advertiser side under respective supply models are reported: for example, Model 2 represents that the reader side is cooperative, but the advertiser side is oligopolistically competitive. The estimates of marginal costs are in 1,000 JPY.

Table 8: OLS Estimation results of marginal cost: Full sample

		Model 1 (Comp, Comp)			Model 2 (Comp, Coop)			Model 3 (Coop, Comp)			Model 4 (Coop, Coop)		
		Est.	S.E.		Est.	S.E.		Est.	S.E.		Est.	S.E.	
Reader	WPI: paper * pages * size	0.673	(0.141)	***	0.584	(0.156)	***	0.703	(0.136)	***	0.714	(0.151)	***
	WPI: ink * pages * size	−0.203	(0.030)	***	−0.182	(0.033)	***	−0.208	(0.029)	***	−0.217	(0.032)	***
	Wage: printing * pages * size	−0.072	(0.036)	**	−0.049	(0.040)		−0.085	(0.035)	**	−0.077	(0.039)	**
	Constant	6.384	(0.042)	***	6.177	(0.046)	***	6.556	(0.040)	***	6.304	(0.045)	***
	R^2	0.945			0.942			0.943			0.946		
Advertiser	WPI: paper * pages * size	0.185	(0.149)		0.189	(0.150)		0.181	(0.149)		0.188	(0.150)	
	WPI: ink * pages * size	−0.100	(0.031)	***	−0.101	(0.032)	***	−0.099	(0.031)	***	−0.101	(0.032)	***
	Wage: printing * pages * size	−0.004	(0.039)		−0.005	(0.039)		−0.003	(0.038)		−0.004	(0.039)	
	Constant	14.156	(0.044)	***	14.156	(0.044)	***	14.156	(0.044)	***	14.156	(0.044)	***
	R^2	0.944			0.944			0.944			0.944		

Note: No. of observations = 1,545. The dependent variables are the logs of the estimated marginal costs under respective supply models. All regressions include magazine fixed effects and year dummies. ***, **, and * denotes statistically significant at 1%, 5%, and 10% level, respectively. The estimated standard errors are in parentheses.

Table 9: Test Statistics of alternative supply models

			h'		
			Model 2	Model 3	Model 4
			(Comp, Coop)	(Coop, Comp)	(Coop, Coop)
		Full samples:			
	1	(Competitive, Competitive)	−7.668	2.956	−15.054
			(11.522)	(10.911)	(12.219)
	2	(Competitive, Cooperative)		5.919	2.819
				(9.799)	(11.198)
	3	(Cooperative, Competitive)			−7.435
					(9.852)
		1992−1997:			
	1	(Competitive, Competitive)	−2.656	1.769	−3.056
			(3.699)	(3.427)	(3.765)
h	2	(Competitive, Cooperative)		2.307	2.218
				(3.005)	(3.761)
	3	(Cooperative, Competitive)			−2.300
					(2.960)
		1998−2007:			
	1	(Competitive, Competitive)	−5.576	3.051	−8.694
			(8.784)	(8.203)	(8.704)
	2	(Competitive, Cooperative)		4.778	0.951
				(7.316)	(8.085)
	3	(Cooperative, Competitive)			−6.201
					(7.073)

Note: Rivers and Vuong (2002) test statistics are presented. H_0: h is asymptotically equivalent to h', H_1: h is asymptotically better than h', and H_2: h' is asymptotically better than h. If α is the size of the test, and t_α and $t_{1-\alpha}$ denote the values of the inverse standard normal distribution evaluated at α and $1-\alpha$, H_0 is rejected in favor of H_1 if $T_n < t_\alpha$ and that H_0 is rejected in favor of H_2 if $T_n > t_{1-\alpha}$. Because the test statistics depend on the estimated demand parameters, the bootstrapped standard errors of test statistics with 500 replications are reported in parentheses.

Table 10: Panel data of the Japanese magazine market

	No.	%
1992	67	4.34
1993	70	4.54
1994	64	4.15
1995	74	4.80
1996	78	5.06
1997	80	5.18
1998	85	5.51
1999	93	6.03
2000	100	6.48
2001	106	6.87
2002	110	7.13
2003	117	7.58
2004	119	7.71
2005	117	7.58
2006	129	8.36
2007	134	8.68
Total	1,543	100.00

Table 11: OLS Estimation results of marginal cost: 1992−1997 & 1998−2007

			Model 1 (Comp, Comp)			Model 2 (Comp, Coop)			Model 3 (Coop, Comp)			Model 4 (Coop, Coop)		
			Est.	S.E.		Est.	S.E.		Est.	S.E.		Est.	S.E.	
1992-1997:	Reader	WPI: paper * pages * size	−0.122	(0.459)		0.067	(0.529)		−0.399	(0.423)		−0.105	(0.496)	
(No. = 433)		WPI: ink * pages * size	−1.285	(0.519)	**	−1.517	(0.599)	**	−1.005	(0.479)	**	−1.426	(0.561)	**
		Wage: printing * pages * size	0.808	(0.379)	**	0.876	(0.438)	**	0.733	(0.350)	**	0.884	(0.410)	**
		Constant	6.158	(0.061)	***	5.989	(0.071)	***	6.317	(0.056)	***	6.050	(0.066)	***
		R^2	0.973			0.968			0.975			0.973		
	Advertiser	WPI: paper * pages * size	0.859	(0.497)	*	0.866	(0.498)	*	0.853	(0.496)	*	0.865	(0.498)	*
		WPI: ink * pages * size	0.777	(0.563)		0.777	(0.564)		0.778	(0.562)		0.777	(0.564)	
		Wage: printing * pages * size	−0.731	(0.411)	*	−0.733	(0.412)	*	−0.730	(0.410)	*	−0.733	(0.412)	*
		Constant	13.771	(0.066)	***	13.769	(0.067)	***	13.772	(0.066)	***	13.768	(0.067)	***
		R^2	0.969			0.969			0.969			0.969		
1998-2007:	Reader	WPI: paper * pages * size	0.630	(0.159)	***	0.496	(0.175)	***	0.712	(0.152)	***	0.661	(0.173)	***
(No. = 1,112)		WPI: ink * pages * size	−0.059	(0.058)		−0.039	(0.064)		−0.072	(0.056)		−0.060	(0.063)	
		Wage: printing * pages * size	−0.103	(0.048)	**	−0.063	(0.053)		−0.126	(0.046)	***	−0.107	(0.053)	**
		Constant	6.259	(0.045)	***	6.065	(0.049)	***	6.455	(0.043)	***	6.135	(0.049)	***
		R^2	0.953			0.953			0.953			0.953		
	Advertiser	WPI: paper * pages * size	0.174	(0.149)		0.178	(0.150)		0.170	(0.149)		0.176	(0.150)	
		WPI: ink * pages * size	−0.183	(0.055)	***	−0.185	(0.055)	***	−0.182	(0.054)	***	−0.184	(0.055)	***
		Wage: printing * pages * size	0.036	(0.045)		0.035	(0.046)		0.036	(0.045)		0.036	(0.046)	
		Constant	13.995	(0.042)	***	13.991	(0.042)	***	13.998	(0.042)	***	13.991	(0.042)	***
		R^2	0.953			0.953			0.953			0.953		

Note: The dependent variables are the logs of the estimated marginal costs under respective supply models. All regressions include magazine fixed effects and year dummies. ***, **, and * denotes statistically significant at 1%, 5%, and 10% level, respectively. The estimated standard errors are in parentheses.