Competitive Effects of Resale Price Maintenance Through Inventory: Evidence from Publishing Industry

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Inventory decision under demand uncertainty

- Often insufficient compared to the social optimum
- Limited access, a higher price.
- Concern for a price war
  - Competitive retailers
  - Deneckere et al. (1996, 1997)
- Double marginalization
  - Monopolistic retailers
  - Tirole (1988); Klein (1999); Blair and Lafontaine (1999)

Resale price maintenance

- RPM: Agreement between a manufacturer and retailer to sell the product above or below a certain retail price
- Competitive effect.
  - The minimum RPM; prevents a price war.
  - The maximum RPM; prevents a double marginalization.
- Hardly openly practiced; Antitrust challenges
  - A type of price fixing
  - The U.S.: rule of reason since Leegin v. PSKS in 2007.
  - Europe, Japan, China: illegal.
  - In Japan allowed for copyrighted goods.

Research questions

- Does RPM improve the consumer surplus?
- How large are the competitive effects of RPM through inventory under demand uncertainty?
- Which of the minimum and maximum RPM are more relevant?
- Fundamentally, how to estimate demand and cost when sales are not equal to production because of demand uncertainty?

This paper

- Develops an empirical model of RPM with pricing and inventory decisions under demand uncertainty.
  - Uncertain demand.
  - Ex-ante price and inventory decisions by a manufacturer.
  - Adjustment costs if realized demand exceeds inventory.
  - Consumer surplus either increases or decreases.
- Apply it to the publishing industry in Japan; RPM is allowed.
- Estimate the model using the monthly title-store level data.
- Perform counterfactual simulations to answer the questions.

Findings

- Bookstores have local market power (elasticity 2-4).
- The shift to the wholesale model damages consumers (-27.7% of sales).
- It benefits bookstores (+5.6%) but publishers/wholesalers (-29.2%).
- It decreases the inventory and increases the price.
- The minimum RPM is irrelevant; the maximum RPM matters.

Contributions

- Gives an empirical framework and results for the evaluation of competitive effects of RPM through inventory: Bonnet and Dubois (2010), Gilligan (1986), Ornstein and Hanssens (1987), Bailey and Leonard (2010).
- Empirically compares the inventory and pricing decisions between agency and wholesale model: De Los Santos and Wildenbeest (2017), Johnson (2017), Foros et al. (2017).
- Empirically studies the welfare implication of RPM in the publishing industry: Li (2021), Daljord (2021).

Legal status of RPM

- Rule of reason in the U.S. since Leegin v. PSKS in 2007.
- Illegal in Japan, EU, and China in general.
- Japan: exemption for copyrighted works in physical media.
- 2001 notice by the JFTC: ”the practice is monitored and reviewed on a regular basis”.

Japanese publishing industry

- Agency model
  - Retail price (=price ceiling and floor) set by publishers.
  - Distributors decide on initial bookstore inventories.
  - Bookstores can return books for free within a period.
- Revenue sharing
  - Bookstore 22%, wholesaler 8%, publishers and authors 70%.
- Sales in 2015
  - Printed books 742 billion yen: brick-and-mortar bookstores 64.6%, convenience store 10.6%, the Internet 9.6%.
  - Ebooks 150.2 billion yen: comics 76.5%.

Japanese publishing industry

- The market of publishers is not concentrated.
  - The top 5 and 10 occupy only 31% and 45% of sales.
  - cf. The top 5 occupy 80% in the U.S.
- The wholesalers are a duopoly.
  - Nippan and Tohan occupy 80% of transactions.
- The bookstores are moderately concentrated.

	Number of stores in the county			
	1	2 to 4	5 to 7	Larger than 7
County	360 (43%)	369 (44%)	84 (10%)	27 (3%)

Demand is uncertain

- The explained variations of the 6-month sales.
- Excluding new authors:

	Dummy included					
	Pub month	Publisher	County	Store	Author	All above
Store-title Level: R^2 (%)	0.03	0.87	1.39	2.65	9.16	20.11
Region-title Level: R^2 (%)	0.02	0.79	2.65	-	9.64	19.85
Title Level: R^2 (%)	0.06	2.91	-	-	47.35	55.81

- New authors:

	Dummy included				
	Pub month	Publisher	County	Store	All above
Store-title Level: R^2 (%)	0.02	1.04	1.42	2.63	3.97
Region-title Level: R^2 (%)	0.02	1.03	2.99	-	4.47
Title Level: R^2 (%)	0.1	4.77	-	-	4.91

Features of the pricing scheme

- Retail price floor.
- Retail price ceiling.
- Uniform pricing.

Competitive effects of retail price floor

- **Perfectly competitive bookstores**
- Deneckere et al. (1997).
- Marginal cost: 0.
- Demand: For $\theta > 1$,

$$D(p, \theta) = \begin{cases} 1 - p & \text{wp } \frac{1}{2} \\ \theta(1 - p) & \text{wp } \frac{1}{2}. \end{cases} \tag{1}$$

- **Vertically-integrated**: Inventory $Q \to$ demand realization $\to$ retail price p^L, p^H.
  - $Q = \frac{\theta}{2}$, $p^L = p^H = \frac{1}{2}$.
  - $CS = \frac{1}{16} + \frac{\theta}{16}$, $PS = \frac{1}{8} + \frac{\theta}{8}$.

Competitive effects of retail price floor

- **Wholesales model**: Wholesale price p^w (publisher) $\rightarrow$ inventory Q (bookstores) $\rightarrow$ demand realization $\rightarrow$ retail price p_L, p_H (bookstores).
- $\theta < 3$:
  - $p^w = \frac{1}{2}$, $Q = \frac{\theta}{1+\theta} < \frac{\theta}{2}, p^L = \frac{1}{1+\theta} < \frac{1}{2}, p^H = \frac{\theta}{1+\theta} > \frac{1}{2}$.
  - $CS = \frac{\theta}{4(1+\theta)} < \frac{1}{16} + \frac{\theta}{16}$, $PS = \frac{1}{1+\theta} < \frac{1}{8} + \frac{\theta}{8}$.
- Why?: Horizontal negative externality of price competition $\rightarrow$ fire sale in the low demand state $\rightarrow$ inventory reduction $\rightarrow$ price hike in the high demand state.
- $\theta > 3$: low demand is ignored.
  - $p^w = \frac{1}{4}$, $Q = \frac{\theta}{2}, p^L = 0, p^H = \frac{1}{2}$.
  - $CS = \frac{1}{4} + \frac{\theta}{16} > \frac{1}{16} + \frac{\theta}{16}$, $PS = \frac{\theta}{8} < \frac{1}{8} + \frac{\theta}{8}$.

Competitive effects of retail price floor

- **Retail price floor**: Wholesale price p^w and retail price floor $\underline{p}$ (publisher) $\rightarrow$ Inventory Q (bookstores) $\rightarrow$ demand realization $\rightarrow$ retail price $p^L, p^H \geq \underline{p}$ (bookstores).
  - $\underline{p} = \frac{1}{2}$, $p^w = \frac{1+\theta}{4\theta}$, $Q = \frac{\theta}{2}$, $p^L = p^H = \frac{1}{2}$.
  - $CS = \frac{1}{16} + \frac{\theta}{16}$, $PS = \frac{1}{8} + \frac{\theta}{8}$.
- The industry-optimal inventory is restored.
- If $\theta < 3$, the CS also improves.

Competitive effects of retail price ceiling

- **Monopoly bookstore** without **Demand uncertainty**.
- Demand: $D(p) = 1 - p$.
- **Vertically-integrated**: retail price p.
  - $Q = \frac{1}{2}$, $p = \frac{1}{2}$.
- **Wholesale model**: Wholesale price p^w (publisher) $\rightarrow$ retail price p (bookstore).
  - $p^w = \frac{1}{2}$, $Q = \frac{1}{4} < \frac{1}{2}$, $p = \frac{3}{4} > \frac{1}{2}$.
- The production (=inventory) is cut in half.

Competitive effects of retail price ceiling

- **Monopoly bookstore** with **Demand uncertainty**.
- Demand: For $\theta > 1$,

$$D(p, \theta) = \begin{cases} 1 - p & \text{wp } \frac{1}{2} \\ \theta(1 - p) & \text{wp } \frac{1}{2}. \end{cases} \tag{2}$$

- **Vertically-integrated**: Inventory $Q \rightarrow$ demand realization $\rightarrow$ retail price p^L, p^H (already solved).
  - $Q = \frac{\theta}{2}$, $p^L = p^H = \frac{1}{2}$.

Competitive effects of retail price ceiling

- **Wholesale model**: Wholesale price p^w (publisher) $\rightarrow$ Inventory Q (bookstore) $\rightarrow$ demand realization $\rightarrow$ retail price p^L, p^H (bookstore).
- $\theta < 3$:
  - $p^w = \frac{1}{2}$, $Q = \frac{\theta}{2(1+\theta)} < \frac{\theta}{2}$, $p^L = \frac{2+\theta}{2(1+\theta)} > \frac{1}{2}$, $p^H = \frac{2\theta+1}{(1+\theta)} > \frac{1}{2}$.
  - The inventory is cut by more than half.
- $\theta > 3$:
  - $p^w = \frac{1}{2}$, $Q = \frac{\theta}{4} < \frac{\theta}{2}$, $p^L = \frac{1}{2}$, $p^H = \frac{3}{4}$.
  - The inventory is cut in half.
- Demand uncertainty can worsen the double marginalization.
- Across-demand-state negative effect.

Competitive effects of retail price ceiling

- **Retail price ceiling**: Wholesale price p^w and retail price ceiling $\bar{p}$ (publisher) $\rightarrow$ Inventory Q (bookstores) $\rightarrow$ demand realization $\rightarrow$ retail price $p^L, p^H \leq \bar{p}$ (bookstores).
- $\theta > 2$:
  - $\bar{p} = \frac{1}{2}$, $p^w = \frac{1}{4}$, $Q = \frac{\theta}{2}$, $p^L = p^H = \frac{1}{2}$.
  - The industry-optimal inventory is restored.
- $\theta < 2$:
  - $\bar{p} = \frac{1}{2}$, $p^w = \frac{1}{2}$, $Q = \frac{1}{2}(< \frac{\theta}{2} \& > \frac{\theta}{4})$, $p^L = p^H = \frac{1}{2}$.
  - The inventory is increased from the wholesale model but does not reach the industry optimal.

Demand for a title in a bookstore

- Assume independent demand across books.
- Model for title j.
- Consider the sales for 6 months after publication.
- In county l, consumer i chooses from a set of bookstores $\mathcal{B}_l$ and the outside option.
- Indirect utility is modeled as

$$u_{ijbl} = x_j'\beta + \alpha p_j + \xi_j + x_{jbl}'\gamma + \eta_{jbl} + \epsilon_{ijbl}$$

  - x_j and x_{jbl}: observed exogenous characteristics.
  - p_j: price.
  - ξ_j, η_{jbl}: demand fixed effects at the title and store level.
  - ϵ_{ijbl}: idiosyncratic preference shock

The decision problem for a publisher

- Regard the publisher-distributor pair as a single player.
- Uncertain about the true ξ_j.
- Unbiased belief $\mathcal{N}(\xi_j, \sigma^2_{j\xi})$.
  - $\sigma_{j\xi} = \exp(c_0 + c_1 * \mathbb{1}\{Past\_Pub_{a(j)j} \geq 1\})$
- Decides the inventory and retail price before demand realization.
- Pays the adjustment cost if the realized demand exceeds the inventory

$$\text{adjustment cost} = \delta(demand - inventory)^2$$

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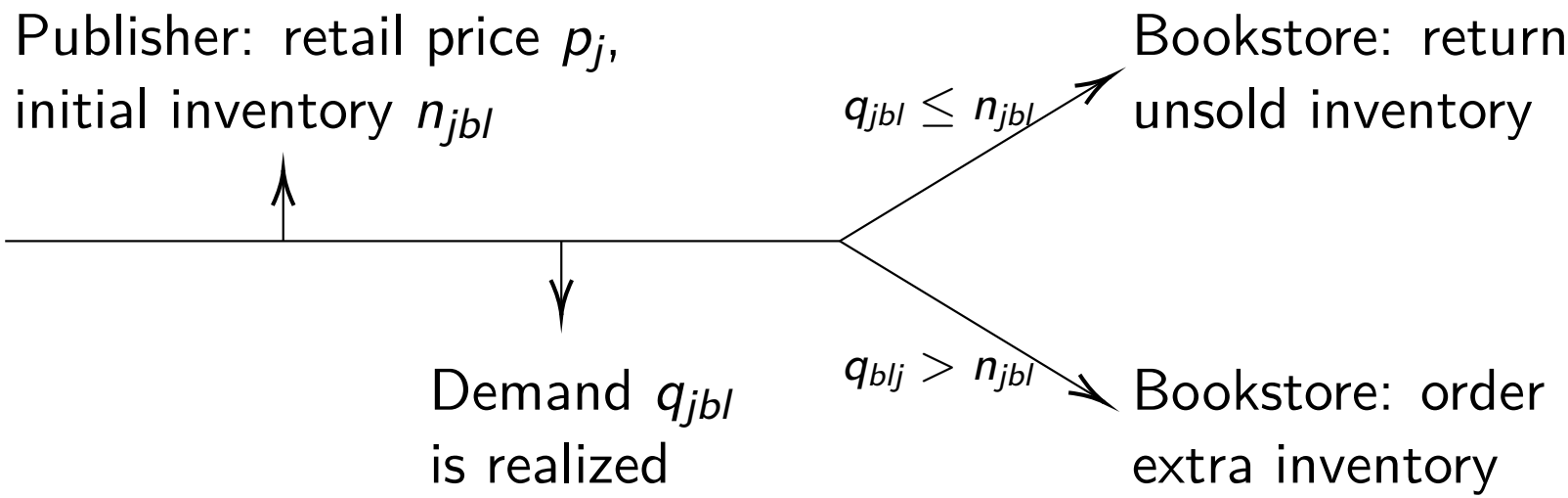
The decision problem for a publisher



The decision problem for a publisher

- Book-title j in region l with a set of bookstore $\mathcal{B}_l$

$$\max_{p_j, n_j} \underbrace{\rho p_j \sum_{l \in \mathcal{L}} \sum_{b \in \mathcal{B}_l} \int min\{n_{jbl}, M_l q_{jbl}\}\ dF(\xi_j^*)}_{\text{Expected initial revenue}} - \underbrace{\sum_{l \in \mathcal{L}} \sum_{b \in \mathcal{B}_l} (\lambda_1' w_{jbl} + \varepsilon_{jbl}) n_{jbl}}_{\text{Initial printing and delivery cost}} .$$

$$+ \underbrace{\rho p_j \sum_{l \in \mathcal{L}} \sum_{b \in \mathcal{B}_l} M_l \int \mathbb{1}_{\{M_l q_{jbl} \geq n_{jbl}\}}\ (M_l q_{jbl} - n_{jbl})\ dF(\xi_j^*)}_{\text{Expected excess demand revenue}}$$

$$- \underbrace{\sum_{l \in \mathcal{L}} \sum_{b \in \mathcal{B}_l} \int \mathbb{1}_{\{M_l q_{jbl} \geq n_{jbl}\}}\ (\lambda_1' w_{jbl} + \varepsilon_{jbl})(M_l q_{jbl} - n_{jbl})\ dF(\xi_j^*)}_{\text{Expected excess demand printing and delivery cost}} \tag{3}$$

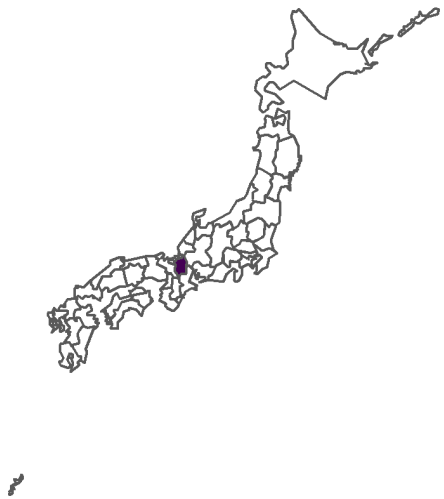
$$- \underbrace{\sum_{l \in \mathcal{L}} \sum_{b \in \mathcal{B}_l} \int \mathbb{1}_{\{M_l q_{jbl} \geq n_{jbl}\}}\ \delta (M_l q_{jbl} - n_{jbl})^2\ dF(\xi_j^*)}_{\text{Expected adjustment cost}},$$

- q_{jbl}, n_{jbl}: choice prob. given ξ_j^*, initial inventory.
- M_l: market size of region l.
- w_{jbl}: publisher fixed effect.
- ϵ_{jbl} marginal cost shock.

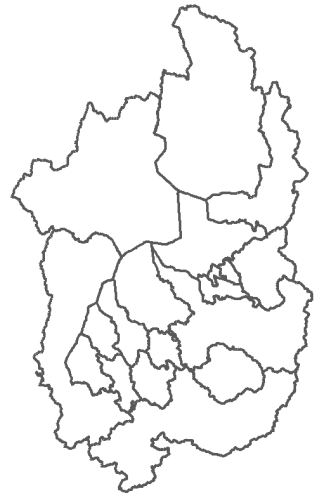
Data

- Point-of-sales data of brick-and-mortar bookstores in Japan from 2015 to 2017.
  - Delivery, sales, return at the bookstore-title-month level.
  - Provided by one of the duopoly wholesalers.
  - Bookstores that transact with the wholesaler.
- Amazon sales rank data.
  - Impute sales from the ranking assuming that the online sales follow Pareto distribution. (Chevalier and Goolsbee (2003))
  - Match the aggregate online sales with data.
- Book category data from openBD project.

Sample selection



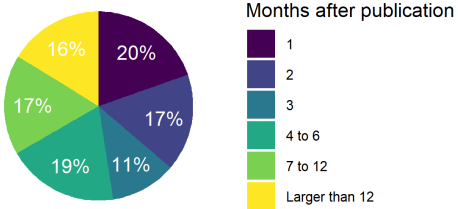
(a) Location of Shiga



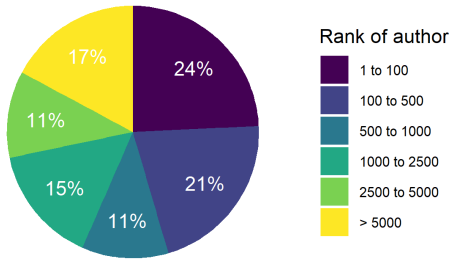
(b) Counties in Shiga

- Focus on Shiga prefecture.
- The highest share for the data provider.

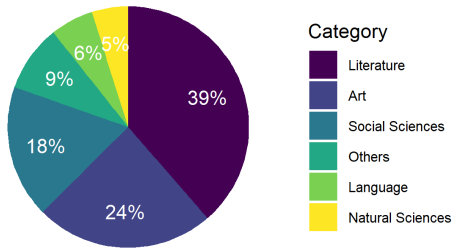
Sample selection



(c) By month after publication



(d) By author sales ranking



(e) By category

- Focus on new titles (published within 6 months) by the top 1000 authors in literature.

Summary statistics

	N	Min	Mean	Max	Sd
County Level					
Population	14	7,566.0	92,327.5	337,634.0	80,869.1
Num. store	14	1.0	3.7	14.0	3.5
Store Level					
Store size (copy)	52	9.3	769.5	1,763.5	479.2
Title Level					
Price (JPY)	4,344	500.0	1,296.3	7,200.0	351.5
Title-store level					
Aggre. sales (copy)	91,800	0.0	2.3	701.0	8.9
Initial inventory (copy)	91,800	0.0	3.2	413.0	7.0
Title-store-month level					
Sales (copy)	1,418,186	0.0	0.2	389.0	1.6
Inventory (copy)	1,418,186	0.0	1.8	216.0	3.2

Demand estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
Price	-0.00203	-0.00193	-0.00145	-0.00214	-0.00179	-0.00163
	(0.00036)	(0.00033)	(0.00033)	(0.00037)	(0.00030)	(0.00060)
Num. books	3335	3335	3335	3335	3335	3335
Num. region	14	14	14	14	14	14
Num .stores	53	53	53	53	53	53
Elasticity						
median	-2.43	-2.312	-1.74	-2.565	-2.146	-1.952
Fixed effects						
top 5 publisher		Yes	Yes	Yes	Yes	Yes
publication date	Yes	Yes	Yes	Yes	Yes	Yes
author	Yes	Yes	Yes	Yes	Yes	Yes
county			Yes			
store	Yes	Yes		Yes	Yes	Yes
Zero sales	Add 0.5	Add 0.5	Add 0.5	Add 0.3	Add 0.7	Dropped
Num.Obs.	91640	91640	91640	91640	91640	55962
R2	0.555	0.559	0.549	0.518	0.582	0.610

- Estimated elasticity between -2.57 $\sim$ -1.74
- Relatively high market power of retailers.

Supply Estimation Results

- Average belief uncertainty $\sigma_{j\xi}$ (relative to the standard deviation of the preference shock):
  - 3.69 for new authors, 3.41 for old authors.
- Average marginal print&delivery cost: 46.02 JPY, around 4% of the average retail price.
  - Most of the cost is fixed.
- Adjustment cost: $\delta = 0.14$.

Model fit

	N	Min	Mean	Median	Max	Sd
Price						
Observed price	90957	500	1259.89	1200.00	6000.00	299.41
Simulated price	90957	500	1336.69	1291.57	5150.41	286.74
Inventory						
Observed inventory	90957	0	3.75	2.00	430.36	11.87
Simulated inventory	90957	0	4.37	1.74	491.77	15.38
Sales						
Observed Sales	90957	0	2.22	1.00	232.00	5.85
Similated sales	90957	0	1.86	0.82	219.48	4.11

- Resample marginal cost shocks 100 times and take the average.
- Top 0.05% price and inventory in the simulation are trimmed.

Counterfactual I: Wholesale model

	Baseline Model	Counterfactual I: wholesale model
Price decision	By publisher, Ex-ante	By bookstores, Ex-post
Inventory decision	By publisher, Ex-ante	By bookstores, Ex-ante
Wholesale price	No	Yes
RPM	Retail price ceiling and floor	no RPM
Flexibility of book price	Uniform	store-specific
Adjustment cost	By publisher	By bookstores

Consumer and supply surplus decreases in the wholesale model than in the baseline model

- Randomly picks up 100 authors and 1 book from each.
- Evaluate surplus at estimated demand and marginal cost shocks.
- Back-of-the-envelope calculation for all literature, all stores and the whole nation by sales value ratio.

	Consumer	Publisher	Store
Counterfactual I - Baseline: 1M JPY			
Sample literature, Shiga, POS stores	-1.26	-1.32	0.25
All literature, POS stores, Shiga	-25.11	-26.42	5.07
All literature, all stores, Shiga	-27.90	-29.36	5.63
All literature, all stores, Japan	-164.10	-172.71	33.11
Diff/Baseline sales: %			
	-27.71	-29.16	5.59

The price is higher and the inventory is lower in the wholesale model than in the baseline model

- Bookstore-title level prices and inventory allocations:

	N	Min	Median	Mean	Max
Retail price					
Baseline	3,009	650.00	1,200.00	1,260.98	4,800.00
Counterfactual I	3,009	1,151.32	1,605.46	1,669.56	2,334.59
Inventory					
Baseline	3,009	0.00	2.00	5.08	545.24
Counterfactual I	3,009	0.00	0.00	0.01	10.81

Counterfactual II: Market pricing

- What if the publisher changes the price for each market?

	Consumer	Publisher	Store
Counterfactual II - Baseline: 1M JPY			
Sample literature, POS stores, Shiga	0.69	1.36	0.37
All literature, POS stores, Shiga	13.74	27.16	7.47
All literature, all stores, Shiga	15.27	30.18	8.30
All literature, all stores, Japan	89.82	177.50	48.80
Diff/Baseline sales: %			
	15.17	29.97	8.24

- The increase in bookstore surplus in the wholesale model was mainly due to market pricing.

Which mechanism is relevant: min RPM or max RPM?

- Counterfactual III: a wholesale model that allows the publisher to set a price floor.
- Counterfactual IV: a wholesale model that allows the publisher to set a price ceiling.

The min RPM is irrelevant

	Consumer	Publisher	Store
Couterfactual III - I: 1M JPY			
	-0.04	-0.04	-0.04
Diff/Baseline sales: %			
	-0.83	-0.89	-0.87

- Equilibrium with the min RPM is almost the same as the wholesale model.

Pro-competitive effects mainly work through the max RPM

	Consumer	Publisher	Store
Counterfactual IV - I: 1M JPY			
Sample literature, Shiga, POS stores	3.16	6.41	-2.09
All literature, POS stores, Shiga	63.18	128.17	-41.74
All literature, all stores, Shiga	70.20	142.41	-46.38
All literature, all stores, Japan	412.94	837.71	-272.80
Diff/Baseline sales: %			
	69.72	141.44	-46.06

Conclusion

- Inventory under demand uncertainty can be a very important channel for the pro-competitive effect of RPM.
- Market power of the retailers is a key determinant of the effectiveness of the minimum and maximum RPM.