



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



Bargaining Power between Food Processors and Retailers: Evidence from Japanese Milk Transactions

K. Hayashida

The University of Tokyo, Department of Global Agricultural Sciences, Japan

Corresponding author email: k.hayashida.milk@gmail.com

Abstract:

Since the 1990s, several studies have pointed out that Japanese retailers exert buyer power over upstream firms in milk transactions (the buyer power hypothesis), despite the high level of competition between supermarkets and between milk suppliers. The conventional new empirical industrial organization approach, which assumes price-taking behavior on either side of players, is not appropriate for this market. Instead, we use the bilateral Nash bargaining model. Using purchase data for the period June 2012--December 2014, we estimate a structural bargaining model for each market in order to identify the relative bargaining strength of the respective agents. The results show that retailers tend to have stronger bargaining power than processors, even in the case of low market concentration. Therefore, these results support the buyer power hypothesis for wholesale milk transactions. In addition, we show the local small and medium-sized supermarkets have moderate bargaining power in the case of NB milk, whereas top-share supermarkets, discounters, and drugstores attempt almost take-it-or-leave-it offers. Finally, we identify the regional differences in the bargaining power of each brand and retailer, highlighting the differences for COOP milk in each region and in the market strategies of large supermarkets.

Acknowledgment: I am grateful to Nao Koike for his kindness in providing me with the data used in this study. I would also like to thank Nobuhiro Suzuki for his support, and Takeshi Sato for his critical reviews of the first draft of this paper. Any errors or omissions are author's responsibility.

JEL Codes: L13, D43

#76



Bargaining Power between Food Processors and Retailers

Evidence from Japanese Milk Transactions

January 14, 2018

Abstract

Since the 1990s, several studies have pointed out that Japanese retailers exert buyer power over upstream firms in milk transactions (the buyer power hypothesis), despite the high level of competition between supermarkets and between milk suppliers. The conventional new empirical industrial organization approach, which assumes price-taking behavior on either side of players, is not appropriate for this market. Instead, we use the bilateral Nash bargaining model. Using purchase data for the period June 2012–December 2014, we estimate a structural bargaining model for each market in order to identify the relative bargaining strength of the respective agents. The results show that retailers tend to have stronger bargaining power than processors, even in the case of low market concentration. Therefore, these results support the buyer power hypothesis for wholesale milk transactions. In addition, we show the local small and medium-sized supermarkets have moderate bargaining power in the case of NB milk, whereas top-share supermarkets, discounters, and drugstores attempt almost take-it-or-leave-it offers. Finally, we identify the regional differences in the bargaining power of each brand and retailer, highlighting the differences for COOP milk in each region and in the market strategies of large supermarkets.

Keywords: Bargaining, Bilaterally Competitive Market, NEIO, BLP, Milk

1 Introduction

The buyer power of retailers in modern agricultural supply chains is a major concern (Myers et al. 2010, Sexton 2012), because inequality in such power can cause problems throughout the supply chain. Several theoretical studies have investigated the effects of strong downstream bargaining power. Chambolle and Villas-Boas (2015) showed that retailers offer low-quality products to processors in order to maintain their buyer power, resulting in distorted consumer welfare and a socially inefficient equilibrium. Battigalli et al. (2007) analyzed the determinants of buyer power and its impact on the investment behavior of sellers. The

total welfare allocation which is determined in the bargaining process affects processors' incentives to invest in quality—the so-called holdup problem. Battigalli et al. (2007) show that extended buyer power decreases suppliers' and consumers' welfare, as well as the retailers who obtains large share of a smaller surplus.

In order to infer vertical market conduct, an estimation of bargaining power is a useful methodology. A few recent studies have empirically investigated the vertical bargaining strengths in bilateral oligopoly markets even when researchers have no wholesale transaction data. Draganska et al. (2009) developed and applied a bargaining model that shows the relative strengths of buyers and sellers. Then, Bonnet and Bouamra-Mechemache (2016) used the model of Draganska et al. (2009) to estimate the vertical power between French fluid milk processors and retailers, based on purchase data. They showed that retailers exert greater bargaining power relative to that of processors in conventional fluid milk products, although manufacturers exercise greater bargaining power in the case of organic milk. Although Draganska et al. (2009) and Bonnet and Bouamra-Mechemache (2016) target bilateral oligopoly markets, which are consolidated horizontally from both the buyer side and seller side, their framework is also applicable to bilaterally competitive markets. However, few studies have examined the vertical market outcomes in bilaterally competitive markets.

In this study, we apply the bargaining framework to the case of Japanese fluid milk transactions, where the markets are characterized by a low concentration of processors and many regional supermarkets. We show how bargaining power is exerted by each players in the channel of bilateral competitive market. As a slightly different study, Kinoshita et al. (2006) empirically estimate the vertical power balance model of Azzam (1996), which is an extension of the new empirical industrial organization (NEIO) approach, using macro data. Their results show that Japanese retailers have strong power over milk processors during their sample period of 1986 to 2000. If the buyer power hypothesis still holds in the 2000s, this can trigger unfavorable market performance. However, conventional NEIO studies, including that of Kinoshita et al. (2006), have several limitations. First, they assume homogenous products, which is not true in many cases. Second, they assume that one of the players in the market behaves as a price-taker. However, this assumption is difficult to accept, especially in the case of Japanese milk bargaining, because there are many local producers and retailers, indicating that their relative bargaining power cannot be determined in advance. The study of Kinoshita et al. (2006) does not suffer from the second limitation, and examines the vertical power balance of the market. They assume that the realized wholesale price is located between the possible monopoly price and the potential monopsony price, without a strong grounding in economic theory.¹

In this study, we use micro level data to estimate the vertical power balance between milk processors and retailers using a bargaining model grounded in non-cooperative game theory. Moreover, we assume a

¹Without the theoretical weakness, this model is implementable because it has fewer data requirements. Recently, Yamaura and Xia (2016) applied the model in the context of international trade, and Park et al. (2017) investigated the performance of the model using a Monte Carlo simulation.

differentiated milk product market, and apply the demand estimation while controlling for endogeneity. This methodology allows us to investigate the relative bargaining power of all pairs of products and retailers in each period. Using this feature, we invert the regional-level bargaining strengths, and point out the spatial similarities in bargaining power.

The rest of this paper is organized as follows. In the next section, we review the literature related to the estimation of vertical relationships, focusing on the bargaining framework. Then, we describe the structure of the Japanese milk industry in section 3. In section 4, we explain the methodology used to estimate the bilateral bargaining model and the BLP demand model. Next, we present our data in section 5, and the results of our estimations in section 6. Lastly, section 7 concludes the paper.

2 Literature review

2.1 Non-bargaining model

Traditionally, the NEIO approach has been used to estimate market power parameters. Studies based on this approach rely on a market conduct parameter, sometimes referred to as the conjectural elasticity. Under certain conditions, this parameter can be identified (Bresnahan 1982). The parameter nests any market competition, and has been applied in various industries and countries.² However, in the traditional market power concept, it is necessary to assume that one of players is a price-taker (Schroeter et al. 2000). This feature makes it challenging to apply the market power model to a bilateral market, which is common in modern food supply chains (Bonanno et al. 2017).

As an alternative to the conduct parameter approach, Schroeter et al. (2000) proposed a test for a bilateral oligopoly. This test considers bilateral, manufacturer, and retailer price-taking behavior, and provides methods to determine which of the three provides the best fit. This method of identifying a bilateral market is called the non-nested test. Non-nested models require the preparation of several possible bilateral models, and then apply the data to each model to select the best statistical fit.

In contrast to these studies that assume homogenous products, other non-nested bilateral models consider product differentiation. As in the case of homogenous products, these require preparing possible bilateral models in advance. Then, a pairwise test and an informal criteria test (e.g., positive marginal cost values) are conducted. Villas-Boas (2007) applied this approach to the U.S. yogurt market, showing that models of non-linear pricing by manufacturers or the high bargaining power of retailers provide the best fit. Following Villas-Boas (2007), Bonnet and Requillart (2013) analyzed the vertical relationships between soft drink

²A recent survey can be found in Perekhozhuk et al. (2017).

processors and retailers in France. Using the model with the best fit, they simulated how tax or production shocks affect consumers' prices, indicating that this vertical channel passes ad valorem tax and cost shocks on to consumers strongly.

Bonnet and Dubois (2015) analyzed the vertical relationships between French water manufacturers and retailers. In their setting, manufacturers are assumed to face two-part tariffs, taking into account retailers' buyer power. Their results show that manufacturers have a two-part tariff contract in this vertical channel, without resale price maintenance.

Although these studies propose many insightful implications, we cannot conclude that the selected bilateral relationships are correct, because they can only test possible relationships using non-nested tests. When the potential bilateral relations are unclear, as in the case of Japanese milk transactions, it is difficult to construct such tests. Therefore, in certain cases, it is better to apply nested tests (as in the bargaining model),³ where we can take into account all possible actions by players, and do not have to assume them in advance.

2.2 Bargaining model

Existing empirical bargaining models are classified according to whether they assume homogenous products or differentiated products. Both cases employ Nash bargaining models (Nash 1953, Rubinstein 1982, Binmore et al. 1986), although there are significant differences in the estimation process.

Both types of studies have been applied within the field of agricultural economics. A representative study that employs bargaining of homogenous products is that of Prasertsri and Kilmer (2008). They estimate the relative bargaining strength of a milk marketing cooperative in Florida, finding that the bargaining strength of the Southeast Dairy Cooperative exceeds that of the processors. Contrary to the findings of Prasertsri and Kilmer (2008), Ge et al. (2015) find that processors have stronger bargaining power relative to that of dairy cooperatives in Florida. These contradictory outcomes are partly caused by different specifications of the disagreement payoff.

Draganska et al. (2009) is a seminal work on differentiated product-based bargaining estimations, without needing actual wholesale transaction data, where they estimate German coffee transactions between manufacturers and retailers. They propose the following specification of the disagreement payoff. If the negotiation of a particular product fails, consumers cannot buy this product at all. Moreover, consumers may purchase other products, or choose not to buy any products. These features suggest that the failure of a negotiation causes the substitution of other products in the market. Subsequently, the processors' and retailers' payoffs change based on the substitution patterns, representing the disagreement payoff for that

³In this sense, empirical bargaining model is similar to the conduct parameter approach.

particular product. Thus, the price elasticity of each product in each market becomes necessary information, which can be acquired using a BLP demand estimation (Berry et al. 1995). Using this methodology, Bonnet and Bouamra-Mechemache (2016) estimated the bargaining power between processors and retailers in the French fluid milk market.

3 Japanese milk supply chain

This section provides an overview of how Japanese fluid milk is transacted, and the potential problems in the supply chain. There are three horizontal structures: farmers, processors, and retailers. In the vertical structure between farmers and processors, 10 designated milk producer cooperatives (DMPCs) are located in each block of a prefecture. In each block, milk processors negotiate the quantities they need with the DMPCs, rather than with the farmers. Moreover, a DMPC offers differential prices based on the use of milk, as in the United States, and blended prices that are paid to farmers.⁴

After being transported to processors' milk plants, raw milk is converted to fluid milk or to various dairy products. The ratio of fluid milk to all dairy products is 46%. Thus, fluid milk is the most common channel in Japan (MAFF 2015). Hence, we limit our analysis to fluid milk, without loss of generality, owing to its popularity in this channel. Retailers negotiate with milk processors after the conversion to fluid milk products, which is our area of research interest.

The market structure for Japanese retailers is given below. According to Motofuji (2010), the share of the top 11 supermarkets is 20.1%, and regional supermarkets exist in all prefectures. The top supermarket groups are AEON and Seven & i; however, they employ different market strategies for private brands (PBs). Seven & i started using PBs as a premium brand in 2007, whereas AEON has tended to price PBs in such a way as to gain market share (Nihonshokuryo-Shinbun 2016). We investigate whether these different strategies influence their respective bargaining power. In contrast to the structure of supermarkets, the CR3⁵ of convenience stores is 71%, which indicates that they are highly concentrated in this category. The structure of drugstores is similar to that of competitive supermarkets. Another characteristic of the retail category is the existence of consumer cooperatives (COOPs). COOPs deliver food products to consumers every week based on customers' orders.

The CR3 of milk processors is less than 30%,⁶ indicating that the bulk of milk is supplied by local processors. As is often the case, we cannot identify the producer of the PB type products, so we assume

⁴Suzuki et al. (1993, 1994) provide further detail on Japanese dairy industry systems. The blended prices are calculated based on the prices at the milk plant. A blended price is not the same as the farm-gate price in the United States. Therefore, coordinating milk quantities by region is the responsibility of DMPCs (Yasaka 2016).

⁵CR3 stands for the concentration ratio of top 3 companies in the market. It is calculated by dividing total sales of top 3 companies by total sales, multiplying 100.

⁶Calculated by the author using the data described in section 4.

that retailers contract with each processor which produces their PB milk.

Despite the competitive horizontal structures, many opinions exist on the relative bargaining strengths of retailers and processors. In late 2006, the cost of feed increased rapidly owing to a world food crisis. As a result, many Japanese dairy farmers struggled because they were not able to pass on the cost shock within the supply chain. Suzuki (2008) proposed that Japanese retailers' have strong buying power over processors, which we call the buyer power hypothesis.

To summarize the horizontal structures, buyers are as competitive as suppliers in terms of the concentration ratio, which means the market structure itself offers little insight into the strength of vertical power. Therefore, we cannot explicitly recognize which side's bargaining power in each pair is stronger antecedently when using micro-level data sets. Given these wholesale structures, bargaining model is needed in each market to test the buyer power hypothesis. As discussed earlier, Kinoshita et al. (2006) relied on the model of Azzam (1996), which uses an ad-hoc specification of the vertical power balance. Here, we apply a more flexible theory-based bargaining approach. In the next section, we set up the model and describe the estimation methods, following the works of Draganska et al. (2009) and Bonnet and Bouamra-Mechemache (2016).

4 Structural model

4.1 Supply models: Nash-in-Nash bilateral bargaining model

Following Draganska et al. (2009) and Bonnet and Bouamra-Mechemache (2016), in this section, we describe the bilateral bargaining model.⁷ First, we assume that the fluid milk vertical channel is composed of n_f upstream processors and n_r downstream retailers. Each upstream processor produces a set of goods G^f , and each downstream retailer sells R^r products to consumers. In the market, we assume there are J differentiated products, which are a combination of a brand and a retailer.

The retailer's profit function is given by

$$\Pi^r(\mathbf{p}) = \sum_{j \in R^r} [p_j - w_j - c_j] M s_j(\mathbf{p}), \tag{1}$$

where c_j is the marginal cost at the retail level, p_j and w_j are the retail price and wholesale price of product j , respectively, and M is the total market size.⁸

⁷Here, we rely heavily on the notation of Draganska et al. (2009), Bonnet and Bouamra-Mechemache (2016).

⁸We omit the subscript t to simplify the notation.

Next, the profit of firm f from all products sold to retailers is given by

$$\Pi^f(\mathbf{p}) = \sum_{j \in \mathbf{G}^f} [w_j - \mu_j] M s_j(\mathbf{p}), \quad (2)$$

where μ_j is the marginal cost of product j .

We first derive the retail margins, as in Draganska et al. (2009) and Bonnet and Bouamra-Mechemache (2016). We assume that retailers compete with each other in a Bertrand–Nash game in the end consumer market. This assumption is persuasive, because Japanese retailers face strong horizontal competition in terms of price in the consumer market.⁹

Each retailer r maximizes its profit $\Pi^r(\mathbf{p})$. Then, the following first-order-conditions are derived, where the price is the sub-game Nash equilibrium. Here, $p_j - w_j - c_j \equiv m^r$ indicates the margin of retailer r .

$$s_k + \sum_{j \in \mathbf{R}^r} [p_j - w_j - c_j] \frac{\partial s_j(\mathbf{p})}{\partial p_k} = 0, (\forall k \in \mathbf{R}^r). \quad (3)$$

Then, we transform equation (3) into matrix form, as follows:

$$\mathbf{m}^r = \mathbf{p} - \mathbf{w} - \mathbf{c}^r = -[\mathbf{T}^r * \Delta_{\mathbf{p}}]^{-1} \mathbf{s}(\mathbf{p}), \quad (4)$$

where \mathbf{w} is a vector of wholesale prices; \mathbf{T}_r is a diagonal ownership matrix ($J * J$), with elements of value one if product j is sold by retailer r , and 0 otherwise; $\Delta_{\mathbf{p}}$ is a matrix ($J * J$) of the market share derivatives with respect to retail prices, with general element $\frac{\partial s_j(\mathbf{p})}{\partial p_k}$, which we can calculate from the differentiated demand models; $\mathbf{s}(\mathbf{p})$ is a vector of market shares; and \mathbf{p} is a vector of retail prices, which we know from the data set. Thus, we know each element of the RHS of equation (4), without knowing \mathbf{w} . Thus, we can calculate the retailer’s margin.¹⁰

Next, we calculate the wholesale price equilibrium. Optimal wholesale prices result from the negotiation between processors and retailers. As we discussed in the literature review section, we model this feature by an asymmetric Nash bargaining game, where each pair of a processor and a retailer secretly and simultaneously bargain and decide product j ’s wholesale price.¹¹

Following Draganska et al. (2009) and Bonnet and Bouamra-Mechemache (2016), who follow Marx and Shaffer (1999), we assume that the bargaining between each processor–retailer pair maximizes the two players’

⁹In our data, we suppose that this assumption is reasonable, but in other cases, this could be restrictive. In conventional NEIO studies in which researchers have estimated conduct parameters, the results from assuming Bertrand–Nash behavior in advance are inconsistent. Thus, we need more sophisticated methods that enable us to simultaneously estimate the conduct parameter and the bargaining power parameter. This improvement is left to future research.

¹⁰This feature is common in merger simulation studies, such as Nevo (2001).

¹¹We implicitly assume that all processors and retailers have rational expectations, where the ultimate equilibrium outcome is anticipated by both parties.

joint profit. Under the bargaining, both players take as given all other negotiated contracts. Based on the retailer's bargaining strength $\lambda_j \in [0, 1]$, the two parties share the joint profit.¹² If the bargaining process fails, both parties earn their respective disagreement payoffs, which we discussed in section 2. Then, we can derive the equilibrium wholesale price for product j by the bilateral Nash bargaining problem between a processor and a retailer, where each pair maximizes the following Nash product:¹³

$$[\pi_j^r(w_j) - d_j^r]^{\lambda_j} [\pi_j^f(w_j) - d_j^f]^{1-\lambda_j}, \quad (5)$$

where $\pi_j^f(w_j)$ and $\pi_j^r(w_j)$ are the profits of the processor firm and the retailer, respectively, for product j . Each element is given by $\pi_j^r(w_j) = (p_j - w_j - c_j^r)Ms_j(p)$, $\pi_j^f(w_j) = (w_j - c_j^w)Ms_j(p)$. Moreover, d_j^f and d_j^r are the disagreement payoffs of the processor firm and the retailer, respectively.

Here, we explain how to construct these disagreement payoffs. As discussed in section 2, when product j 's negotiation fails, it disappear from the market. Then, the retailer gains d_j^r and the firm earns a profit d_j^f from the sales of its other products. Thus, given the retail prices, we can express the disagreement payoffs d_j^f and d_j^r by:

$$\begin{aligned} d_j^r &= \sum_{k \in \Omega^r \setminus j} (p_k - w_k - c_k^r) M \Delta s_k^{-j}(p), \\ d_j^f &= \sum_{k \in \Omega^f \setminus j} (w_k - c_k^f) M \Delta s_k^{-j}(p), \end{aligned}$$

where the term $\Delta s_k^{-j}(p)$ is the change in the market share of product k when product j is no longer available in the market. We now have data for all the terms in d_j^f and d_j^r , except for $\Delta s_k^{-j}(p)$. Thus, we can obtain the disagreement payoff values, as long as $\Delta s_k^{-j}(p)$ can be calculated. We obtain $\Delta s_k^{-j}(p)$ from the demand side structural parameters because these terms fundamentally grasp the substitution pattern. Therefore, we can calculate $\Delta s_k^{-j}(p)$ as follows:

$$\Delta s_k^{-j}(p) = \int \frac{\exp(\delta_k + \mu_{ik})}{(1 + \sum_{l \in \Omega \setminus j} \exp(\delta_l + \mu_{il}))}.$$

From equation (5), we obtain the following first-order conditions with respect to w_j :

$$\lambda_j (\pi_j^r - d_j^r)^{\lambda_j - 1} \frac{\partial \pi_j^r}{\partial w_j} (\pi_j^w - d_j^w)^{1-\lambda_j} + (\pi_j^r - d_j^r)^{\lambda_j} (1 - \lambda_j) (\pi_j^w - d_j^w)^{-\lambda_j} \frac{\partial \pi_j^f}{\partial w_j} = 0.$$

¹²The processor's bargaining strength is $1 - \lambda_j$.

¹³Here, we impose the following information restrictions, for simplification. First, we assume that a manufacturer negotiates with a given retailer for each of its products, and that each product is negotiated separately with the manufacturer. Second, we suppose that the retail prices are not observable during the bargaining over the wholesale prices. Thus, the retail prices are considered fixed when calculating the bargaining solution.

Then,

$$\lambda_j(\pi_j^w - d_j^w) \frac{\partial \pi_j^r}{\partial w_j} + (1 - \lambda_j)(\pi_j^r - d_j^r) \frac{\partial \pi_j^f}{\partial w_j} = 0.$$

We can now substitute in $\frac{\partial \pi_j^r}{\partial p_j^w} = -Ms_j(p)$ and $\frac{\partial \pi_j^w}{\partial p_j^w} = Ms_j(p)$, as long as our assumption that the retail prices are given during the negotiation is correct. We believe this is true and, thus, obtain the final bargaining model, as follows:

$$\pi_j^w - d_j^w = \frac{1 - \lambda_j}{\lambda_j} (\pi_j^r - d_j^r). \quad (6)$$

Stacking equation (6) over all products in the market, we obtain the following matrix representation:

$$T^f * \begin{bmatrix} s_1 & -\Delta s_2^{-1} & \dots & -\Delta s_N^{-1} \\ -\Delta s_1^{-2} & s_2 & \dots & -\Delta s_N^{-2} \\ \vdots & \vdots & \ddots & \vdots \\ -\Delta s_1^{-N} & -\Delta s_2^{-N} & \dots & s_N \end{bmatrix} \begin{bmatrix} m_1^f \\ m_2^f \\ \vdots \\ m_N^f \end{bmatrix} = \frac{1 - \lambda}{\lambda} T^r * \begin{bmatrix} s_1 & -\Delta s_2^{-1} & \dots & -\Delta s_N^{-1} \\ -\Delta s_1^{-2} & s_2 & \dots & -\Delta s_N^{-2} \\ \vdots & \vdots & \ddots & \vdots \\ -\Delta s_1^{-N} & -\Delta s_2^{-N} & \dots & s_N \end{bmatrix} \begin{bmatrix} m_1^r \\ m_2^r \\ \vdots \\ m_N^r \end{bmatrix},$$

where T^f is the processor's ownership matrix. When the same processors sell products k and j , the general element $T^f(k, j)$ of the ownership matrix T^f is equal to one, and is zero otherwise.

Rewriting this in vector notation, we have:

$$\mathbf{m}^f = \frac{1 - \lambda}{\lambda} [T^f * \mathbf{S}]^{-1} [T^r * \mathbf{S}] \mathbf{m}^r, \quad (7)$$

where

$$\mathbf{S} = \begin{bmatrix} s_1 & -\Delta s_2^{-1} & \dots & -\Delta s_N^{-1} \\ -\Delta s_1^{-2} & s_2 & \dots & -\Delta s_N^{-2} \\ \vdots & \vdots & \ddots & \vdots \\ -\Delta s_1^{-N} & -\Delta s_2^{-N} & \dots & s_N \end{bmatrix}, \mathbf{m}^f = \begin{bmatrix} m_1^f \\ m_2^f \\ \vdots \\ m_N^f \end{bmatrix}, \mathbf{m}^r = \begin{bmatrix} m_1^r \\ m_2^r \\ \vdots \\ m_N^r \end{bmatrix}.$$

When the same retailers sell products k and j , the general element $T^r(k, j)$ of the ownership matrix T^r is equal to one, and zero otherwise.

As Draganska et al. (2009) mention, when both processors and retailers are single-product firms, then $T^r = T^f = I$, where I is the identity matrix. In this case, equation (7) reduces to $m_j^f = \frac{1 - \lambda}{\lambda} m_j^r$, which means that the profit share is determined by the perfectly exogenous bargaining power λ . In the case of $d_j^f = d_j^r = 0$, the result is the same.

Now, we assume that the retail price of each product is composed of the marginal cost of supplying the product and the respective margins of the processor and the retailer. Here, we assume a total marginal cost

$\mathbf{c} = \mathbf{c}^f + \mathbf{c}^r$. From equations (4) and (7),

$$\begin{aligned}
\mathbf{p} &= \mathbf{c}^f + \mathbf{c}^r + \mathbf{m}^f + \mathbf{m}^r \\
&= \mathbf{c} + \left[\frac{1-\lambda}{\lambda} [T^f * \mathbf{S}]^{-1} [T^r * \mathbf{S}] + \mathbf{I} \right] \mathbf{m}^r \\
&= \mathbf{c} - \left[\frac{1-\lambda}{\lambda} [T^f * \mathbf{S}]^{-1} [T^r * \mathbf{S}] + \mathbf{I} \right] \left[[T^r * \Delta_p]^{-1} \mathbf{s}(\mathbf{p}) \right],
\end{aligned} \tag{8}$$

where \mathbf{I} is the identity matrix.

This equation (8) is the final estimation model in our bargaining setting. As long as we use appropriate observable variables, we can identify the fixed coefficients λ for each pair of a processor and a retailer without knowing the observably separate marginal costs. All we need is the structural demand parameters in order to obtain Δ_p and \mathbf{S} matrix.

4.2 BLP demand model

We use the BLP method to estimate the differentiated demand (Berry et al. 1995) in order to capture the structural demand parameters. We denote consumer $i \in [1, N]$'s indirect utility as U_{ibrt} when she buys product $b \in [1, B]$ in retail store $r \in [1, R]$ at time $t \in [1, T]$. Assuming linear relationships, we set the indirect utility as follows:

$$U_{ibrt} = \alpha_{br} - \beta_i p_{brt} + \gamma X_{brt} + \xi_{brt} + \epsilon_{ibrt}, \tag{9}$$

where α_{br} is the fixed effect of the product,¹⁴ and X_{brt} are exogenous variables that affect a consumer's purchasing choice. We use the fat content and Ca content as exogenous variables. We also use the variety sold by each retailer r at time t and its squared term as exogenous variables. These variety variables control consumers' preferences for a variety. Let ξ_{brt} denote the unobserved factor that researchers cannot see from the data. Potentially, ξ_{brt} is correlated with p_{brt} . Then, ϵ_{ibrt} denotes the i.i.d. residual, which follows a type-I extreme value distribution, following the ordinal discrete choice models of (Train 2009). We infer consumers' idiosyncratic behavior from this term.

We also assume that β_i is heterogeneous over consumers:

$$\beta_i = \beta + \sigma_p v_i, v_i \sim N(0, 1). \tag{10}$$

From equation (9), we can divide this into a mean utility part $\delta_{brt} = \alpha_{br} - \beta p_{brt} + \gamma X_{brt} + \xi_{brt}$ and a deviation from the mean part $\mu_{ibrt} = \sigma_p v_i p_{brt}$.

¹⁴We use the term product to denote the combination of brand b and retailer r .

Following Berry et al. (1995), we set the outside option as $b = r = 0$, and its utility as $U_{i00t} = \epsilon_{i00t}$. Then, consumer i buys brand b at r in t , as long as $U_{ibr t} > U_{ib'r't}, (\forall b' \neq b, \forall r' \neq r)$. Thus, the choice probability s_{brt} is expressed as follows:

$$s_{brt} = \int \frac{\exp(\delta_{brt} + \mu_{ibr t})}{1 + \sum_{k=1}^B \sum_{s=1}^R \exp(\delta_{kst} + \mu_{ikst})} dF(\mu). \quad (11)$$

For the estimation of equation (9), we adopt the BLP contraction mapping algorithm (Berry et al. 1995). Because we cannot observe ξ_{brt} , this part can be the source of the omitted variables. In the BLP method, we invert ξ_{brt} using the contraction mapping algorithm. Then, we construct the moment conditions using the instruments, denoted by $z_{j,t}$. Thus, we can apply the GMM method to obtain the parameters $\hat{\theta}$, as follows:

$$E(\xi_{j,t} h(z_{j,t}, x_{j,t})) = 0. \quad (12)$$

The contraction mapping algorithm is as follows. First, we set arbitrary initial parameters, and then calculate equation (11). Equation (11) denotes the estimated share, which should correspond to the real share. Then, the true ξ_{brt} is realized. Therefore, we can express the algorithm as follows:

$$\xi_t^{h+1} = \xi_t^h + \log(S_t) - \log(s(x_t, p_t, \xi_t^h; \theta_k)). \quad (13)$$

Here, we update the value of ξ_{brt} until the difference between ξ_{brt}^{h+1} and ξ_{brt}^h becomes small. In this contraction mapping process, we do not need to worry about convergence under the general conditions (Berry 1994, Berry et al. 1995).

We follow three works that adapt the BLP methods for the instruments $z_{j,t}$ which is correlated with endogenous variables, and is not associated with ξ_{brt} . The details of the adapted instruments are as follows. Following Dubé et al. (2012), we use the quadratic approximation of the product characteristics and the production cost data, such as the gasoline price index, electricity price index, or labor index. Following Hausman (1996), we also use the mean retail prices of the other market m in the same period t . Then, following Reynaert and Verboven (2014), Berry et al. (1995), we use the sum of the characteristics for the different products.

5 Data

We use home-scan panel data from representative Japanese consumer panel data, collected by Macromill Ltd., a major data company in Japan. From this data set, we determine when and where consumers buy certain products, and the name of the purchased brand at the dairy level. The data are collected from all prefectures, except for Okinawa, which is located in the southeast of Japan. The consumer panel is constructed in proportion to the Japanese demographics, and contain around 37,068 monitors for the period June 2012 to December 2014.

We aggregate the original data according to the following criteria. First, we aggregate all data at the monthly level from the day-level data. Then, we include all brands for which the name is identified in the data, and aggregate the unknown brands into three categories according to the brand type (COOP milk, PB, and NB). This process yields 37 selected brands. Next, we select the top three retailers (AEON, Seven & i, COOP), representing the top three quantities of sold milk in the data. As in the brand selection, we aggregate the rest of the retailers by type (e.g., “Discounters,” “Drugstores,” “Convenience stores,” “Other retailers”). We have seven selected retailers in total.

Figure 1 shows a price level for the brand type and for the retailer type. On average, COOP milk is the most expensive, and PB milk is the least expensive. This feature does not change during the study period. For retailers, the COOP, which distributes using the delivery system, has the highest price level, and discounters and drugstores have the lowest retail prices. The top-share retailers, AEON and Seven & I, have different price ranges, reflecting the different strategies of milk sales. The bottom part of Figure 1 shows the trend in the quantity sold by retailers. The “Other retailers” category has the largest share in all periods, indicating that regional supermarkets have part of the overall share.

As product attributes, we use the fat content (denoted by FAT) and the Ca content (indicated by Ca) collected from the processors’ websites or from telephone interviews. Additionally, we use the retail gasoline price,¹⁵ wage index,¹⁶ wholesale milk output index,¹⁷ and farmers’ pool milk prices as instruments.¹⁸ These data were collected at the month level. For gasoline prices, we also have prefecture level variations. The final sample size is 63,507.

¹⁵Monthly data for the prefectural capital cities, taken from the Retail Price Survey of the Statistics Bureau, Ministry of Internal Affairs and Communications.

¹⁶Monthly data, obtained from the Monthly Wage Survey of the Ministry of Health, Labour and Welfare.

¹⁷Monthly data, collected from the Firm Price Index of the Bank of Japan

¹⁸Monthly data for the Pool Milk Price, provided by the Japan Dairy Council.

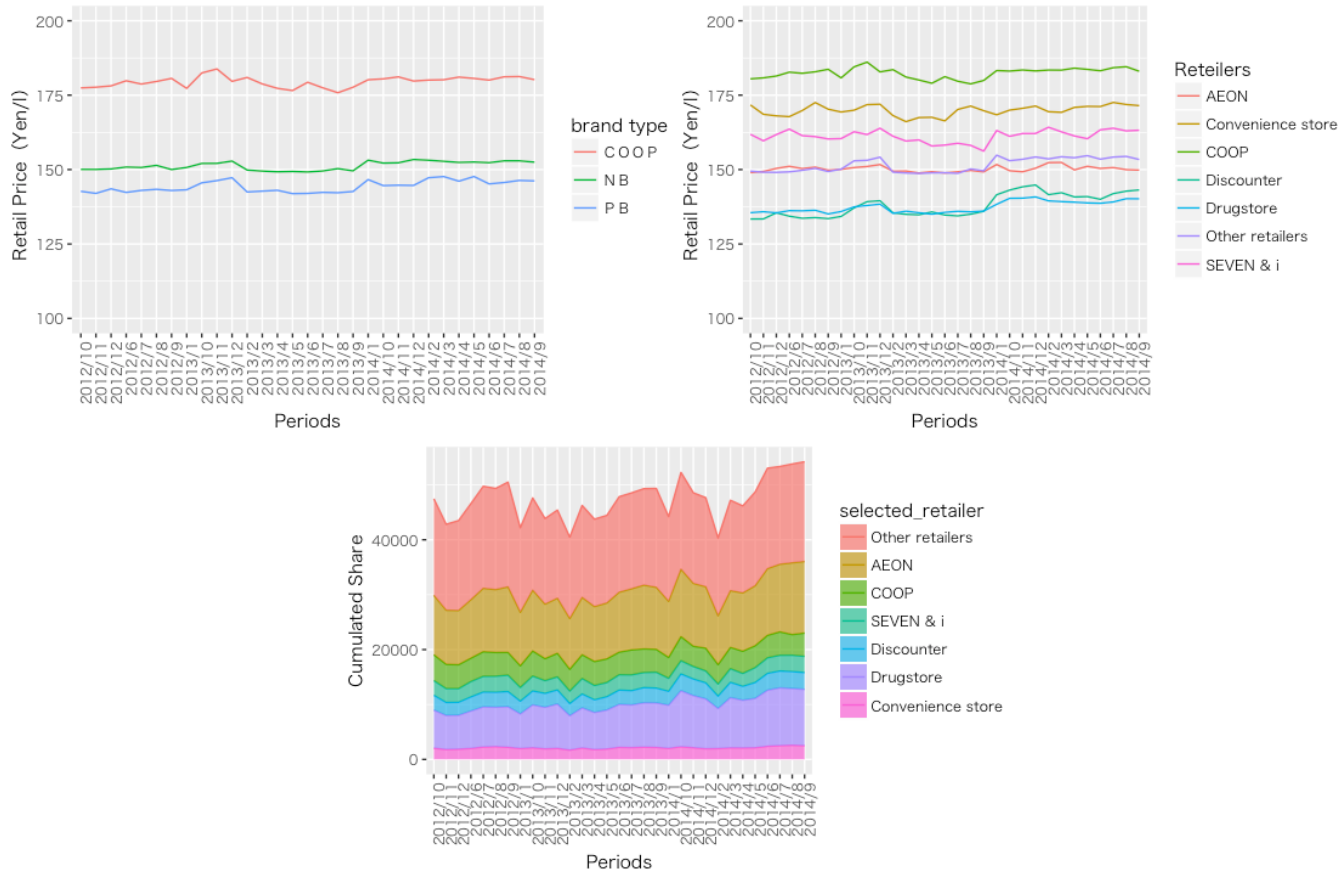


Figure 1: Price and quantity variation over the sample period

Note 1: 1 JPY = 0.0088 US dollars in 2017.

6 Results and discussion

6.1 Demand estimates

The result of the BLP demand estimation is shown in Table 1. As predicted by the theory, the coefficients of the retail prices are negative for the utility. In addition, this result indicates that the price response is heterogeneous over consumers because there is a 0.015 standard deviation from the mean value.

The coefficients of the varieties have negative signs, and the squared terms of the varieties have positive signs. This feature of the coefficients indicates the concave relationship between the indirect utility function and the variety, such that the best number of the choice set exists.¹⁹

Using these demand-side structural parameters, we calculate the substitution patterns in each market, which are required in the bargaining model estimation.

¹⁹In general, consumers' information processing ability is limited. A choice set with too many options can reduce consumers' willingness to buy. The theoretical paper presenting this finding is Branco et al. (2015), Kuksov and Villas-Boas (2009), and the empirical paper is Sato and Niiyama (2008), Richards et al. (2014, 2016).

Table 1: Result of the BLP demand estimation

	Coefficients	S.E.
Retail Price		
mean	-0.047***	(0.001)
SD	0.015***	(0.001)
Brand Characteristics		
Fat	0.271***	(0.004)
Ca	0.061***	(0.017)
NB	0.095	(0.051)
PB	-0.670***	(0.055)
Retail Characteristics		
Variety	-0.108***	(0.005)
Variety 2	0.001***	(0.000)
AEON	-0.059***	(0.021)
COOP	-0.171*	(0.046)
Seven & i	-0.748***	(0.028)
Discounters	-1.760***	(0.029)
Drugstores	-1.140***	(0.028)
Convenience stores	-0.622***	(0.039)
Constant	2.698***	(0.188)
Observations	63,507	

Note 1: The removed dummy is “COOP” in Brand Characteristics, and Retail 1 (other retailers) in Retail Characteristics.

Note 2: Robust S.E are given in parentheses.

Note 3: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

6.2 Bargaining power estimates of each product

Using the estimated demand parameters and the supply side model, we calculate the bargaining power of each pair of a processor and a retailer. Table 2 shows the estimated means of the bargaining power parameters for the three types of milk and the seven retailers. The closer a parameter value is to one, the

Table 2: Estimated bargaining power parameters

	AEON	Convenience	Seven & i	Other retailers	Discounters	COOP	Drugstores
COOP	1.015	NA	NA	0.969	NA	0.551	NA
NB	0.943	1.000	1.000	0.586	0.995	1.000	1.179
PB	0.209	0.857	0.982	0.669	0.971	NA	1.057

Note1: NA indicates no data.

more bargaining power retailers have. Large retailers, such as AEON and Seven & i, and convenience stores, discounters, and drugstores have the stronger bargaining power than that of the milk processors. In the case of NB milk transactions, convenience stores, Seven & i, and COOPs have complete bargaining power over their buyers, which indicates a take-it-or-leave-it offer by retailers. However, one of the large retailers, AEON, exerts bargaining power of 0.209 only in the PB, whereas the other large retailer Seven & I, has 0.982 over PB processors. This divergence is possibly caused by the different strategies for PB milk between AEON and Seven & i, as discussed in section 3.

The bargaining power of “Other retailers” category is 0.585, suggesting that NB processors are better off when they sell milk to retailers in the “Other retailers” category than when they sell milk to large retailers or to discounters. The “Other retailers” group is aggregated, and contains many local small and middle-sized supermarkets, suggesting that regional NB processors can survive with better profitability than that of the other buyers. This reduces the exits of Japanese milk processors, resulting in the low concentration in the processors’ horizontal structure.

“Other retailers” have strong power when they purchase COOP milk, showing 0.969 bargaining power. In contrast, a COOP’s bargaining power in COOP milk is 0.551, suggesting that COOPs share the margin in milk transactions more fairly than in the case of other transactions. However, COOP do not contract fairly in their negotiation with NB-type milk processors, on average. Thus, in terms of aggregated estimates, we reject that a COOP contains fair share contracts in NB milk transaction.

6.3 Regional differences of the bargaining power

Figure 2 shows that the bargaining power varies by region and by milk type. Retailers have stronger bargaining power, on average, in terms of NB milk in all prefectures. Retailers have lower bargaining power in PB milk in almost all prefectures, although it still exceeds 0.500 in many regions. We detect the largest regional differences of the bargaining strengths in the PB category. COOP milk stays in the middle range of bargaining power in many regions. As a rule, we can see spatial relationships between each prefecture in that the neighborhoods’ bargaining power is similar.

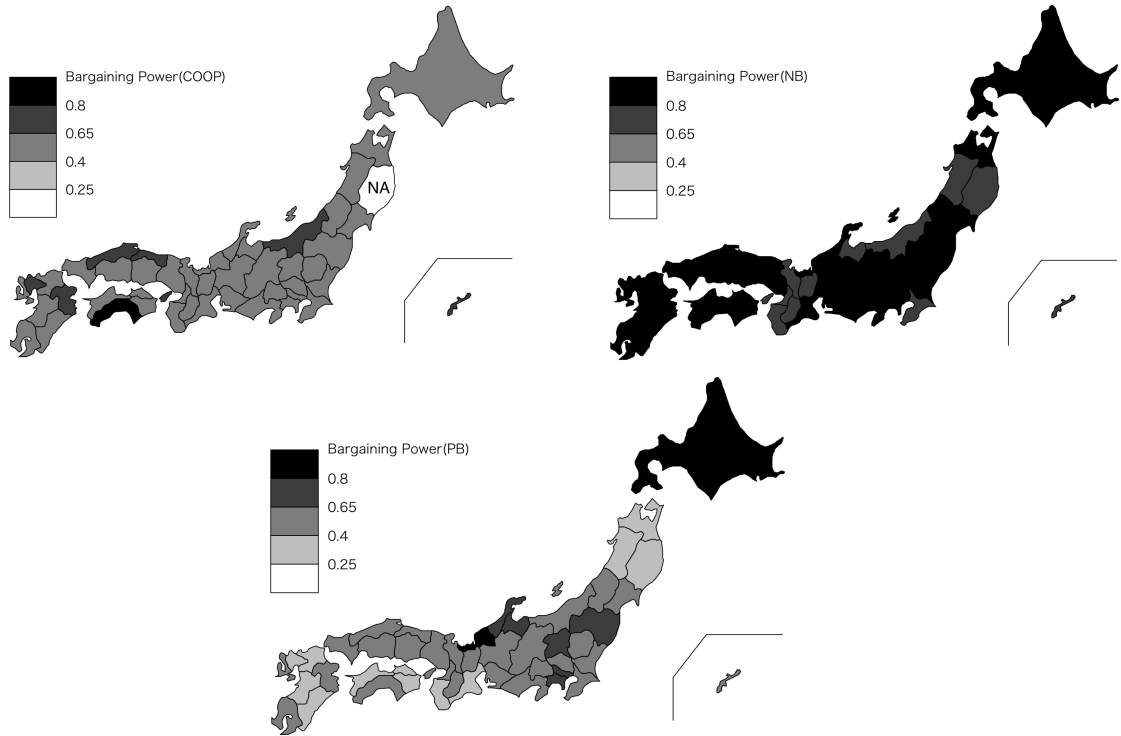


Figure 2: Regional differences in retailers' bargaining power, by type of milk

Note 1: NA indicates no data.

Figure 3 illustrates the variation in bargaining power by retail group. As discussed previously, convenience stores, discounters, and drugstores have stronger power, and this feature is consistent in every prefecture. On the other hand, other small and middle-sized retailers have less bargaining power, although they have homogenous spatial differences. Large retailers, such as AEON and Seven & i, show different results. Seven & i has homogeneously stronger bargaining power in most of the regions we investigated, whereas AEON has over 0.8 bargaining power in only a few regions. These findings imply that even within the same category of large retailers, different market strategies result in differences in bargaining power. Moreover, we find regional differences for COOP milk. COOP milk has equal bargaining power in some prefectures, including consumption areas such as Osaka and Tokyo, but unequal power in others, including many rural areas.

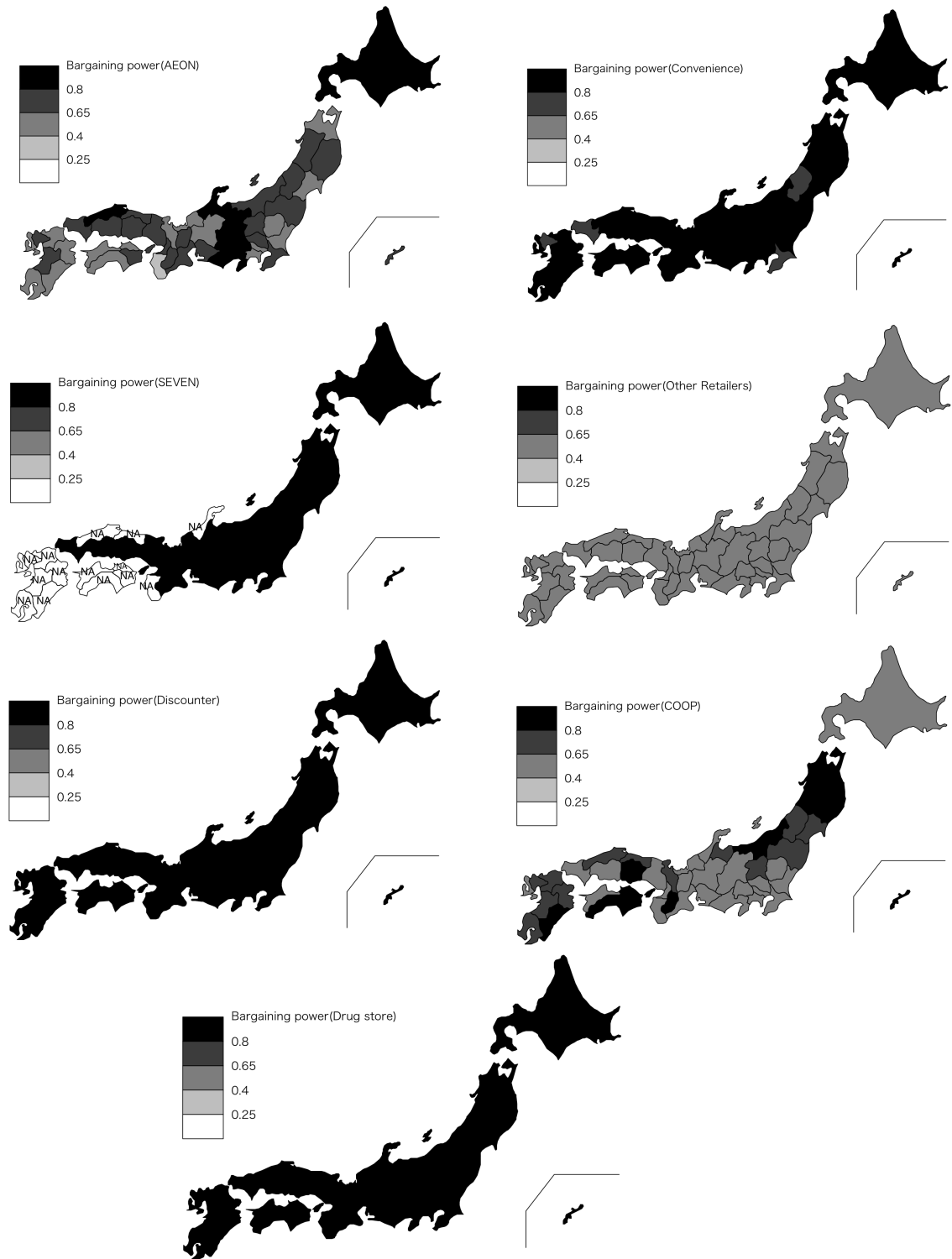


Figure 3: Regional differences in retailers' bargaining power, by retailer

Note: The white area (NA) signifies that no data are available.

6.4 Determinants of the bargaining strengths

To investigate the determinants of the strength of bargaining power, we regress the bargaining power parameters λ_{br} on the milk-type characteristics X_M and on retailers' characteristics X_R . This enables us to identify the exogenous factor that determines the size of the bargaining power.²⁰

$$\lambda_{brt} = \beta_0 + \beta_r * X_{bt} + \beta_r * X_{rt} + \mu_{brt} + \epsilon_{brt}. \quad (14)$$

The results are shown in Table 3. Models 1 and 2 show similar results, but model 2 has a greater R^2 value. These findings indicate that retailers have stronger bargaining power in NB than they do in COOP milk, and that there are slight differences between PB and COOP milk. With regard to retail type, discounters, drugstores, and convenience stores have far greater power than other types of retailers do, including many local retailers.

Then, table 3 shows that AEON has relatively less bargaining power, even though it is a top-share retailer. Another top-level retailer, Seven & i, has far greater bargaining power. To investigate which factor divides these retailers, we introduce a cross-term effect in equation (14). The results appear in columns for models 3 and 4. AEON has greater bargaining power when purchasing NB milk, but less power when purchasing PB milk. In contrast, Seven & i has significant bargaining power when purchasing both types of milk. These results reflect the different positioning of the private brand in terms of the retailers' sales strategies, as discussed in section 3. AEON sells PB milk at a lower retail price, sacrificing their margin, whereas Seven & i positions PB milk as a premium brand, yielding high profitability.

²⁰Draganska et al. (2009) and Bonnet and Bouamra-Mechemache (2016) perform a similar estimation. Note that this regression only reveals a correlation, not a causal effect. An analysis of the mechanisms contributing to stronger bargaining power is left to future research.

Table 3: Determinants of bargaining power

	<i>Dependent Variable: Bargaining Power λ_{br}</i>			
	(1) Pooling	(2) FE	(3) Pooling	(4) FE
Milk Type (Base: COOP)				
NB	0.251*** (0.005)	0.262*** (0.005)	-0.198*** (0.004)	-0.195*** (0.004)
PB	0.020*** (0.005)	0.029*** (0.005)	-0.270*** (0.004)	-0.268*** (0.004)
Retail Type (Base: Other Retailers)				
AEON	-0.160*** (0.004)	-0.158*** (0.004)	0.015 (0.011)	0.010 (0.011)
COOP Delivery	0.004 (0.004)	0.008* (0.005)	-0.433*** (0.004)	-0.431*** (0.004)
Seven & i	0.215*** (0.005)	0.208*** (0.005)	-0.033** (0.015)	-0.038** (0.015)
Discounters	0.190*** (0.004)	0.188*** (0.004)	-0.016 (0.013)	-0.027** (0.013)
Drugstores	0.224*** (0.004)	0.223*** (0.004)	0.003 (0.017)	-0.006 (0.018)
Convenience Stores	0.138*** (0.004)	0.139*** (0.004)	0.006 (0.014)	0.0001 (0.015)
Milk Type * Retail Type				
NB: AEON			0.141*** (0.011)	0.146*** (0.011)
PB: AEON			-0.452*** (0.011)	-0.446*** (0.011)
NB:COOP delivery			0.650*** (0.005)	0.647*** (0.005)
PB:COOP delivery			0.655*** (0.018)	0.643*** (0.019)
NB: Seven & i			0.254*** (0.015)	0.256*** (0.015)
PB: Seven & i			0.303*** (0.015)	0.305*** (0.015)
NB: Discounters			0.245*** (0.013)	0.257*** (0.013)
PB: Discounters			0.280*** (0.013)	0.288*** (0.013)
NB: Drugstores			0.288*** (0.017)	0.297*** (0.018)
PB: Drugstores			0.331*** (0.018)	0.341*** (0.018)
NB: Convenience Stores			0.220*** (0.014)	0.225*** (0.015)
PB: Convenience Stores			0.097*** (0.014)	0.102*** (0.015)
Constant	0.635*** (0.005)		0.975*** (0.004)	
Observations	16,134	16,134	16,134	16,134
R ²	0.636	0.644	0.930	0.935
Adjusted R ²	0.636	0.609	0.929	0.928
F-Statistic	3,527.910***	3,323.323***	10,626.250***	10,529.630***

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

7 Conclusion

This study analyzed the vertical channel of Japanese milk transactions, where both buyers and sellers have competitive structures, and estimated the relative bargaining power of processors and retailers. Here, we model the bilateral bargaining between the two parties, without assuming price-taking behavior on either side of the bargaining process, in contrast to conventional NEIO studies. For the bargaining power estimation, we prepared structural demand parameters, applying home-scan panel data to the BLP demand estimation. Then, we calculated the bargaining power of each pair of a processor and a retailer in each market.

First, our results indicate that retailers have stronger bargaining power, even in the horizontally competitive structure. This suggests that the vertical structure cannot be inferred from the horizontal structure. Second, although retailers exert greater bargaining power than that of processors overall, regional supermarkets, which have the highest total share, have modest levels of bargaining power in the case of NB milk and PB milk. Thus, local processors' bargaining power is not weak, enabling them to survive. Third, we show the difference in bargaining power between AEON and Seven & I, which exhibit contrasting PB strategies, even though the organizations are of a similar size. Here, we find that the different market strategies result in different levels of profitability in the case of Japanese fluid milk transactions.

The novelty of this research is that it shows the regional differences in bargaining power. We find both regional homogeneity and heterogeneity in terms of bargaining strength. COOPs and small and medium-sized supermarkets tend to have similar power to that of their suppliers. Despite this, the bargaining power of COOPs tends to be heterogeneous, and that of small and medium-sized supermarkets tends to be homogeneous.

Overall, we find empirical support for the buyer power hypothesis in Japanese milk transactions. This is the first detailed empirical evidence of Japanese retailers exerting buying power over milk suppliers. Although we do not directly investigate the impact of the bargaining strength of retailers, several of the recent market failures in the Japanese milk supply chain are attributable to the buying power of retailers. The policy implications of these findings are that we have to improve the unequal bargaining structures in order to enhance the market mechanisms. At the same time, an appropriate retail price for fluid milk should be determined, because it tends to be used as a loss leader, with some retailers selling it below cost. Moreover, employing fluid milk as a loss leader makes it difficult to pass costs down the supply chain, resulting in low wholesale prices. In addition, institutional reforms should promote informational transparency in order to realize more balanced bargaining power. For instance, the EU milk package encompasses inter-branch organizational initiatives, where stakeholders in the milk supply chain become involved to ensure fair price negotiations. Our results strongly suggest that institutional change in the Japanese milk supply chain is

required.

Unlike Bonnet and Bouamra-Mechemache (2016), who state that there are two major food companies and five large retailers, we find there are many suppliers and buyers, as well as many local companies in Japan. Our results suggest that even in a horizontally competitive retail market, retailers can exert strong bargaining power over suppliers. Thus, horizontal structures cannot be used to identify vertical conduct. These inferences are based on a structural bargaining model, which we use to model bilateral negotiations. This methodology can be applied to a bilateral oligopoly market and to a bilateral competitive market. A possible extension to this model is to relax the assumption of the information set in the bargaining process. See Bonnet and Bouamra-Mechemache (2016) for further details. Another interesting extension would be to incorporate the multi-product profit maximization of processors in the bargaining process. Moreover, modeling the spatial competition directly in the bargaining estimation would enable us to empirically observe the spatial relationships.

References

- Azzam, Azzeddine M (1996) “Estimating the degree of dominance in a bilateral oligopoly,” *Applied Economics Letters*, Vol. 3, No. 4, pp. 209–211.
- Battigalli, Pierpaolo, Chiara Fumagalli, and Michele Polo (2007) “Buyer power and quality improvements,” *Research in Economics*, Vol. 61, No. 2, pp. 45–61.
- Berry, S, J Levinsohn, and A Pakes (1995) “Automobile prices in market equilibrium,” *Econometrica*, Vol. 63, No. 4, pp. 841–890.
- Berry, S T (1994) “Estimating discrete-choice models of product differentiation,” *The RAND Journal of Economics*, Vol. 25, No. 2, pp. 242–262.
- Binmore, Ken, Ariel Rubinstein, and Asher Wolinsky (1986) “The Nash bargaining solution in economic modelling,” *The RAND Journal of Economics*, Vol. 17, No. 2, pp. 176–188.
- Bonanno, Alessandro, Carlo Russo, and Luisa Menapace (2017) “Market power and bargaining in agrifood markets: A review of emerging topics and tools,” *Agribusiness*, No. November, pp. 1–18.
- Bonnet, Celine and Zohra Bouamra-Mechemache (2016) “Organic Label, Bargaining Power, and Profit-sharing in the French Fluid Milk Market,” *American Journal of Agricultural Economics*, Vol. 98, No. 1, pp. 113–133.
- Bonnet, Celine and Pierre Dubois (2015) “Identifying Two Part Tariff Contracts with Buyer Power: Empirical Estimation on Food Retailing,” *TSE Working Paper*.
- Bonnet, Celine and V Requillart (2013) “Impact of Cost Shocks on Consumer Prices in Vertically-Related Markets: The Case of The French Soft Drink Market,” *American Journal of Agricultural Economics*, Vol. 95, No. 5, pp. 1088–1108.
- Branco, Fernando, Monic Sun, and J Miguel Villas-Boas (2015) “Too Much Information? Information Provision and Search Costs,” *Marketing Science*, Vol. 35, No. 4, pp. 605–618.
- Bresnahan, Timothy F (1982) “The oligopoly solution concept is identified,” *Economics Letters*, Vol. 10, No. 1-2, pp. 87–92.
- Chambolle, Claire and Sofia Berto Villas-Boas (2015) “Buyer power through the differentiation of suppliers,” *International Journal of Industrial Organization*, Vol. 43, pp. 56–65.

- Draganska, Michaela, Daniel Klapper, and Sofia Berto Villas-Boas (2009) "A Larger Slice or a Larger Pie? An Empirical Investigation of Bargaining Power in the Distribution Channel," *Marketing Science*, Vol. 29, No. 1, pp. 57–74.
- Dubé, Jean-Pierre, Jeremy T Fox, and Che-Lin Su (2012) "Improving the numerical performance of static and dynamic aggregate discrete choice random coefficients demand estimation," *Econometrica*, Vol. 80, No. 5, pp. 2231–2267.
- Ge, Jiaoju, Alfonso Flores-Lagunes, and Richard L Kilmer (2015) "An analysis of bargaining power for milk cooperatives and milk processors in Florida," *Applied Economics*, Vol. 47, No. 48, pp. 5159–5168.
- Hausman, Jerry A (1996) "Valuation of new goods under perfect and imperfect competition," in *The economics of new goods*: University of Chicago Press, pp. 207–248.
- Kinoshita, J, N Suzuki, and H M Kaiser (2006) "The degree of vertical and horizontal competition among dairy cooperatives, processors and retailers in Japanese milk markets," *Journal of the Faculty of Agriculture Kyushu University*, Vol. 51, No. 1, pp. 157–163.
- Kuksov, Dmitri and J Miguel Villas-Boas (2009) "When More Alternatives Lead to Less Choice," *Marketing Science*, Vol. 29, No. 3, pp. 507–524.
- MAFF (2015) "Statistics survey on milk dairy products (In Japanese)."
- Marx, Leslie M and Greg Shaffer (1999) "Predatory accommodation: below-cost pricing without exclusion in intermediate goods markets," *The RAND Journal of Economics*, Vol. 30, No. 1, pp. 22–43.
- Motofuji, Takaki (2010) "Analysis of price sensitive effect and a percentage of repeat custom for retail institutions in small trade areas (In Japanese)," *The Journal of Tokyo Keizai University: Business*, pp. 251–272.
- Myers, Robert J, Richard J Sexton, and William G Tomek (2010) "A century of research on agricultural markets," *American Journal of Agricultural Economics*, Vol. 92, No. 2, pp. 376–403.
- Nash, John (1953) "Two-person cooperative games," *Econometrica*, Vol. 21, No. 1, pp. 128–140.
- Nevo, Aviv (2001) "Measuring Market Power in the Ready-to-Eat Cereal Industry," *Econometrica*, Vol. 69, No. 2, pp. 307–342.
- Nihonshokuryo-Shinbun (2016) "Contrasted Profitability of PB between Large Retailers; Seven & i and AEON (In Japanese)."

- Park, Seongjin, Chanjin Chung, and Kellie Curry Raper (2017) “Modelling upstream and downstream market power in bilateral oligopoly,” *Applied Economics*, Vol. 49, No. 10, pp. 1016–1031.
- Perekhozhuk, Oleksandr, Thomas Glauben, Michael Grings, and Ramona Teuber (2017) “Approaches and Methods for the Econometric Analysis of Market Power: A Survey and Empirical Comparison,” *Journal of Economic Surveys*, Vol. 31, No. 1, pp. 303–325.
- Prasertsri, P and R L Kilmer (2008) “The bargaining strength of a milk marketing cooperative,” *Agricultural and Resource Economics Review*, Vol. 37, No. 2, pp. 204–210.
- Reynaert, Mathias and Frank Verboven (2014) “Improving the performance of random coefficients demand models: the role of optimal instruments,” *Journal of Econometrics*, Vol. 179, No. 1, pp. 83–98.
- Richards, Timothy J, Miguel I Gómez, and Jun Lee (2014) “Pass-Through and Consumer Search: An Empirical Analysis,” *American Journal of Agricultural Economics*, Vol. 96, No. 4, pp. 1049–1069.
- Richards, Timothy J, Gordon J Klein, Celine Bonnet, and Zohra Bouamra-Mechemache (2016) “Strategic Obfuscation and Retail Pricing ,” *TSE working paper*.
- Rubinstein, Ariel (1982) “Perfect equilibrium in a bargaining model,” *Econometrica*, Vol. 50, No. 1, pp. 97–109.
- Sato, Masayuki and Yoko Niiyama (2008) “The information quantity and consumer choice behavior at the point-of-food-purchase: Information providing on traceability-system,” *Journal of Food System Research (In Japanese)*, Vol. 14, No. 3, pp. 13–24.
- Schroeter, John R, Azzeddine M Azzam, and Mingxia Zhang (2000) “Measuring market power in bilateral oligopoly: the wholesale market for beef,” *Southern Economic Journal*, Vol. 66, No. 3, pp. 526–547.
- Sexton, Richard J (2012) “Market power, misconceptions, and modern agricultural markets,” *American Journal of Agricultural Economics*, Vol. 95, No. 2, pp. 209–219.
- Suzuki, Nobuhiro (2008) “Exhaustion of dairy farmers and direction of the crisis breakthrough of dairy management (In Japanese),” *Agriculture and Economy*, Vol. 74, No. 6, pp. 79-90.
- Suzuki, Nobuhiro, John E Lenz, and Olan D Forker (1993) “A conjectural variations model of reduced Japanese milk price supports,” *American Journal of Agricultural Economics*, Vol. 75, No. 1, pp. 210–218.
- Suzuki, Nobuhiro, Harry M Kaiser, John E Lenz, Olan D Forker, and Kohei Kobayashi (1994) “Evaluating generic milk promotion effectiveness with an imperfect competition model,” *American Journal of Agricultural Economics*, Vol. 76, No. 2, pp. 296–302.

Train, Kenneth E (2009) *Discrete choice methods with simulation*: Cambridge university press.

Villas-Boas, Sofia Berto (2007) “Vertical relationships between manufacturers and retailers: Inference with limited data,” *The Review of Economic Studies*, Vol. 74, No. 2, pp. 625-652.

Yamaura, Koichi and Tian Xia (2016) “Measuring Bilateral Market Power in International Markets of Vertically Differentiated Agricultural Commodities,” *Journal of Agricultural and Food Industrial Organization*, Vol. 14, No. 1, pp. 33-42.

Yasaka, Masamitsu (2016) “Current Situation and Challenges of Milk Transaction and Distribution,” *Nosai*, pp. 31-48.