Measurement of consumer benefit of competition in retail outlets[*]

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Abstract

   In this paper, we estimated the consumer benefits from the competition in retail industry. In our analysis, we incorporated the service quality of retail outlets as outputs. In Japan, in the process of the deregulation of entry restriction on large-scale retail stores, specialty supermarkets have increased its market share with low price strategy. At the same time, despite its high price, the convenience store has increased its market share through 1990s. We demonstrate changes in market share of each retail format are explained by the changes in the service quality of each retail format.

1.   Introduction

Entry regulation has anti-competitive effects, because it prevents innovative new firm from entering a market and it brings about high price and consequently hinders welfare improvement. Besides, the entry regulation might reduce incumbents' incentive for innovation due to the lack of threat of a competition hence it might have a harmful effect on productivity growth. Therefore, to stimulate the economic growth, policy makers as well as researchers have strong interest in the competition effects of deregulations of entry.

In Japan, it is well known that the Large-Scale Retail Store Law (LSRS Law, hereinafter) restricted the entry and floor expansion of large scale retailers. Due to the regulations, incumbent large stores enjoyed monopolistic rent and lead to higher prices. And because of lack of competitive pressure, so-called Pop and Mum shops, traditional small stores were allowed to continue their business even if unprofitable. The LSRS Law has been severely criticized through "The Japan-U.S. Structural Impediments Initiative," in late 1980s and it was gradually relaxed and finally repealed in 2000.

However, contrary to all expectations, the share of large Generalized Merchandise Store (GMS) did not increase so much. Moreover, Carrefour and Wal-Mart, French and U.S., multinational retail chains, struggled in the Japanese retailing market: because of low profitability, Carrefour left Japan in 2005 and, Wal-Mart has not yet succeeded in expanding the market share. Judging from these facts, the deregulation seemed to have not affected Japanese retail market. Nevertheless, so-called new retail formats, such as specialty supermarket (middle-sized discount store) and convenience stores have substantially increased their market shares, which feature low prices or distinctive services. Therefore, to assess the consumer benefits from severe competition due to the deregulations, we should take into account the differentiation in retail services.

The purpose of this study is two fold. First, to measure the welfare gain from increased competition, by shedding light on low price and distinctive service offered by retailing new formats; specialty supermarket and convenience stores; Second, to explore why gigantic GMSs, such as Carrefour and Wal-Mart, failed to dominate retailing market despite abolishment of LSRS Law.

The organization of the paper is as follows. The next section introduces the historical and institutional background of Japanese retail industry and discuses measurement issues. Third section surveys related literature and then, we will present the model at the 4th section. The 5th section explains our data set, while the 6th section will provide estimation results. A summary and conclusion are presented in the final section.

2.   Background

In this section, we first review the historical overview of the entry restrictions. Second, we present some indicators about Japanese retail market. Third, the definition of retail output will be discussed.

2.1. Historical Overview of Large Scale Retail Store Law (LSRS Law)

In Japan, the business of large-scale retailers has been highly restricted by law to protect the businesses of smaller-sized retailers.[1] The protection for small retail businesses was originated from "Department Store Law" established in 1937. Although the law was once repealed after the WWII by GHQ, it came to life again in 1956 in almost the same manner as before. In 1974, the law was enforced as "Large Scale Retail Store Law (LSRS law)" targeting the stores with floor space with more than 500 meter squares, which includes not only department stores but also large superstores. At the same time the new law had another purpose to restrain new entrants with large capital from abroad. The law has not only been that of protecting smaller businesses but also restricting the competition among large retailers through controlling the entry of new businesses.

In 1978 the law was reinforced. When a large-scale retailer starts a new business in a certain area, it first has to notify the Minster of International Trade and Industry. The minister investigates the effect of the new entry on smaller retailers in that area. If a significant negative effect is expected after the investigation, the minister urges the entrant to modify his business plan regarding their service characteristics such as floor space, business days, closing times, or the number of holidays.

The role of the minister is just to illustrate guidelines. Representatives in regional business districts carry out substantial adjustments. Furthermore, local governments have been allowed to impose additional regulations on an entry of large stores, their floor space and operating hours. Figure 1 (a) and (b) depict the relationship between the food price index by GMS and the entry regulation indices, and between operating hours by GMS and the entry regulations at prefecture level in 1991. The entry regulation indices are based on the information about additional regulations imposed by city or prefecture government. It is an indicator of strictness of entry restrictions. For food price by GMS and the regulations in panel (a), there seems positive correlation between them, suggesting the price level is higher in prefectures with strict entry regulations. The weak negative correlation between operating hours by GMS and the indices in

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[1] For historical survey on this issue, see Nishimura and Tachibana (1996), Lark (1994) and Mayer-Ohle(2003).

panel (b) infers the regulation is effective for not only price level, but also retailers' service quality, such as operating hours.

2.2. Market Transition

In the 1990s, the trend changed from protectionism to deregulation as a result of ``The Japan-US Structural Impediments Initiative," which was aimed at creating a Japanese open market and promoting competition. In 1994, LSRS law was eased to give more freedom to new entrants to the retail industry with less than 1000 square meters of floor space. And, finally, in 1998 the law was completely repealed.

Along with the process of deregulation, the entry and exit rate has been increased in late 1990s. Figure 2 presents annual average entry and exit rate of retail outlets from 1979 to 2004. After 1997, both entry and exit rate has been increasing substantially. At the same time, while the share of small retailers has been decreasing, non-traditional, new retail formats has emerged through 1990s. Figure 3 indicates the transition of the sales share among retail formats. While we saw the share of traditional stores has been shrinking from 70% to 58%, specialty supermarkets and convenience stores have substantially increased their market shares[2].

On the other hand, from the viewpoint of international comparison, the share of small retailers, such as convenience stores and traditional stores still remain large despite of increased competitive pressure. Compared with US, UK and France, the share of Japanese traditional stores in food retailing is the highest among them (Figure 4). At the same time, although there are substantial industry dynamics, the productivity of retail industry has remained at the same level through 1990s. Figure 5 presents the transition of labor productivity and it indicates upward trend has disappeared after 1990.

These trends are puzzling, since the increased competitive pressure should replace smaller unproductive outlets with large retail outlets along with the increased competitive pressure. A possible explanation is that the conventional labor productivity index could not measure 'true productivity" accurately, and, especially, it fails to account for changes in both the input and the output. As for the input, *Census of Commerce*, a comprehensive data source for Japanese retail industry, does not survey input information except for the number of employees. Besides, while the number of part-time worker has drastically increased through 1990s[3], the data of each employment status is available only after 1999. In case of the output for retail sector, the situation is

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[2] The definition of retail formats are summarized in Table 2.
[3] According to Matsuura (2007), the ratio of the number of part-time worker to total employee in retail industry has increased from 33.4% to 54.5 between 1991 and 2004.

more complicated, because it is related to the question; what is the appropriate definition of retail output?

2.3 How should we define retail output?

The definition of retail output is the much debated topic among economist. Conceptually, as augured by Oi (1992) and Betancourt and Gautschi (1988), the retail outputs are considered as mix of distribution services, such as assortment, assurance and etc. Betancourt and Gautschi (1988) discuss the economic function of retail organization and propose concepts of distribution service in the empirical perspective. According to their definition, distribution service is classified as the following five categories: (1) *accessibility of location*, (2) *assortment*, (3) *assurance of product delivery in the desired form and at the desired time*, (4) *information* and *ambiance*. And then, they step forward to the empirical analysis in Betancourt and Gautschi (1993) and Betancourt and Gautchi (1996).

The emergence of non-traditional outlets might be explained by their distinct distribution services. While specialty supermarkets have increased its share by discounting prices, convenience stores have grown its share because of its innovative distribution services[4]. In Table 1, there is substantial price gap among retail formats. While specialty supermarkets attract consumers with low price products, convenience stores offer relatively high prices among retail formats. The reason why convenience stores have grown its share despite relatively high prices might lie in its distinctive services. For example, advanced information system, such as Pos-System, enables convenience stores to implement advanced merchandising. 7-elven Japan, the largest convenience store operator, deals with their own brand merchandise and it amount to 50% by sales[5].

Besides, long business hours and additional services are also fundamental to convenience stores operation. Basically, in Japan, most convenience stores operate 24-hours and offer additional services, such as making photocopies, photo development, postal package handling, and payment of utility charges.

Finally and most importantly, Japanese convenience store chains have well-organized distribution and supply systems. These days, major chains operate deliveries to each retail outlets from 3 to 5 times a day, since Japanese consumers prefers fresh, sometimes

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[4] Some specialty supermarket chain has increased the market share because of its distinctive services. See chapter 9 to 11 in Larke and Causton (2005).
[5] For details of Japanese convenience stores, see chapter 8 in Larke and Causton (2005).

highly perishable food products. While the sales share of convenience stores are still low compared with specialty stores, their profitability is competing with that of US-level. According to MGI (2001), the profitability of stores operated by 7-eleven Japan is 50% higher than that of US average level.

In this study, we focus the consumer benefit from distribution servicese. Consumer benefits can be measured by estimating demand function, and in case of US, Hausman and Leibtag (2006) quantified the benefits of price competition by the entry of Wal-Mart. As for the quality of services in retail sector, Sunada (2004) estimated the changes in service quality and consumer welfare for shopping. In this paper, we extend Hausman or Sunada's specification to incorporate the regional differences of prices and service quality, and estimate consumer benefits from increased market dynamics.

3.   Related literature

There are many empirical frameworks, which enable us to estimate a demand structure in differentiated product settings by utilizing the market-level or aggregated data. The most well-known type of such frameworks is the family of logit model. Berry (1994) introduces the useful empirical framework with the extreme-value distribution of consumers preference, and Berry, et al. (1995) apply the random coefficient model to the U.S. automobile market. Other applications of this type of framework are, for example, Nevo (2001) to the U.S. cereal market, Ohashi (2003) to the U.S. VTR market, and Werden and Froeb (1996) to the merger simulation. The logit family may be the most standardized framework in the recent empirical IO literatures.

Feenstra (1995) summarizes the exact hedonic price indexes, which are derived from various random utility models, and among them, he introduce the CES model with the extreme-value distribution of consumers preference, and a different type of functional forms of individual indirect-utility from logit family. Sunada (2004) uses the CES model in order to construct the cost-of living index of the Japanese Retail industry. The most different feature of the CES model from the logit family and (vertical models) is that, while consumers are assumed to purchase only one unit of products in the logit model, there is not such a restriction in the CES model.

On the other hand, Bresnahan (1981 and 1987) analyze the U.S. automobile market utilizing the vertical differentiation model in which differentiated products are ordered in product quality or price, and the marginal utility of product quality is assumed to vary among consumers, and follow a certain type of distribution. Such an ordering structure may be somewhat strong assumption. Sunada (2005) applies the vertical model in order to access the quality change and new products in the Japanese mobile

telecommunication market, in which the marginal utility of quality is assumed to conform of the uniform distribution.

Another type of empirical frameworks is the almost ideal demand system (AIDS). Hausman (1996) and Hausman and Leonard (2002) apply the AIDS to the U.S. cereal market and the U.S. bath tissue market, respectively, and access the welfare effects of new products. Hausman (1997), and Hausman, et al. (1994) utilize the AIDS in order to access the competitive effects of mergers in the U.S. bath tissue and the beer industries. On the other hand, Okada and Hatta (1999) study the Japanese telecommunications market applying the AIDS. However, there is an important problem in the AIDS: the parameters to be estimated increase with the number of differentiated products in the market.

4.   Model

Consumer Choice

We suppose that consumers are choosing over type of outlets $j=1\ldots N$, and have the indirect utility function

$$V_j^h = \ln y - \ln \phi\left[p_j, z_j\right] + \varepsilon_{jh}^h, \qquad j = 1, \cdots N \tag{1}$$

where y is consumers' income, p_j is the price of type j service, and z_j is a vector of the characteristics of type j retail outlets. Each consumer chooses their preferred product j with probability

$$P_j = \mathrm{Pr}\,ob\left[V_j > V_k, \qquad \forall k = 1, \ldots, N\right] \tag{2}$$

If type j retail outlet is chosen, then the quantity consumed by a consumer is determined from the indirect utility function in (1), using Roy's Identity;

$$x_j = -\frac{\partial V_j^h / \partial p_j}{\partial V_j^h / \partial y} = y\left(\partial \ln \phi / \partial p_j\right) \tag{3}$$

It follows that expected demand for each product is

$$X_j = x_j \,\mathrm{Pr}_j. \tag{4}$$

In this setting, we allow the consumer to make a continuous choice of the quantity purchased. This falls into the category of so-called continuous/discrete models. According to McFadden (1978, 1981), if the random term in (2) follows type 1 extreme value distribution, it turn out that the following aggregated indirect utility function is obtained;

$$G(p_1, z_1, \ldots, p_N, z_n, y) = \ln y + \ln H\left[\phi(p_1, z_1)^{-1}, \ldots, \phi(p_{1N}, z_N)^{-1}\right] \quad (5)$$

CES Demand System

Here, we specify the individual utility function as CES form, such as,

$$V_j^h = \ln y - \alpha \ln\left[p_j / f(z_j)\right] + \varepsilon_{jh}^h \qquad \alpha > 0, \tag{6}$$

where we are measuring prices relative to consumers' perceived "quality" of products $f(z_j)$.

We will choose the function H as linear such as,

$$H(e^{-\varepsilon_1}, \ldots, e^{-\varepsilon_N}) = \sum_{j=1}^N e^{-\varepsilon_j}, \tag{7}$$

We obtain the aggregated utility function as

$$U = G(p_1, z_1, \cdots, p_N, z_N, y) = y \sum_{j=1}^N \left[p_j / f(z_j)\right]^{-\alpha}, \tag{8}$$

so that expected aggregate demand is

$$X_j = -\frac{\partial G / \partial p_j}{\partial G / \partial y} = y\left(\frac{\alpha \cdot p_j^{-\alpha-1} / f(z_j)}{\sum_{k=1}^N \left[p_k / f(z_k)\right]^{-\alpha}}\right), \tag{9}$$

The elasticity of substitution for CES indirect utility function or associated CES demand function is $\alpha + 1$.

Given this demand function, market share function for type j service is reduced as follows;

$$S_j = \frac{p_j X_j}{\sum_k p_k X_k} = \frac{\left(p_j / f(z_j)\right)^{-\alpha}}{\sum_{k=1}^N \left[p_k / f(z_k)\right]^{-\alpha}} \tag{10}$$

Specify service quality function as $f(z_j) = \exp(\gamma z_j + \zeta_j)$, we obtain the following regression equation to be estimated.

$$\ln\left(\frac{p_i X_i}{p_j X_j}\right) = \ln\left(\frac{S_i}{S_j}\right) = -\alpha \ln\left(\frac{p_i}{p_j}\right) + \alpha \cdot \gamma\left(z_i - z_j\right) + \alpha\left(\xi_i - \xi_j\right) \tag{11}$$

ξ_j is the unobservable service characteristics of type j retail outlet, which is a random variable with the mean equal zero.

Nested CES system

Now, suppose that the consumers have a choice between two levels of the differentiated retailing service. The structure of consumer choice is presented in Figure 6. First, an individual decides whether to purchase a product from each of $g=1,\dots,$ G groups (for example, GMS, specialty supermarket store, or convenience store), and second, the individual decides which of outlets in that group to purchase. Suppose that the outlets available in each group g are denoted by $J_g \subset \{1,\dots,N\}$. Utility for consumer h is given by the following equation.

$$V_j^h = \ln y - \alpha \ln\left[p_j / f(z_j)\right] + \varepsilon_{jh}^h \qquad \alpha > 0. \tag{12}$$

Following from Berry(1994), the random error term ε_j^h are defined as follows.

$$\varepsilon_j^h = \zeta_g^h + (1-\rho)e_j^h, \quad \text{for} \quad j \in J_g \tag{13}$$

where the errors e_j^h are iid extreme value.

We will choose the function H as linear such as,

$$H(e^{-\varepsilon_1},\dots,e^{-\varepsilon_N}) = \sum_{g=0}^{G}\left[\sum_{j\in J_g} e^{-\varepsilon_j/(1-\rho_g)}\right]^{(1-\rho_g)}, \tag{14}$$

We obtain the aggregated utility function as

$$U = G(p_1,z_1,\cdots,p_N,z_N,y) = y\sum_{g=0}^{G}\left[\sum_{j=1}^{N}\left[p_j/f(z_j)\right]^{-\alpha/(1-\rho_g)}\right]^{(1-\rho_g)}, \tag{15}$$

so that expected aggregate demand is

$$X_j = -\frac{\partial G/\partial p_j}{\partial G/\partial y} = y\left(\frac{\alpha y}{p_j}\right)\frac{p_k/f(z_k)}{D_g}\times\frac{D_g^{(1-\rho_g)}}{\sum_{g=1}^{G}D_g^{(1-\rho_g)}}, \quad \text{for} \quad j\in J_g \tag{16}$$

where the term $D_g = \sum_{j\in J}\left[p_k/f(z_k)\right]^{-\alpha/(1-\rho_g)}$ is the "inclusive value"

The expected demand on the right-hand side of (16) is composed of three terms: the frist term $y\left(\dfrac{\alpha y}{p_j}\right)$, is the conventional Cobb-Douglas demand function, the second term, $p_k/f(z_k)/D_g$, is the share or the probability of choice of outlets j in the demand for group of retailing format g, the third term, $D_g^{(1-\rho_g)}\Big/\sum_{g=1}^{G}D_g^{(1-\rho_g)}$, is the share or the

probability of choice of group of retail format g.

Here, we assume the symmetry of price p_j and z_j within group g, in other words, we assume $p_j = p_g$, $f(z_j) = f(z_g)$ and for $j \in J_g$ [6].

Since $D_g = \sum_{j \in J} [p_k / f(z_k)]^{-\alpha/(1-\rho_g)} = [p_g / f(z_g)]^{-\alpha/(1-\rho_g)} N_g$, the aggregated demand function is derived as follows;

$$X_j = -\frac{\partial G / \partial p_j}{\partial G / \partial y} = \frac{\alpha y}{p_g} \frac{1}{N_g} \left(\frac{(p_g / f(z_g))^{-\alpha} N_g^{(1-\rho_g)}}{\sum_{l=1}^{L} [p_l / f(z_l)]^{-\alpha} N_l^{(1-\rho_g)}} \right) \qquad (17)$$

$$X_g = X_j N_g = \frac{\alpha y}{p_g} \left(\frac{(p_g / f(z_g))^{-\alpha} N_g^{(1-\rho_g)}}{\sum_{l=1}^{L} [p_l / f(z_l)]^{-\alpha} N_l^{(1-\rho_g)}} \right) \qquad (18)$$

Given this demand function, market share function for type j service is reduced as follows;

$$S_g = \frac{p_g X_g}{\sum_l p_l X_l} = \frac{(p_g / f(z_g))^{-\alpha} N_g^{(1-\rho_g)}}{\sum_{l=1}^{L} [p_l / f(z_l)]^{-\alpha} N_l^{(1-\rho_g)}} \qquad (19)$$

Specify service quality function as $f(z_g) = \exp(\gamma z_g + \xi_g)$, we obtain the following equation to be estimated. ξ_g is the unobservable service characteristics of type g retail format, which is a random variable with the mean equal zero.

$$\ln\left(\frac{p_g X_g}{p_{g'} X_{g'}}\right) = \ln\left(\frac{S_g}{S_{g'}}\right) = -\alpha \ln\left(\frac{p_g}{p_{g'}}\right) + \alpha \cdot \gamma(z_i - z_j) + (1-\rho_g)\ln\left(\frac{N_g}{N_{g'}}\right) + \alpha(\zeta_g - \zeta_{g'}) \quad (20)$$

Notice that if $\rho_g = 1$, the increase in N_g does not affect the affect the share of group g [7].

On the other hand, when $0 < \rho_g < 1$, the sales share of group g increases as entry of outlets in group g.

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[6] This specification is proposed and used by Berry and Waldfogel (1999), which quantifies the social inefficiency of free entry in radio broadcasting.

[7] When $\rho_g = 1$, increases N_g does affect only the sales share of outlet j in each group of retail format g. For details, see Appendix A.

Extension: Welfare

We now demonstrate how we can estimate the changes in consumer welfare that arise form the expansion of variety of service.

The correspondence expenditure function to the social welfare function or indirect utility function (21),

$$E(U,p,z:\alpha) = \left(\sum_{g=0}^{G} \left[\sum_{j=1}^{N} \left[p_j / f(z_j) \right]^{-\alpha/(1-\rho_g)} \right]^{(1-\rho_g)} \right)^{-1} G$$
$$= \left(\sum_{g=0}^{G} \left[p_g / f(z_g) \right]^{-\alpha} N_g^{(1-\rho_g)} \right)^{-1} G. \tag{21}$$

We define compensating variation as the log-difference in the consumers' expenditure function, holding utility constant at the beginning of the periods;

$$CV = \ln E(U,\mathbf{p}^0,\mathbf{z}^0,\mathbf{N}^0 : \alpha) - \ln E(U,\mathbf{p}^1,\mathbf{z}^1,\mathbf{N}^1 : \alpha). \tag{22}$$

where $\mathbf{p}^0, \mathbf{z}^0, \mathbf{N}^0$ is the price and quality index and number of outlets in the beginning of sample periods and $\mathbf{p}^1, \mathbf{z}^1, \mathbf{N}^1$ are those of the end of sample periods.

Following from Sunada (2005), the changes in compensation variation can be decomposed into two parts as follows;

$$\begin{aligned} CV &= \ln E(U,\mathbf{p}^0,\mathbf{z}^0,\mathbf{N}^0 : \alpha) - \ln E(U,\mathbf{p}^0,\mathbf{z}^1,\mathbf{N}^0 : \alpha) \\ &+ \ln E(U,\mathbf{p}^0,\mathbf{z}^1,\mathbf{N}^0 : \alpha) - \ln E(U,\mathbf{p}^0,\mathbf{z}^1,\mathbf{N}^1 : \alpha) \\ &+ \ln E(U,\mathbf{p}^0,\mathbf{z}^1,\mathbf{N}^1 : \alpha) - \ln E(U,\mathbf{p}^1,\mathbf{z}^1,\mathbf{N}^1 : \alpha) \\ &= CV_q + CV_N + CV_p \end{aligned} \tag{23}$$

The first term CV_q represents the increase in welfare due to the average quality change, holding the prices and number of outlets in group g at their pre-change level. The second term CV_N and third term CV_p are the welfare changes due to the changes in number of outlets and prices respectively, holding other factors fixed. The increase in CV_N is considered as the effect of changes in share of retail format with high service quality.

5.   Data and Estimation Methodology

Our dataset is food retailing outlets prefecture-level panel dataset covering 1991, 1997 and 2002. The primary data source is the *Census of Commerce*, which is compiled by the Ministry of Economy, Trade and Industry. The *Census of Commerce* covers all the establishments which belong to wholesale and retail industry. From the Census, we can obtain the sales by commodity, and characteristics of establishments. One limitation of the Census is the lack of cost and price information. Therefore, as for the price information, we use *National Survey of Prices* (Ministry of Internal Affaire and Communication), which provides us the commodity-level price information by region and the type of retail outlets (retail formats). Since the *Census of Commerce* and the *Survey of Price* have different definition of the retail formats, we aggregated establishment-level data of the *Census of Commerce* in order to match the definition of type of retail formats in *Survey of Price*. Table 2 indicates our definition of retail formats. Note that not all specialty superstores have been affected by deregulation, because they contain stores with floor space less than 500 meter squires, which are not covered by LSRS raw. However, the sales share of the stores with floor space between 250 and 500 meter squires in total specialty superstores is 1.2% in 2002. Therefore, we consider the entry of specialty superstores has been strongly affected by deregulations. And we assume the retailing markets are segmented by region, that is, 47 prefectures. The food retailing sales shares by retail format are presented in Figure 7[8]. Price indices by region, and retail formats are estimated by aggregating commodity-level price with the weight of Consumer Price index (Ministry of Internal Affaire and Communication).

As for the service quality indicator, we use "Log of operating hours", "Goods in stock per sales", "Single store ratio", "Log of floor space per employee", "Method of payment" and "Breadth assortment." "Log of operating hours" is the proxy for *time accessibility* or *assurance of product delivery*. We expect a positive significant effect of "Log of operating hours" on the market share. "Goods in stock per sales" is the inverse of merchandise turnover ratio, and it is defined as the ratio of value of stocks to sales of products. Low "Goods in stock-sales ratio" imply adoption of just-in time delivery system, which enables retailers to provide fresh food products with customers. We expect positive and significant coefficient. "Log of floor space per employee" is proxy for *broad assortment* services or *information* supply for customer. Retailing outlets with larger floor space offer broader variety of products. On the other hand, to provide sufficient information of prices or characteristics of products for customers, managers have to increase the number of employees. The expected sign of the coefficient will be

[8] Although GMS deals with various products, sales data here are restricted to food and beverage products.

positive or negative depending on consumers' preferences. "Method of payment" is defined as the ratio of cash settlement to total sales, which suggest an index for variety of payment. While most of non-traditional or chain stores usually offers variety of methods of payments, such as davit card, credit cards or prepaid electric money card, traditional stores does not. Thus, the negative sign is expected for the coefficient. "Single store ratio" will have negative effect on the market share, since single stores are inferior to multiple stores in terms of providing *information* of prices, availability and other characteristics. "Breadth assortment" means dealing with broad variety of product lines. The following index is used as the proxy for "Breadth assortment",

$$D_i = 1 - \sum_{k=1}^{K} \omega_{ik}^2 ,$$

where ω_{ik} indicates sale share of products k for outlet i[9]. The more retail outlets deals with the product lines, the index D will approach 1. On the other hand, Retail outlets dealing with only 1 product line have $D=0$. This index is calculated by each establishment, and aggregated by prefecture and retail formats with the sales share weight. We constructed two indexes according to commodity basket. One is the index calculated over all commodities, and the another one is calculated only about food and beverage products. While former indicates the depth of assortment regarding all commodities, the latter represents width of variety within food and beverage products. Finally, to capture unobservable format specific service quality, sales format dummy variables are included in the equation.

Table 3 indicates summary of variables we used as service characteristics for food retailing outlets. While Convenience stores have the second highest price level, their distinctive services are reflected by longer operating hours and low goods in stock per sales.

Since the relative price and number of outlets are considered as endogenous variables, the OLS estimates are not consistent. Therefore, the instrument variables are needed. In our study, as discussed in Barry (1994), Berry, et al. (1995), Hausman (1996), and Nevo (2001), we use standard instrumental variables, such as (1) the observed own service characteristics, (2) the mean of service characteristics of other type of retail formats, (3) the mean of price of same retail formats in other market (prefecture), and (4) cost side variables; average wage by prefecture and retail formats. We obtain wage information from Census of Wage Structure (Ministry of Health and Labor).

6.   Estimation Results

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[9] Product line is defined according to 4 digit commodity code.

The estimation results are presented in Table 4. We estimated the model with both OLS (Model 1 and Model 3) and GMM (Model 2, Model 4) including retail format dummies, prefecture dummies and year dummies. While OLS estimates for the coefficients of relative price are all positive, those for GMM are negative and significant. The specification of Model 1 and Model 2 does not include log of number of outlets, which is equivalent to CES demand function expressed as in the equation (11). Nested CES specification is estimated in Model 3 and Model 4, and the coefficients for log of number of outlets, which are correspondence with $1 - \rho_g$, are estimated between 0 and 1. Moreover, while the Hansen's J test is rejected for Model 2, Model 4 does not; therefore we conclude the nested CES demand specification is more appropriate than CES demand specification[10].

Focusing on other variables in Model 4, log of operating hours, method of payments, single stores ratio and two breadth assortment have also significant coefficients and expected sign. Negative coefficients for "Goods in stock per sales" suggest that since low "Goods in stock per sales" implies adoption of just-in time delivery systems, consumers highly evaluate those outlets which provide fresh food products. The coefficients for log of floor space per employee are negative but insignificant for nested CES model with the GMM estimation.

Furthermore, using estimated parameters, we calculated the quality indices by retail formats. Since dummy variable for retail format captures service quality each retail format offers, we regard the coefficient for retail format dummy as part of service quality. The indices are normalized so as the quality index for traditional store in 1991 to be 1.0. The estimated indices are presented in Table 5. We can find substantial variation in quality indices among retail formats. The services quality indices for large retailers, such as GMS, Specialty superstores and Department stores are almost 2 or 2.5 times larger than that of Traditional stores. Convenience stores offer the highest services quality. In addition, services quality for Convenience stores has been increasing during sample periods and it has amounted to 3.56 in 2002. Therefore, the substantial share increase for convenience stores can be attributed to the improvement of its service quality.

Table 6 presents the annual average welfare change and its decomposition. In this calculation, changes in price are measured as relative price changes against general CPI.

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[10] Wald test statistics for significance of log of number of outlets in Model 4 is 58.55 and the null hypothesis is rejected at the 1% level of significance. Test statistics for the hypothesis $\rho_g = 0$ is 9.17 and rejected at 1% level of significance, as well.

The annual average welfare changes between 1991 and 2002 are around 3.7% to 1.9%, more than half of which are explained by CV_q, the quality changes. It amounts to 2.1% or 1.2% between 1991 and 1997 and between 1997 and 2002, respectively. We also found significant contribution of CV_N (1.4%) during 1990s. Since CV_N is considered as the effects of changes in share of number of outlets by retail format, positive CV_N reflects the decreases in stores with low service quality, such as traditional stores and the increases in non-traditional stores. Considering the fact that there is substantial increase in consumers' perceived quality for convenience store in sample periods and the increases in the share, emergence of convenience store have played an important role of changes in welfare for food retailing.

7.   Discussion

Combined with the estimation results and service characteristics by sales format in table 3, the reason why GMS failed to expand market share despite deregulation is mainly due to insufficient price competitiveness and failure to differentiate its service characteristics against specialty superstores. For example, in table 3, while the price index for GMS is 0.963, that for specialty superstores is 0.907. Index for operating hours and goods in stock per sales for GMS are also same with those for specialty superstores. And insignificant coefficient on floor space per employment reflects the fact that Japanese consumers dose not place an importance on huge floor space for daily food shopping. According to Aoyama (2007), retailing MNEs, such as Wal-Mart and Carrefour, has succeeded in oversea market by collaborating with manufacturers and adopting factory-direct model, which enables them to undercut competitors' prices. However, in Japan, their offers are refused by Japanese manufacturers and failed to adopt the model, thus, both had no cost advantages. Besides, taking advantages of huge floor space, Carrefour and Wal-Mart stick to their strategies for low-cost operations, such as stack-them-up-and-sell-them-cheap strategy, where products are displayed without being taken out of corrugated boxes. However, bulk purchase is not familiar with Japanese consumers and that strategy failed to lure consumers.

8.   Concluding remarks

In this paper, we propose the framework which enables us to evaluate consumer benefits from the competition in retail industry. In our framework, we incorporated the service quality of retail outlets as outputs. In Japan, in the process of the deregulation of entry restriction on large-scale retail stores, specialty supermarkets have increased its market share with low price strategy. At the same time, despite its high price, the

convenience store has increased its market share through 1990s. We demonstrate changes in compensation variation are explained by the changes in prices, the number of outlets and the service quality of each retail format.

However, this research offers various agenda for future research. First, since our data is based on prefecture panel data set, we can compare the changes in welfare among regions. Market structure for food retailing sector varies significantly between major metropolitan areas and other areas. According to Matsuura and Motohashi (2006), the growth rate of sales for specialty supermarket stores for rural area has been significantly larger than for major metropolitan areas between 1997 and 2002, reflecting the fact that there is substantial increase in car ownership rate in rural areas and it encourages consumers to go shopping at large scale specialty supermarket in outside city.

Second, our framework enables us to make an international comparison on the differences in services quality and consumer gains from retail outlets. The difficulties in international comparison on the productivity in services sector lie in incorporating the differences in consumer testes. In our framework, we can expect differences in consumer testes are reflected by parameters for price and service characteristics.

Third, this research framework can be applied not only to retail industry, but also to other service sector with service differentiation, such as hotel, amusement park and restaurant. There are difficulties in estimating productivity in those sectors since conventional output index are not adjusted quality change. However, our framework enables us to estimate quality adjusted cost of living index based on compensation variation and construct quality adjusted output index. Productivity in services sector has recently been paid much attention to by economists, thus it must be promising research agenda.

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Appendix A: Historical overview of Large Scale Retail Law

In Japan, the business of large-scale retailers has been highly restricted by law to protect the businesses of smaller-sized retailers.[11] The protection for small retail businesses was originated from "Department Store Law" established in 1937. Although the law was once repealed after the WWII by GHQ, it came to life again in 1956 in almost the same manner as before. In 1974, the law was enforced as "Large Scale Retail Law (LSR law)" targeting not only department stores but also large superstores. At the same time the new law had another purpose to restrain new entrants with large capital from abroad. The law has not only been that of protecting smaller businesses but also restricting the competition among large retailers through controlling the entry of new businesses.

In 1978 the law was reinforced. When a large-scale retailer starts a new business in a certain area, it first has to notify the Minster of International Trade and Industry. The minister investigates the effect of the new ently on smaller retailers in that area. If a significant negative effect is expected after the investigation, the minister urges the entrant to modify his business plan regarding such items as floor space, business days, closing times, or the number of holidays.

The role of the minister is just to illustrate guidelines. Representatives in regional business districts carry out substantial adjustments. Furthermore, local governments have been allowed to impose additional entry regulations on large stores.

In the 1990s, the trend changed from protectionism to deregulation as a result of ``The Japan-US Structural Impediments Initiative," which was aimed at creating a Japanese open market and promoting competition. In 1994, LSRS law was eased to give more freedom to new entrants to the retail industry with less than 1000 square meters of floor space. And, finally, in 1998 the law was completely repealed.

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[11] For historical survey on this issue, see Lark (1994) and Mayer-Ohle(2003).

Appendix A: The effects of the increase in N_g on market share.

As we saw in the equation (10), the share or choice probability of group g is

$$\Pr_g = \frac{(p_g / f(z_g))^{-1/\alpha} N_g^{1-\rho_g}}{\sum_l (p_l / f(z_l))^{-1/\alpha} N_l^{1-\rho_g}}.$$

Therefore, the elasticity of choice probability of group g to N_g, η_g, is

$$\eta_g = \frac{\partial \Pr_g}{\partial N_g} \frac{N_g}{\Pr_g} = (1-\rho_g)\left[1 - \frac{(p_g / f(z_g))^{-1/\alpha} N_g^{-\rho_g}}{\sum_l (p_l / f(z_l))^{-1/\alpha} N_l^{1-\rho_g}}\right] = (1-\rho_g)(1-\Pr_j)$$

One the other hand, the choice probability of outlet j in group g is

$$\Pr_j = \Pr_{j|g} \Pr_g = \frac{1}{N_g} \frac{(p_g / f(z_g))^{-1/\alpha} N_g^{1-\rho_g}}{\sum_l (p_l / f(z_l))^{-1/\alpha} N_l^{1-\rho_g}},$$

where $0 \le \rho_g \le 1$.

If $\rho_g = 1$,

$\eta_g = 0$ and $\eta_j = -1$. Therefore, while the share of outlets j in group g is

decreasing as increase in N_g, the share of group g dose not.

If $\rho_g = 0$, $\Pr_j = \frac{(p_g / f(z_g))^{-1/\alpha}}{\sum_l (p_l / f(z_l))^{-1/\alpha} N_l}$,

$$\eta_g = 1 - \frac{(p_g / f(z_g))^{-1/\alpha}}{\sum_l (p_l / f(z_l))^{-1/\alpha} N_l} = 1 - \Pr_j < 0,$$

$$\eta_j = -\frac{(p_g / f(z_g))^{-1/\alpha}}{\sum_l (p_l / f(z_l))^{-1/\alpha} N_l} = -\Pr_j.$$

Hence,

$0 \le \eta_g \le 1 - \Pr_j$ and $-1 \le \eta_j \le -\Pr_j$. So, when $0 < \rho_g < 1$, increases in N_g

accompanies the increases in the share of group g and the decreases in the share of

outlet j in group g.

Table 1. Price gap by products and retail formats

	013 Pillow type instant noodle, *Chicken Ramen* (per package, Yen)	078 Plain yogurt, *MEIJI Bulgaria LB51* (500ml, Yen)	023 Microwave, *Toshiba ER-VS6* (Yen)	108 Imported dress shirt, made in South East Asia, 35-percent-cotton, 65-percent polyester (Yen)	130 Toothpaste, *Lion Dentor T Lion* (170g, Yen)
Average price in all over Japan	81.60	228.17	81,169	2,298	212.0
Average price in Tokyo	82.30	231.81	81,230	2,316	213.1
Chain Supermarket	82.06	230.21	79,442	2,295	216.0
Other Supermarket	81.14	227.60	71,500	1,682	210.7
Convenience stores	83.74	235.70	-	-	223.0
Department stores	83.59	239.61	86,037	2,279	224.3
General retail outlets	82.30	236.02	80,855	2,313	207.2

Source: *National Price Survey* in 1992, Management and coordination Agency

Table 2. Definition and Concordance of Retail Formats

(1) The definition of retail formats

		Self-service system	Sales floor space	Operating hours	Note
1	GMS	Yes	$3000m^2$ or over		2
2	Specialty supermarket	Yes	$250m^2$ or over		3
3	Department stores	No	$3000m^2$ or over		2
4	Traditional stores	No			
5	Convenience stores	Yes	between $30m^2$ and $250m^2$	14 hour or more	

Note
  1) Self-service stores are defined as those establishments who adopt the self-service system in 50% or more of the sales floor.
The "Self-service system" means that the establishment meets the following conditions;
    i) Merchandise are put on the shelf unwrapped or prepackaged with price labeled on them.
    ii) Shopping baskets or shopping carts are provided for customers.
    iii) Customers pay for all of the purchases at the check-out counters.
 2) Department and General supermarkets are stores that retail clothing, food and housing products,
    in which retail sales for each of these categories is over 10% but under 70%.
 3) Specialty supermarkets are those stores which retail clothing, food or housing products,
    one of which retail sales is 70% or over

(2) Concordance of Retail formats

		National Survey of Price		Census of Commerce
		1997, 2002	1992	
1	GMS	Supermarket	Chain Supermarket	General Supermarkets
2	Specialty supermarket	Specialty supermarket	Other Supermarket	Specialty supermarket
3	Department stores	Department stores	Department stores	Department stores
4	Traditional stores	General retail outlets	General retail outlets	Other Supermarket
				Specialty stores
				Semi-specialty stores
5	Convenience stores	Convenience stores	Convenience stores	Convenience stores

Table 3. Average service characteristics for food retailing outlets

(i) Price level	1991	1997	2002
1 GMS	0.908	0.991	0.963
2 Specialty Supermarkets	0.922	0.966	0.907
3 Department store	1.024	1.121	1.139
4 Traditional store	0.96	0.974	0.953
5 Convenience store	0.969	1.021	0.982

(ii) Operating hours	1991	1997	2002
1 GMS	0.385	0.425	0.452
2 Specialty Supermarkets	0.419	0.448	0.45
3 Department store	0.364	0.384	0.388
4 Traditional store	0.423	0.419	0.405
5 Convenience store	0.71	0.878	0.919

Note: Operating hours are divided by 24.

(iii) Single stores ratio	1991	1997	2002
1 GMS	0.047	0.029	0.02
2 Specialty Supermarkets	0.192	0.172	0.138
3 Department store	0.181	0.152	0.21
4 Traditional store	0.806	0.781	0.777
5 Convenience store	0.753	0.799	0.774

(iv) Goods in stock per sales	1991	1997	2002
1 GMS	0.07	0.08	0.09
2 Specialty Supermarkets	0.06	0.08	0.09
3 Department store	0.10	0.09	0.08
4 Traditional store	0.14	0.14	0.14
5 Convenience store	0.05	0.04	0.04

Note: Goods in stock per sales = Value of goods in stock/Total Sales

(v) Floor space per employee	1991	1997	2002
1 GMS	37.89	48.60	42.82
2 Specialty Supermarkets	24.98	33.76	34.31
3 Department store	34.55	45.52	55.02
4 Traditional store	15.07	17.26	17.35
5 Convenience store	11.59	10.57	8.39

(vi) Method of Payments	1991	1997	2002
1 GMS	0.266	0.208	0.118
2 Specialty Supermarkets	0.650	0.650	0.527
3 Department store	0.022	0.039	0.051
4 Traditional store	0.431	0.435	0.442
5 Convenience store	0.655	0.696	0.704

Note: Method of payments defined as ratio of cash settlement to total sales

(vii) Index of breadth assortment	1991	1997	2002
1 GMS	0.74	0.72	0.68
2 Specialty Supermarkets	0.25	0.24	0.24
3 Department store	0.81	0.80	0.78
4 Traditional store	0.15	0.16	0.15
5 Convenience store	0.26	0.31	0.35

Source: Authors' calculation based on *Census of Commerce.*

Table 4. Estimation result of market share equation

	Model 1	Model 2	Model 3	Model 4
Number of obs	1410	1410	1410	1410
Adj R-sq:	0.9229	0.9229	0.9739	0.9739
Relative price	0.82	-4.94	1.23	-1.45
	[3.53]***	[-4.68]***	[9.11]***	[-1.84]*
Log(Number of outlets)			0.82	0.65
			[51.29]***	[6.92]***
Log(operating hours)	1.95	2.39	0.59	1.01
	[13.32]***	[11.53]***	[6.60]***	[4.42]***
method of payments	-0.25	-0.18	-0.29	-0.24
	[-2.71]***	[-1.73]*	[-5.38]***	[-3.67]***
Good in stock per sales	-0.19	-3.36	-3.74	-4.27
	[-0.35]	[-3.68]***	[-11.30]***	[-7.28]***
Single store ratio	-0.63	-0.39	-0.3	-0.35
	[-6.86]***	[-2.35]**	[-5.65]***	[-3.43]***
Log(Floor space per employee	-0.07	0.13	-0.09	-0.01
	[-1.27]	[1.57]	[-2.87]***	[-0.30]
Breadth assortment	0.57	0.47	0.39	0.39
(all products)	[6.45]***	[4.35]***	[7.51]***	[6.71]***
Breadth assortment	1.34	1.47	0.83	1.00
(food and beverage)	[6.13]***	[5.63]***	[6.50]***	[6.52]***
Sales format dummy				
(base= GMS)				
Speciality Supermarket	-0.08	0.03	2.14	1.64
	[-0.39]	[0.10]	[16.27]***	[5.79]***
Department	2.26	2.13	1.75	1.73
	[16.71]***	[9.34]***	[22.07]***	[12.70]***
Traditional store	-0.91	0.07	2.33	2.01
	[-4.07]***	[0.22]	[16.12]***	[6.18]***
Convenience store	3.56	3.8	-0.21	0.64
	[29.18]***	[22.34]***	[-2.10]**	[1.35]
const	-0.1	-0.28	-0.02	-0.17
	[-1.06]	[-3.20]***	[-0.36]	[-4.26]***
Prefecture dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
Estimation Method	OLS	GMM	OLS	GMM
Hansen J Statistics		16.695		5.445
Chi-sq p-value		0.011		0.364

Note:

1) Figures in brackets are t-value.

2) "***","**", and "*" represents level of significance at 1%, 5% and 10%, respecti

Table 5. Estimated Quality Indices by sales formats

		1991	1997	2002
1	General Supermarkets	2.701	2.799	2.913
2	Specialty supermarket	2.038	1.913	1.912
3	Department stores	2.207	2.439	2.455
4	Traditional stores	1.000	1.009	0.990
5	Convenience stores	2.348	3.194	3.560

Note; The quality indices are estimated by using estimated regression coefficients and normalized so that Traditional stores' in 1991 equals 1.

Table 6. The decomposition of annual average welfare changes

Table 6. The decomposition of annual average welfare cha:

	1991−1997	1997−2002
CV	3.7%	1.9%
CV_q	2.1%	1.2%
CV_N	1.4%	0.1%
CV_p	0.2%	0.5%

Figure 1

panel (a)

Food Price (GMS) v.s. Regulation Index

panel (b)

Operating Hours (GMS) v.s. Regulation Index
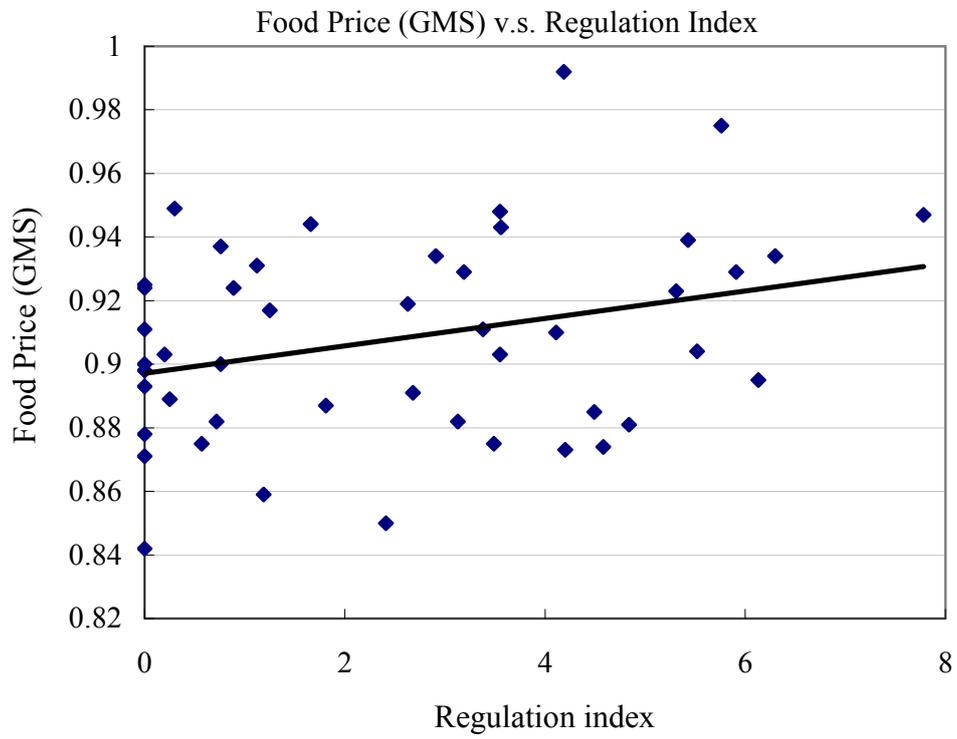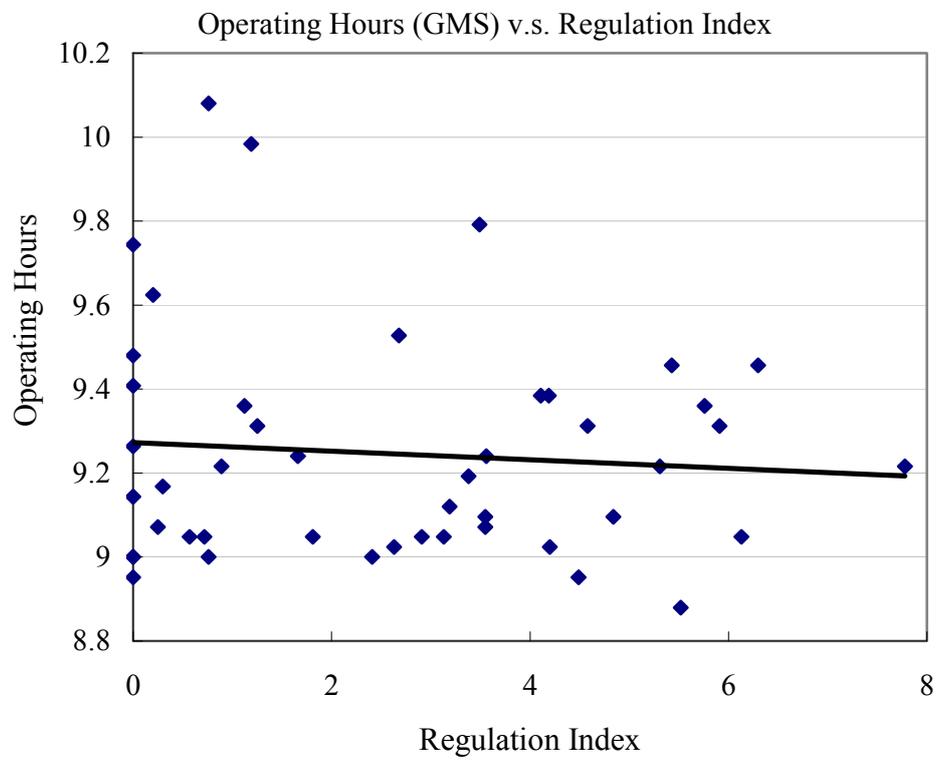
Figure 2.Annual Average Entry and Exit rate
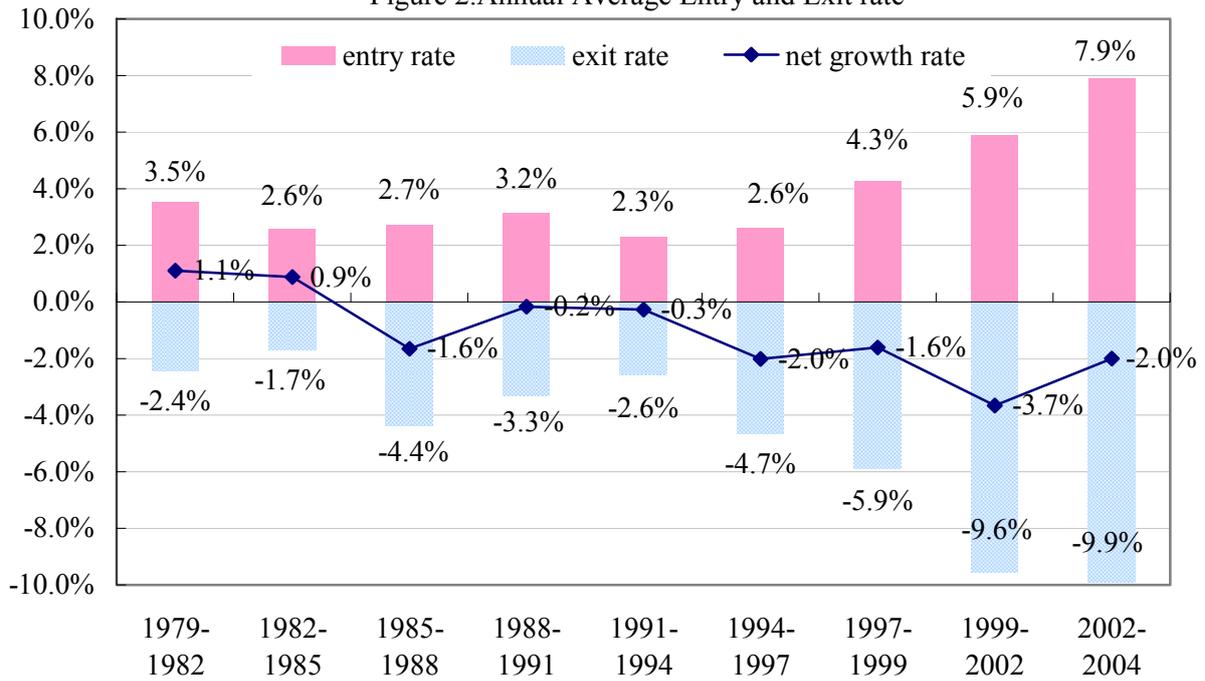
Source: Census of Commerce

Figure 3. The tranition of the sales sahre by retail
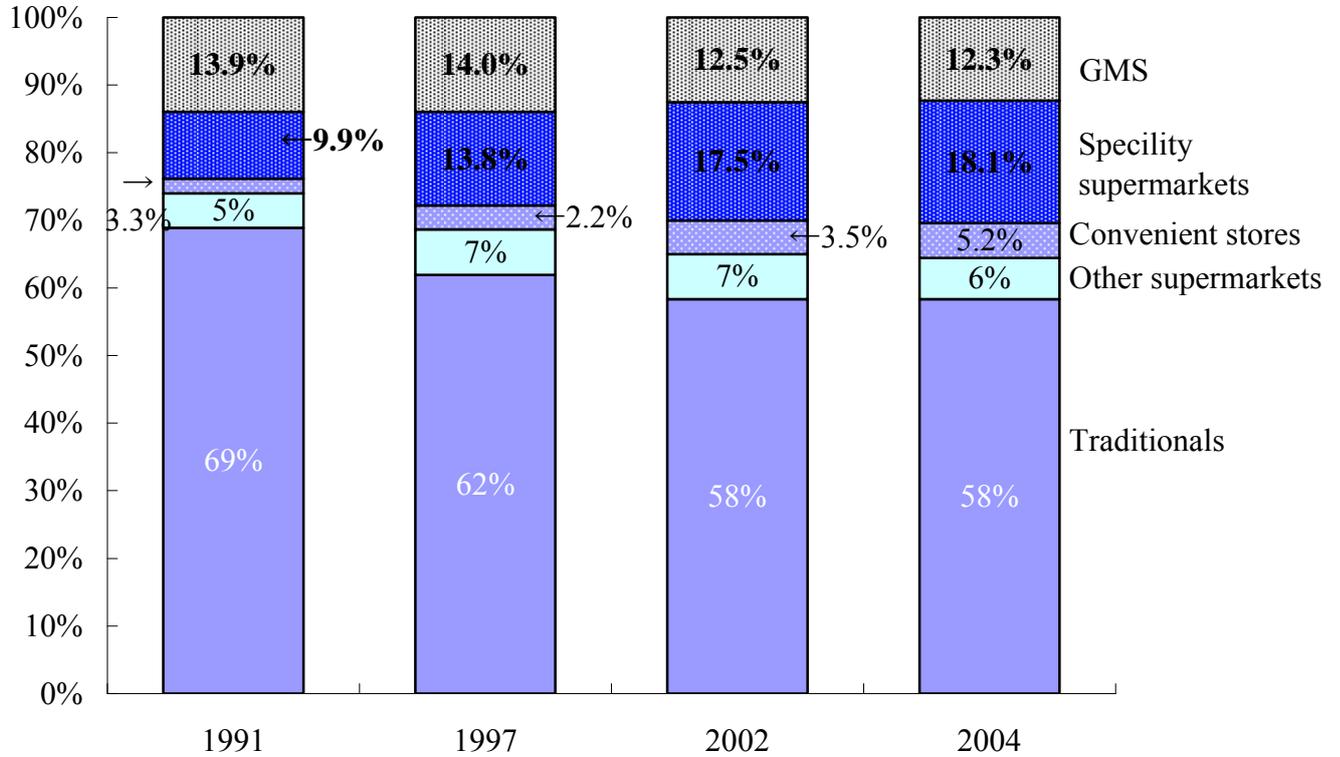
Source: Census of Commerce

Note: See footnote at Table 2 for the definition of retail formats.

Figure 4. International Comparison on the share of food retailing by formats

Source: Mckinsey Global Institute (2000)
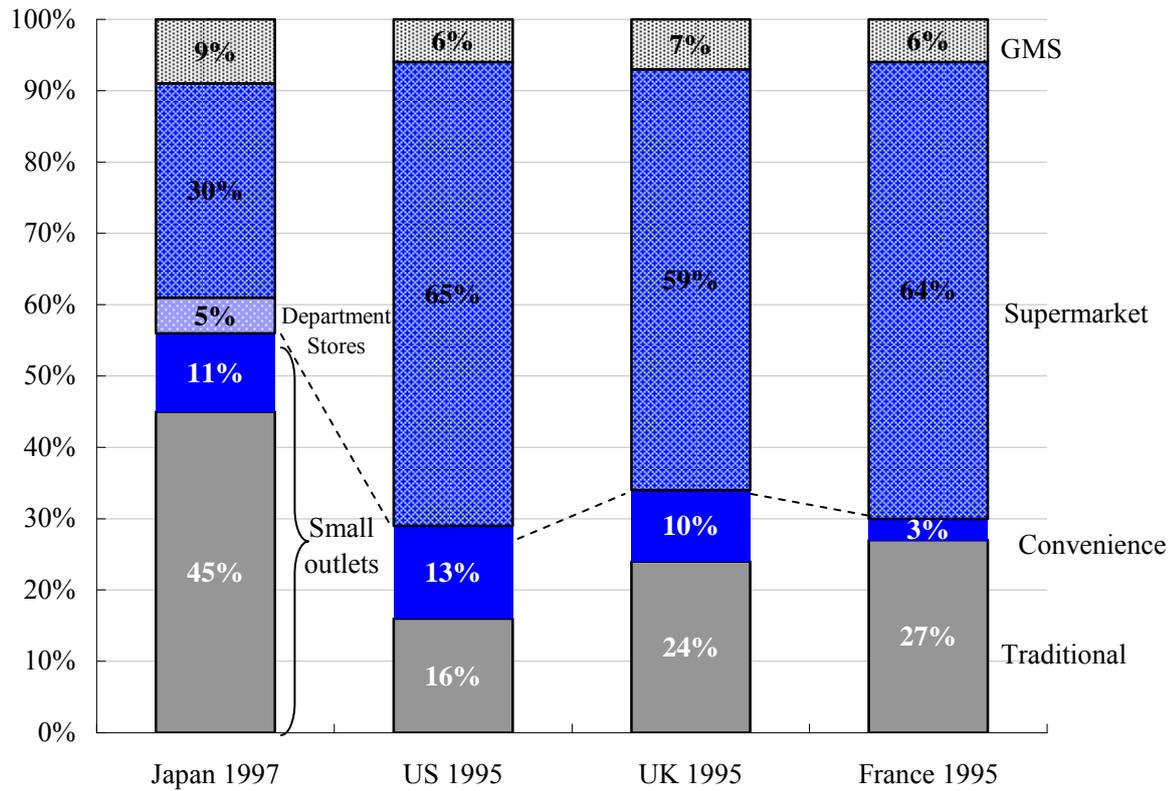
(milion yen)　Figure 5. Retail sales per employee
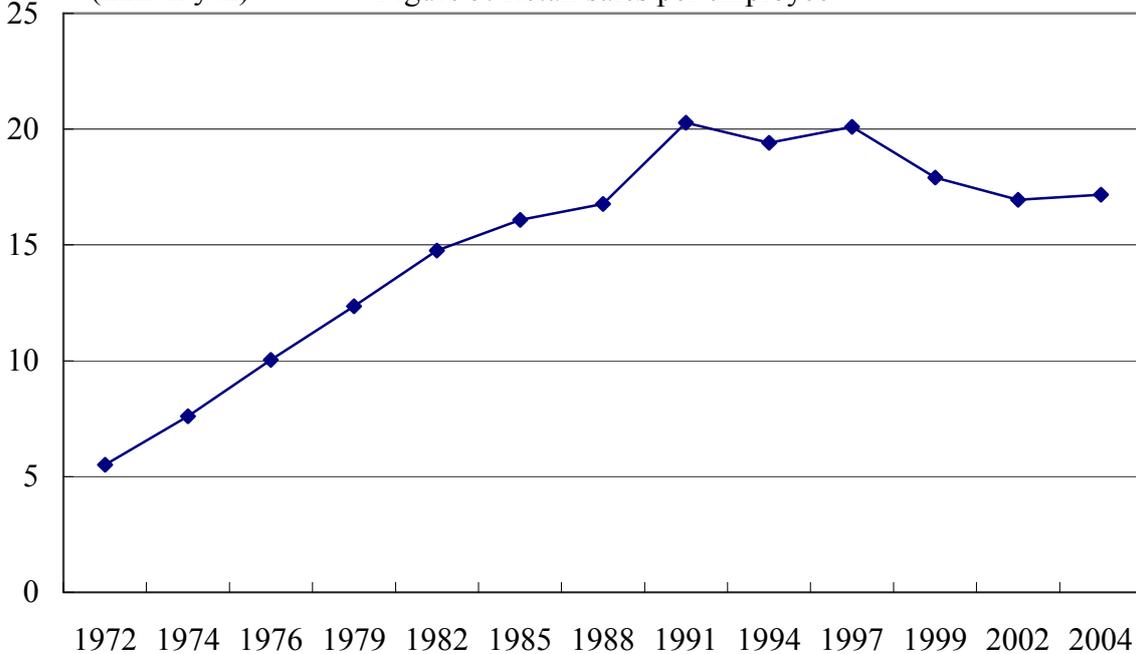
Source: Census of Commerce

Figure 6. Structure of consumers' choice
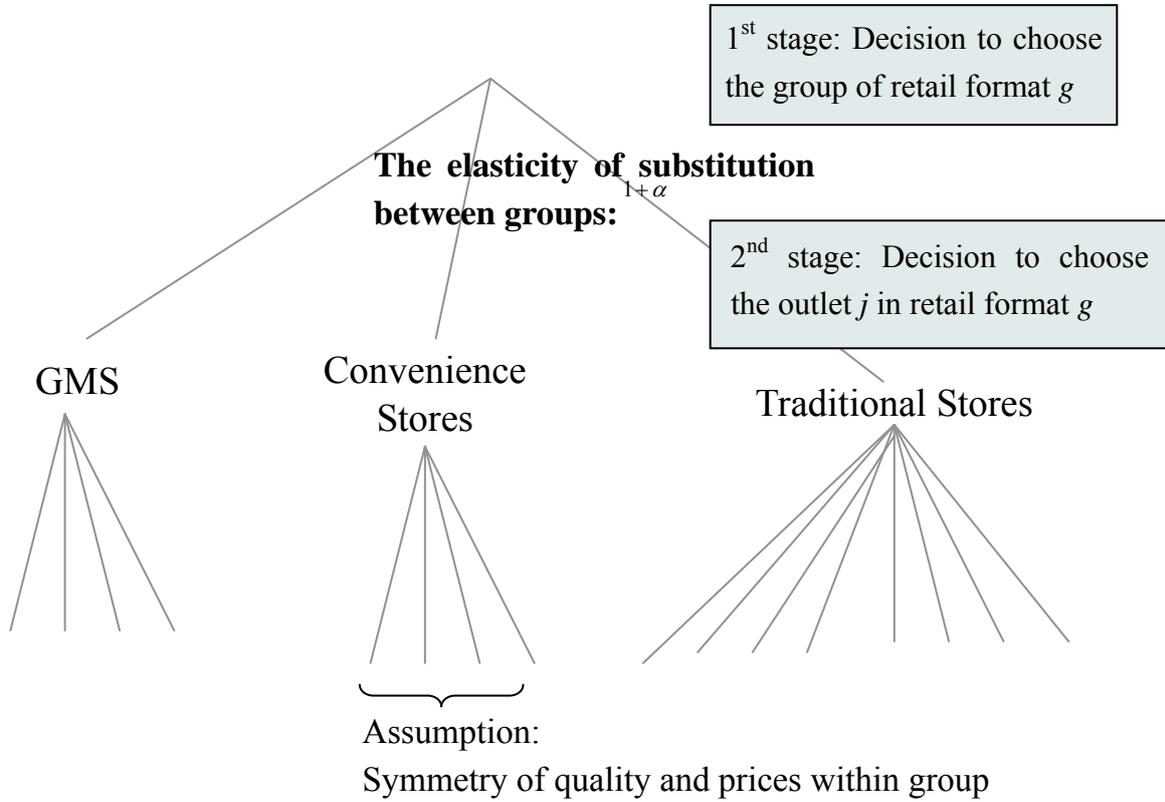
Figure 7. The sales share of retail formats by commodity group and retail formats