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Measurement of the Consumer Benefit of Competition in Retail Outlets

MATSUURA Toshiyuki
Keio University

SUNADA Mitsuru
Competition Policy Research Center, Japan Fair Trade Commission

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Measurement of the Consumer Benefit of Competition in Retail Outlets*

Toshiyuki Matsuura†
Keio Economic Observatory, Keio University

Mitsuru Sunada
Competition Policy Research Center, Japan Fair Trade Commission

Abstract

In this paper, we estimate the consumer benefits of competition in the 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 their market share with a low price strategy. At the same time, despite their high prices, convenience stores have increased their market share through 1990s. We demonstrate changes in market share for each retail format are explained by the changes in each formats respective service quality.

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†To correspond with author via e-mail: matsuura@sanken.keio.ac.jp

1. Introduction

Entry regulation has anti-competitive effects because it prevents innovative new firms from entering a market and it brings about high prices and consequently hinders welfare improvement. Besides, entry regulation might reduce incumbents' incentives for innovation due to a lack of threat of competition; hence, it might have a harmful effect on productivity growth. Therefore, to stimulate economic growth, both policymakers and researchers have a strong interest in the effects of deregulating entry on competition.

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 that lead to higher prices. And because of a lack of competitive pressure, traditional small "mom-and-pop" stores were allowed to remain in business even if unprofitable. The LSRS Law was severely criticized through "The Japan-U.S. Structural Impediments Initiative" in the late 1980s, and gradually relaxed before finally being repealed in 2000.

However, contrary to all expectations the share of large generalized merchandise stores (GMS) did not increase very much. Moreover, the French multinational retail chain Carrefour and its U.S. counterpart Wal-Mart have both struggled in the Japanese retail market because of low profitability. Carrefour eventually abandoned the Japanese market in 2005 while Wal-Mart has still proven unsuccessful at expanding its market share. Judging from these facts, deregulation seems to have not affected the Japanese retail market. Nevertheless, so-called new retail formats such as specialty supermarkets (middle-sized discount stores) and convenience stores have substantially increased their market share by featuring either low prices or distinctive services. Therefore, to assess the consumer benefits of severe competition due to deregulation, the differentiation of retail services should be taken into consideration.

The purpose of this study is twofold: first, to measure the welfare gain from increased competition by shedding light on low prices and distinctive service offered by new retailing formats such as specialty supermarket and convenience stores; and second, to explore why gigantic GMS, such as Carrefour and Wal-Mart have failed to dominate the retailing market despite the abolishment of the LSRS Law.

The organization of the paper is as follows: the next section introduces the historical and institutional background of the Japanese retail industry and discuses measurement issues; the third section surveys related literature; a model is presented in the fourth section; the fifth section explains our dataset; the sixth section contains estimation results; and 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 for Japanese retail market. Third, the definition of retail output is 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 of small retail businesses originally began with the "Department Store Law" that was passed in 1937. Although the law was once repealed after WWII by the GHQ, it came to life again in 1956 in almost the same manner as before. In 1974, the law was enforced as the "Large Scale Retail Store Law" (LSRS Law) targeting stores with floor space in excess of 500 square meters, 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 protecting smaller businesses, but also restricting competition among large retailers by controlling the entry of new businesses.

In 1978 the law was reinforced. When a large-scale retailer wanted to start a new business in a certain area, it first had to notify the Minster of International Trade and Industry. The minister would then investigate the effect of the new entry on smaller retailers in that area. If a significant negative effect could be expected after the investigation, the minister would urge the entrant to modify his business plan regarding 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 the entry of large stores, their floor space and operating hours. Panels (a) and (b) of Figure 1 depict the 1991 relationships 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, respectively. The entry regulation indices are based on information about additional regulations imposed by city or prefecture government. It is an indicator of the strictness of entry restrictions. For food price by GMS and the regulations in panel (a), there seems to be a positive correlation between them, suggesting the price level is higher in

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

prefectures with stricter entry regulations. The weak negative correlation between operating hours by GMS and the indices in panel (b) infers that the regulation is effective for not only price level, but also for 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-U.S. Structural Impediments Initiative," which was aimed at creating a Japanese open market and promoting competition. In 1994, the LSRS Law was eased to give more freedom to new entrants to the retail industry with less than 1,000 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 both increased in the late 1990s. Figure 2 presents average annual entry and exit rates of retail outlets from 1979 to 2004. After 1997, both entry and exit rates have been increasing substantially. At the same time, while the share of small retailers was decreasing, non-traditional, new retail formats were emerging throughout 1990s. Figure 3 indicates the transition of the total sales share among retail formats. We can see that while the share of traditional stores has been shrinking from 70% to 58%, specialty supermarkets and convenience stores have both substantially increased their market share.[2]

On the other hand, from the viewpoint of international comparison, the share of small retailers, such as convenience stores and traditional stores, still remains large despite increased competitive pressure. Compared with the U.S., 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 the retail industry has remained at the same level throughout the 1990s. Figure 5 presents the transition of labor productivity and indicates that its upward trend disappeared after 1990.

These trends are puzzling, since the increased competitive pressure should have led to smaller unproductive outlets being replaced by larger retail outlets. A possible explanation is that the conventional labor productivity index could not accurately measure "true productivity," and it fails in particular to account for changes in both the input and output. As for the input, the *Census of Commerce* is a comprehensive data source for the Japanese retail industry, but it does not survey input information except for the number of employees. Besides, while the number of part-time workers

[2] The definitions of retail formats are summarized in Table 2.

drastically increased throughout the 1990s,[3] specific data for each employment category is available only after 1999. Output for the retail sector is more complicated, because the appropriate definition of retail output must first be determined.

2.3 How should we define retail output?

The definition of retail output is a much-debated topic among economists. Conceptually, as argued by Oi (1992) and Betancourt and Gautschi (1988), the retail outputs are considered as a mix of distribution services, such as assortment, assurance, etc. Betancourt and Gautschi (1988) discuss the economic function of a retail organization and develop the concept of a distribution service from the empirical perspective. According to their definition, a distribution service is characterized by 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 (5) *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 their share by discounting prices, convenience stores have grown in share because of their innovative distribution services.[4] In Table 1, there is a 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 increased market share despite relatively high prices might lie in their distinctive services. For example, advanced information systems such as the POS-System make it possible for convenience stores to implement advanced merchandising. 7-Elven Japan, the largest convenience store operator, has its own branded merchandise that amounts to 50% of sales.[5]

Long business hours and additional services are also fundamental to convenience store operations. Most convenience stores in Japan operate 24 hours and offer additional services, such as making photocopies, developing photographs, handling postal packages, and accepting payments for utility charges.

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[3] According to Matsuura (2007), the ratio of the number of part-time worker to total employees in the retail industry has increased from 33.4% to 54.5% between 1991 and 2004.

[4] Some specialty supermarket chains have increased their market share because of distinctive services. See chapters 9-11 in Larke and Causton (2005).

[5] For details of Japanese convenience stores, see chapter 8 in Larke and Causton (2005).

Finally and most importantly, Japanese convenience store chains have well-organized distribution and supply systems. These days, major chains operate deliveries to each retail outlet from 3 to 5 times a day to meet the needs of Japanese consumers who prefers fresh, sometimes highly perishable food products. While convenience stores' share of total sales is still low compared to specialty stores, their profitability is competitive with U.S. stores. According to MGI (2001), the profitability of stores operated by 7-eleven Japan is 50% higher than the average level in the U.S.

In this study, we focus on the consumer benefit obtained from distribution services. Consumer benefits can be measured by estimating the demand function. In the U.S. case, Hausman and Leibtag (2006) quantified the benefits of price competition by the entry of Wal-Mart. As for the quality of services in the retail sector, Sunada (2004) estimated the changes in service quality and consumer welfare for shopping. In this paper, we extend Hausman's and Sunada's specifications 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 that enable us to estimate demand structure in differentiated product settings by utilizing market-level or aggregated data. The most well-known type of such framework is the family of logit models. Berry (1994) introduces this useful empirical framework with the extreme-value distribution of consumer preferences, and Berry et al. (1995) applies the random coefficient model to the U.S. automobile market. Other applications of this type of framework are, for example, Nevo (2001) with respect to the U.S. cereal market, Ohashi (2003) with respect to the U.S. VCR market, and Werden and Froeb (1996) with respect to merger simulation. The logit family may be the most standardized framework in recent empirical IO literature.

Feenstra (1995) summarizes the exact hedonic price indexes that are derived from various random utility models, and among them he introduce the CES model with the extreme-value distribution of consumer preference, and a different type of functional form of individual indirect-utility from the logit family. Sunada (2004) uses the CES model to construct the cost-of-living index for the Japanese retail industry. The most different feature between the CES model and the logit family (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) analyzes the U.S. automobile market by utilizing the vertical differentiation model, in which consumers order products

differentiated by 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 of a strong assumption. Sunada (2005) applies the vertical model in order to access both the change in quality and introduction of new products in the Japanese mobile telecommunication market, where the marginal utility of quality is assumed to conform to the uniform distribution.

Another type of empirical framework 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 market and beer market. On the other hand, Okada and Hatta (1999) study the Japanese telecommunications market by 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… 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

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

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

$$X_j = x_j \Pr_j . \tag{4}$$

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 a 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 a CES form, such as,

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

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

We will choose the function H to be linear such as,

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

We obtain the aggregated utility function as

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

so that expected aggregate demand is

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

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

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

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

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

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

ξ_j represents the unobservable service characteristics of type *j* retail outlet, which is a

random variable with mean equal to zero.

Nested CES system

Now, suppose that the consumers have a choice between two levels of the differentiated retail 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,…, G groups (for example, GMS, specialty supermarket store or convenience store), and second, the individual decides which outlets in that group to purchase from. Suppose that the outlets available in each group g are denoted by $J_g \subset \{1,\ldots,N\}$. 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 is 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 i.i.d. extreme value.

We will choose the function H to be linear such as,

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

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

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

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 first term $y\left(\frac{\alpha y}{p_j}\right)$, 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 the group of retailing format *g*; and 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 the group of retailing 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 $D_g = \sum_{j \in J} \left[p_k / f(z_k) \right]^{-\alpha/(1-\rho_g)} = \left[p_g / f(z_g) \right]^{-\alpha/(1-\rho_g)} N_g$, the aggregated demand function is derived as follows;

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

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

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

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

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

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

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

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

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

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

Extension: Welfare

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

The corresponding expenditure function to the social welfare function or indirect utility function (21) is as follows,

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

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

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

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

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

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

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 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 market share per retail format with high service quality.

5. Data and Estimation Methodology

Our data is from a prefecture-level, food retailing outlets 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 that belong to the wholesale and retail industry. From the Census, we can obtain the sales by commodity, and characteristics of establishments. One limitation of the Census is its lack of cost and price information. Therefore, we obtained price information from the *National Survey of Prices* (Ministry of Internal Affairs and Communication), which provides us with commodity-level price information by region and type of retail outlet (retail format).

Since the *Census of Commerce* and the *Survey of Prices* have different definitions of the retail formats, we aggregated establishment-level data of the *Census of Commerce* in order to match the type of retail formats with the *Survey of Prices*. Table 2 indicates our definition of retail formats. Note that not all specialty superstores have been affected by deregulation, because some contain stores with floor space less than 500 square meters that are not covered by the LSRS Law. However, the total sales share of the stores with floor space between 250 and 500 square meters in the specialty superstores was 1.2% in 2002. Therefore, we consider the entry of specialty superstores to have been strongly affected by deregulations.

We also assumed that the retailing markets were segmented by region, that is, among 47 prefectures. The food retailing sales share by retail format are presented in Figure 7.[8] Price indices by region and retail formats are estimated by aggregating commodity-level prices with the Consumer Price Index weight (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 the merchandise turnover ratio, and it is defined as the ratio of the value of stocks to

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

product sales. A low "goods in stock per sales" ratio implies the adoption of a just-in-time delivery system that enables retailers to provide fresh food products to customers. We expect a positive and significant coefficient for this factor. The "log of floor space per employee" is a proxy for *broad assortment* services or *information* supply for the customer. Retailing outlets with larger floor space offer broader variety of products. On the other hand, to provide sufficient price or product characteristic information for customers, managers have to increase the number of employees. The expected sign of the coefficient will be positive or negative depending on consumers' preferences.

The "method of payment" is defined as the ratio of cash settlement to total sales, which suggest an index for variety of payment. While most non-traditional and chain stores usually offer a variety of methods of payments, such as debit cards, credit cards, and prepaid electric money cards, traditional stores do not. Thus, the negative sign is expected for the coefficient. The "single store ratio" will have a negative effect on the market share, since single stores are inferior to multiple stores in terms of providing *information* on prices, availability, and other characteristics.

The "breadth assortment" refers to how broad the variety of product lines is. 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 share of sales of product k for outlet i.[9] The more retail outlets that deal with the product line, the closer index D will come to the value 1. On the other hand, Retail outlets dealing with only one product line have D=0. This index is calculated by each establishment, and aggregated by prefecture and retail format with sales share weighted.

We constructed two indexes according to commodity basket. One index is calculated for all commodities and the other is calculated only for food and beverage products. While the 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 a 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.

[9] Product line is defined according to the four-digit commodity code.

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 types of retail formats, (3) the mean of prices among the same retail formats in other market (prefectures), and (4) cost variables such as average wage by prefecture and retail format. We obtain wage information from Census of Wage Structure (Ministry of Health and Labor).

6. Estimation Results

The estimation results are presented in Table 4. We estimated the model with both OLS (Model 1 and Model 3) and GMM (Model 2 and 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 the CES demand function as expressed in equation (11). Nested CES specification is estimated in Model 3 and Model 4, and the coefficients for log of number of outlets, which corresponds to 1- ρ_g, are estimated between 0 and 1. Moreover, while the Hansen's J test is rejected for Model 2, it is not rejected for Model 4; therefore, we conclude that the nested CES demand specification is more appropriate than the CES demand specification.[10]

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

Furthermore, using estimated parameters, we calculated the quality indices by retail formats. Since a dummy variable for retail format captures the service quality that each retail format offers, we regard the coefficient of the retail format dummy as part of service quality. The indices are normalized so that the quality index for a traditional

[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 ρ_g=0 is 9.17 and also rejected at the 1% level of significance.

store in 1991 is unity. The estimated indices are presented in Table 5. We can find substantial variation in quality indices among retail formats. The service quality indices for large retailers, such as GMS, specialty superstores and department stores are almost 2 to 2.5 times larger than that of traditional stores. Convenience stores offer the highest service quality. In addition, service quality for convenience stores has been increasing during sample periods, and it 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 average annual welfare change and its decomposition. In this calculation, changes in price are measured as relative price changes against general CPI. The average annual 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 change. It amounts to 2.1% in 1991-1997, and 1.2% in 1997-2002. We also found a significant contribution from CV_N (1.4%) during the 1990s. Since CV_N is considered as the effects of changes in share of the number of outlets by retail format, positive CV_N reflects both decreases in stores with low service quality, such as traditional stores, and increases in nontraditional stores. Considering the fact that there is a substantial increase in both consumers' perception of quality for convenience stores in sample periods and in the share of sales commanded by convenience stores, their emergence has played an important role in 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. The indices for operating hours and goods in stock per sales for GMS are also the same as those for specialty superstores. An insignificant coefficient on floor space per employment reflects the fact that Japanese consumers do not place importance on a large amount of floor space for daily food shopping.

According to Aoyama (2007), retailing MNEs such as Wal-Mart and Carrefour have succeeded in overseas markets by collaborating with manufacturers and adopting the factory-direct model, which enables them to undercut competitors' prices. However, in Japan their offers were refused by Japanese manufacturers and that led to their failure to adopt the factory-direct model in Japan. Thus, neither Wal-Mart of Carrefour developed

a cost advantage. In addition to taking advantage of large amounts of floor space, Carrefour and Wal-Mart both stuck to their strategies for low-cost operations, such as the stack-them-up-and-sell-them-cheap strategy, where products are placed on shelves without being taken from their corrugated boxes. However, bulk purchases are not familiar to Japanese consumers and that strategy failed to attract consumers.

8. Concluding remarks

In this paper, we propose a framework that enables us to evaluate consumer benefits from competition in the retail industry. In our framework, we incorporate 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 their market share with a low-price strategy. At the same time, despite their high prices, convenience stores have also increased their market share throughout the 1990s. We demonstrate that changes in compensation variation are explained by changes in prices, the number of outlets and the service quality of each retail format.

However, this research offers various agendas for future research. First, since our data is based on a prefecture panel dataset, we can compare the changes in welfare among regions. Market structure for the 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 in rural areas has been significantly larger than in major metropolitan areas in 1997-2002, reflecting the fact that there has been a substantial increase in the rate of car ownership in rural areas, which encourages consumers to shop at large scale specialty supermarket outside of the city.

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

Third, this research framework can be applied not only to the retail industry, but also to other service sectors with service differentiation, such as hotels, amusement parks and restaurants. There are difficulties in estimating productivity in those sectors since conventional output indices are not adjusted for changes in quality. However, our framework enables us to estimate quality adjusted for cost of living by varying compensation and constructing a quality-adjusted output index. Economists have recently paid much more attention to productivity in the services sector, thus it must be

promising area for research.

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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 originated from the “Department Store Law” established in 1937. Although the law was once repealed after the WWII by the GHQ, it came to life again in 1956 in almost the same manner as before. In 1974, the law was enforced as the “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 was not only for protecting smaller businesses, but also for restricting competition among large retailers through controlling the entry of new businesses.

In 1978 the law was reinforced. Before a large-scale retailer could start a new business in a certain area, it first had to notify the Minster of International Trade and Industry. The minister would then investigate the effects of the new entry on smaller retailers in that area. If a significant negative effect was expected after the investigation, the minister would urge 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 for illustrating the guidelines. Representatives in regional business districts carry out the 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, the LSRS law was eased to give more freedom to new entrants to the retail industry with less than 1,000 square meters of floor space. And, finally, in 1998 the law was completely repealed.

[11] For a 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 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 decreases as N_g increases, 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 decrease 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.

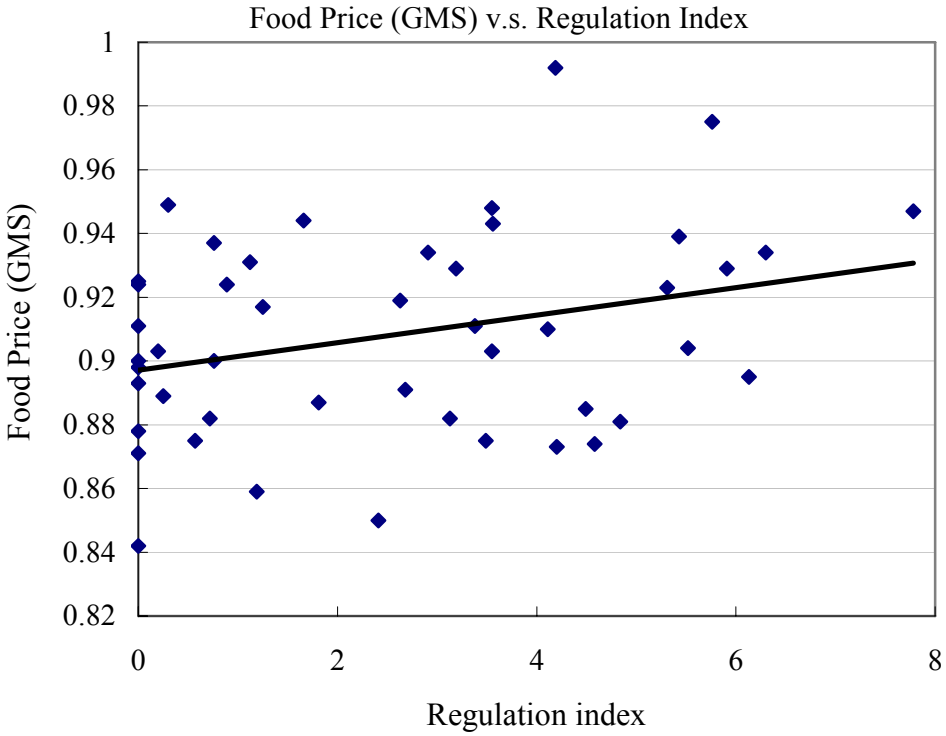
Table 6. The decomposition of annual average welfare changes

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)



panel (b)

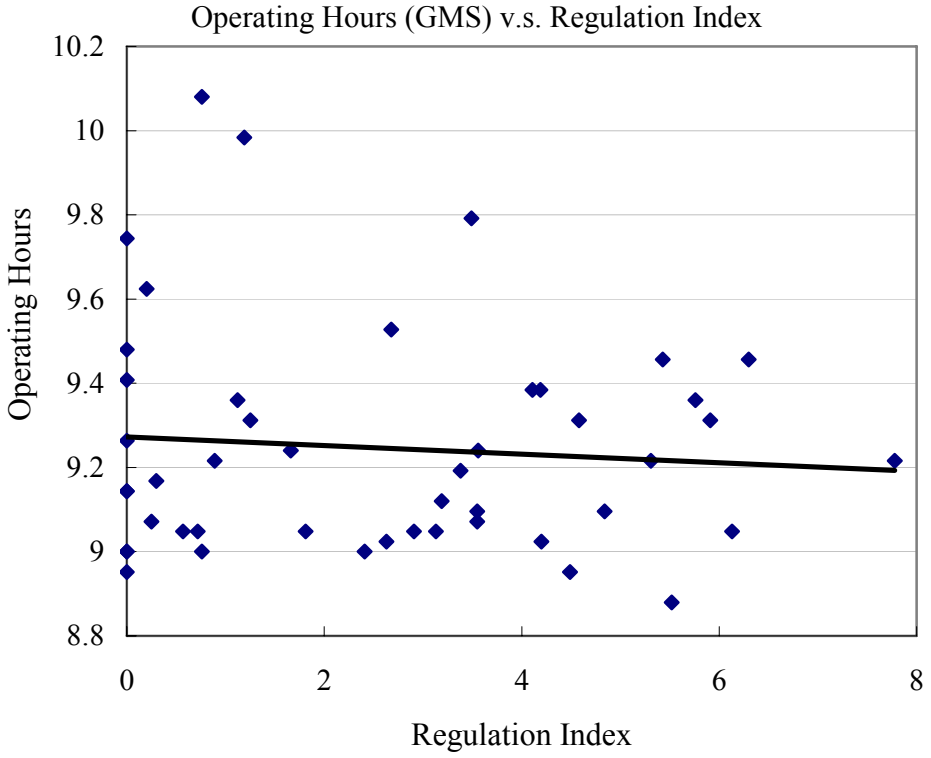
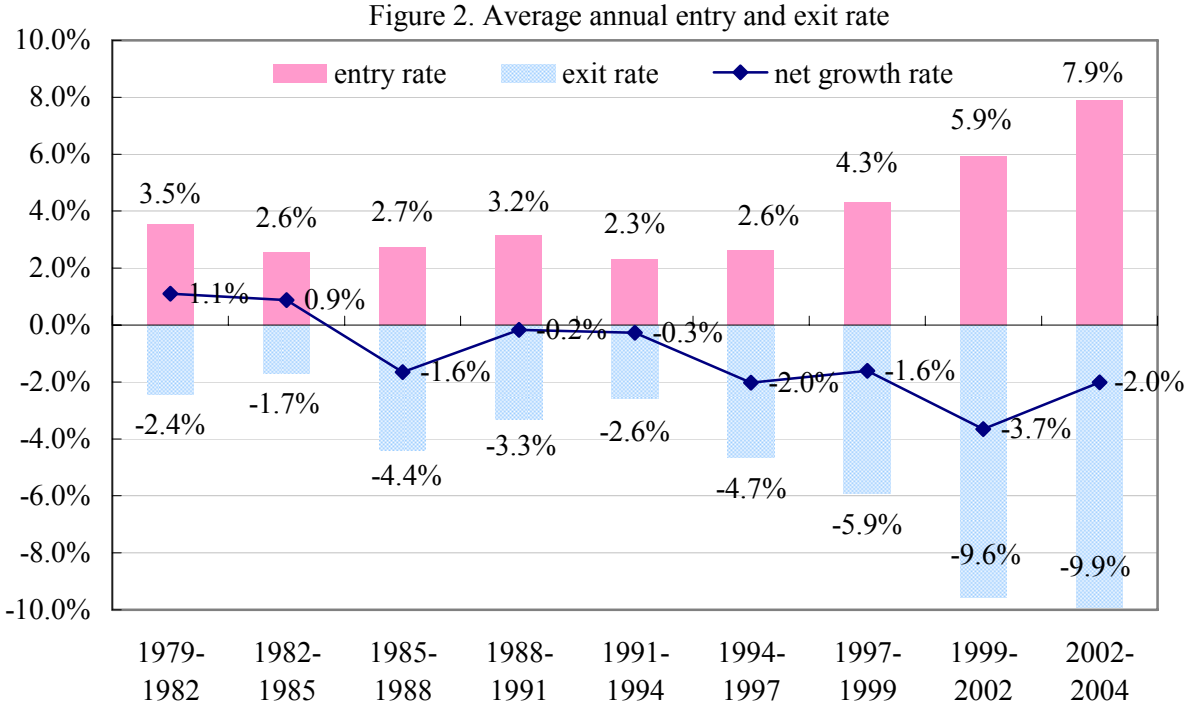
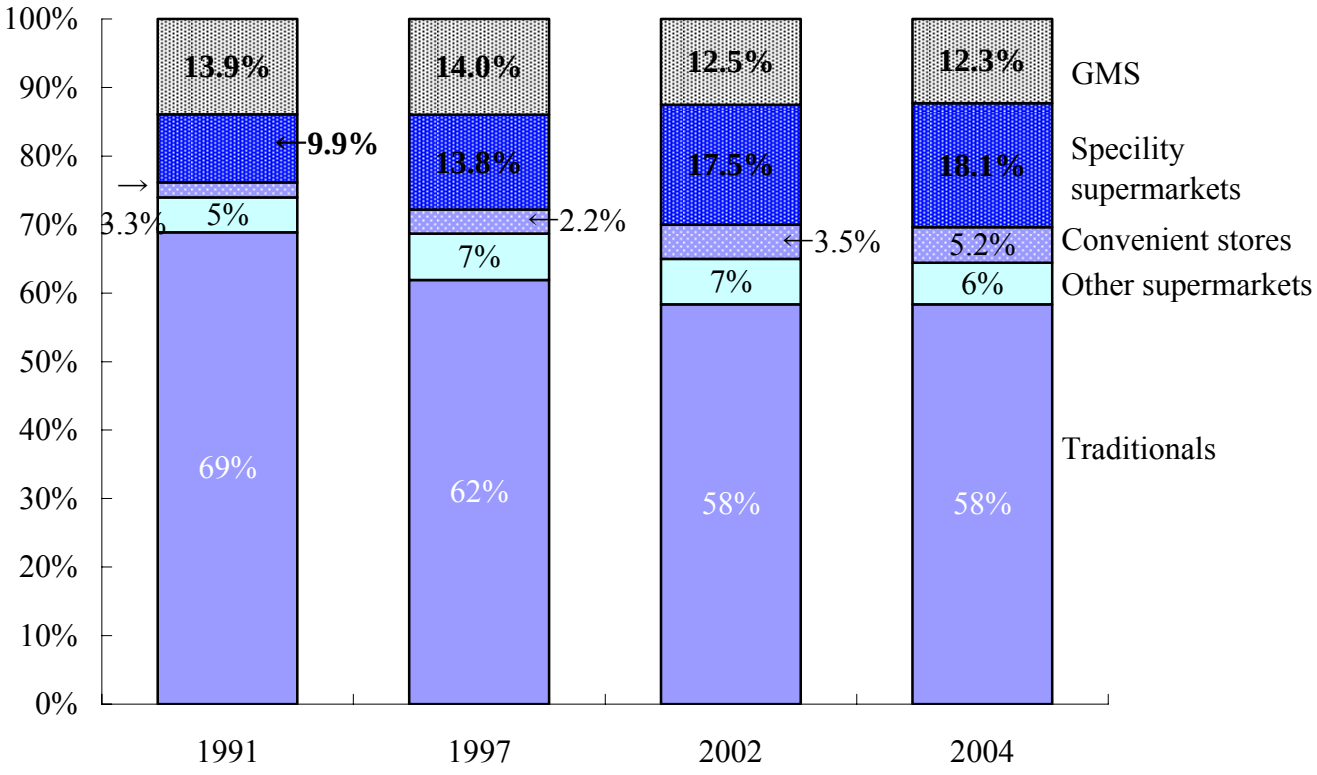


Figure 2. Average annual entry and exit rate



Source: Census of Commerce

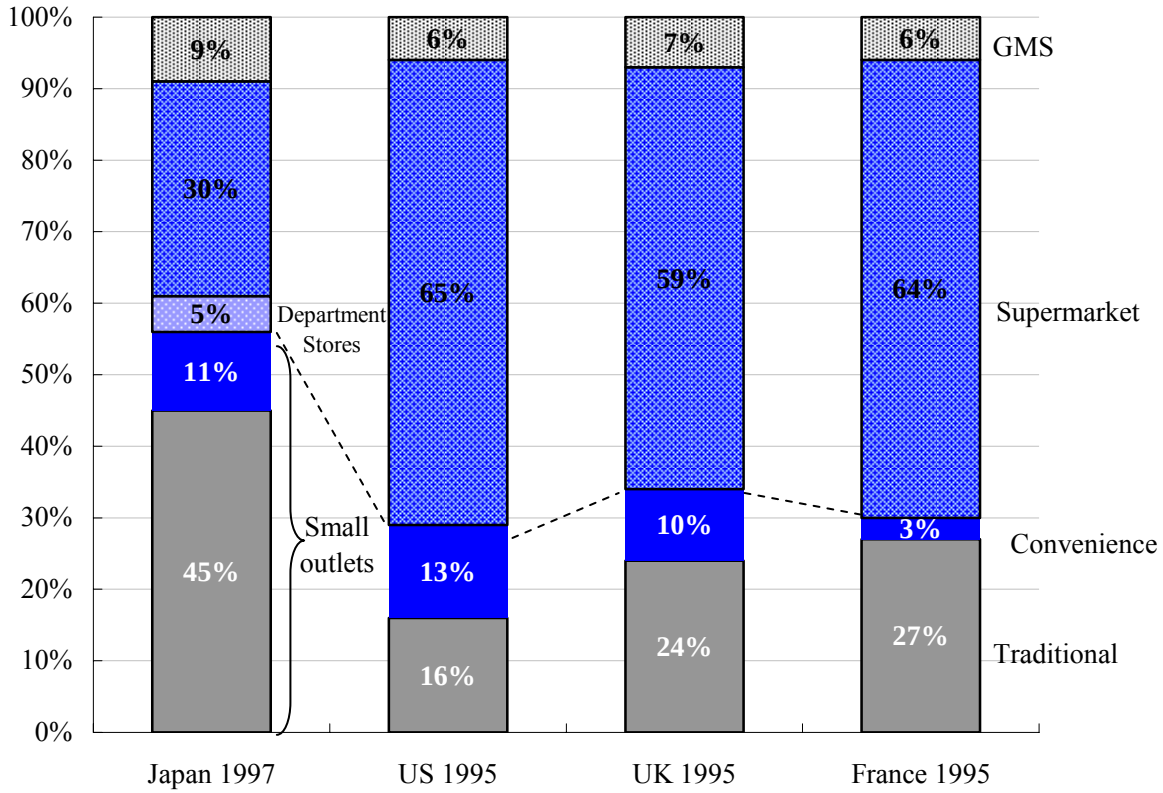
Figure 3. The tranition of share of sales by retail format



Source: Census of Commerce

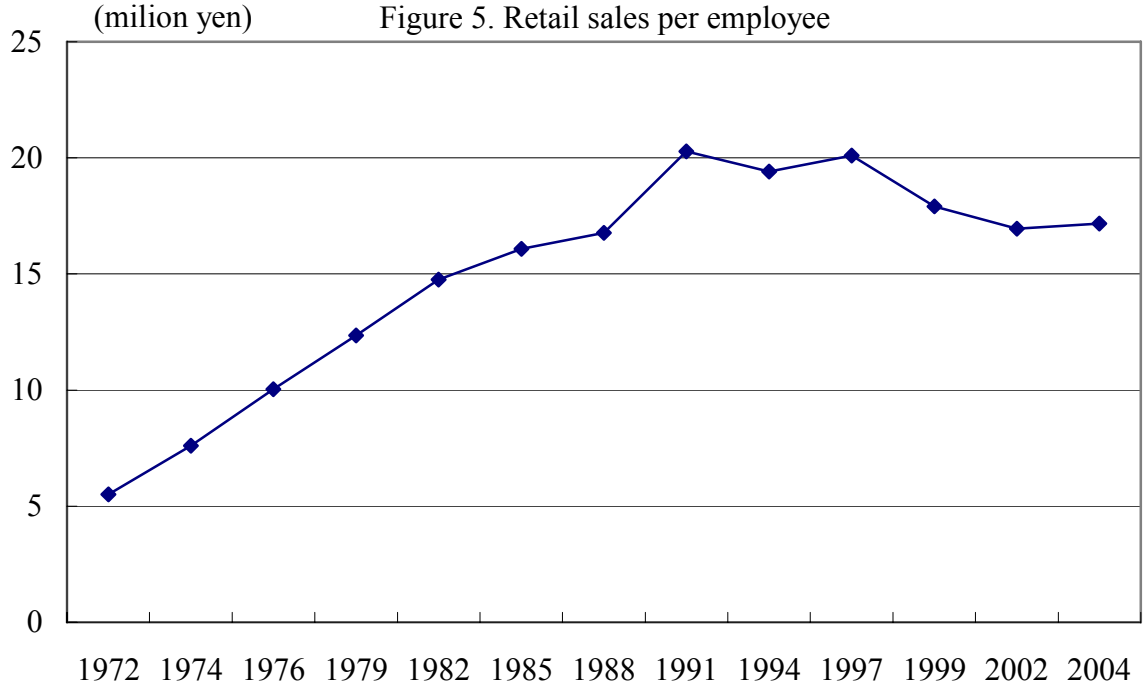
Note: See footnote at Table 2 for the definition of retail formats.

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

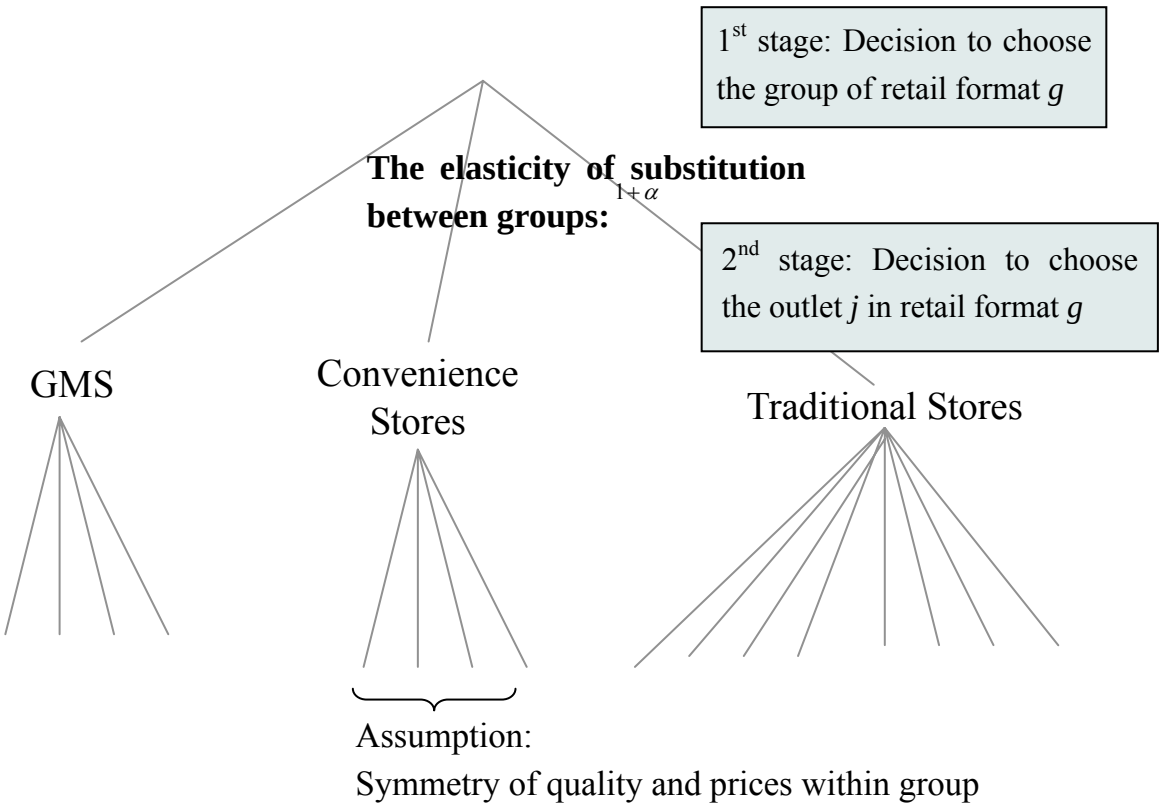


Figure 7. The sales share of retail formats by commodity group and retail formats