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Does Big Drive Out Small?

Entry, Exit, and Differentiation in the Supermarket Industry

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Abstract This paper measures the impact of the entry of large supermarkets on incumbents of various sizes. Contrary to the conventional notion that big stores drive small rivals out of the market, data from Tokyo in the 1990s show that large supermarkets' entry induces the exit of existing large and medium-size competitors, but *improves* the survival rate of small supermarkets. These findings highlight the role of store size as an important dimension of product differentiation. Size-based entry regulations would appear to protect big incumbents, at the expense of small incumbents and potential entrants.

Keywords Deregulation · Entry and exit · Product differentiation · Retail

JEL Classification L11 · L13 · L51 · L81

1 Introduction

This paper empirically assesses the impact of large supermarkets' entry on existing supermarkets of various sizes. Contrary to the conventional notion that big stores drive small rivals out of the market, the results indicate that big entrants drive out big and medium-sized incumbents, while benefiting small stores. The outcome is consistent with economic theories of product differentiation; i.e., store size is providing an important dimension to differentiate among retailers.

The deregulation of the Tokyo supermarket industry in the early 1990s provides a suitable setting to evaluate the differential impacts of large stores' openings on existing stores. First, I analyze the incumbent stores' responses to the entry events by ordered

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probit regressions, where their four alternative actions are (1) exit, (2) shrink floor size, (3) stay unchanged, and (4) expand floor size. Second, since entry events are based on big retailers' choices of towns to enter, this prompts a concern over potential selection biases. I conduct a series of IV probit regressions in which I instrument the entry events by the big entrants' affiliations with particular geographical markets. Finally, I employ tobit regressions to analyze the magnitude of changes in floor size, using incumbent stores' percentage change in floor size as the dependent variable.

The results suggest that large entrants displace large and medium-size incumbents, but small supermarkets' survival rate actually *improves*. Large and medium stores seem to compete directly with the new rivals, while small incumbents are insulated by product differentiation and even benefit from the positive demand externality (additional flow of shoppers).

These findings have direct public policy implications. Regulators around the globe often restrict the entry of large retail outlets.[1] Such (anti-)competition policies are often based on the premise that big stores drive out small ones. However, when store size is the source of differentiation across retail services, the unintended consequences of size-based entry regulations would appear to include: (1) softer competition among large retailers, hence limited, pricier choices for consumers on a daily basis; and (2) forgone profit opportunities for small stores, who could have benefited from the positive externalities of new big entrants.

2 Literature

This research contributes to three strands of economic literature: First, the paper offers new empirical evidence to support economic theories of product differentiation, by comparing the effect of large supermarkets' entry on competing stores of various sizes. D'Aspremont et al. (1979), Shaked and Sutton (1982), and Perloff and Salop (1985) showed that product differentiation could soften price competition.[2] However, as Borenstein and Netz (1999) noted, theoretical work on product differentiation has produced few corresponding empirical studies. I examine a particular type of product differentiation in the retail industry: store size. The results highlight the role of product differentiation in relaxing competition. More specifically, this study supports the theoretical prediction by Zhu et al. (2006) that the tradeoff between the business-stealing effect and the positive demand externality depends on the degree of differentiation between the entrant and the incumbents.

[1] Zoning laws in Britain, France, Germany, India, Japan, Korea, and Poland restrict the development of large stores (Lewis 2004). Even in the United States, state and local authorities and state courts often make the final decisions on whether to allow the entry of a new Wal-Mart store (Sobel and Dean 2008).

[2] Theoretical predictions vary with respect to the extent of differentiation. For example, D'Aspremont et al. (1979) show that, in order to soften price competition, two firms would maximally differentiate on a Hotelling product line. Neven and Thisse (1990) and Irmen and Thisse (1998) extend this framework to competition over multiple product attributes. In contrast, Anderson et al. (1992) show that firms that compete in two dimensions may locate together at the center of the market under certain conditions. Still, the basic insight remains the same: Differentiation opens the possibility for softening competition.

Second, this paper augments the empirical work on entry and exit, by introducing the product-differentiation aspect to the analysis in two ways: by examining the differential impacts of entry on the exit rates of the incumbents of different sizes; and by analyzing the incumbents' responses in terms of store-size changes. It is only recently that the economics of product differentiation has been studied explicitly in conjunction with entry and exit. Mazzeo (2002) uses a static framework, while Ellickson (2007) uses a dynamic structure. This paper takes an alternative approach to capture the dynamics of the phenomena, by exploiting exogenous regulatory changes and studying incumbents' responses to the entry of bigger stores.

Third, this paper sheds new light on the economic analysis of the "Wal-Mart effects;" i.e., inquiries into the competitive effects of big entrants on incumbents, by introducing the viewpoint of product differentiation. Shoppers world-wide have witnessed the rise of big retailers, such as Wal-Mart and Carrefour. The proliferation of these large stores has stirred the debate over the consequences of their entry into local markets. Some analysts credit them with lowering prices, raising productivity, and making wider product variety available (Hausman and Leibtag 2007; Basker 2005); others blame them for destroying jobs and local businesses (Wal-Mart Watch 2005). Basker's (2007) survey summarizes the discoveries to date and concludes that incumbents' exit due to Wal-Mart range between two to five stores at a county level. Detailed panel data of supermarkets at a sub-county level allow me to address this issue while mitigating concerns over spurious correlations.[3]

3 Industry and Data

The supermarket industry in Tokyo in the early 1990s provides a suitable testing ground for evaluating the impact of large stores' openings on incumbents' exit rates for three reasons: First, stores of various sizes compete in this sector, offering a laboratory to analyze the differential impacts of large entrants on incumbent stores of different sizes. Second, it is relatively easy to identify local markets geographically. Unlike shopping for, say, fashion apparel or consumer electronics, which tends to cluster in urban centers, shoppers stay close to their home as far as the day-to-day purchase of food staples is concerned. Third, the (exogenous) relaxation of entry regulations in 1990 allows me to identify the impact of large stores' entry by comparing the exit rates of incumbent supermarkets in similar towns *with* and *without* an entry event.

3.1 Definition of Supermarket

This study follows the industry standard in defining a supermarket as: (1) a self-service store, with (2) floor space of at least 231 m^2 (2, 486 ft^2) and/or minimum annual

[3] County-level observations may mask the rise and fall of towns; therefore using sub-county-level data increases the relevance of empirical analysis to actual shopping behavior and competition. Additionally, stores often change their size over time. If, for instance, a small store expands its floor area, a simple census might count it as a small store exit and, simultaneously, a medium store entry as if the latter drove out the former. Panel data are a convenient way to capture actual exit patterns.

revenue of ¥100 million ($1 million), and with (3) over 30% of revenue from food products including (but not limited to) fish, meats, and vegetables.[4] My data on supermarkets—based on the Shogyokai's (1990 & 1995) trade press *Japan Supermarket Directory*—contain retail establishments satisfying these conditions.[5]

Practical meanings of the definition will be clearer in comparison with other retail formats. Conditions (1) and (2) distinguish supermarkets from more traditional specialty shops that sell fish, meats, or vegetables, which typically offer customized services and are smaller in size. Additionally, condition (3) ensures that a supermarket is an outlet primarily for the retailing of food, as distinguished from convenience stores, drug stores, tobacco shops, or department stores. More recently, a larger supermarket with a wider lineup of household merchandise is often called a GMS (general merchandise store), hypermart, or superstore. The industry standard does not exclude these types of supermarkets from the definition; neither does this paper.[6] Hence the likes of Aeon, Daiei, or Seiyu (the Japanese equivalent to Wal-Mart, Tesco, Carrefour, or Metro) are incorporated in the subsequent empirical analysis.

3.2 Train Station-Centered Geographical Markets

In the suburbs of the Greater Tokyo region (which spans Tokyo, Kanagawa, Saitama, and Chiba prefectures), relevant geographical markets can be identified by train stations along major railways (Fig. 1). This is because daily shopping activities in suburban Tokyo are concentrated around train stations. Since trains are the predominant means of transport for commuters, stations provide focal points for both shoppers and retailers (Kawaguchi 1996, p. 175).

Note that 91.7% of the supermarkets shown in Fig. 1 are located within 1.5 km from a station. Hence, the market database from Toyokeizai's (a private business press and think tank) *Metropolitan Commercial Map 1995* compiles demographic and retail-related information by 240 suburban "towns" along major railway lines in the region.[7] Each "town" contains a geographical area within a radius of approximately 1.5 km (0.93 mile) from the train station.

[4] This (establishment level) definition of a supermarket is analogous to the one used in the U.S.: "a store selling a full line of food products and generating at least $2 million in yearly revenues" (Ellickson 2007, p. 48).

[5] For each store, the directory lists its name, street address, year of opening, operating firm, location type, building structure, parking capacity, gross revenue, types of merchandise sold, floor area, rented area, and the number of employees.

[6] This is also the convention in the U.S. supermarket industry (Ellickson 2007).

[7] *Metropolitan Commercial Map 1995* contains a number of localities that are better characterized as central business districts rather than suburban residential areas. Hence I drop 29 local markets in which the number of regular commuters exceeds that of residents. I also drop one locality in which the train station was established only after 1990. Finally, I drop four towns for which the data on train users are unavailable, and another four towns for which exit rates are not available. All of this leaves 202 towns.

The listed variables include population, the number of households and commuters, the principal means of transport between residence and the nearest train station, commercial land price, the number of retail shops, and their aggregate floor space and revenue as of 1991. In addition, the growth rate between 1984 and 1989 of the number of regular commuters is taken from the Institution for Transport Policy Studies' annual survey (1986 and 1991 issues), directed by the Ministry of Transport.

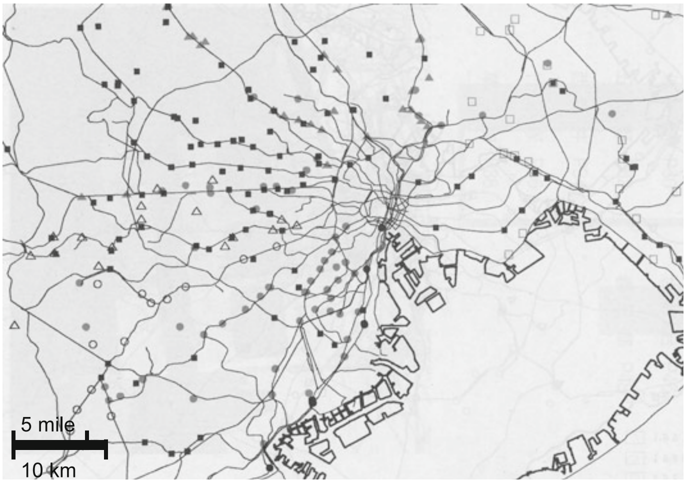

Fig. 1 Towns and Railways in the Greater Tokyo Area. Solid lines represent major railway lines. Subway lines in the central business districts are not shown. *Markers* represent the locations of large and medium supermarkets (hence of towns) as of 1994. This map is for illustration purposes only, so some towns analyzed in this paper are outside this map. However, note that, of the 242 large and medium supermarkets pictured here, only 20 (or 8.3%) are located far from stations, underlining this paper's focus on station-centered "towns." *Source*: Toyokeizai (1995)

This disaggregated (and non-administrative) unit of observation is expected to be the most relevant to the actual grocery shopping pattern, and hence competition, for three reasons concerning physical structure of transportation, consumers' shopping patterns, and supermarkets' operations.[8] First, for a typical railway line, the average distance between two adjacent suburban stations is 3.8 km (2.4 miles). The 1.5 km-radius towns comfortably split the terrain.

Second, approximately 1 km is the radius for the standard trade area and geographic market for Japanese supermarkets. The exact distance may vary between 0.9 and 1.5 km depending on town characteristics, but both the Japan Fair Trade Commission (2005) and numerous industry experts agree on these numbers.

Third, consumer surveys also substantiate the previous point. Most activities of a typical suburban housewife/husband take place within 0.5 km from her/his dwelling. So it is unsurprising that urban geographers decided to characterize a daily grocery shopping as: (1) conducted by a housewife/husband, (2) either on foot or by bicycle, and (3) within 1.5 km from her/his home at maximum (Arai 1996, pp. 58–62; Kawaguchi 1996, p. 161).

[8] Ideally, a formal check of the market definition, such as the SSNIP test, would be desirable for further assurance. Without detailed household-level information and price data, however, the task of defining local markets requires some simplifying assumptions (such as mine).

To avoid using existing geographic boundaries (e.g., zip codes or counties), Ellickson and Misra (2008) resorted to cluster analysis. My approach is similar in spirit, although the need for cluster analysis is precluded by the focus on train stations. Exact physical features may differ across countries, but the clustering of stores in my data resonates with their findings in the U.S. data that "these store clusters are somewhat larger than a typical zip code, but significantly smaller than the average county."

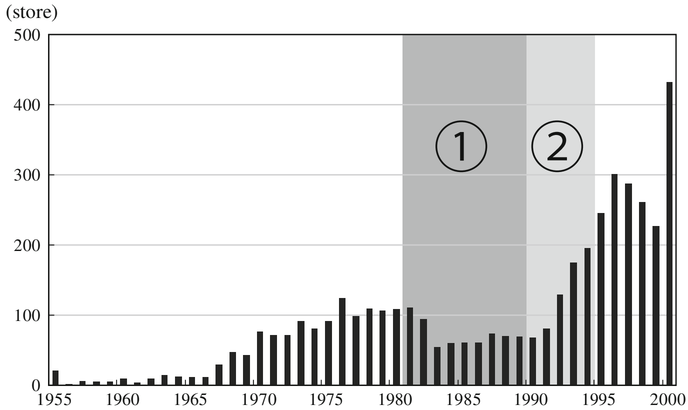

Fig. 2 Number of supermarket openings. *Note*: The number for the year 1955 includes those stores that opened before 1955. *Source*: (Minakata 2004, Tables 1–3, p. 16)

3.3 The 1990 Deregulation and Its Historical Context

A priori, there are no natural classification criteria for the sizes of retail outlets. In the regulatory context of the Japanese retail sector, however, a suitable categorization arises from the laws that define large, medium, and small stores. The Large-scale Retail Law, introduced in March 1974, sought to cap the new openings of any retail store with floor space 1, 500 m^2(16, 146 ft^2) and up.[9] Later, the 1979 revision of the law further added another target category: stores with 500–1,499 m^2 (5,382–16,145 ft^2). This paper defines stores with floor space of 1, 500 m^2 and above, 500–1,499 m^2, and less than 500 m^2 as "large," "medium," and "small," respectively, because these are the size categories that had defined the evolution of the sector.[10]

The new entry of supermarkets was particularly hindered during the 1980s. The Ministry of International Trade and Industry (MITI) tightened the enforcement of the regulations in October 1981, publicly dissuading retailers from opening new large stores. Consequently, only small supermarkets could open during this period (Fig. 2: the period marked by "1").

In May 1990, however, some of the prohibitive conditions in the Large-scale Retail Law were relaxed, which prompted a boom of new large outlets. The regulators began to accept all of the entry requests, regardless of store sizes, and abolished so-called "entry control areas" that were previously untouchable for newcomers. The driving

9 This was not the first time that government regulations targeted larger stores. Since the inception of department stores a century ago, various forms of legal entry barriers existed in Japan. The first was the Department Store Law, introduced in the 1930s in response to conventional retailers' political activism. The law targeted nascent department stores and restricted their entry and operation. See Minakata (2004) for the industry context.

10 Although the *threshold* for being "large" (1, 500 m^2) is relatively low by international comparison, the actual size of the large entrants in my study (4, 992 m^2, or 53, 716 ft^2, on average) is comparable to those of major supermarkets in other countries including the U.K., where the average store size of supermarket chains range between 5,800 and 45, 200 ft^2 (Smith 2004).

force behind this policy shift was the pressure from the U.S. government to "liberalize" Japan's domestic markets during the trade talks in the late 1980s. One can therefore regard this entry deregulation as an exogenous change in the industry environment.[11] This study focuses on the years immediately after the deregulation (Fig. 2: the period marked by "2") in order to avoid confounding the effects from the subsequent waves of deregulation.

The exogenous change in regulatory policies allows me to address the timing of big retailers' entry. To capture the changes following the 1990 deregulation, I employ the 1990 and 1995 editions of *Japan Supermarket Directory*, which list the store information as of September 1989 and 1994. This sample period gives a sufficient time interval for observing new entries and incumbents' responses, which typically take at least a year or two, while limiting the risk of confounding the effects of various policy changes in the late 1990s.[12] Moreover, five years would allow big retailers to open *some* outlets but not in *all* the promising towns, mainly because of the illiquid nature of markets for huge properties and credit constraints. The resulting variation across towns allows me to identify the impact.

3.4 Descriptive Statistics of Towns and Supermarkets

From these two sets of data, I reconstruct the market configuration for each of the 202 localities, by connecting stores' street addresses to those corresponding to towns. Table 1 presents summary statistics.

The average town counts 88,957 residents. Tokyo is comparable to other urban areas in terms of population density. With 4,430 people per km^2, it ranks as mere number 128 among the world's 189 major urban areas.[13] Prominent European cities such as Madrid ($5,680/\text{km}^2$), Athens ($5,500/\text{km}^2$), London ($5,290/\text{km}^2$), and Barcelona ($5,210/\text{km}^2$) surpass Tokyo. In short, Tokyo is not Hong Kong ($25,740/\text{km}^2$).

The growth potential of demand is proxied by the growth rate between 1984 and 1989 of the number of "regular commuters,"[14] the sample mean of which is 16.4%. There are on average 1,162 retail shops of all categories, with total floor space of $72,800\,\text{m}^2$ ($783,619\,\text{ft}^2$). I intend to measure the "depth" of demand by total retail revenue per capita (which averaged ¥1.35 million, or $13,500), which reflects the extent of shoppers from outside the town and other household characteristics such as income and taste. In 1989, a typical local market had 1.50 small, 1.77 medium, and 1.25 large food supermarkets.

11 Even if the Japanese retailers had exercised considerable bargaining power over the timing and the extent of the entry deregulation, the analysis and conclusion of this paper would remain unchanged. In that case, the results would actually *under*estimate the true impact of new entry because the incumbents, who were in a position to influence the policy change, should have been better prepared than otherwise for the intensified competition from new entrants. This direction of bias would not favor my result.

12 An "entry" is the opening for business in my data set. The majority of the entries occurred in the first half of the 1990–1994 interval. The latest entry events occurred in April 1994. I confirmed that dropping the two towns (out of 27) that experienced entries in 1994 does not alter the results materially.

13 Wikipedia, accessed on August 13, 2009.

14 Train users with fixed-route commutation tickets for one month or longer (*teiki-ken*).

Table 1 Summary statistics for town characteristics

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
Population growth rate (%)	202	16.4	20.6	-15.6	135.5
Population	202	88,957	33,956	13,766	182,590
Retail revenue per capita (mn yen)	202	1.35	0.96	0.22	9.56
Num. retail shops	202	1,162	758	197	4,704
Retail floor area (m^2)	202	72,800	46,385	10,471	345,600
Num. incumbents: large	202	1.25	1.13	0.00	6.00
Num. incumbents: medium	202	1.77	1.35	0.00	6.00
Num. incumbents: small	202	1.50	1.48	0.00	6.00

Following the regulatory thresholds, store size categories are defined based on floor area (*Small*: 1–499 m^2, *medium*: 500–1,499 m^2, and *large*: 1,500 m^2 or larger)

The outcome variable of interest is the incumbent supermarkets' responses between 1989 and 1994: exit, shrink, stay unchanged, or expand. Table 2 displays the store-level descriptive statistics.

Out of the 912 incumbent supermarkets in 1989, 94 exited, leaving 818 stores in 1994. Those who survived expanded their floor size by 2.9% on average. There were 252 large, 358 medium, and 302 small incumbents in 1989. Across all stores, 10% exited, 15% expanded, and 10% shrank their floor sizes ("stay unchanged" is the omitted category that accounts for the remaining 65%). These percentages do not vary much by size although small stores are slightly more likely to exit (16%).

4 Empirical Analysis

This section presents the findings from three sets of empirical analyses: (1) ordered probit regressions of incumbents' decisions to exit, shrink, stay unchanged, or expand (Sect. 4.1); (2) the set of similar (binary) probit regressions with geographical instruments for big entrants' town choice (Sect. 4.2); and (3) tobit regressions of incumbents' change in floor space (Sect. 4.3).

In all of the specifications, the identification of the entry effects on incumbents relies on the following two features of the study. First, the framework assumes independent local markets in which the following three events occur: (1) The incumbent supermarkets of various sizes, without knowledge of the entry deregulation, operate from before 1990;[15] (2) Upon the deregulation in 1990, the potential (big) entrants observe the existing store configuration in all local markets and choose towns to enter; and (3) The incumbents observe the actual entrants and decide by 1994 whether to continue in business (and if so, whether to change own store size). These timing and

[15] It is reasonable to assume a lack of anticipation because most incumbents had opened by the mid 1980s, long before the U.S.-Japan trade talks started discussing the retail deregulation.

Table 2 Summary statistics for store-level observations

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
1. All incumbent stores					
Floor Size in 1989 (m^2)	912	1,908	3,078	57	27,413
Floor Size in 1994 (m^2)	818	2,024	3,221	62	27,413
Change in floor size (%)	818	2.9	29.4	−74.7	53.2
Indicator: *Exit*	912	.10	.30	0	1
Indicator: *Expansion*	912	.15	.36	0	1
Indicator: *Shrinkage*	912	.10	.30	0	1
Indicator: treatment (Large Entrant)	912	.11	.31	0	1
2. Large incumbent stores					
Floor size in 1989 (m^2)	252	5,199	4,350	1,508	27,413
Floor size in 1994 (m^2)	236	5,332	4,488	735	27,413
Change in floor size (%)	236	−0.3	16.3	−74.7	179.0
Indicator: *exit*	252	.06	.24	0	1
Indicator: *expansion*	252	.19	.39	0	1
Indicator: *shrinkage*	252	.12	.32	0	1
Indicator: treatment (large entrant)	252	.11	.31	0	1
3. Medium incumbent stores					
Floor size in 1989 (m^2)	358	948	306	500	1,499
Floor size in 1994 (m^2)	328	969	383	390	3,800
Change in floor size (%)	328	4.0	35.0	−65.4	503.2
Indicator: *exit*	358	.08	.28	0	1
Indicator: *expansion*	358	.16	.37	0	1
Indicator: *shrinkage*	358	.14	.35	0	1
Indicator: treatment (large entrant)	358	.12	.32	0	1
4. Small incumbent stores					
Floor size in 1989 (m^2)	302	300	135	57	499
Floor size in 1994 (m^2)	254	313	141	62	895
Change in floor size (%)	254	4.3	30.9	−33.3	383.2
Indicator: *exit*	302	.16	.37	0	1
Indicator: *expansion*	302	.10	.30	0	1
Indicator: *shrinkage*	302	.04	.19	0	1
Indicator: treatment (large entrant)	302	.09	.28	0	1

Following the regulatory thresholds, store size categories are defined based on floor area (*Small*: 1–499 m^2, *medium*: 500–1,499 m^2, and *large*: 1,500 m^2 or larger)

informational assumptions are motivated by the historical/institutional background of the industry (see Sect. 3).

Second, the data set contains observations of similar towns (and individual stores within each of them) *with* and *without* entry events, both *before* (1989) and *after*

Table 3 Ordered probit regressions of decision to *Exit* < *Shrink* < *Unchanged* < *Expand*

Dep. var.:	Decision to *Exit* < *Shrink* < *Stay Unchanged* < *Expand*		
	(1)	(2)	(3)
Treated: large	0.03 (.30)	−0.82 (.46)*	−0.73 (.47)
Treated: medium	−0.56 (.20)***	−0.74 (.22)***	−0.79 (.22)***
Treated: small	0.28 (.17)*	0.23 (.16)	0.22 (.20)
Treated * floor		1.69e−4 (0.81e−4)**	1.49e−4 (0.80e−4)*
Floor		1.28e−5 (1.4e−5)	1.44e−5 (1.48e−5)
Large	0.29 (.10)***	0.23 (.13)*	0.23 (.13)*
Medium	0.23 (.10)**	0.22 (.10)**	0.22 (.10)**
Constant (=Small)	–	–	–
Controls	No	No	Yes
Instruments	No	No	No
Observations	912	912	912
Pseudo R^2	.01	.01	.02

Standard errors (clustered by 202 towns) in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

(1994) the entry deregulation. This variation in data, together with the institutional background, allows me to identify the impact of big entrants on existing supermarkets.

4.1 Ordered Probit: Exit, Shrink, Stay Unchanged, or Expand

The first set of results is based on ordered probit regressions (Table 3). The dependent variable is the four discrete alternatives for an incumbent: (1) *exit*; (2) stay and *shrink*; (3) stay *unchanged*; or (4) stay and *expand*, ordered in this manner.

Formally, store i's observed choice is

$$y_i = \begin{cases} \textit{exit} & \text{if } y_i^* \leq c_1 \\ \textit{shrink size} & \text{if } c_1 < y_i^* \leq c_2 \\ \textit{stay unchanged} & \text{if } c_2 < y_i^* \leq c_3 \\ \textit{expand size} & \text{if } c_3 < y_i^*, \end{cases} \quad (1)$$

where c_1, c_2, and c_3 are threshold parameters. I specify the latent variable y_i^* representing incumbent supermarket i's profit as

$$y_i^* = \alpha_{SIZE_i} + \beta_{SIZE_i} D_i + X_i \gamma + \varepsilon_i, \quad (2)$$

where D_i is the dummy variable that indicates the entry of a new big supermarket ("treatment") in the town in which store i operates.

The vector X_i includes the following town characteristics: *Population growth rate* between 1984 and 1989, *Population, Retail revenue per capita*, the *Number of retail shops* (of any kind), and *Retail floor area*, (i.e., the town's total floor space that was dedicated to retail trade).[16] It also incorporates the number of existing rival supermarkets in the town as of summer 1989, specified as a linear combination of the numbers of large, medium, and small incumbents, and their squared terms.[17] The error term ε_i is i.i.d. standard normal.

Large, medium, and small incumbents may have different intercepts, α_{SIZE_i}, where $SIZE_i \in \{large,\ medium,\ small\}$, with *small* as the omitted category. The coefficients of interest are the effects of new entry, β_{SIZE_i}, which are also allowed to vary by size classes of incumbents.[18]

The estimation results in Table 3 suggest that the entry of new large supermarkets negatively affects large and medium incumbents, whereas the impact tends to be positive for small ones.[19] Column (1) is the simplest specification with the entry dummy variable and incumbents' size classes (large, medium, and small).

In addition to the three size classes, column (2) incorporates incumbents' floor space (in m^2 as of 1989) together with its interaction term (*Floor* and *Treated* * *Floor*), controlling for potential heterogeneity within each category. The positive coefficient estimates on this detailed size measure suggest that, within each size class, larger stores tend to fare better.

Finally, column (3) controls for the town characteristics (X_i in Eq. (2)). In all of the specifications, the impact on medium stores is negative and statistically significant at 1% level. Negative impact on large stores and positive impact on small stores are less precisely estimated but consistently appear across all specifications (except for the case of large stores in column (1)).

4.2 Geographical Instruments for Entrants' Town Choice

Potential selection biases are a cause of concern: It may be that the big-box stores were able to foresee the towns where incumbents were most likely to exit. In that case, the negative impacts on large and medium incumbents could be over-estimated (in magnitude), while the positive impacts on small incumbents might be under-estimated (again, in magnitude).

To address this issue of potential *selection on unobservables*, I construct instrumental variables (for the big entrants' choices of town to enter) based on the following industry characteristics: Each chain retailer usually operates within predetermined geographic areas, which leaves only a *subset* of the total of the 202 towns in that

[16] Except for *Population growth rate*, the values at the beginning of the deregulation are used. Each variable's squared term is also included, to capture possible nonlinearities in the way that the town characteristics affect the outcome variables. More flexible specifications would be preferable in principle, but the relatively small sample size limits the extent of higher-order polynomials.

[17] An alternative specification that uses dummy variables was also tried (unreported), but does not materially alter the results.

[18] Although there is no theoretical reason a priori for ordering $shrink \prec unchanged \prec expand$, I proceed with this particular ordering because it fits the data best.

[19] I also run the same ordered probit regressions separately for each of the three size classes (unreported). The results are qualitatively similar but less precisely estimated due to smaller samples. An F-test of a null hypothesis $\beta_{\text{large}} = \beta_{\text{medium}} = \beta_{\text{small}}$ is rejected at the 1% level, which indicates that the entry effects are indeed different across incumbents' size classes.

firm's choice set for entry. In particular, two different urban structures are relevant: (1) railway lines; and (2) prefectures.

Regarding railways, many of the major retailers are closely affiliated with particular railway lines and their train operators. Some retailers are the grocery-store divisions of the conglomerates that also own and operate railway and property businesses.[20] The institutional context is as follows: First, the railway transport enterprise involves massive property investment, in both land strips beneath railroads and train station structures. Second, over time, the train operators diversified into real estate brokerage/development activities and retail services due to strong complementarities that surround property deals. Third, since location is central to successful retail services, major retailers either are engaged in close connections with railway/property conglomerates or are parts of such entities themselves. It is therefore not surprising that the chain operators *tend to open big stores along their affiliated railway lines*, exploiting informational advantages in local real estate markets.[21]

With respect to prefectures, a chain retailer is often rooted in a certain prefecture as a matter of geographic origin. In addition to the informational advantages in local property markets, geographic familiarity brings two benefits. First, geographical proximity to its supplier/distribution networks facilitates the arrangement of logistics. Second, the familiarity with local rules (such as ordinances) ensures low probabilities of legal and/or political disruptions in opening new big stores. Therefore, the propensity of entry is higher when a town belongs to a major retailer's prefecture of origin.[22]

I identify each big retailer's geographic specialization from the Appendices of the *Metropolitan Commercial Map* (Toyokeizai 1995) and various issues of *Large-scale Retail Shops Directory* (an annual publication also from Toyokeizai). Two sets of IVs are constructed: (IV-1) the number of big retail firms that operate along each railway line, and prefecture *dummy* variables; and (IV-2) the same railway-based IVs, and the *number* of big retail firms that operate from each prefecture.

Due to the institutional background in the above, a potential entrant enjoys significant informational and cost advantages when opening a new store in its familiar geographic areas (either along specific railway lines, in certain prefectures, or both).[23] Thus, towns that happen to be located in the "backyards" of many big-box operators (i.e., towns that are located along railway lines and prefectures that are home to many big retailers) are more likely to experience entry events, for economic mechanisms

[20] Examples include Odakyu, Keio, Tokyu, Keikyu, Seibu, and Tobu. See Masuda (2002) for the historical background on the railway networks and urban development in Tokyo.

[21] This advantage of an entrant is *uncorrelated* with incumbents' decisions to exit or change floor size because it is a strictly private benefit. Let us also note that such an informational clout does *not* translate into an entrant's ability to "kick out" incumbents (by means other than product-market competition). See Masuda (2002) for the close interaction between the railway transport, real estate, and retail businesses.

[22] This instrumentation strategy is similar in spirit to the one employed in the Wal-Mart literature: A location's physical distance from the company's headquarter in Bentonville, Arkansas, predicts the likelihood and timing of new store openings in that town (see Basker 2007).

[23] See Sect. 3 for the details of the urban structure in the Greater Tokyo region. One rationale for such local specializations and informational advantages is the illiquid nature of markets for huge properties, which creates an environment characterized by imperfect information.

that are *unrelated to* the likelihood of incumbents' exit or expansion (i.e., the outcome variables of interest).

Table 4 shows the results of binary IV-probit regressions. Ordered IV-probit regressions may achieve higher efficiency, in principle, but the actual estimation would become computationally expensive. As a logically consistent alternative method, I conduct three *binary* IV-probit regressions that divide an incumbent's four choices differently: (Panel-A) "*exit*" or "*shrink/unchanged/expand*;" (Panel-B) "*exit/shrink*" or "*unchanged/expand*;" and (Panel-C) "*exit/shrink/unchanged* " or "*expand*."

For each of Panels A, B, and C, columns (1), (2), and (3) use no IV, while (4) and (5) use IV-1 and IV-2, respectively. The results are qualitatively similar across columns and panels: An entry's impact is negative on large and medium incumbents but positive on small ones. The order of magnitude is also similar. Thus, the potential issue of selection on unobservables is unlikely to be driving my baseline findings using ordered probit (Sect. 4.1).

4.3 Tobit: Percentage Change in Incumbents' Floor Size

In the preceding analyses, I characterize incumbents' decisions as discrete choice problems. However, changes in floor size take continuous values. Some incumbents more than double their floor spaces by converting one-story buildings into two-story ones, while others increased their sizes only 10% by renting adjacent spaces in a commercial complex. Similarly, stores shrink floor sizes by different degrees.

In this section, I incorporate such heterogeneity in incumbents' size changes by employing tobit regressions. The dependent variable is *the realized percentage change in floor size*. Recycling the notation from the preceding probit regressions, the observed outcome is now

$$y_i = \begin{cases} -100 & \text{if } y_i^* \leq c_1 \\ y_i^* & \text{if } c_1 < y_i^* \leq c_2 \\ 0 & \text{if } c_2 < y_i^* \leq c_3 \\ y_i^* & \text{if } c_3 < y_i^*, \end{cases} \tag{3}$$

The latent variable is the *desired* percentage change in floor space between 1989 and 1994. The underlying economic model assumes some fixed sunk costs that a store must incur when changing its floor size (i.e., when $y_i \neq 0$).

Recall that almost two-thirds of the incumbents stay unchanged, hence the dependent variable has a mass of observations at $y_i = 0$. For this reason, I explicitly include $y_i = 0$ as a separate case in Eq. (3), which makes this censored regression different from the standard tobit.

I address the issue of lumpy observations by analyzing the *exit/shrink* and *expansion* decisions separately.[24] First, I concentrate on the floor reduction decision by running two-sided tobit where the focus is on the cases with $c_1 < y_i^* \leq c_2$. The percentage

[24] More fundamentally, there is no theoretical reason to impose symmetry between shrinkage and expansion rates. Two separate censored regressions allow for the possibility of asymmetric effects of entry.

Table 4 Three sets of binary IV-probit regressions

Dep. var.:	Decision *Not to Exit*				
	(1)	(2)	(3)	(4)	(5)
A. "Exit" or "Shrink/Unchanged/Expand"					
Treated: large	−0.33 (.28)	−1.36 (.58)**	−1.42 (.66)**	−2.04 (2.61)	−3.74 (4.75)
Treated: medium	−0.49 (.31)	−0.83 (.32)**	−0.90 (.38)**	−0.60 (1.22)	−0.42 (4.01)
Treated: small	0.22 (.41)	0.12 (.41)	0.08 (.46)	1.20 (1.18)	1.40 (5.07)
Treated * floor		3.17e−4 (1.65e−4)*	3.11e−4 (1.67e−4)*	3.18e−4 (4.45e−4)	9.46e−4 (7.84e−4)
Floor		7.36e−5 (5.24e−5)	8.62e−5 (5.64e−5)	8.56e−5 (6.18e−5)	7.03e−5 (5.35e−5)
Large	0.59 (.17)***	0.29 (.25)	0.25 (.26)	0.42 (.33)	0.36 (.28)
Medium	0.47 (.14)***	0.43 (.14)***	0.45 (.15)***	0.50 (.18)***	0.40 (.18)**
Constant (= Small)	0.98 (.10)***	0.96 (.10)***	1.18 (.56)**	0.96 (.70)	0.57 (1.90)
Controls	No	No	Yes	Yes	Yes
Instruments	No	No	No	IV-1	IV-2
Observations	912	912	912	912	912
Pseudo R^2	.03	.05	.09	–	–
Dep. var.:	Decision *Not to Exit or Shrink*				
	(1)	(2)	(3)	(4)	(5)
B. "Exit/Shrink" or "Unchanged/Expand"					
Treated: large	−0.13 (.35)	−0.72 (.49)	−0.46 (.54)	−1.65 (1.42)	−3.25 (2.50)
Treated: medium	−0.52 (.24)**	−0.65 (.25)***	−0.61 (.24)**	−0.10 (.83)	−0.25 (1.08)
Treated: small	0.37 (.41)	0.33 (.41)	0.35 (.46)	0.91 (1.03)	0.77 (1.10)
Treated * floor		1.30e−4 (.81e−4)	0.91e−4 (.83e−4)	4.45e−4 (2.12e−4)**	7.32e−4 (3.53e−4)**
Floor		0.53e−5 (1.88e−5)	1.38e−5 (1.99e−5)	0.60e−5 (2.63e−5)	−0.19e−5 (2.93e−5)
Large	0.09 (.14)	0.06 (.17)	0.05 (.18)	0.12 (.21)	0.17 (.22)

Table 4 continued

Dep. var.:	Decision *Not to Exit or Shrink*				
	(1)	(2)	(3)	(4)	(5)
Medium	−0.01 (.12)	−0.01 (.12)	0.02 (.12)	−0.02 (.15)	−0.03 (.14)
Constant (= Small)	0.83 (.09)***	0.83 (.09)***	0.55 (.49)	0.25 (.53)	0.29 (.59)
Controls	No	No	Yes	Yes	Yes
Instruments	No	No	No	IV-1	IV-2
Observations	912	912	912	912	912
Pseudo R^2	.01	.01	.04	–	–
Dep. var.:	**Decision *Not to Exit, Shrink, or Stay Unchanged***				
	(1)	(2)	(3)	(4)	(5)
C. "Exit/Shrink/Unchanged" or "Expand"					
Treated: large	0.23 (.30)	−0.66 (.60)	−0.54 (.68)	−3.56 (1.53)**	−1.90 (1.85)
Treated: medium	−0.73 (.33)**	−0.89 (.31)***	−1.02 (.30)***	0.50 (.77)	0.67 (1.02)
Treated: small	0.27 (.31)	0.22 (.32)	0.31 (.29)	2.22 (1.12)**	2.11 (1.25)*
Treated * floor		1.57e−4 (.97e−4)	1.33e−4 (1.03e−4)	5.72e−4 (2.15e−4)***	4.12e−4 (2.62e−4)
Floor		1.19e−5 (1.90e−5)	0.46 (2.00e−5)	−1.61e − 5 (2.56e−5)	−0.74e − 5 (2.85e−5)
Large	0.39 (.13)***	0.33 (.17)*	0.39 (.18)**	0.72 (.19)***	0.62 (.21)***
Medium	0.36 (.14)**	0.35 (.14)**	0.31 (.14)**	0.23 (.17)	0.22 (.17)
Constant (= Small)	−1.29 (.10)***	−1.30 (.10)***	−0.74 (.44)*	−1.12 (.58)*	−1.24 (.61)**
Controls	No	No	Yes	Yes	Yes
Instruments	No	No	No	IV-1	IV-2
Observations	912	912	912	912	912
Pseudo R^2	.02	.03	.06	–	–

Standard errors (clustered by 202 towns) in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

change in floor space is left-censored at −100 (i.e., exit) and right-censored at 0, the latter of which encompasses stores' decisions to both "stay unchanged" and "expand."

Second, I exclusively analyze the floor expansion decision by conducting one-sided tobit where I focus on the cases with $c_3 < y_i^*$. Here the percentage change in floor space is left-censored at 0 and not right-censored.

Table 5 presents two-sided tobit estimation results on incumbents' decisions to shrink floor space. Here again, large and medium supermarkets respond "negatively" to the new entry of large rivals by shrinking their own size, or by exiting the town altogether. In contrast, small supermarkets are less inclined to shrink or exit.

Table 6 tells a similar story regarding the floor expansion decision of incumbents. Medium stores tend not to expand their shopping space, followed by large incumbents to a lesser degree. Again, small supermarkets seem to respond more "aggressively" by expanding their size although coefficients are not very precisely estimated.

4.4 Discussion

The basic finding from these empirical analyses is that the entry of new large rivals affect incumbents differently depending on the latter's sizes. In other words, incumbents of different sizes face different incentives in responding to the entry shock.

This simple observation implies that large, medium, and small supermarkets offer differentiated services from the perspective of consumers. Hence the results highlight the role of product differentiation in relaxing competition, which is the common insight from numerous theoretical studies (see Sect. 2).

How do supermarkets' retail services differ by store sizes? The most important differentiation mechanism is that, while larger supermarkets offer a wider variety of merchandise for weekend shopping trips, consumers use their nearest (often small) supermarkets for quick, daily purchase of fresh foods (fish, vegetables, and meats). The latter is the principal mode of shopping in Tokyo.

Three demand-side factors may explain the high frequency of fresh-food shopping. First, houses (and therefore refrigerators) are small in Tokyo, leaving no storage space. Second, many Japanese are obsessed with the freshness of meat, vegetables, and especially fish. Third, the female labor-force participation rate is lower in Japan than in most developed economies, so that there are still many "professional" housewives.

The most intriguing feature of the estimation results is that small incumbents are not just insulated from the increased competition at the top end of the size spectrum. Small supermarkets seem to benefit from the entry of new big rivals. An economic interpretation of this finding would need to rely on some sort of positive externalities from the new entrant. Since it is not very conceivable to imagine new entrants directly facilitating small incumbents on the supply side, the positive externalities likely come from the demand side.

One example is the increased traffic of shoppers in town, attracted by new big retailers. Such is the theoretical model of Zhu et al. (2006), which incorporates both product differentiation and positive demand externality of new entry in the retail context. My findings fit well with their prediction that the tradeoff between the business-stealing effect (i.e., increased competition from new entrants) and the positive demand

Table 5 Shrinkage: two-sided Tobit regressions of change in floor size (%)

Dep. var.:	*Change in Floor Size (%)*				
	(1)	(2)	(3)	(4)	(5)
Treated: large	−33.13 (54.79)	−169.27 (111.22)	−132.86 (113.45)	−61.47 (73.30)	−663.08 (704.96)
Treated: medium	−96.04 (40.95)**	−128.44 (47.86)**	−119.95 (49.75)**	−12.49 (46.26)	−59.64 (266.22)
Treated: small	65.51 (63.15)	55.71 (63.21)	56.01 (64.38)	30.33 (48.97)	224.67 (306.81)
Treated * floor		31.30e−3 (23.49e−3)	25.46e−3 (23.21e−3)	17.31e−3 (8.60e−3)**	153.36e−3 (102.75e−3)
Floor		31.75e−4 (46.35e−4)	48.84e−4 (48.38e−4)	4.22e−4 (12.34e−4)	29.44e−4 (65.91e−4)
Large	47.89 (25.36)*	32.42 (33.29)	28.90 (33.78)	2.67 (9.76)	56.38 (47.31)
Medium	29.30 (22.58)	27.15 (22.64)	33.25 (22.55)	0.73 (5.29)	29.27 (29.39)
Constant (= Small)	146.36 (23.28)***	144.41 (23.13)***	111.59 (86.08)	12.11 (31.14)	53.10 (143.81)
Controls	No	No	Yes	Yes	Yes
Instruments	No	No	No	IV-1	IV-2
Observations	912	912	912	912	912
Left-censored at −100%	94	94	94	94	94
Uncensored	92	92	92	92	92
Right-censored at 0%	726	726	726	726	726
Pseudo R^2	.01	.01	.02	–	–

Standard errors (clustered by 202 towns) in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6 Expansion: one-sided Tobit regressions of change in floor size (%)

Dep. var.:	*Change in Floor Size (%)*				
	(1)	(2)	(3)	(4)	(5)
Treated: large	11.98 (23.37)	−42.98 (48.91)	−24.45 (50.15)	−259.82 (150.37)*	−133.97 (154.08)
Treated: medium	−66.47 (30.18)**	−75.52 (30.93)**	−79.45 (31.40)**	66.90 (76.88)	82.17 (74.11)
Treated: small	31.70 (25.68)	28.76 (25.77)	33.29 (28.35)	184.73 (114.36)*	175.06 (109.14)*
Treated * floor		9.13e−3 (6.91e−3)	5.66e−3 (7.05e−3)	43.65e−3 (21.15e−3)**	31.44e−3 (21.45e−3)
Floor		3.89e−4 (18.98e−4)	−.16e-4 (19.03e−4)	−16.22e − 4 (25.03e−4)	−10.43e − 4 (25.21e−4)
Large	21.92 (12.15)*	19.97 (15.45)	23.88 (15.42)	53.88 (21.23)**	44.66 (20.48)**
Medium	28.47 (11.22)**	28.22 (11.29)**	24.21 (11.24)**	15.20 (16.50)	13.69 (15.77)
Constant (= Small)	−111.75 (11.95)***	−111.89 (11.97)***	−47.51 (44.57)	−98.83 (55.73)*	−103.68 (54.88)*
Controls	No	No	Yes	Yes	Yes
Instruments	No	No	No	IV-1	IV-2
Observations	912	912	912	912	912
Left-censored at 0%	775	775	775	775	775
Uncensored	137	137	137	137	137
Pseudo R^2	.01	.01	.02	–	–

Standard errors (clustered by 202 towns) in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

externality (i.e., increased demand thanks to new entrants) hinges on the degree of differentiation between entrants and incumbents.

Existing large and medium supermarkets suffer higher exit rates because they directly compete with the new big rivals at the same end of the store-size spectrum. Small supermarkets, in contrast, stand at the other end of the product space, serving different demands, and are thus insulated from the business-stealing effect of the new entry. On average, the small incumbents benefit from the entrants probably because the latter attracts an additional flow of shoppers to the neighborhood.

Aside from the decisions to exit, incumbents' incentives in changing store size seem quite nuanced in some size categories. First, the incentive for medium supermarkets *not* to expand is understandable. They already suffer from the proximity (in size) to the new competitor. There is no reason to spend their shrinking profits to get even closer in size to their big rivals.

Second, the story could be more complicated for large incumbents. On the one hand, they, too, may want to follow medium stores' strategy and distance themselves from the new entrants by shrinking floor space. On the other hand, however, large incumbents already belong to roughly the same size segment as new entrants, where their central appeal to consumers is to offer the widest variety of merchandises in town.

Hence, it would not be totally surprising if some of them choose to expand floor space, in an effort to regain their former position as the champion of one-stop shopping. They would race to the top end of the size spectrum to attract weekend shoppers back. I suspect that this mixture of incentives to shrink and expand might lie behind the estimation results on large incumbents, which are generally negative but not as precisely estimated as the response of medium stores.

Finally, why do the small supermarkets expand? Two mechanisms may possibly be at work. One is that the increased exits among medium stores leave some niche on the size spectrum. Even though it seems risky to become closer in size to the new big entrants, small stores' initial positions are so distant from the high end of the product space that they might be able to capture the now under-served customer segment, without serious concerns over direct competition with the big entrant. The other possible reasoning is that the arrival of the new product (i.e., big-box retail service) somehow shifts upwards the entire product space effectively demanded by shoppers. The latter mechanism is reminiscent of Sutton's (1991) endogenous sunk cost theory. These explanations are not mutually exclusive.

These potentially complicated incentives of floor shrinkage/expansion seem to suggest room for further investigation—both theoretical and empirical—on product differentiation in conjunction with entry and exit.

5 Conclusion

Instead of driving out small rivals, large entrants seem to improve their survival prospects. This paper presents new evidence that supports the economic theory of product differentiation, and introduces the perspective of product differentiation to the empirical analysis of entry and exit.

I conduct ordered and IV probit regressions of each incumbent store's responses (i.e., exit, stay and shrink, stay unchanged, or stay and expand). The results suggest that, even after accounting for both the (ordered) discrete nature of the decision problem and the potential issue of new entrants' town selection based on the unobservable town characteristics, the main findings stand out: Large and medium incumbents are adversely affected by the new entries of big rivals, whereas small incumbents seem to benefit from them. The results from tobit regressions on the percentage change of floor space further confirms this contrast between large, medium, and small supermarkets.

These findings imply that store size functions as a key dimension of product differentiation among retailers.[25] On the one hand, large and medium incumbents compete as closer substitutes to new large entrants. On the other hand, small supermarkets—thanks to a sufficient degree of differentiation—benefit from the increased traffic of shoppers that is generated by the entrants.

Consequently, this research critically examines the conventional notion that big drives out small, a notion that continues to motivate size-based entry regulations in many economies, both developed and emerging. Ironically, such policies appear to shield big retailers from competition and even preclude small stores from enjoying the increased customer flow that can be generated by large new entrants. The specifics of geographical and regulatory setting may differ by country and region, but these basic economic forces of product differentiation and entry/exit are likely to be at play in many markets.

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[25] Hence it is not surprising that the retail chains known for "hypermart" formats, such as Tesco and Carrefour, are introducing new store formats that are much smaller than their original sizes (Tesco Express and Carrefour Express). Even Wal-Mart, the synonym of big-box retailer, developed smaller store formats in Mexico and is now considering their transplantation to rural China (*Financial Times*, December 2, 2010).

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