Chapter 1
The Effect of Regulation on a Dominant Firm to Protect Fringe Firms in a Local Market

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Abstract A model of competition between a large-scale dominant firm and fringe firms is analyzed to examine the effect of market share regulation on the dominant firm to protect the small firms. One feature of the model is that the dominant firm and the small firms provide close but different services to consumers. Because business stealing effects are possible for both the dominant firm's and small firms' entries, the effect on social welfare is generally indefinite. When small firms face the danger of extinction because of the expansion of the dominant firm, it is demonstrated that the effect is evaluated solely by the excessiveness of the number of small firms. As small firms tend to enter excessively when there is spatial competition, the market share regulation on the dominant firm prevents efficient outcome unless small firms are eliminated. In most regional retail markets in Japan, small ordinary stores are far from total elimination, so a restriction on the expansion of large-scale stores is not needed.

1.1 Introduction: Competition Between Dominant Firm and Fringe Firms

In this paper, I would like to argue on a type of spatial competition between a dominant firm and numerous small firms—a model of partial monopoly. Textbook models of partial monopoly have analyzed strategies of a dominant firm under the asymmetric distribution of firm size in a market of a homogeneous good. In these models, the asymmetries are from the disadvantages of the cost condition or the restricted capacity of fringe firms. The asymmetry considered here is not based on differences in such cost conditions in manufacturing the homogeneous good. I discuss the competition between a market with numerous small firms and a large-scale firm, where they supply a close substitute. Thus, I analyze a competition with outside goods in Salop (1979) explicitly.

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T. Ishikawa and D. Nakamura (eds.), *Industrial Location and Vitalization of Regional Economy*, https://doi.org/10.1007/978-981-19-8128-9_1

When a new product is introduced, it may create quite a new market, but mostly, the product finds its niche close to the incumbent goods. If a new product gains its share successfully by getting consumers' acceptance of the new dimensions of innovative quality or service not provided by old products, the newcomer gains a substantial market share in the market consisting of numerous small incumbents. Then, a quasi-partial monopoly develops. This is the situation I argue here. These innovations can be seen everywhere, especially in service industries, where substantial shares are occupied by firms who have achieved standardization of service traded such as e-commerce bookstore platforms. It is obvious that a brick-and-mortar bookstore on a street corner would provide consumers with very close but different services. Often, conflicts occur between the large-scale newcomer and the small incumbents. The small incumbents are inclined to pursue political compromise and achieve a regulation on the share of the new product. Conflicts in this composition are often observed in the transition of regional economies, especially when large-scale innovative retailers enter regional markets previously supplied by small-scale retailers. A typical example is conflicts between large retail chain stores (e.g., general merchandising stores) and small ordinary stores that were regulated by a previous Large Store Law in Japan. The law had been enacted to restrict the activity of large stores and had effectively deterred them from entering local retail markets, at least throughout the last decades of the twentieth century.

Unlike the anti-competitive feature of the regulation, the effect of the share of the dominant firm on social welfare in the regional economy of the regulation is not so clear. First, consumers may suffer from the elimination of small firms in the competitive fringe due to the increasing share of the dominant firm. If the goods or services are heterogeneous, consumer surplus depends not only on the equilibrium price but also on the share of competitive fringe because the smaller firms provide consumers a type of product diversity or quality that is different from what the newcomer provides. This is different from the markets considered in standard models of a partial monopoly with a perfectly homogeneous good. When the goods are homogeneous, the effect of regulation can be reckoned by the outcome of price and quantity supplied at the new equilibrium. Consumer surplus does not depend on who supplies the goods. This problem has been analyzed in the context of price leadership.[1]

Second, there seems to be no obvious conclusion on whether the share of the dominant firm is excessive from the perspective of social welfare or not. If smaller firms provide consumers with an indispensable type of service or quality, there should be an optimal sharing of the market between the dominant firm and the fringe firms. The dominant firm may tend to increase its market excessively, driving out smaller firms, whereas too many smaller firms caused by free entry may lead to excessive diversity, as opined by Mankiw and Whinston (1986), Economides (1989), and Suzumura et al. (1988), leading to an insufficient share of the dominant firm. Thus, when the goods are heterogeneous, two possibilities of partial excessiveness of entry must be evaluated—an excessive share of the dominant firm and an excessive number of small

[1] Schenzler et al. (1992).

firms. Here, I use the word partial excessiveness as follows. The share of the dominant firm is excessive if (if and only if) the marginal decrease of the share improves the social welfare derived from maintaining the number of smaller firms and vice versa. As the two markets, one for the dominant firm and the other for smaller firms, are segmented, these partial excessivenesses can be analyzed by keeping the other market as outside goods. Therefore, this paper treats the market for outside goods explicitly.

In general, as both markets tend to allow excess entry through the business stealing effect described by Mankiw and Whinston (1986), whether restrictions on the share of the dominant firm may improve or deteriorate social welfare is indefinite. However, I argue that, at least, when the small firms face a threat to be expelled entirely, the optimality is solely dependent on the excessiveness of the number of small firms. If the number of small firms is excessive, the share of the dominant firm will be insufficient irrespective of the condition of the market of the dominant firm and vice versa. Moreover, if the equilibrium of the market of small stores is determined by free entry, the tendency of excess entry caused by the business stealing effect will make the share of the dominant firm too little for social optimality. If this occurs, the regulation should be discarded.

A similar problem has been analyzed in the study of Nishimura (1994), where one market is shared by competitive large-scale firms equipped with standardized mass-production technologies and smaller local firms. He demonstrated that consumers tend to prefer excessive mass-produced goods when there is no externality in the consumption of mass-produced goods. This paper is different from his in the analysis of two segmented markets, as it does not specify it so definitely, at least, in the general proposition and is not dependent on the assumption of competition among large-scale firms.

In Sect. 1.2, a general model of quasi-partial monopoly is constructed and the effect of a regulation that restricts the share of the dominant firm is analyzed. I try to analyze the problem by not depending on a specific spatial competition model as far as possible. The results of the spatial competition models are dependent on how the models are constructed, the linear demand function, the quadratic trip cost function, and so on. In Sect. 1.3, I apply the model to investigate the effect of the regulation of the previous Large Store Law in Japan. In Sect. 1.4, implications and some discussions are provided.

1.2 A Model Analysis of a Partially Monopolized Market

The two definitions of excessiveness facilitate the following discussions. There are segmented markets—Markets 1 and 2. Consider a function $W(N^1, N^2)$, which the social planner wants to maximize. N^1 and N^2 are some conditions of the markets or the number of firms in Markets 1 and 2, respectively. N^1 is *partially excessive (insufficient)* iff

$$\frac{\partial W}{\partial N^1} < 0\,(> 0),$$

and N^1 is *totally excessive (insufficient)* iff

$$\frac{dW}{dN^1} = \frac{\partial W}{\partial N^1} + \frac{\partial W}{\partial N^2}\frac{dN^2}{dN^1} < 0\,(> 0).$$

Note that they are both local concepts.

For the convenience of explanation, I construct a model in a spatial competition context. Consider a market where two types of services, L and S, are supplied to consumers who are distributed in a segmented liner city. The two services substitute each other. Ordinary consumers buy both, although if one thinks a type of service is too expensive, the individual will buy only one type. These services can be completely compensated for each other. The first type of service (L) is served by a single corporation; the firm is geographically monopolist or effectively differentiated, so there is no alternate supplier of service L for consumers. Service L is characterized by a quality index q. Every consumer who buys service L can enjoy the same quality. Therefore, service L is a standardized service.

The second type of service (S) is served by small firms. Why should they be small? It is because they survive by relying on the local convenience of their service. To compete with service L, these small firms offer services that need intensive user-specific information, so marginal cost increases rapidly, and the optimal firm size is small. Even if there is only one firm that supplies the service, the firm can meet only a fraction of the market. Unlike service L, service S cannot be described by a single quality index because consumers have different valuations of the type of service offered or the location-specific benefit. Thus, the firms have to survive by offering more accessible and convenient services that are difficult to standardize. The firms compete against each other through the price and the horizontal quality of the good. Therefore, I assume spatial competition in service S.

The whole market of services L and S appears as a partial monopoly. The monopolistic firm is dominant because it has an established brand name or reputation. Other firms have no national brand name, but nearby consumers know the quality and service supplied well. I assume the marginal costs of these suppliers are zero. The fixed cost is $F(\cdot)$ $(F' > 0)$ for the firm supplying service L and F^s for all firms supplying service S. I specify the gross consumer benefit of these goods as $U(N, q)$, where N is the number of small firms, and I assume the function is differentiable, and the differential coefficients are positive for the following two arguments: consumers benefit from the diversity among small firms (N) and the quality of the service of the dominant firm (q). Consumers' taste or the locations of firms in horizontal quality space is symmetric for service S and all firms supply the same amount, so no argument is made about the respective quantity supplied by small firms in function U. Thus, the social surplus on which I argue the optimality is as follows:

$$W(N, q) \equiv U(N, q) - NF^s - F(q).$$

Smaller firms can enter their market freely, whereas a new entrant achieves a nonnegative profit. I neglect the discreetness of the entry condition and assume N to be a continuous real number. I denote the number of firms at the free entry equilibrium by N^e. Then, $R(N^e, q) = F^s$, where $R(N, q)$ is the revenue function of smaller firms. I assume twice differentiability of R by N and q, and the revenue decreases as the total number of small firms increases ($R_N \leq 0$) and decreases as the quality level of the dominant firm increases ($R_q < 0$), where the subscripts denote partial derivatives throughout this paper. Then, N^e is a non-increasing function of q. Function R is determined by how smaller firms compete with each other, which I avoid specifying to make the conclusions as general as possible.

Using this revenue function, I specify the situation of the quasi-partial monopoly described above, defining the fringe firm as follows:

Assumption *Fringe Firm in Quasi Partial Monopoly.*

For any value of q, there exists N^*, such that

$$R\big(N^2, q\big) < R\big(N^1, q\big) < R\big(N^*, q\big) \text{ if } \mathrm{N}^* < N^1 < N^2,$$

$$R(N, q) = R\big(N^*, q\big) \text{ if } \; N \leq N^*,$$

$$\left.\frac{\partial R}{\partial N}\right|_{N=N^*} = 0.$$

This definition is depicted in Fig. 1.1. The condition sets the largest size of small firms as follows: even if its neighboring small suppliers or competitors disappear, the firm cannot supply to a larger number of customers. In the conventional spatial competition model, this upper bound of revenue can be naturally introduced by the maximum supplying area constrained by trip costs and the reservation price set by outside goods. In that situation, N^* corresponds to the maximum number of firms at which they can set the monopoly price. At the border, the reservation price is the same as the trip cost of a consumer, so the demand level is zero. This satiated number of firms N^* is dependent on q. The example is demonstrated in the later part. Without this condition, the market turns into an oligopoly as N becomes smaller. When F^s or q is sufficiently small, the free entry equilibrium N^e should be sufficiently large such that $N^e(q) > N^*$. In these conditions, the entry of a new small firm reduces the profits of all small firms through the business stealing effect.

The last part of the assumption may need some explanation to make the model more specific. The assumption of the existence of the upper bound for small firms' revenue implies that if the market for small firms is segmented to N^* submarkets, they can set a monopoly price (p^M) without impinging on their neighbors. The firm avoids setting a lower price to increase its territory, supplying $Q(p^M; N^*, q)$, which is the demand at price p^M under N^* and q. Therefore, it is natural to assume that even when the number of firms increases to $N^* + \epsilon$, they can earn at least $(p^M+\delta)Q(p^M+\delta;\ N^*+\epsilon, q)$, where δ is the price increase that prevents the firm from

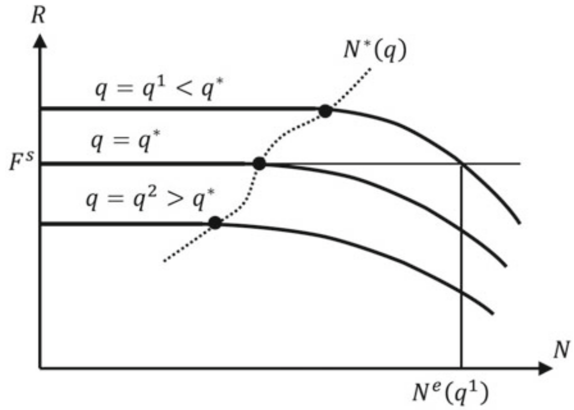

Fig. 1.1 Definition of fringe firms

impinging on its neighbors' territories. A small increase in the number of small firms requires smaller territory sizes for each of them. Then, the price needs to increase to narrow down the size of territories. Thus, I define $\Delta(\epsilon)$ as the minimum price increase under which small firms would not impinge on their neighbors' territories, then $\lim_{\epsilon\to 0}\Delta(\epsilon) = 0$. If this is not accepted, the assumption of the existence of the upper bound for small firms' revenue should also be questioned. Thus, there are kinked equilibria in the neighborhood of monopoly equilibria (see Salop, 1979). Expanding $(p^M + \Delta(\epsilon))Q(p^M + \Delta(\epsilon); N^* + \epsilon, q)$, we derive the following:

$$R(N^* + \epsilon, q) \geq (p^M + \Delta(\epsilon))Q(p^M + \Delta(\epsilon); N^* + \epsilon, q)$$

$$= \big(p^M + \Delta(\epsilon)\big)Q\big(p^M + \Delta(\epsilon); N^*, q\big)$$

$$\geq p^M Q\big(p^M; N^*, q\big) + \Delta(\epsilon)\big(Q(p^M); N^*, q) + p^M Q_P(p^M; N^*, q)\big) + o\big(\Delta^2(\epsilon)\big)$$

$$= R(N^*, q) + o(\Delta^2(\epsilon))$$

where the partial differential coefficient of Q by P is denoted as Q_P. Note that $Q(p^M) + p^M Q_p(p^M) = 0$, $Q(p^M + \Delta; N^* + \epsilon, q) = Q(p^M + \Delta; N^*, q)$ as $\epsilon > 0$. Then, so far as $\Delta(\epsilon)/\epsilon$ does not diverge to infinity, the last part of the assumption is equal to assume kinked equilibria around the neighborhood of the monopoly equilibria, which I think is general. As the monopoly equilibrium is a special case of kinked equilibria, the derivative should smoothly be continuous at this point.

Now, the social surplus can be written as $w(q) \equiv W(N^e(q), q)$, which is a function of the value of q that the social planner should pay attention. The derivative of w,

$$w'(q) = \frac{\partial W}{\partial q} + \frac{\partial W}{\partial N^e} \cdot \frac{dN^e}{dq} = \left(\frac{\partial U}{\partial q} - F'(q)\right) + \left(\left(\left.\frac{\partial U}{\partial N}\right|_{N=N^e} - F^s\right) \cdot \frac{dN^e}{dq}\right)$$

comprises consumers' direct benefit from improvement in the quality of service L minus the incremental fixed cost (inside the first parenthesis) and the loss from the decreased diversity provided by small firms plus the saved fixed cost of small firms (the second parenthesis). The first term represents the partial excessiveness of the side of the dominant firm, and the second term represents the partial excessiveness of the side of the small firms. We have to evaluate the two excessivenesses, which make the evaluation of the optimality of q very complicated. Nevertheless, the sign of w' can be determined by only one partial excessiveness of the share of small firms when they face a catastrophe.

First, the catastrophic point is defined by the value of $q = q^*$ such that $R(N^*, q^*) = F^s$. When $q > q^*$,

$$\max_N R(N, q) = R(N^*(q), q) < R(N^*(q), q^*) < R(N^*(q^*), q^*) = F^s,$$

then no small firm can survive. When $q = q^*$, $N^e(q^*) = N^*$ because $R(N^*, q^*) = F^s$. When $q < q^*$,

$$R(N^*(q), q) = R(1, q) > R(1, q^*) = R(N^*(q^*), q^*) = F^s,$$

then $N^e(q) > N^*$, and firms enter the market beyond the satiated number of small firms. Thus, I call the market of small firms face a catastrophic point in the market when $q = q^*$.

Note that when $q < q^*$ the definition of $N^e(q)$ implies $R(N^e(q), q) = F^s$. To investigate the relation between q and the number of small firms at the free entry equilibrium, differentiating this relation by q gives:

$$R_N \frac{dN^e(q)}{dq} + R_q = 0.$$

Evaluating this relation at $(N, q) = (N^e(q^*), q^*)$ leads to:

$$\lim_{\substack{N \to N^{*+} \\ (q \to q^{*-})}} \frac{dN^e(q)}{dq} = -\infty \text{ because } \left.\frac{\partial R}{\partial N}\right|_{N=N^e(q^*)} \to 0^- \text{ and } \left.\frac{\partial R}{\partial q}\right|_{q=q^*} < 0.$$

Therefore, in the decomposition of differential w' the absolute value of $\frac{\partial W}{\partial N^e} \cdot \frac{dN^e}{dq}$ overwhelms the value of $\frac{\partial W}{\partial q}$, and the sign of w' is determined solely by the sign of $\frac{\partial W}{\partial N^e}$. This term represents the partial excessiveness of the number of small firms.

Then, I propose the following proposition:

Proposition Under the situation of the quasi-partial monopoly described above, when the small firms face a catastrophe that makes the dominant firm expel them entirely from the market, the optimality of the share of the dominant firm can be determined only by the partial excessiveness of the number of small firms, which is the difference between the incremental consumer benefit from the small firms and their cost. We can neglect the partial excessiveness of the side of the dominant firm.

When $q > q^*$, the outcome in the market is beyond the scope of this model. The price and quality of the service should change discontinuously at the point $q = q^*$, and the social surplus function should also jump at this point. Therefore, I refrain from analyzing the global optimality of the share of the dominant firm. However, at least, in the neighborhood of the catastrophic point, the sign of $w'(q)$ should be the same as that of the catastrophic point.

1.3 A Model Analysis of Competition Between Large-Scale Stores and Ordinary Small Stores

In this section, the model that is presented as general as possible in Sect. 1.2 is reformulated as a specific model to discuss the effect of a regulation. The general model has been constructed somewhat ambiguous to make it applicable to many purposes. Therefore, the discussion in this section may help with the recognition of the model. If the general model is accepted, the result in this section can be directly obtained without detailed discussions, making it redundant.

Although the Large Retail Store Law in Japan requires entrants to only notify the Ministry of International Trade and Industry (MITI) at that time[2] or local governments, the law had effectively deterred entrances of large-scale retail stores since its legislation in 1974 until May 1990 when a modification was issued. In 1979, the statute was amended to expand coverage, and in 1981 and 1982, MITI issued guidance on self-restraint and repression, respectively. The upraise of notifications in 1979 led to rushed applications before the revision of the law. In the change of total floor area and the number of establishments of those stores, the effects of these restraints are reflected in lags.[3]

It is reported that legal procedures took three or four years and often more than six years. This slowness of negotiation periods discouraged entrances of large-scale stores. The main cause of this slowness was knotty negotiation in the Local Commercial Activities Adjustment Board, which comprised representatives of local retailers, consumers, scholars, and experienced persons. The board plays a role in the adjustment of the store's floor space, components items, and opening hours and schedules. It is not hard to consider how difficult it was to coordinate conflicting interests on

[2] MITI was reorganized into Ministry of Economy, Trade and Industry (METI) in 2001.

[3] Large Store Law was replaced in 2000 by Large-scale Store Location Law. The new law regulates location, layout, and operational method of the facilities of large-scale stores. The role of regulating store openings has receded.

such boards. Even if this uphill task passes through, the entrant suffers frustration in the resulting conditions.

This regulation policy on the opening of large-scale stores in Japanese regional retail markets is aimed to protect small and medium size ordinary retailers. This purpose is clearly stated in the preamble of the law. Therefore, the issue is not only in large-scale stores but also in small and medium size retailers. The restrictions of large-scale retail stores are related to the efficiency of small retail stores. If small retail stores are really inefficient, the regulation of entry of a large-scale store would simply mean protection of smaller ones because they are small. However, the problem is not so clear as its appearance. Large-scale retail stores and smaller ones supply different types of services to consumers. Whereas large-scale stores supply wider assortments, cheaper prices, and an opportunity for one-stop shopping, smaller stores offer convenience in location, information and recommendation of items sold, and assistance in selecting and gathering products.

Therefore, if the entrance of large-scale retail stores leads to a decrease in the number of small ordinary stores, it deprives consumers of the opportunity to get the services that small ordinary stores provide. We do not see this problem as competition between large- and small-scale enterprises in homogeneous markets such as manufacturing industries, rather we consider the problem as competition between markets that supply very close substitutes. To analyze the optimal composition of large-scale stores and small ordinary stores, we compare the effects on distributors' and consumers' costs.

I assume that consumers pay attention to the type of services supplied by different types of stores even if the item sold is physically the same. In models of spatial competition, consumers often compare the sum of mill price and trip cost and select one store that offers the minimum total cost. There is no viewpoint that consumers buy from several stores, making the best mix of the services provided. This is because those models are not constructed to analyze a retail market but to analyze competition among manufacturing firms in a horizontal quality space.

Empirically, when determining where to buy, the price level is not so critical, but other factors, such as parking lot spaces and width of assortments, are.[4] Services that are not supplied by retailers should be compensated for by consumers themselves. For example, if assortments are not enough, they have to make a trip to another store to seek more suitable goods. Therefore, consumers have the opportunity to minimize their shopping costs by shopping from different types of stores, as they offer different compositions of services.

Here, I consider a market for a convenience good. The commodity is a necessity, and the elasticity of demand is zero, so we have to consider only the distribution cost for social optimality. When a consumer buys the good, he/she needs distribution services in several dimensions. The quality of the service provided by a large-scale

[4] *Gravitation Law in Retail* assumes that consumers incur trip costs in determining where to shop. However, where to shop is determined probabilistically, and the probability is inversely associated with trip costs. Theories explaining these conducts assume that consumers maximize a class of utility function. It is parallel to minimizing the total shopping cost for a given amount of service.

store (q) comprises the average nearness from the consumer, the width of assortment, chances of one-stop shopping, and so on. These services help consumers to save on their shopping costs. However, small stores provide other benefits, especially convenience in store locations (x), which are far nearer than the location of the large store. The distribution service and its cost incurred by consumers depend on q and x. I assume that consumers are located on a circle of radius $r/(2\pi)$ with uniform unit density. When there are N small stores, they are located in the same distance r/N, which is denoted as D. x is the shorter distance for a consumer to reach small stores. Given the prices of both type of stores, p^L for the large-scale store and p^s for small stores, as well as q and x, consumers will choose an optimal combination of shopping.[5] It is assumed that the large-scale store is located at the center of the circle, and q is the inverse of the radius of the circle.[6]

When q is quite small, which is likely in the retail market of fresh groceries, the total demand for goods from ordinary small stores becomes inelastic because most of the demand is already directed to them, and the ratio is expected to be stable. If the excessive entry theorem is valid in this market of smaller stores, D is smaller, and p is higher than the optimal values that minimize the total distribution costs. Thus, the number of small stores is partially excessive, and q is totally insufficient. Conversely, if q is quite large and the ratio of the demand for goods from ordinary small stores is so small that no store survives, the system may suffer higher social distribution costs as consumers are deprived of their chances to optimize the ratio. Thus, we can conjecture that at some level of q, the total distribution cost is minimized.

The strategy of setting q by large-scale stores has not been considered. Depending on the function of the fixed cost $F(q)$ of the large-scale store and its conjecture about reactions of small stores (q), the service quality or the share of the large-scale store is chosen at some level. The problem is the relationship between the optimal level and the chosen level of q.[7] To make the problem complicated, at some level of q, all

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[5] Specifically, assuming there are two dimensions in distribution services,(v^1, v^2), Type L supplier supplies (v^{1L}, v^{2L}) with price p^L, and Type s supplier supplies (v^{1s}, v^{2s}) with price p^s. For example, the simplest form of these two dimensions is (width of assortment, convenience of the location of the store). The large store offer $(q, -x^L)$, whereas small stores offer $(q^s, -x)$, where $q^s \ll q$ and $x \ll x^L$. The total distribution service required to buy a good is (v^{1T}, v^{2T}), which costs a consumer $C(v^{1T} - tv^{1L} - (1-t)v^{1s}, v^{2T} - tv^{2L} - (1-t)v^{2s})$, where t is the ratio the consumer buys from small stores. Then, the total consumer cost, which is the sum of the price and service cost, is $tp^s + (1-t)p^L + C$, whose derivative is $p^s - p^L + C_1 \cdot (v^{1s} - v^{1L}) + C_2 \cdot (v^{2s} - v^{2L})$, where the suffixes of C represent partial derivatives. If the components of (v^{1s}, v^{2s}) and (v^{1L}, v^{2L}) are quite different and C_{11} and C_{22} is sufficiently large, as expected in retail markets, the total cost can be maximized internally at $0 < t < 1$.

[6] We can regard the quality of the large-scale store as the average distance from consumers. Consider a broader market with several large-scale stores and scattered small stores, if a new large-scale store enters the market, the average distance from consumers to large-scale stores decreases, which improves the convenience of large-scale stores. Therefore, the share of the large-scale stores would increase. In this story, q is positively associated with the number of large-scale stores, and the share of the large-scale stores is an increasing function of q. Furthermore, the radius of the circle would shrink as new large-scale stores enter the market.

[7] If we consider q as the number of large-scale stores, as described in Footnote 6, q is not chosen but determined by some entry mechanism of them.

the small stores are expelled. Thus, the relationship of these three levels of q—the optimal, chosen, and catastrophic points—should be considered.

Depending on the value of q, the intervals of small stores at free entry equilibrium are determined by $D(q) \equiv r/N^e(q)$. The maximization problem of social surplus equals the minimization of the total distribution cost because zero elasticity of demand is assumed. The total distribution cost of consumers on the circle is as follows:

$$DC(q) = F(q) + \frac{r}{D(q)} F^s + r \cdot TC(q, D(q))$$

where $DC(q)$ denotes the total distribution cost, and $TC(q, D(q))$ is the total trip cost incurred by consumers per unit length of arc; $TC_q < 0$, and TC_D>0.[8] Then, we get:

$$\frac{d}{dq}DC(q) = \left(\frac{dF(q)}{dq} + TC_q(q, D(q))\right) + r\left(-\frac{F_s}{\{D(q)\}^2} + TC_D(q, D(q))\right)\frac{dD(q)}{dq} \qquad (1.1)$$

The first term represents the partial excessiveness of the share of the large-scale store, and the second term represents the partial excessiveness of the share of small stores. Generally, we cannot evaluate the total value of Eq. (1.1), but we have to consider only the second term, that is, the partial excessiveness of the share of smaller firms at the catastrophic point where the elimination of all small stores is imminent.

The revenue function of a small store is as follows:

$$\tilde{R}(p^s; N, q, p^L) = 2\int_0^{\frac{r}{2N}} t(q, x, p^s, p^L)p^s dx$$

where t is the ratio of the demand directed to small stores, and I assume that $t_q < 0$. p^s is determined by q and competition between small stores. Regarding the competitive outcome of p^s, I assume that the revenue function has an upper bound, so when $p^s = p^m$, it is maximized for any positive and bounded value of q and p^L. To put it precisely:

Assumption of the limited elasticity of substitution

For any value of $(\infty, \infty) > (q, p^L) > (0, 0)$, there exists p^m such that $p^m = \text{argmax}_{\,p^s}\ \tilde{R}(p^s; 1, q, p^L)$ and $t(q, r/2, p^m, p^L) = 0$.

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[8] If we assume the situation described in Footnote 6, we have to consider the total distribution cost from unit arc as follows:

$$DC(q) = \frac{F(q)}{r} + \frac{F_s}{D(q)} + TC(q, D(q)).$$

We have to redefine $F(q)$ as $F(q)/r$, which is the fixed cost of the large-scale store for a unit supplying area. Then, the following analysis is valid for this story setting r as 1.

When a monopolistic small firm sets the monopolistic price (p^m), there exist boundaries such that $t = 0$ in the circle. This assumes that r should be sufficiently large. Given q and p^L, at some distance x from the store, the ratio of $p^m + \gamma(x)$ to p^L exceeds the maximum elasticity of substitution, where $\gamma(\cdot)$ represents the cost of the consumers' trip. If the elasticity of substitution between two types of services becomes infinite when t approaches zero or if the trip cost is trivial, this condition is not satisfied. The services are thus substituted close enough to be completely compensated for each other. I denote the minimum distance x as $x^m(q, p^L)$, then $t(q, x^m(q, p^L), p^m, p^L) = 0$.

Even when the number of small stores is small, this assumption is still valid—no demand is directed to small stores at the boundaries of the supplying areas of two adjacent small stores. I denote $N^m(q, p^L) \equiv r/(2x^m(q, p^L))$, then $t(q, r/(2N^m), p^m, p^L) = 0$. Hereafter, $x^m(q, p^L)$ and $N^m(q, p^L)$ are simply expressed as x^m and N^m, respectively. N^m is the maximum number of small firms, and they can keep a supplying area with $2x^m$ length. When the number of firms is not more than N^m, the distance from the most inconvenient consumer to the nearby small store exceeds x^m. As $t(q, x^m, p^m, p^L) = 0$, no revenue is expected from the area ($x > x^m$), so the total revenue remains at the same level:

$$\tilde{R}(p^m; N < N^m, q, p^L) = \tilde{R}(p^m; N^m, q, p^L).$$

The state of monopoly is not altered. They can act as a monopolist in their supplying area.

When N exceedsN^m, the revenue should be a non-increasing function of$N$, at least in the neighborhood ofN^m. Given q and p^L at some n such that $n > N^m$, suppose the small firms get the revenue higher than the revenue of a monopolist at the pricep^{sn}. If so, whether $t(q, r/(2n), p^s, p^L) = 0$ or$t(q, r/(2n), p^s, p^L) > 0$, a monopolist can earn a profit that is greater than $\tilde{R}(p^m; N^m, q, p^L)$ setting the pricep^{sn}, a contradiction. Note that we do not know whether the price level increases or decreases with the number of firms, so the result above is not self-evident. In the context of spatial competition, prices that are higher than the monopoly price can result depending on the assumption of the conjectures of reaction functions.[9]

When the competition between the large-scale store and small firms is specified, the number of small firms and the revenue of a monopolist are determined by q. I denote the number of small firms as $\overline{N}^m(q) \equiv N^m(q, \overline{p}^L(q))$ and the maximum revenue of the monopolist as $\overline{R}(q) \equiv \tilde{R}(\overline{p}^m(q); N^m(q, \overline{p}^L(q)), q, \overline{p}^L(q))$, where $\overline{p}^m(q)$ and $\overline{p}^L(q)$ are p^m and p^L, respectively resulted from the specified competition. When q increases from a very low level $\tilde{R}_p(p) = 0$ by maximization and $\tilde{R}_N = 0$ by:

$$\left.\frac{\partial R}{\partial N}\right|_{N=N^m} = -\frac{r}{2(N^m)^2} t(q, \frac{r}{N^m}, p^m, p^L) p^m = 0,$$

[9] See Greenhut et al. (1976).

so,

$$\frac{d\overline{R}}{dq} = \widetilde{R}_p \frac{d\overline{p}^m}{dq} + \widetilde{R}_N \left(\frac{\partial N^m}{\partial q} + \frac{\partial N^m}{\partial p^L} \frac{d\overline{p}^L}{dq} \right) + \widetilde{R}_q + \widetilde{R}_{p^L} \frac{d\overline{p}^L}{dq} = \widetilde{R}_q + \widetilde{R}_{p^L} \frac{d\overline{p}^L}{dq}.$$

At some value of q, $\overline{R}(q)$ coincides with F^s. If q increases beyond the value, small firms would suddenly disappear from the market because the maximum value of the revenue is under F^s. This is the catastrophic point in the market for small firms. Therefore, at the catastrophic point, $q = q^*$, it is assumed that

$$\overline{R}(q^*) = F^s \quad \text{and} \quad \left. \frac{d\overline{R}}{dq} \right|_{q=q^*} = \widetilde{R}_q + \widetilde{R}_{p^L} \frac{d\overline{p}^L}{dq} < 0.$$

I use q^* as defined in Sect. 1.2. From the revenue function, it is straightforward that, at least, in the neighborhood of the catastrophic point, the assumption of the limited elasticity of substitution is sufficient for the condition of the fringe firms in partial monopoly defined in Sect. 1.2. N^* corresponds to N^m.

Consider the neighborhood of the catastrophic point. When the given value of q falls in the region $q < q^*$, the number of small firms at free entry equilibrium $N^e(q)$ is determined to satisfy the condition $\widetilde{R}(\overline{p}^s(q); N^e, q, \overline{p}^L(q)) = F^s$. Differentiating the equation at the catastrophic point, $(q, N^e) = (q^*, N^*)$, the following is derived:

$$\left\{ \widetilde{R}_{p^s}\big|_{p^s=p^m} \left. \frac{d\overline{p}^s}{dq} \right|_{q=q^*} + \left. \left(\widetilde{R}_q + \widetilde{R}_{p^L} \frac{d\overline{p}^L}{dq} \right) \right|_{q=q^*} \right\} dq + \tilde{R}_N \big|_{N=N^*} dN^e = 0.$$

Note that $\overline{R}(q^*) = \widetilde{R}(\overline{p}^s(q^*); N^m(q^*), q^*, \overline{p}^L(q^*)) = F^s$, then $N^e(q^*) = N^m(q^*)$. Therefore, $\widetilde{R}_N\big|_{N=N^e(q^*)} = \widetilde{R}_N\big|_{N=N^*(q^*)} = 0$. Because $\widetilde{R}_{p^s}\big|_{p^s=p^m} = 0$ by maximization of small firms, the inside of the parenthesis of the first term is $\left. \left(\widetilde{R}_q + \widetilde{R}_{p^L} \frac{d\overline{p}^L}{dq} \right) \right|_{q=q^*}$, which is negative. Moreover, when $N < N^m$, $\widetilde{R}_N = -r/(2N^2)t(q, r/N, p^m, p^L) < 0$. Therefore, as q increases to the catastrophic point, $q \to q^{*-}$,

$$\lim_{q' \to q^{*-}} \left. \frac{dN^e(q)}{dq} \right|_{q=q'} = \infty.$$

Then,

$$\lim_{q' \to q^{*-}} \left. \frac{dD(q)}{dq} \right|_{q=q'} = -\frac{r}{(N^e(q))^2} \left. \frac{dN^e(q)}{dq} \right|_{q=q'} = -\infty.$$

Intuitively, as consumers at the border do not buy from small firms, $t(x^m/2) = 0$, and the small firms behave like a monopolist, although there are N^m small firms. They ignore the existence of their neighbors, and the revenue function does not depend on the number of other firms. Thus, reducing the number of small firms will not improve their revenue, and all the small firms will suddenly disappear from the market.

Therefore, in Eq. (1.1), the absolute value of the second term is overwhelming, and the sign of derivative of the total distribution cost $\frac{d}{dq}DC(q)$ is determined by whether the number of small firms is partially excessive or not, $-F^s/(D^2) + TC_D$. A positive value of the second term indicates that the amount supplied by ordinary small stores could have been distributed cheaper by a larger number of stores and vice versa.

1.4 Implications

If it is assumed that the same amount of goods could be distributed by a smaller number of small stores, the inside of the parenthesis of the second term of Eq. (1.1) is negative, and the value of Eq. (1.1) is negative at the neighborhood of the catastrophic point. As the share of the large-scale store is increasing, the total distribution cost is still decreasing.[10]

Figure 1.2 depicts how the number of small-scale grocery stores decreases as the regional retail activity declines. The data are from the *Census of Commerce in 2014* area mesh statistics. All the area in Japan was divided into meshes of 1 km each, and the number of stores, retail and wholesale sales, and sales floor space were surveyed. In the figure, the x-axis represents the number of retail workers in each of the 6,658 10 km mesh areas, which is expected to proxy the magnitude of regional retail activities, and the y-axis represents the number of grocery specialty stores in the same areas as the proxy for the activities of ordinary small stores.[11] The figure depicts that there are many areas where the relationship between retail activities and the number of small firms looks almost proportional. This is because, in many rural areas, inhabitable lands are very limited, surrounded by mountainous terrain. The population is concentrated in a small area; thus, population density is high. Therefore, retail activities and the number of small stores are proportional—both are determined by the ratio of inhabitable lands in these areas. This property causes a large variance on the y-axis—the number of small stores. Nevertheless, it is obvious

[10] Torii (1993) demonstrated that if only the distribution cost is considered, under free entry and elastic demand, the number of stores will be excessive whether the type of competition is Zero Conjectural Variation or Lösch as the same amount of goods can be distributed by smaller number of stores. This implies that the inside of the parenthesis of the second term of Eq. (1.1) is negative.

[11] I aggregated the number of stores to 10 km mesh because 1 km mesh is too small as an area to consider the competition between retail stores, especially those in rural areas. I surveyed 65,710 1 km mesh areas, finding that 21,552 areas have only one store. The reason I used the number of retail workers in the areas and did not use the retail sales as the proxy for retail activities is that in many areas, the sales data are kept confidential because of the small number of stores. Grocery specialty stores are those who sell 50% or more of their sales in food product, except for grocery supermarkets, chain convenience stores, and department stores.

that in many areas, small stores face the danger of elimination. When the number of workers in their 10 km mesh decreases to less than 100, grocery specialty stores face extinction. Note that both axes are on the logarithmic scale. If these crises are caused by expansions of large-scale stores nearby, the possible effect on the total increasing distribution cost should be considered. However, in most areas in Japan, there are spaces for large-scale stores, contributing to efficient retail distribution costs.

The full shape of the DC function, that is, the total distribution cost, cannot be known unless the trip cost function or pricing strategies are specified. Therefore, there may be several local optimal points that minimize DC. However, at least in the neighborhood of the catastrophic point, the increased share of large-scale stores decreases the total distribution cost (See Fig. 1.3). If large-scale stores stop increasing their share before they reach the catastrophic point because they have reached the optimal, this free entry equilibrium of large-scale stores does not mean an excess entry of large stores unless there are several minimizing points in the DC function. If this occurs, there is no need for market share regulation of large-scale stores. The share of the large store is still insufficient at the free entry equilibrium.

If large-scale stores enter beyond the catastrophic point, then the situation is beyond the ability of this model. In such a case, the competition among large-scale stores has to be explicitly considered. The total distribution cost may be discontinuous at this point. However, it is at least valid that unless the entrance of large-scale stores eliminates all the ordinary small stores, entries occur only when it decreases the total distribution cost. Then two conditions are necessary for sound rationality of the market share regulation. The total distribution cost jumps up at the catastrophic

Fig. 1.2 Relationship between regional retail activity and number of small firms in mesh statistics in Japan

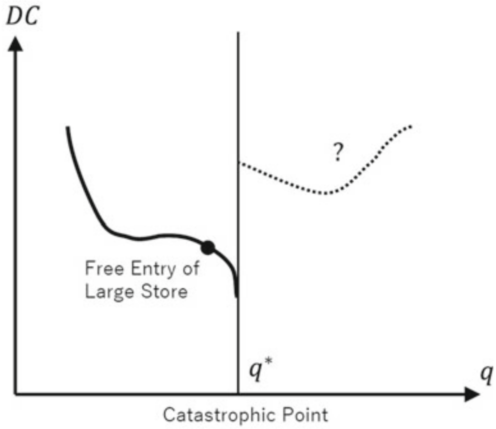

Fig. 1.3 Possible effect of expansion of a large-scale store in regional retail market

point, and new entry or an increase in the share of the large store is still observed at the catastrophic point.

The catastrophic point is located at a high value of q when the demand density is high and the fixed costs of small stores are small, as expected of the Japanese retail market. There is only a limited probability that small firms would face extinction. Thus, the analysis of this study reveals that there is no economic reason to restrict the entrance of large-scale stores unless we find the rationalization to protect small stores because they are small.

A more specific model that assumes the conduct of consumers and the pricing strategy of large-scale stores is analyzed by Torii (1990). In the model, consumers select a combination of where to buy from to minimize their total shopping cost. Using that model, the proposition stated above is examined explicitly.

The level of actual restrictions is far before the free-entry equilibrium of large-scale stores. The presence of rents caused by the restriction reported by Hosono (1987) can be used to ascertain this phenomenon. The author also identifies the existence of rents in large-scale stores in 1979—the same year the restriction was tightened. Therefore, this tendency was expected to become stronger after that year.

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