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Keywords: Competition, Welfare analysis, Retail Industry
JEL classification code; L13, L81, L51

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1. Introduction

The entry and exit dynamics of firms are considered a major source of economic growth. Entering firms often have new innovative business models and relatively high productivity. Competition caused by a surge of entering firms not only stimulates incumbents' incentive for innovation but also force inefficient firms to exit markets. In the service sector, it is known that the reallocation effects of entry and exit play an important role in productivity growth. For example, in the case study of the U.S. retail industry, Foster et al. (2006) investigated the impact of entry and exit on the aggregate-level productivity growth during the 1990s and showed that the relatively more productive entering retail outlets have displaced the less productive exiting retail outlets throughout the 1990s, accounting for the labor productivity growth during the decade.

In this study, we measure the welfare gain caused by the entry of new retailers in Japan. During the 1990s, the Japanese retail sector experienced a significant reallocation due to entry and exit dynamics. Two types of retail formats expanded their market shares throughout the 1990s. One was the mid-sized specialty supermarket store featuring discount pricing strategy that expanded its market share partially due to the deregulation of entry restriction for large-scale stores in the 1990s. The other retail format that expanded its share was the so-called convenience store that offered innovative services by making active use of information technology. In this study, we estimate the welfare impact of the entry of these new retail formats.

However, measuring the performance of service industries, such as the retail industry, is fraught with many difficulties. Within the retail industry, for example, each firm differentiates its service by offering a distinct range of products with additional service. Since entering firms often bring new innovative services, it is necessary to measure accurately the quality of

service provided by each firm in order to assess the impact of the entry of new service providers. Moreover, as a result of product differentiation, each firm is likely to have some market power. In such cases, the hedonic method, which is the most commonly used approach to measure quality under the perfect competition assumption, cannot be applied to this sector.

In the case of Japanese retail industry, the two entering retail formats mentioned above adopt different policies: while specialty supermarket stores use discount pricing strategy, convenience stores feature service quality. Thus, to measure the welfare gain caused by new retailer entries, we need to employ a model that accommodates the differences in price and quality of output. In fact, there are many empirical frameworks that enable us to estimate the demand structure in differentiated product settings by utilizing the market-level or aggregated data. The most well-known framework is the logit family model. Berry (1994) introduced a useful empirical framework using extreme-value distribution of consumer preferences, and Berry et al. (1995) applied the random coefficient model to the U.S. automobile market.

In this study, instead of using the logit family model, we employ the CES model that was introduced by Feenstra (1995) with the extreme-value distribution of consumer preferences, and a different type of individual indirect utility function from the logit family model. The main difference between the CES and logit family models is that while the latter assumes that consumers purchase only one unit of product, in the former, there is no such restriction. In the case of retail industry, since consumer decision is not always a discrete choice, the CES model seems more appropriate for our analysis. In previous studies, Sunada (2010) estimated the changes in service quality and consumer welfare for shopping using the CES model. We extend Sunada's specification to incorporate the regional differences in price and service quality, while estimating consumer benefits from increased market dynamics.

Welfare assessment of the entry of new retail formats will provide us with policy

implications. In Japan, although the entry of large-scale stores had been restricted by the Large Scale Retail Store Law (LSRS Law, hereinafter) until the early 1990s, it was gradually relaxed and finally repealed in 2000. However, the impact of deregulation seems to have been limited. While specialty supermarket stores –relatively large discounting food retailing stores− have increased their market shares, Generalized Merchandise Store (GMS), which have much larger floor space and deal with a wider range of products, failed to increase its market share. In fact, Carrefour and Wal-Mart, the French and the U.S. multinational retail chains, struggled in the Japanese retail market because of low profitability. Carrefour exited Japan in 2005, and Wal-Mart has not yet succeeded in expanding its market share. Based on these facts, some economists argue that the abolition of the LSRS Law has not created enough impact on the Japanese retail industry. In this study, by measuring consumer preferences with regard to price and service quality, we also assess the impact of deregulation and explore why gigantic GMSs, such as Carrefour and Wal-Mart, failed to dominate the Japanese retail market despite the abolition of the LSRS Law.

The structure of this paper is as follows. We introduce the historical and institutional background of the Japanese retail industry in the next section. We explain the background of retail industry in Japan in section 3 and present our model in section 4. In section 5, we explain our data set. Section 6 provides estimation results and section 7 discusses the implications from estimation results. A summary and conclusion are presented in the final section.

2. Background

There is a conventional notion that the Japanese retail industry is quite peculiar. This is because Japan has more retailers per capita than other countries. Most stores are small and

family-owned firms, the so-called Mom and Pop stores. For example, according to Ito (1992), while retail store per 1000 residents for the U.S. and Germany was 8.3 and 6.7 respectively, it was 14.5 for Japan in 1982. Workers per retail store for Japan, Germany, and the U.S. were 3.7, 5.9, and 8.1, respectively. Throughout the 1980s and 1990s, retail density in Japan has been gradually decreasing and reached 11.3 in 1997, which was still quite high since the U.S. retail density in 1997 was around 6.0.

The discussion on these facts has attracted attention from researchers and policy makers since the 1980s. There are two opposing views on the reason for the large number of retailers in Japan. The first view is that since transportation and inventory costs for consumers are high in Japan, they prefer shopping at nearby small retail stores almost every day. For example, Flath (1990) and Nariu and Flath (1996) empirically investigated the effect on retailers per capita using passenger car per capita and the average housing size as proxies for consumers' transportation and inventory costs. Their research demonstrated that Japan's retail density is not exceptionally high.

The second view is that entry restrictions on large-scale stores have affected consumer behavior, and therefore consumption tendencies and preferences have been distorted. For example, McCraw and O'Brien (1986) argued that since public transportation has been well developed, there is no reason for consumers to choose nearby small retailers. They attributed high retail density to entry restrictions imposed by the LSRS Law on large-scale stores. In fact, Nishimura and Tachibana (1996) analyzed the effects of the LSRS Law on retail store productivity and showed that LSRS Law has brought some distortions in the Japanese retail market.

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 opening up the Japanese

retail market and promoting competition. In 1994, the LSRS Law was eased to give more freedom to new entrants into the retail industry with less than 1000 m^2 of floor space. Finally, in 2000, the LSRS law was completely repealed[1].

Along with the process of deregulation, the entry and exit rate increased in the late 1990s. Figure 1 presents the annual average entry and exit rates of retail outlets from 1979 to 2004. After 1997, both the entry and exit rates have been increasing substantially. At the same time, while the share of small retailers has been decreasing, the non-traditional new retail formats emerged throughout the 1990s.

== Figure 1==

Figure 2 indicates the changes in sales shares among food retail formats. Two retail formats expanded their market share during regulatory transition periods: specialty supermarket stores and convenience stores[2]. Specialty supermarket stores are mid-sized stores that occupy more than 250 m^2 floor space and primarily deal with food products. Since they are relatively large stores, their expansion might be attributed to by the deregulation. Convenience stores are relatively small stores that operate for more than 14 hours a day and deal with not only food products but also a broad range of items. The shares of specialty supermarket stores and convenience stores have substantially increased from 25.5% to 35.3% and from 4.7% to 10.4%, respectively. On the other hand, the share of Generalized Merchandized Stores (GMS) that have a floor space of more than 3000 m^2 and deal with a broad range of items, has remained unchanged through the 1990s[3].

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[1] For details of LSRS Law, see Appendix A.
[2] The definition of retail formats are summarized in Appendix B.
[3] Although GMS deals with not only food and beverage but also clothing, furniture, and other

== Figure 2==

The emergence of specialty supermarket stores may be attributed to their price policy as well as the deregulation. Table 1 shows a substantial price gap between retail formats. While specialty supermarket stores attract consumers by offering products with the lowest prices, convenience stores offer relatively high prices.

== Table 1==

Convenience stores in Japan are quite different from what would be expected in Europe and the U.S.. For example, while the majority of small stores cannot adopt advanced information technology in Japan, major convenience store operators actively make use of these technological advances such as the POS System, which enables them to organize an efficient distribution system. Currently, major chains organize deliveries to each retail outlet 3 to 5 times a day and provide consumers with fresh and sometimes highly perishable food products. Some convenience store operators collect records of each customer's gender and age for each purchase, and make active use of this information for their original brand product development and merchandising. According to Larke and Causton (2005), Seven-Eleven Japan, the largest convenience store operator, sells its own branded merchandise, which amounts to 50% in total sales. Moreover, long business hours and additional services are also fundamental to convenience stores' operation. In Japan, most convenience stores generally operate 24 hours a day, and offer additional services such as making photocopies, photo

household goods, sales data in Figure 2 are restricted to sales of food and beverage products.

developing, postal package handling, and payment of utility charges.

These dynamic market transitions affect consumer welfare. However, previous studies have not empirically examined their impact during periods of regulatory transition. Since previous studies such as Flath (1990), Nariu and Flath (1996), and Nishimura and Tachibana (1996) are all cross sectional studies, it does not distinguish the cause from the effect. Our welfare assessment based on the structual estimation of demand function for shopping will reveal how the dynamics of entry and exit has impacted the retail market and to what extent entry restrictions have been influential.

3. Model

Consumer Choice

We suppose that consumers choose from different types of outlets $j = 1 \ldots N$, and have the following 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 his or her preferred product j with probability

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

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 the 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 in 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, 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 in the CES form, such that

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

where we measure prices relative to consumers' perceived "quality" of products $f(z_j)$. We will choose H as a linear function such that

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

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 the 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 the CES indirect utility function or the 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 denotes the unobservable service characteristics of type j retail outlet, which is a random variable with the mean value of zero.

Nested CES system

Now, suppose that consumers have a choice between two levels of differentiated retailing services. The structure of consumer choice is presented in Figure 3. First, an individual consumer decides whether to purchase a product from each of g =1,…, G groups (for example, GMS, specialty supermarket store, or convenience store). Second, the consumer decides from which outlet in that group to purchase. 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:

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

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

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

where the errors e_j^h are iid extreme values.

We will choose the linear function H such that

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

and obtain the aggregated utility function as

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

so that the expected aggregate demand is

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

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 $y\left(\frac{\alpha y}{p_j}\right)$ represents the conventional Cobb-Douglas demand function. The second term, $p_k/f(z_k)/D_g$, stands for the share or the probability of choice of outlets j in the demand for the group of retail format g, and the third term, $D_g^{(1-\rho_g)}\Big/\sum_{g=1}^{G} D_g^{(1-\rho_g)}$, denotes 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 $j \in J_g$ [4].

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, the 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 represents the unobservable service characteristics of type

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

g retail format, which is a random variable with the mean value of zero.

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

Note that if ρ_g=1, the increase in N_g does not affect the share of group g[5]. On the other hand, when 0 < ρ_g <1, the sales share of group g increases as entry of new outlets in group g.

Extension: Welfare

We now demonstrate how we can estimate the changes in consumer welfare that arise from the expansion of various services. The corresponding expenditure function to the social welfare function or indirect utility function is given by

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

We define the compensating variation as the log-difference in the consumer expenditure function, holding utility as constant at the beginning of each period;

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

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

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

[5] When ρ_g=1 increases, N_g affects only the sales share of outlet j in each group of retail format g. For details, see Appendix C.

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

The first term CV_q represents the increase in welfare due to the average quality change, holding the prices and the number of outlets in group g at their pre-change level. The second and third terms represent the welfare changes caused by the changes in prices and the number of outlets, respectively, holding other factors fixed. The increase in CV_{N} is considered as the effect of changes in market share on the part of retail formats with high-service quality or discount price strategy. If deregulation promotes the entry of discounting stores, CV_{p} will contribute to the overall changes in compensating variation.

4. Data and Estimation Methodology

Our dataset includes food retailing outlets at the prefecture level and the 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 belonging to the wholesale and retail industry. From the Census, we obtained the data for the sales by commodity-type and establishment characteristics. One limitation of the Census is the lack of price information. Therefore, we referred to the *National Survey of Prices* (Ministry of Internal Affair and Communication), which provides the commodity-level price information by region and the type of retail outlet (retail format). Since the *Census of Commerce* and the *National Survey of Prices* define retail formats differently, we aggregated establishment-level data from the *Census of Commerce* in order to

match the retail format type defined in the *National Survey of Prices*[6]. Price indices by region and retail formats are estimated by aggregating the commodity-level price with the weight of the Consumer Price index (as estimated by the Ministry of Internal Affair and Communication).

For service quality indicators, we referred to previous studies that address the definition of retail output, e.g., Oi (1992) and Betancourt and Gautschi (1988). In these previous studies, retail outputs are considered as a mix of distribution services, such as assortment and assurance. Betancourt and Gautschi (1988) discussed the economic function of retail organization and proposed the concepts of distribution service from an empirically-based perspective. According to their definition, distribution service is classified into the following four categories: (1) *accessibility of location*, (2) *assortment,* (3) *assurance of product delivery in the desired form and at the desired time*, (4) *information* and *ambience*. We refer to these concepts and construct the following service quality indicators based on different retail format characteristics: operating hours, goods in stock per sales, broad assortment index, single store ratio, floor space per employee, and method of payments.

As proxy for *time accessibility* or *assurance of product delivery*, we use "Log of operating hours." We expect "Log of operating hours" to have a positive effect on market share. "Goods in stock per sales" is the inverse of the merchandise turnover ratio, and is defined as the ratio of value of stocks to sales of products. Low "goods in stock-sales" ratio implies adoption of just-in-time delivery system, which enables retailers to provide fresh food products to customers. For *assortment*, we prepare a direct measure, "Breadth assortment," which is defined as the following index;

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

[6] For details on our definition of retail formats, see Appendix B.

where ω_{ik} indicates the sale share of products k for outlet i[7]. The more retail outlets deal 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 construct two indices according to commodity basket: one is calculated by taking into account all commodities, and the other is calculated based only on food and beverage products. While the former indicates the range of assortment regarding all commodities, the latter represents the variety within food and beverage products.

"Single store ratio" will have negative effects on market share, because single stores are inferior to multiple stores in terms of providing price information, availability, and other characteristics. We expect a positive and significant coefficient. "Log of floor space per employee" is proxy for *broad assortment* services or *information* supply to customers. Retail outlets with larger floor space offer a broader variety of products. On the other hand, in order to provide consumers with sufficient price and product information, managers have to increase the number of employees. The expected sign of the coefficient will be positive or negative depending on consumer preferences. "Method of payment" is defined as the ratio of cash settlement to total sales, which suggests an index for a variety of payment. While the majority of non-traditional or chain stores usually offer a variety of payment methods, such as debit card, credit card, or prepaid electric money card, traditional stores do not. Thus, a negative sign is expected for the coefficient. Finally, to capture unobservable format-specific service quality, retail format dummy variables are included in the equation.

Table 2 provides a summary of the variables we use as service characteristics by retail formats. Three items are noteworthy. First, while Convenience stores have the second highest

[7] Product line is defined according to the 4-digit commodity code.

price level, their distinctive services are reflected by longer operating hours and low goods in stock per sales. Second, looking at floor space per employee, there are clear differences between large and small retail formats. While floor space per employee for GMS, Specialty supermarket stores, and Department store exceeds 30, those for Traditional stores and Convenience stores are 17.26 and 10.57, respectively. Third, Traditional stores are inferior to other retails formats in terms of service quality. Their operating hours are relatively short; goods in stock per sales are highest among five retail formats and two indices of breadth assortment are at the lowest.

= Table 2 =

Since the relative price and number of outlets are considered endogenous variables, the OLS estimates are not consistent. Therefore, instrumental variables are needed. As discussed in Berry, et al. (1995), Hausman (1997), 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 price of the same retail formats in other markets (prefectures), and (4) cost-side variables; average wage by prefecture and retail formats. We obtained wage information from the Census of Wage Structure (Ministry of Health, Labor and Welfare).

5. Estimation Results

The estimation results are presented in Table 3. We estimate the model using both OLS (Models 1 and 3) and GMM (Models 2 and 4) methods 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 Models 1 and 2 does not include log of number of outlets, which is equivalent to the CES demand function as expressed in equation (11). Nested CES demand specification is estimated in Models 3 and 4, and the coefficients for log of number of outlets, which correspond with $1-\rho_g$, are estimated between 0 and 1. Moreover, while Hansen's J test is rejected for Model 2, it is not in Model 4; therefore, we conclude that the nested CES demand specification is more appropriate than the CES demand specification[8].

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

= Table 3 =

Furthermore, using estimated parameters, we calculate quality indices by retail formats. Since the dummy variable for each retail format captures the quality of service that each retail format offers, we regard the coefficient for retail format dummy as part of service quality. The indices are normalized so as to make the quality index for traditional store in 1991 1.0. The estimated indices are presented in Table 4. There is a substantial variation in quality indices

[8] Wald test statistic 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 statistic for the hypothesis $\rho_g = 0$ is 9.17 and rejected at 1% level of significance, as well.

among retail formats. The service quality indices for large retailers, such as GMS, Specialty supermarket stores, and Department stores are almost 2 or 2.5 times larger than that of Traditional stores. Convenience stores offer the highest service quality. In addition, service quality of Convenience stores has been increasing during the sample periods, and it reached 3.5 in 2002. Therefore, the substantial increase in market share of Convenience stores can be attributed to the improvement of its service quality.

= Table 4 =

Table 5 presents the average annual welfare change and its decomposition. In this calculation, changes in price are measured as relative price changes against the general CPI. The changes in the average annual welfare between 1991 and 2002 are roughly 3.7% to 1.9%, more than half of which are explained by CV_q or quality changes. It amounts to 2.1% and 1.2% between 1991 and 1997 and between 1997 and 2002, respectively. We also found significant contribution of CV_N (1.4%) during the 1990s. Since CV_N considers the effects of changes in number of outlets by retail format, positive CV_N reflects the decrease in the number of stores with low service quality, such as traditional stores, and the increase in the number of non-traditional stores. On the other hand, CV_P was 0.2% between 1991 and 1997 and 0.5% between 1997 and 2002, respectively, implying that the impact of price reduction is limited. Considering the substantial increase in consumers' perception of convenience store quality in the sample periods and the increase in these stores' market share, we see that the emergence of convenience stores has facilitated welfare changes in food retailing.

= Table 5 =

6. Discussion

Combined with the estimation results and service characteristics by retail format in Table 2, the reason why GMS failed to expand market share despite deregulation can be explained by insufficient price competitiveness and failure to differentiate its service characteristics from those of specialty supermarket stores. For example, in Table 2, while the price index for GMS is 0.926, for specialty supermarket stores it is 0.917. The indices for operating hours and goods in stock per sales for GMS are also the same with those for specialty supermarket stores. Insignificant coefficient on floor space per employment reflects the fact that Japanese consumers do not place particular importance to huge floor space for daily food shopping. According to Aoyama (2007), retailing MNEs such as Wal-Mart and Carrefour, have succeeded in expanding their markets overseas by collaborating with manufacturers and adopting factory direct models, which enable them to undercut competitors' prices. However, in case of Japan, their offers were refused by Japanese manufacturers, and they failed to adopt the model. Thus, both Carrefour and Wal-Mart had no cost advantages in Japan. Moreover, taking advantages of huge floor space, Carrefour and Wal-Mart stuck to their low-cost operations, such as the stack-them-up-and-sell-them-cheap strategy, whereby products are displayed without being taken out of corrugated boxes. However, that strategy failed because Japanese consumers were not familiar with bulk purchase.

7. Concluding remarks

In this study, we measured the welfare gain caused by the entry of new retailers. During the 1990s, the retail sector in Japan experienced significant reallocation dynamics. Two retail formats have expanded their market share: one is specialty supermarket stores that expanded

their market shares partially due to the deregulation of large-scale stores, and the other is convenience stores that take advantage of their distinctive service quality and efficient operation system. In our analysis, since retail service providers usually distinguish their service quality, we incorporate the differences in their service characteristics as well as in their price, and measure the consumer benefit by estimating the CES type demand function.

Our results show that changes in consumer welfare during the 1990s are predominantly explained by changes in the quality of service, not by changes in price. We conclude that the effects of deregulating entry restriction on large-scale retail stores are quite limited. Furthermore, estimated parameters for the demand function imply that Japanese consumers place more importance to long operation hours rather than huge floor space for daily food shopping. This might be one of the reason why retailing MNEs such as Wal-Mart and Carrefour had difficulties in expanding market share in Japan.

However, this research offers directions for future research. First, our framework enables to make an international comparison of the differences in service quality and consumer gains among retail outlets. Typically, the difficulties in international comparison of productivity in the service sector lie in incorporating the differences in consumer tastes. In our framework, we expect differences in consumer tastes to be reflected by parameters for price and service characteristics.

Second, this research framework is applicable to not only the retail industry but also 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 quality changes. However, our framework enables to estimate a quality-adjusted cost of living index based on compensation variation as well as construct a quality-adjusted output index. Productivity in the service sector has recently attracted much

attention from economists as additional inquiries may lead to 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 small-scale retailers. The protection of small retail businesses originated from the "Department Store Law" established in 1937. Although the law was once repealed after WWII by 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 not only department stores but also large superstores. At the same time, the new law had the added purpose of restraining new entrants with large capital from abroad. The law had not only protected smaller businesses but also restricted competition among large retailers through controlling the entry of new businesses.

In 1978, the law was reinforced. When a large-scale retailer started a new business in a certain area, it first had to notify the Minister of International Trade and Industry. The minister would then investigate the potential effects of the new entry on small-scale retailers in that area. If the investigation detected potentially negative effects, the minister would urge the entrant to modify its business plan based on factors such as floor space, business days, closing times, or the number of holidays.

The role of the minister was just to provide guidelines. Representatives in regional business districts carried out substantial adjustments. Furthermore, local governments were allowed to impose additional entry regulations on large stores.

In the 1990s, the trend shifted from protectionism to deregulation as a result of "The Japan-US Structural Impediments Initiative," which aimed at opening up the Japanese market and promoting competition. In 1994, the LSRS Law was eased to give more freedom to new entrants into the retail industry with less than 1000 $m^2$of floor space. Finally in 2000, the law was completely repealed.

Appendix B: Definition and Concordance of Retail Formats

(1) The definition of retail formats

id		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			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 establishments that 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 is put on the shelf unwrapped or prepackaged with price labeled on them.

ii) Shopping baskets or shopping carts are provided to 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 whose retail sales is 70% or over.

(2) Concordance table of retail formats between National Survey of Prices and Census of Commerce

id		National Survey of Price		Census of Commerce
		1997, 2002	1992	
1	GMS	Supermarket	Chain Supermarket	GMS
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

Appendix C: 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 $0 \leq \rho_g \leq 1$.

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

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

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

Hence,

$0 \leq \eta_g \leq 1 - \Pr_j$ and $-1 \leq \eta_j \leq -\Pr_j$. 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

	White bread, Ordinary Quality (100g, Yen)	Hen eggs (10 pieces, Yen)	Ice cream, "Morinaga Eskimo Romana 8%," (150ml)	Pillow type instant noodle, *Chicken Ramen* (per package, Yen)	Plain yogurt, *MEIJI Bulgaria LB51* (500ml, Yen)
GMS	40.68	164.70	97.81	82.06	230.21
Specialty supermarket stores	41.05	163.39	97.85	81.14	227.60
Department stores	48.74	180.31	101.09	83.59	239.61
Traditional Stores	45.13	174.82	100.63	82.30	236.02
Convenience stores	43.97	178.50	101.33	83.74	235.70

Source: National Survey of Prices, 1992, Ministry of Internal Affair and Communication

Note: For the details of the definition of retail formats, see Appendix B.

Table 2. Average service characteristics for food retailing outlets in 1997

	GMS	Specialty Supermarket	Department store	Traditional Store	Convenience store
Price Index	0.926	0.917	1.297	1.017	1.020
Operating hours	0.425	0.448	0.384	0.419	0.878
Method of Payments	0.208	0.650	0.039	0.435	0.696
Single stores ratio	0.029	0.172	0.152	0.781	0.799
Goods in stock per sales	0.083	0.080	0.090	0.144	0.044
Floor space per employee	48.60	33.76	45.52	17.26	10.57
Breadth assortment (all products)	0.550	0.159	0.683	0.117	0.216
Breadth assortment (food and beverage)	0.718	0.237	0.799	0.156	0.314

Source: Authors' calculation based on Census of Commerce

Note: For normalization, operating hours are divided by 24.

Table 3. 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]***
retail 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-values.

2) "***," "**," and "*" represent level of significance at 1%, 5%, and 10%, respectively.

Table 4. Estimated Quality Indices by retail formats

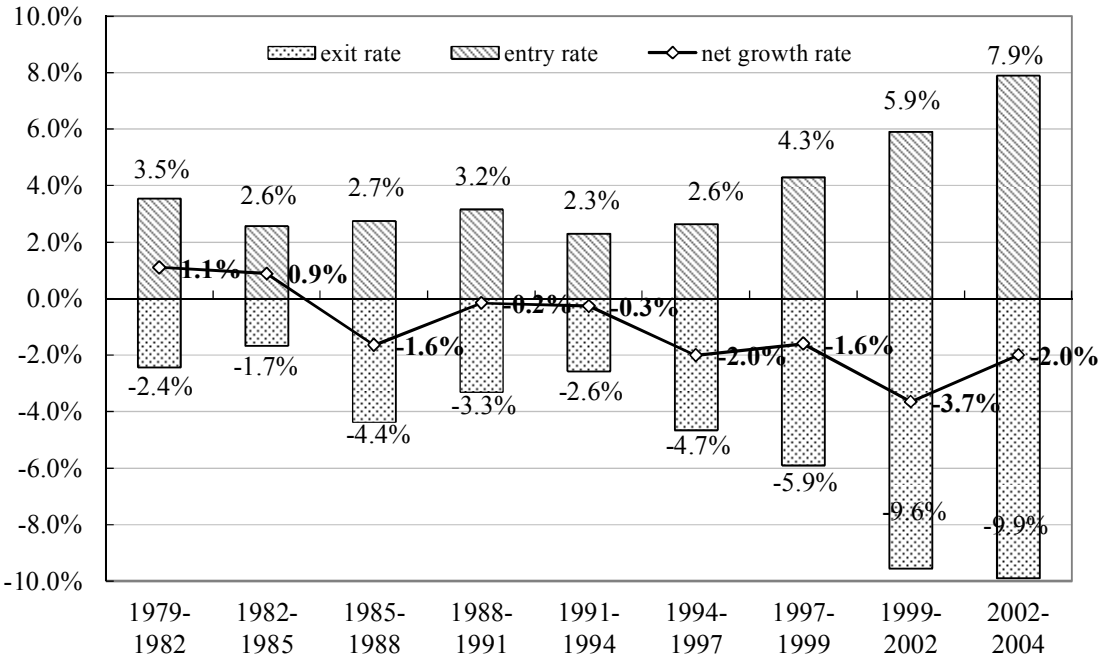
		1991	1997	2002
1	GMS	2.701	2.799	2.913
2	Specialty supermarket	2.038	1.913	1.912
3	Department stores	2.207	2.439	2.455
4	Traditional stores	1.000	1.009	0.990
5	Convenience stores	2.348	3.194	3.560

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

Table 5. The decomposition of average annual welfare changes

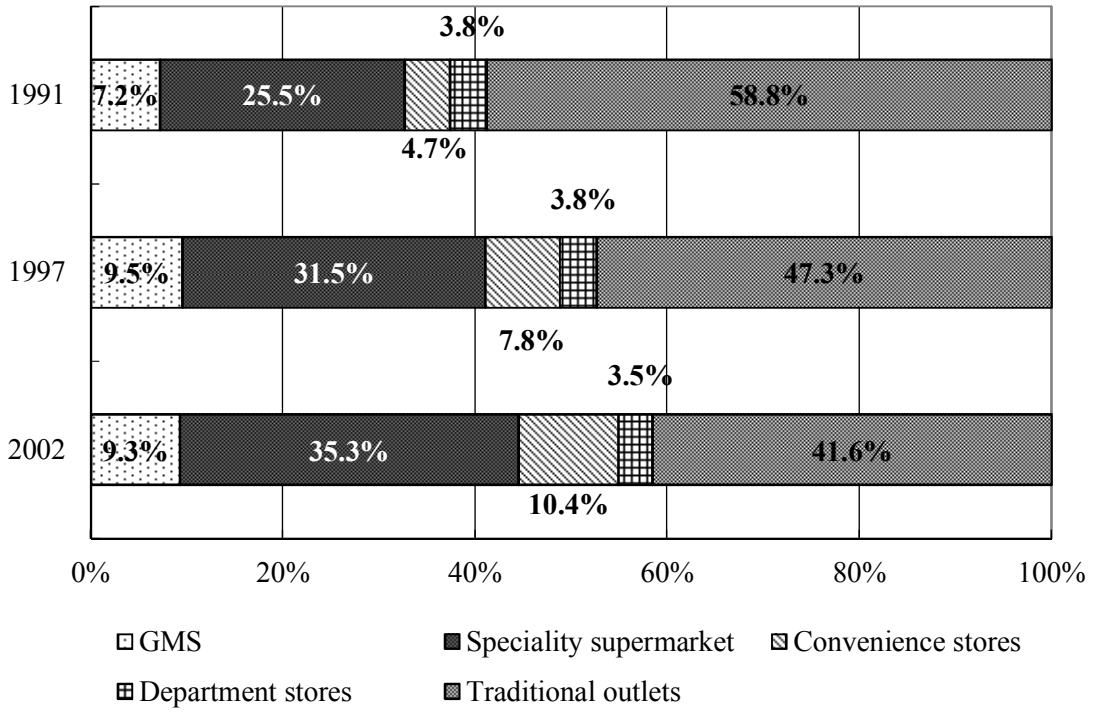
	1991-1997	1997-2002
CV	3.7%	1.9%
CV_q	2.1%	1.2%
CV_N	1.4%	0.1%
CV_p	0.2%	0.5%

Figure 1. Average Annual Entry and Exit Ratio



Source: Census of Commerce

Figure 2. The sales share of retail formats by commodity group and retail formats



Note: See Appendix B for the definition of retail formats.

Figure 3. Structure of consumers' choice