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Identifying Neighborhood Effects among Firms: Evidence from Location Lotteries of the Tokyo Tsukiji Fish Market[1]

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Abstract

The theories of retail cluster formation suggest that stores perform better when surrounded by other stores of diverse complementary products because diverse stores attract consumers with love of variety preference. We analyze the impact of the diversity of neighboring stores among intermediate wholesalers located in the Tokyo Tsukiji Fish Market by exploiting a unique feature of their shop locations within the market in which their locations are determined every 4-10 years by relocation lotteries, generating exogenous variation in the diversity of neighboring stores. First, we confirm that these intermediate wholesalers' shop locations are indeed randomly distributed. Then, we find that the diversity of the types of neighboring firms positively affect the performance of small-sized and specialized firms. We find no effect of the characteristics of close neighbors not facing the same corridor and thus not sharing the flow of shoppers. This provides evidence that our results are not due to factors other than shopping behavior, such as technology spillovers. Finally, to illustrate the general applicability of the mechanism we find, we use the Census of Commerce covering all the retailers in Tokyo to show that smaller and more specialized retailers are more likely to be located in close proximity, while larger and standardized ones are isolated. Overall, our analysis shows that the complementarity of products between specialized diverse stores is an important factor behind urban agglomeration.

Keywords: Neighborhood effects, Lottery, Shopping externality, Micro-foundation of agglomeration, Market place

JEL classification: R11

[1]This study is conducted as a part of the Project "Dynamics of Inter-organizational Network and Firm Lifecycle" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). This study utilizes the micro data of the questionnaire information based on "the Census of Commerce" which is conducted by the Ministry of Economy, Trade and Industry (METI). We are indebted to Kyoko Fukuchi of Tsukiji Ginrinkai for her invaluable support in the early stage of the project, without which this project would not have been possible. We thank many intermediate wholesalers in the Tsukiji market who tirelessly answered our questions. We thank Takatoshi Tabuchi and David Weinstein for their insightful discussions and encouragement. We are grateful to David Atkin, Andy Bernard, Don Davis, Jonathan Dingel, Michal Fabinger, Masahisa Fujita, Ed Glaeser, Jessie Handbury, Koichiro Ito, Amit Khandelwal, Daiji Kawaguchi, Ayako Kondo, Hideo Konishi, Hisaki Kono, Noriaki Matsushima, Kiminori Matsuyama, Yuhei Miyauchi, Yasusada Murata, Takeshi Murooka, Ryo Nakajima, Stuart Rosenthal, Bryce Steinberg, Adam Storeygard, Jacques Thisse, Junichi Yamasaki, Yosuke Yasuda and seminar/conference participants at various places for helpful discussions. We thank Francisco Carrera and Paola Ugalde for their excellent research assistance. We gratefully acknowledge financial support from the JSPS (Nos.15H03329, 16H02018, 17K18552, 17H02517, 17H02524, and 17H02508).

1 Introduction

Access to a variety of goods is the heart of urban attractiveness (Glaeser, Kolko, and Saiz 2001, Handbury and Weinstein, 2015).[1] Shopping is a way to access to a variety of goods that a city affords, and a significant part of it takes place at retail clusters, such as shopping districts and shopping malls. Retail clusters, or more generally clusters of firms in service sectors, is the major form of urban agglomeration.

This raises the question of why such clusters arise, despite potentially tough competition. Do many stores just locate together in places with higher consumer demands, or do they benefit from existing neighboring stores? Existing, mostly theoretical, studies use the latter argument to explain within-city agglomeration.[2] In particular, they state that clusters of retailers allow consumers to reduce the search/trip costs to find a set of complementary varieties. This idea suggests a particular type of externality (sometimes referred to as the shopping externality) where firms perform better if they are surrounded by firms selling other diverse complementary products.[3]

Identifying complementarity arising from the diversity of neighboring stores is challenging. First, a fundamental challenge in identifying externalities or neighborhood effects of any type is the endogeneity problem that results from the self-selection of firm locations. This challenge is even greater for identifying the effects of the diversity of neighboring stores because researchers would need exogenous variations in the location of multiple firms in many areas, rather than just one firm (c.f. Greenstone, Hornbeck, and Moretti (2010)). In addition, the detailed information of the location within market places, clusters or cities has not been readily available.

We overcome this challenge by analyzing the neighborhood effect among fish intermediate wholesalers located in the Tokyo Tsukiji Fish Market and by exploiting a unique feature of their locations within the market; their locations are determined every 4-10 years by relocation lotteries. In our sample period, the Tokyo Tsukiji Fish Market hosts approximately one

[1]Couture (2015) and Schiff (2015) show that consumers benefit from the variety of restaurants in large metropolitan areas. Handbury and Weinstein (2015) show that a bigger city offers more varieties that lead to a lower price index.

[2]See, for example, Matsuyama (1992, 1995), Henkel, Stahl and Walz (2000), Arakawa (2006), and Tabuchi (2009).

[3]The idea that the complementarity of stores with different varieties shapes shopping districts goes back to at least to Chamberlin (1962). See also Matsuyama (1992) that clarifies Chamberlin's point.

thousand intermediate fish wholesalers specializing in different types of fish.[4] The feature that the location of firms is randomly determined by the lotteries implies that the characteristics of the neighborhood are generated by chance, meaning that, within a market, there are areas with more diversity and areas with less of it exogenously. We also compile the exact location of every intermediate wholesaler within the market and thus those of their neighbors.[5]

The Tokyo Tsukiji Fish Market is particularly suitable for our purpose. In addition to the very rare opportunity to exploit a random source of variation in firm locations, there are two noteworthy features. First, the intermediate fish wholesalers are all firms in a very narrowly defined industry; however, they exhibit substantial heterogeneity along important dimensions, particularly the type of fish they sell, their operation scales, and how they are specialized in that type. Thanks to the heterogeneity in the type of fish, the lotteries generate exogenous variations in diversity of neighboring firms as well as other neighborhood-level characteristics such as fraction of firms of a particular type. We then can analyze what type of firms benefit from such neighborhood characteristics.

Second, the Tsukiji market has several features that allow us to distinguish externality due to shopping from other forms of neighborhood or spillover effects. The fact that these firms are all located in the same market place means that there is no role for the consumption amenities and that there is no permanent vertical buyer-supplier relationship among intermediary wholesaler themselves.[6] Thus, these channels of neighborhood effects that could be potentially important elsewhere do not exit in this setting. Furthermore, the firms have two types of neighbors: those with whom they directly share buyer flow because they face each other across a corridor for buyers and those with whom they do not because they are back to back to each other without having a corridor for buyers in between. The effect of diversity due to shopping behavior should exist only from the first type of neighbors, while knowledge spillover could exist for both neighbors. Thus, finding neighborhood effects only from the first type of neighbors provides compelling evidence of complementarity due to shopping behav-

[4]Intermediate wholesalers are intermediary firms that purchase fish from wholesale traders, who receive fish from outside the market and sell to restaurants and supermarkets. See Section 2 for more detail. We use the term "intermediate wholesalers" according to Bester (2004), a comprehensive anthropological study of the Tsukiji market. Throughout the paper, we also use "firms" to indicate the intermediate wholesalers.

[5]In this paper, we focus on one lottery cycle in 1990 and analyze the firm performance until 1995, which is the year that the next lottery occurred. We plan to extend our analysis to more lottery cycles.

[6]A firm can buy fish from other firms if it encounters a shortage of fish on a particular day, or it can sell fish to other firms that run short of their fish, but these actions should cancel out over time.

ior.[7] In short, the Tsukiji market provides an ideal setting for testing complementarity due to shopping externality.

We proceed with our analysis according to the following steps. First, we perform various types of analysis to show that the locations of the intermediate wholesalers are indeed randomly distributed by the location lotteries. Then, we find that the characteristics of neighboring firms significantly affect firm performance. Specifically, for small-sized firms, the diversity of the neighboring firms positively affect the performance.[8] Then, after several types of robustness checks, we present the analysis to further explore the mechanism behind the neighborhood effects. We show that firm performance is influenced by the characteristics of other firms facing it across a corridor (i.e., directly sharing buyer flows), but not by the characteristics of other firms with their back to them equally close yet on a different corridor from the firm (i.e., not directly sharing buyer flows). Finally, we present analysis focusing on heterogeneity of neighborhood effects by the degree of specialization of firms. We also analyze a subset of firms for which we can obtain information about an alternative measure of post-lottery performance. We show persistent neighborhood effects for specialized firms. These findings confirm that the neighborhood effects we find arise from the interaction of firms through their buyer flow and that small specialized firms benefit from such neighborhood effects persistently.

The results of the analysis of the Tsukiji market offers a way to understand the force behind the nature of retail clusters beyond our context, such as shopping districts and shopping malls, in particular regarding what types of sellers do or do not form retail clusters. Our results suggest that diverse and specialized stores benefit from one another because of complementarity of their products. Therefore, they have incentives to cluster together to form a shopping district.[9] In the final part of our analysis, using the census of commerce covering all

[7]Our analysis to distinguish neighborhood effects due to shopping from knowledge spillover is similar to the analysis performed by Mas and Moretti (2009), who analyze the spillover effects among checkers in cashiers in a shop. They exploit the variation in relative positions of checkers to find that the performance of a checker improves when they are viewed by a better colleague but not when they are observing a better colleague. Thus, they are able to distinguish the effects of peer pressure from other mechanisms such as knowledge spillover.

[8]Additionally, we find evidence that the fraction of neighboring firms that deal with the same fish specialty increases the performance of small shops and the proportion of large firms in the neighborhoods decreases the performance of similarly large firms.

[9]We could also understand a shopping mall as a device to achieve a more centralized way of realizing of complementarity of diverse stores, since the presence of the externality implies the potential room for internalizing it in a centralized way. Henkel, Stahl and Walz (2000) analyze theoretically the sub-optimality of spatial equilibrium due to externality and how to internalize it. Pashigian and Gould (1998) provide empirical evidence of internalizing externality showing that the rents for anchor stores are heavily discounted in shopping malls. Konishi and Sandfort (2003) analyze the role of anchor stores theoretically.

the retailers in Tokyo, we confirm that smaller and more specialized retailers are more likely to be located together while larger and standardized ones are isolated, suggesting that the complementarity of products between specialized diverse stores is an important factor behind urban agglomeration in general.

The mechanism we empirically identify has been a central theoretical mechanism to explain retail clusters, market places or within-city agglomeration. Matsuyama (1992, 1995), Henkel, Stahl and Walz (2000), Arakawa (2006), and Tabuchi (2009), among others, describe the mechanism of organizing marketplaces within a city based on consumer's love of variety preference. According to the love of variety preference, the substitutability of heterogeneous products attracts consumers dispersed in space to marketplaces, and the cluster of retail firms increases their performance by reducing consumers' trip costs.[10] However, due to the identification difficulty and limitation in data availability, few empirical studies exist that elucidate the empirical relevance of the mechanism. We provide the first randomization-based evidence of this type of theory.[11]

Our paper contributes to the recently growing literature of the micro geography in service sectors within city. In particular, Schiff (2015) Cosman (2014), Couture (2015) analyze the gains from diversity or density of restaurants and bars.[12] They quantify the gains from diversity/density of shops for consumers, while we analyze the mechanism how diversity or density of shops could benefit shop themselves. Jardim (2015) estimates structurally the degree of externality among retailers and conducts counterfactual policy experiments, while our paper provides quasi-experimental evidence of a particular mechanism of complementarity between diverse stores in a narrower but cleaner setting.[13] It is also worth noting that our paper is the first to document directionally heterogeneous externality among firms using the front and back

[10] There is another branch of this type of theory using the ideal demand approach. In Wolinsky (1983), each consumer has an ideal demand for the product characteristics, and each firm sells specialized products, which have specific characteristics. Under these circumstances, market places with a large number of firms emerge to attract consumers through reducing search costs for the product that matches the consumer's preference. Konishi (2005) further introduces price competition across firms and shows that low price expectations as well as reducing search costs make the clusters attractive for consumers.

[11] Our effect is based on love of variety, which is also a fundamental ingredient of the sharing mechanism of agglomeration, as noted by Duranton and Puga (2004). Thus, our paper is also the first randomization-based evidence of the sharing mechanism of agglomeration.

[12] Handbury and Weinstein (2015) show the gains from product variety at the city level.

[13] Other relevant papers include the following: Arzaghi and Henderson (2008) who analyze the localized knowledge spillover among advertising agencies in Manhattan in NYC; Davis, Dingel, Monras and Morales (2016), who analyze social segregation in restaurant visits in NYC; and Billings and Johnson (2016), who propose a method to detect agglomeration within a city.

neighborhood analysis, which allows us to distinguish externality due to shopping behavior from other potential neighborhood effects and can be important in studying neighborhood effects or externality in other settings.

Our paper also contributes to the small and growing literature of neighborhood effects among firms in service sectors. Benmelech et al (2014) and Shoag and Veuger (2017) are two papers closely related to ours. Both find that retail firms' performance deteriorated when a branch of a national retail chain in their neighborhood disappeared because of the bankruptcy of the whole chain. They interpret their respective findings as evidence of neighborhood spillover effects. Our study is different in that we have random variations in all firms' locations due to the lotteries, thus variation in the diversity of surrounding stores.

Our paper is also related to the natural experiment approach in economic geography. For natural experiments, researchers have exploited various factors, such as disasters,[14] bombings,[15] changes in borders,[16] and the creation and closure of transportation.[17] [18] Furthermore, many areas in economics have been increasingly exploiting random variations generated through lotteries or (i.e., quasi) random assignment to estimate the spillover effects.[19] To the best of our knowledge, we are the first to exploit a random source of variation in firm locations generated by lotteries.

This paper is organized as follows. Section 2 describes the background information of the Tokyo Tsukiji Fish Market and the details of the relocation lottery. Section 3 describes the

[14]See, for example, Hornbeck and Keniston (2017), for the analysis of the Great Boston Fire of 1872.

[15]See, for example, Davis and Weinstein (2002) for the analysis of the allied bombing in Japan, and see Redding and Sturm (2016) for the analysis of the German bombing in London.

[16]See, for example, Redding and Sturm (2008) and Burchardi and Hassan (2013) for the analysis of the German division and reunification, and see Nakajima (2008) for the analysis of the separation of the Korean Peninsula from the Japanese territory.

[17]See, for example, Redding, Sturm, and Wolf (2011) for the analysis of a closure of a major airport in Germany; see Faber (2014) for the analysis of the construction of highways in China, and see Bernard, Moxnes, and Saito (2017) for the analysis of the new construction of a bullet train route in Japan. In the context of international trade and growth, Feyrer (2009) analyzes the closure of the Suez Canal from 1969 to 1975.

[18]In particular, our paper is complementary to Hornbeck and Keniston (2017) and Redding and Sturm (2016) who analyze neighborhood effects exploiting exogenous destruction of a city. Our paper focuses more on a specific and narrow mechanism of neighborhood effects, while their studies provide evidence of the implication of neighborhood effects (i.e., urban sorting).

[19]Researchers have analyzed peer effect of roommates in dormitories (Sacerdote, 2001); neighborhood effects on employment (Kling, Liebman and Katz, 2007, Kondo and Shoji, 2015, and Chyn, 2016, among others); productivity effects of co-workers in the workplace (Mas and Moretti, 2009, and Bandiera, Barankay and Rasul, 2010); impact of collaborator in scientific outputs (Azoulay, Zivin and Wang, 2010); peer effects of inmates in crimes (Bayer, Hjalmarsson and Pozen, 2009); and peer effects in sports (Brown 2011, Yamane and Hayashi, 2015).

data and the empirical strategy. In Section 4, we provide evidence of the exogeneity of the locations due to the lottery. In Section 5, we present the main results. Section 5.1 shows the baseline estimation results. Then, in Section 5.2 and 5.3, we present the results using alternative measures of neighborhood diversity, and alternative definition of neighborhood. Further, we show additional results for externality due to shopping against other mechanisms of neighborhood effects using direction of neighborhood effects. Finally, in section 5.4 we discuss the persistence of the neighborhood effects for specialized firms using alternative measure of performance. Section 6 provides additional evidence on complementarity using the data set covering all the retailers in Tokyo. Section 7 concludes with our future plan of analysis. In addition, we present a theory in Appendix showing that the diversity of neighboring stores positively affect the performance of stores.

2 Background

2.1 Tsukiji Fish Market

The Tsukiji fish market, located in downtown Tokyo, is the largest wholesale fish and seafood market in the world. In 1990, the period we focus on this paper, the market was handling more than 700,000 metric tons per year (i.e., 2,000 tons daily) of more than 400 different types of seafood. There were more than 1,000 firms in the market, including wholesaler traders, intermediate wholesalers, and related equipment and machinery companies, which together employ more than 60,000 workers (Annual Report of Tokyo Central Wholesale Market).

The flow of fish from producers to consumers is summarized in Figure 1. Fish that arrive from all of the ports in Japan and from around world are first handled by seven large wholesale traders (i.e., "O-oroshi" in Japanese). Then, the wholesale traders sell the fish to intermediate wholesalers, either through auctions or through direct negotiations. Next, the intermediate wholesalers, at their shops within the market place, resell the fish to their buyers, which include supermarkets, local fish stores, or restaurants. Then, these buyers serve their respective customers at their shops or restaurants outside the market, mostly in the Tokyo area. This paper focuses on the relationship between the intermediate wholesalers and buyers, as shown in the rectangular box in Figure 1.[20]

[20]Some large supermarket chains can buy directly from wholesale traders if they obtain a license. They are

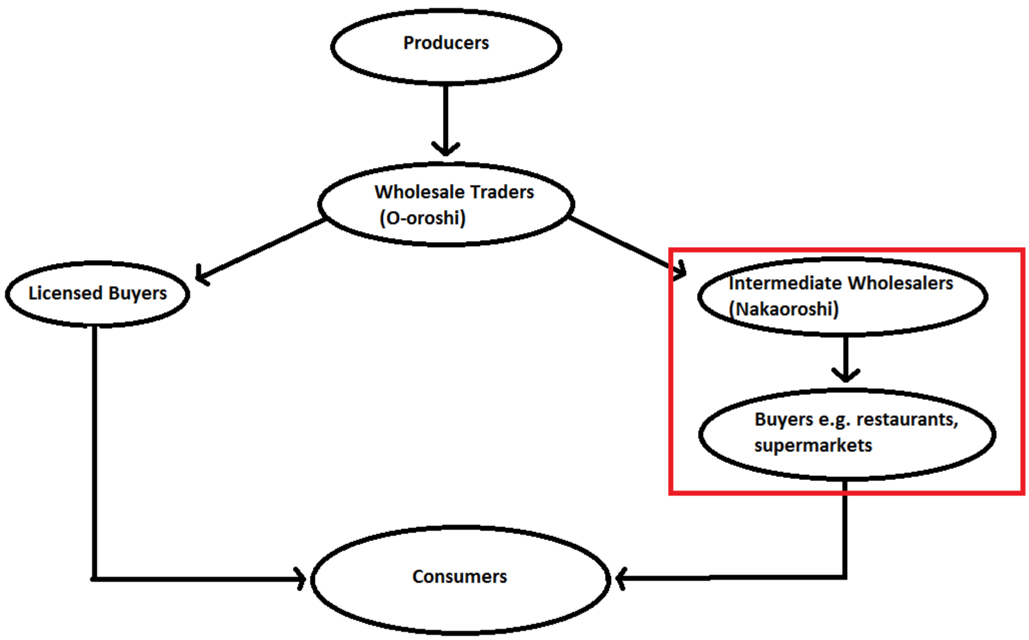


Figure 1: Flow of Fish

2.2 Types of Intermediate Wholesalers [Nakaoroshi]

Intermediate wholesalers can be classified according to several dimensions. First, they have different fish specialties. In the Tsukiji fish market, there are sixteen trade groups (i.e., "Gyokai") formed by firms of similar specializations. Intermediate wholesalers form these trade groups to negotiate with other interested parties. Trade groups can be directly associated with specific fish, such as tuna, with fish caught from specific locations, or with the way the fish are handled. One trade group that is exceptional is the trade group of intermediate wholesalers who specialize in high-quality fish for sushi and tempura served at sushi restaurants and high-end Japanese cuisine restaurants. As we mentioned above, firms in Tsukiji belong to trade groups depending on the type of fish they handle. It is generally thought to be difficult for a business to change its fish category because of the extensive requirement for fish-specific skill, knowledge, and equipment.[21] Firms, however, can belong to more than one trade association. In this case, firms typically tend to belong to similar types of trade groups, such as shrimp and Japanese Lobster. Table 1 shows the list of trade groups, the type of fish each trade group handles, and the number of firms and shops in 1990.[22]

Firms dealing with tuna have the largest share of firms and shops in Tsukiji. In second place are firms selling fish for sushi and tempura. The third and fourth largest shares are taken by firms that mainly sell their fish to supermarkets and small and mid-sized fish shops.[23] These four categories are the main trade groups in the Tsukiji Fish Market. At the same time, we can observe a certain number of firms that only handle extremely specialized seafood, such as shrimp, Japanese lobster, octopus, and shark.

Second, they can be heterogeneous in the number of shops they have in the marketplace. Third, they can differ in their degree of specialization and in the diversification of the type of

shown as "Licensed Buyers" in the figure.

[21] Fish arriving from different areas are sold from the wholesale traders to intermediate wholesalers in different areas of the market in distinct ways. For example, different areas could have distinct ways of implementing auctions. This has made it difficult for intermediate wholesalers, particularly small ones, to deal with a wide variety of fish, as they would have to send employees to distinct transaction places and they would have to learn the respective rules for these transactions. This is why some trade groups are based on where the fish are from.

[22] A firm can have multiple shop spaces. An explanation of the shop spaces is given in the next section.

[23] Enkai and Kinkai mean "far coast" and "near coast," respectively. The former is outside the greater Tokyo bay area, while the latter is in the greater Tokyo bay area. These two trade groups merged into one group in the 2000s. The name for the new trade group is "Sengyo", meaning fresh fish. This generic name suggests that they are in the non-specialized segment.

Table 1: Overview of trade groups in 1990

Name	Product	Variable name	Number of firms	Number of shops
Omono	Tuna	Tuna	334	545
Tokushumono	Fish for sushi and tempura	Sushi	236	531
Enkai	Popular fish outside Tokyo	Enkai	144	224
Kinkai	Popular fish within Tokyo	Kinkai	109	174
Hokuyo	Salmon	Salmon	75	170
Ebi	Shrimp	Shrimp	68	134
Aimono	Half-processed fish	Aimono	63	108
Renseihin	Fish cake	Renseihin	61	113
Enkanmono	Dried fish	Enkan	55	102
Enyomono	Fish in Far Ocean	Enyo	27	94
Tako	Octopus	Octopus	22	29
Tansuigyo	Freshwater fish	Tansui	16	30
Togei	Whale	Whale	16	74
Tsukudawakai	Tsukudani	Tsukudawa	8	18
Iseebi	Japanese lobster	Iseebi	8	23
Tookakai	Shark	Shark	4	4

fish they handle. Forth, intermediate wholesalers can either sell to large-scale supermarkets or to smaller restaurants. These factors are correlated with one another. Generally, intermediate wholesalers belonging to trade groups that are characterized by the location of fish are more likely to sell to large-scale customers and to handle many varieties of fish. On the other hand, intermediate wholesalers that belong to either the trade group dealing with fish for Sushi or the trade group of specific fish are more likely to sell to a smaller-scale customer and to specialize in one of a few varieties of fish. Finally, small-scale intermediate wholesalers, typically those with only one shop, are likely to be more narrowly specialized or in a niche segment, consistent with an argument by Holmes and Stevens (2014). The demand for specialized type of fish typically come from small-scale restaurants while the demand from large-scale supermarkets are not so specialized.

2.3 Building for Intermediate Wholesalers

Figure 2 is the panoramic picture of the Tsukiji Fish Market. In the center of the picture, there is a quarter circle shaped building. The building houses intermediate wholesalers. Figure

Figure 2: Picture of Tsukiji Fish Market

3 shows the introductions of each building in the market, flow of fish, and flow of buyers.[24] As we discussed, fishes in Tsukiji are first handled by seven large wholesale traders and they

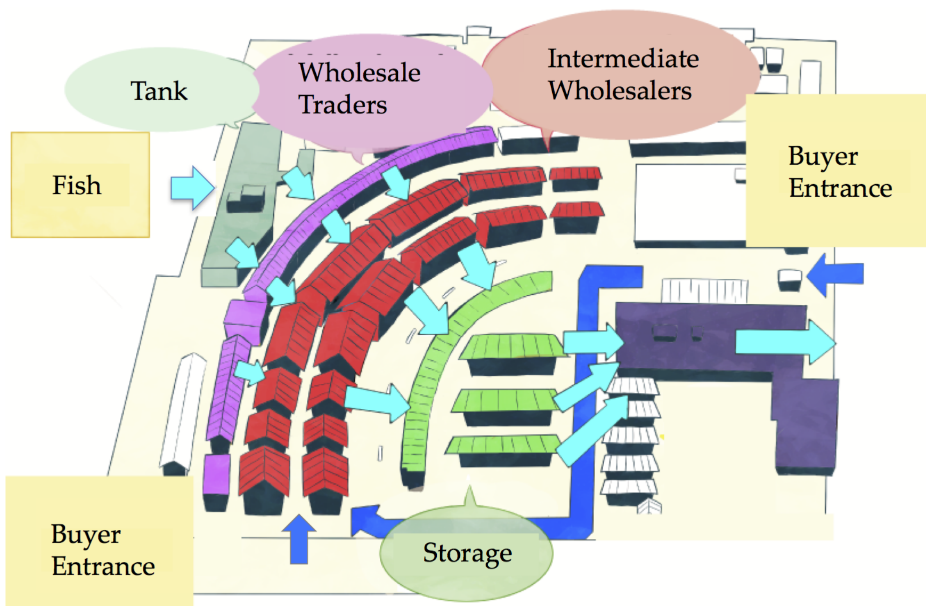


Figure 3: Buildings of Tsukiji Fish Market, Flow of Fishes, and Buyers

sell the fish to intermediate wholesalers at the light-colored (purple) curved buildings at the left side of the figure. The transactions between the wholesale traders and the intermediate wholesales occur at dawn. Then, intermediate wholesalers sell their fish to their customers

[24]There used to be railway tracks right outer area for the wholesale traders.The market was built in its shape in order to handle efficiently fish carried by trains.

who come to the market early in the morning till around 9 am. Fan-shaped areas in dark color (red) are the building housing intermediate wholesalers.[25] The fish flows are shown in the figure by light-colored (sky-blue) arrows. Customers of intermediate wholesalers come from two entrances of the market, and enter the building of intermediate wholesalers from the bottom part of the figure. The buyer flows are shown in the figure by dark-colored (blue) arrows.

Detailed structure of the building housing intermediate wholesalers is shown in Figure 4. The width of the building is around 70 meters, and the length (walking through the center

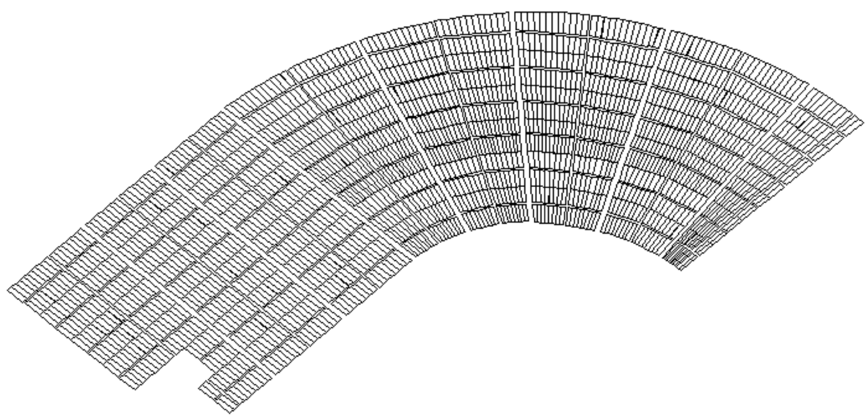


Figure 4: Building for Intermediate Wholesalers

of the building from the left to the right ends) is around 300 meters. As the figure shows, the building consists of 12 rows and 15 column blocks of stalls (i.e., shop spaces),[26] where each column block has eight to twelve stalls. Each small rectangle in the figure is one stall. There are approximately 1,700 stalls overall. The rows and column blocks are divided by vertical streets and horizontal corridors.[27] All of the horizontal corridors between rows have the same width, but the width of the streets between columns is different. There are seven large and eight small vertical streets.[28] Figure 5 shows the location of corridors and streets in the market. Figure 5a shows the horizontal corridors. Curves in black are the horizontal

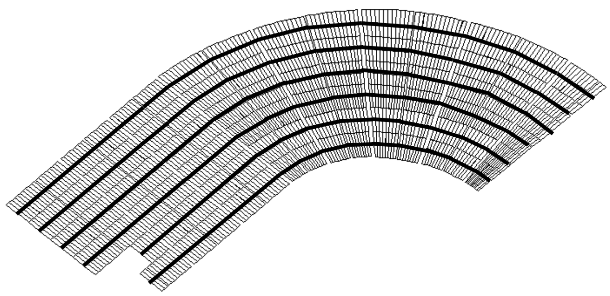
[25]In Figure 3, the buildings for the wholesale traders and intermediate wholesalers look separated, but they are in fact under one roof.

[26]We use stalls and shops interchangeably.

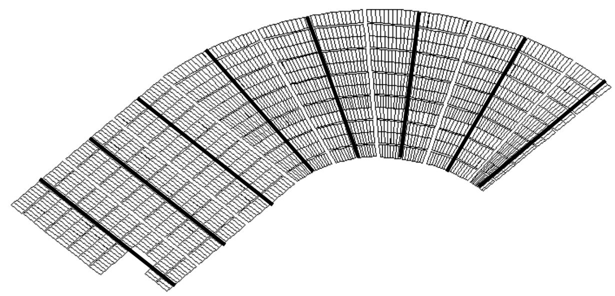
[27]We use "street" to indicate a vertical street, while we use "corridor" to indicate a horizontal corridor.

[28]They are literally called "large streets" and "small streets" in the market.

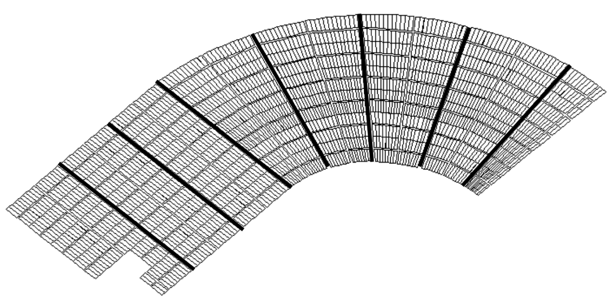
corridors. As the figure shows, there are six horizontal corridors. Figure 5b shows the location of small vertical streets in black. Finally, Figure 5c shows the location of large vertical streets in a similar way.



(a) Horizontal Corridors



(b) Vertical Streets (Small)



(c) Vertical Streets (Large)

Figure 5: Corridors and Streets in Tsukiji Fish Market

The characteristics of the stalls differ within the building. As we can see from Figure 4, there are stalls in the rectangular areas on the left and fan-shaped areas on the right. Stalls in the rectangular area are of the same size, but in the circular area, the stalls become larger from the inner to the outer parts (i.e., from the bottom part of the figure to the top part). On average, the area of one stall is 7.2 m^2. The main entrance of the building for buyers is located at the bottom left of the figure. Buyers walk through the building to shop for fish. Thus, the rectangular area and the stalls in the bottom part of the figure are attractive because they provide easy access for the customers. The stalls located on the corners of one of the large streets are also attractive to customers, since the other corridors and streets are quite narrow. As mentioned above, the attractiveness of stalls differs and greatly affects the performance of the firms. The intermediate wholesalers agree that the stalls on the corner are good locations for them. Ensuring fairness for the firms in terms of their locations is one important reason why they continue to use the location lottery system for the long term.

Since there are approximately 1,700 stalls (i.e., shop spaces), which exceeds the number of firms, some firms occupy more than one shop space. Firms can extend their shops by buying the right of stall-holding from the other firms. As we mentioned, the area of one stall is quite small, especially for high-performing firms, which have many customers and deal with a high volume of fish. In general, high-performing firms tend to extend their shops to deal with the large amount of fish. When they occupy more than one shop space, they almost always occupy spaces that are horizontally adjacent to each other because of the convenience for the business.[29] [30]

2.4 Buyer Trip Behavior

In this section, we explain background information and anecdotes of buyer trip behavior and those about complementarity of products. There are two points worth mentioning that shape buyers' trip behavior. First, there is uncertainty in the availability of fish in each store because the types of fish arriving at the market vary daily. Second, although the entire Tsukiji Fish Market is not very large, the corridors are small. Furthermore, the market is only open in the early morning (mainly 6 a.m.- 9 a.m.), so navigating the narrow corridors in heavy congestion through the entire market is extremely costly for buyers with limited time.

These two factors lead to the following buyers' trip behavior. First, buyers typically have one to five of their favorite sellers that they visit daily.[31] Buyers have these favorite sellers because these sellers treat them well to compensate for the uncertainty of fish availability. Second, buyers are simultaneously willing to try new sellers and to eventually replace them as new favorite sellers. Third, because of all these factors, typical buyer trip behavior is to

[29] Since the average size of a stall is only 7.2 m^2, the benefit of using connecting stalls without a wall is substantial.

[30] One may be concerned that it is difficult to buy the right of stall-holding from horizontally located firms. However, in the location lottery, a firm with multiple shops applies for one lottery for all of its shops and can thus have its shops next to one another. Therefore, a firm that plans to extend its shops does not need to buy the right of stall-holding from the horizontally located firms if they buy the right of stall-holding just before the lottery. In fact, most of the trading rights for stall-holding take place just before the location lottery.

[31] In fact, many sellers keep fish for their frequent buyers under their counters, hidden from wandering strangers, which makes it even more difficult for new buyers to search.

visit a few main sellers and then briefly look around the surrounding stores of the main sellers. We are still collecting the anecdotes of shopping behaviors. Many seem to walk through the horizontal corridor of their main sellers where firms face each other and is easy to look around the stores for buyers, avoiding walking through vertical streets where the visibility is limited.

Under such trip behavior, we were able to collect ample anecdotes of complementarity from the diversity of neighboring stores. It is recognized as a realistic channel of neighborhood effects among intermediate wholesalers.

The term "Tsuidegai" is used in the Tsukiji fish market. This term refers to a mostly unplanned purchase of fish at one shop after a planned purchase of another type of fish nearby.[32] We have ample stories demonstrating "Tsuidegai" from our interviews with managers of intermediate wholesalers. One manager told us that shops selling fish for Sushi can benefit from the presence of a high-performing shop specialized in tuna because a Sushi restaurant chef typically buys tuna first and then looks for other fish.[33] Another manager who specializes in high-quality whitefish for Sushi restaurants told us that his shop would benefit from the presence of other shops that specialize in other types of high-quality fish for Sushi. On the other hand, a manager who operates a large-scale shop dealing with popular fish shared that "Tsuidegai" is not important for his business, as his customers are large-scale supermarkets. These episodes suggest that a diverse neighborhood benefits buyers with love of variety preference because it enhances the potential list of shops they could visit, and it can enhance experimentation and discovery through unplanned purchases. Furthermore, these episodes suggest that a more specialized shop is likely to benefit more from the diversity of other shops. In addition, the impact of this would be higher for small-scale intermediate wholesalers because new purchases generated by such shopping externalities should be larger in proportion.

2.5 Relocation Lotteries

The market and the land are owned by the Tokyo Metropolitan government. The relocation lottery was introduced to mitigate inequality and unfairness associated with the location advantages described in the previous section. These relocations (i.e., Tempo Ido) have been major events, as they involve the whole re-installation of equipment for every shop. The relo-

[32] "Tsuide" literally means "on the occasion of" or "in addition to" in Japanese, and "gai" means "purchase."

[33] This anecdote may better correspond to what marketing studies call "anchor stores."

cations and associated lotteries took place every four years until 1990. After 1990, the timing became irregular because of debates on the relocation of the whole market. The lotteries were performed in 1990, 1995, and 2004.

Each lottery consisted of two parts: the preliminary and main lotteries. In the preliminary lottery, the market was divided into four blocks. Then, firms submitted their preferences to one another. If there were more firms than locations in these blocks, the lottery was implemented to determine who could enter the block. If a firm did not win a lottery for a block, it had to reapply for a different block where there was still a vacancy. Figure 6 shows the blocks for the preliminary lottery. Then, after the blocks the firms went to were determined, the main lottery was held for each block, and the exact location within the block was determined.

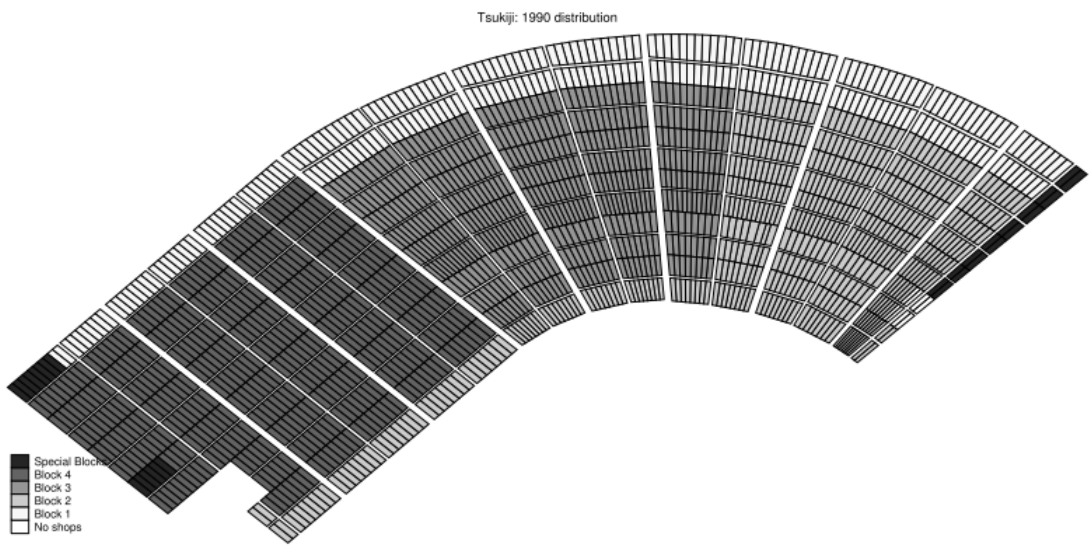


Figure 6: Blocks for the preliminary lottery

In the main lottery, a firm owner drew a ball printing a number by a lottery machine. The location was determined by the number printed on the ball in the manner shown in Figure 7. Namely, the location in each block was assigned to the first row from left to right and then to the second row from right to left, etc. For example, for the case of Block 1, colored white in Figure 7, the assignment of the shop locations started from a stall located at the left-end of the block highlighted by a circle. A firm that drew the number one in the lottery was assigned to the stall. If the firm had multiple rights of, for example, four shops, four contiguous stalls from the starting stall to the direction of the arrow were assigned to the firm. Then, the firm that drew the number two assigned their stalls next to those for the firm that drew the number one. Once this process reached the right-end, it turned to the left and was repeated until the all the shops in the block were assigned, as Figure 7 shows. The other blocks were assigned by the same procedure. The starting stalls are also highlighted by circles. This lottery system allowed a firm with multiple shops (i.e., multi-shop firms) to place their

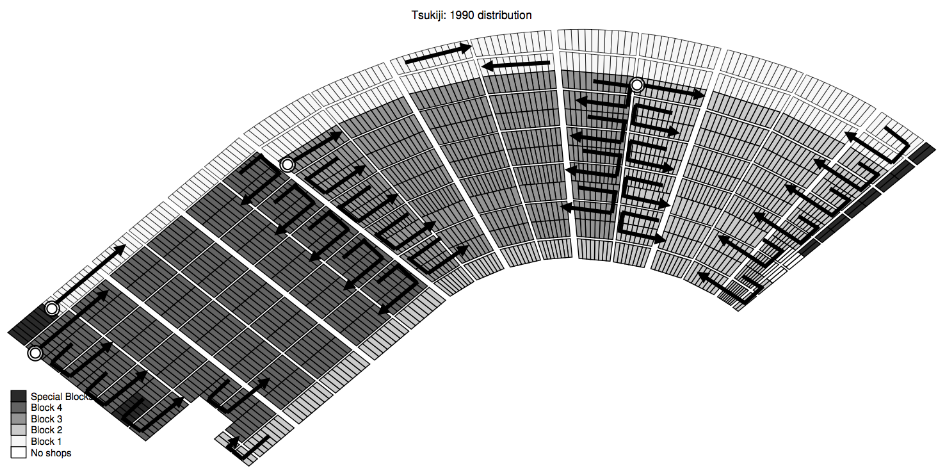


Figure 7: Assignment of shop location by main lottery

shops next to one another. One feature of the lottery worth emphasizing is that the lottery number would not determine the exact location ex ante because of the assignment rule and because of the existence of multi-shop firms. The exact location of a firm depended on its lottery number and the number of shops that would have been occupied by the other firms that drew lottery numbers smaller than theirs. This feature was useful in preventing fraud, since there was no point in aiming for a particular lottery number. In addition, exchanges of shops after the lottery is not allowed.[34]

There was another important feature of the lottery. The unit of application for the lottery was two shops. Single-shop firms as well as firms with odd-numbered store spaces had to form a pair. Furthermore, group application for more than one unit was allowed. According to Bester (2004), the average size of a group was 3.6 shops in the 1990 lottery.

This system of group applications could potentially pose a threat to our identification strategy, as there is a degree to which horizontal neighbors are self-selected. Unfortunately,

[34]For the 1995 lottery, we were able to obtain hand-written records of the lottery published internally a day after the lottery implementation and to compare the records to the actual location of shops. We did not find any evidence of shop space swapping.

we do not have information on joint applications. However, we find that when one space of a unit (two consecutive store spaces) is occupied by a firm with an odd number of store spaces, the other space is also occupied by another firm with an odd number of store spaces for more than 95 % of the cases where the second firm is different from the first one. This suggests that large-scale groups that involve more than two firms are rare.[35] Our analysis for the validity of randomization, presented in Section 4, suggests that group applications do not lead to a systematic violation of randomization. A suspicious reader might still wonder whether this could be because our data do not capture all of the relevant characteristics. However, whether neighbors faced each other across horizontal corridors was completely out of the control of the firms because the lottery numbers of the two shops facing each other were typically far apart, which is a point also mentioned by Bester (2004). We will explore this feature in one of the robustness check analysis presented in Section 5.3.

Finally, economists may wonder why the Tsukiji market has been implementing lotteries as their way of assigning store spaces to intermediate wholesalers. Different arrangements have indeed been discussed. It seems that assigning "good locations" to firms that have a higher willingness to pay is incompatible with the notion of fairness of firms in the market. Another interesting anecdote is that creating zones according to fish specialty was discussed but not adopted precisely because it would have forced buyers to walk around wider areas of the market if they want to buy several types of fish. This anecdote suggests that firms in this market recognize the value of diversity of shops in all parts of the market.[36]

3 Data and Empirical Strategy

3.1 Data

For our analysis, we need to know the exact location of firms within the market and the characteristics of firms. We use industry newspapers ("Nikkan Shokuryo Shimbun") and the directories ("Kumiaiin Meibo") compiled by the union (To-oroshi) and the news paper company ("Nikkan Shokuryo Shimbun") for the 1990 and 1995 location lotteries. Directories compiled

[35] Anecdotes tell of enormous psychological pressure on a person who draws a lottery on behalf of other firms.

[36] Indeed, it is not theoretically straightforward to achieve optimal allocation when diversity is important or when externality is present. Simulating alternative mechanisms based on our estimates would be an interesting extension.

by the union (To-oroshi) and the news paper company ("Nikkan Shokuryo Shimbun") provide information on the locations and trade group affiliations, which allows us to identify the fish specialties of firms. Furthermore, we obtain the block information on the preliminary lottery from industry newspapers ("Nikkan Shokuryo Shimbun").

In addition, we use two sources in the analysis for robustness check and extension. First, we use internal records of the trade group for sushi to classify firms into high quality and more specialized ones and firms that are not. The detail is explained in the later relevant section. Second, we use the Census of Commerce which is conducted by the Ministry of Economy, Trade and Industry to obtain information on firm-level sales. This Census survey is conducted every two or three years on all stores engaged in wholesale and retail trade, though the response rate for small firms such as ones in our sample is not extremely high (around 70% in our sample). The Census of Commerce is available to researchers only since 1997. Therefore, we cannot analyze the changes in sales before and after the 1990 lottery. However, if the 1990 neighborhood characteristics generated by the lottery are random, we could attribute the differences in sales 1997 to the neighborhood characteristics.

3.2 Key Mechanism of Neighborhood Effect

Both theory and anecdotal evidence of the neighborhood effects suggest that the diversity of neighboring shops reduce the trip and search cost of buyers who have demand for varieties of fish. Therefore, we investigate the following hypothesis.

Hypothesis: Neighborhood diversity affects the firm performance.

This hypothesis states that the wide variety of specialized neighboring firms makes a neighborhood more attractive through the customers' love of variety preferences, positively affecting firm performance in such a neighborhood. Under customers' love of variety preferences with monopolistic competition, we can derive the positive effect of diversity for firms in realistic settings. As an example, in the Appendix, we present a model of three-tier CES with R regions, M groups and N varieties, a setting borrowed from Matsuyama (1992), to show that the diversity positively affects the performance of stores if the elasticity of substitution between regions is higher than that between varieties which in turn is higher than that between groups.[37] This means that the degree of competition is highest among regions and the degree of intra-group competition is higher than that of inter-group competition, which we believe is quite realistic for close regions.

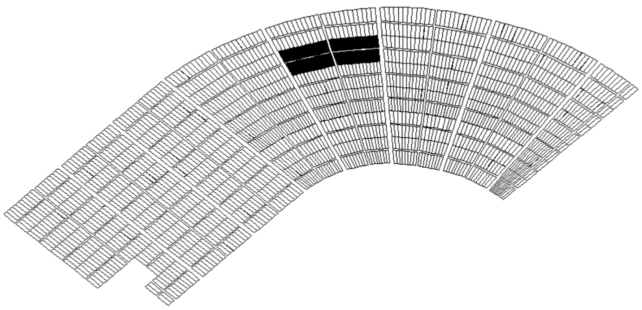
In our empirical analysis, we add one layer of heterogeneity based on our understanding of the context, namely, we hypothesize that this diversity is likely more beneficial for smaller or specialized firms. Some of neighborhood effects through diversity come from unplanned, auxiliary or trail purchases by customers, though firm may manage to become eventually one of the main sellers for them. The amount of the demand by such purchases is likely to be smaller than those from the main customers. Thus, the magnitude of the neighborhood effects would be relatively larger for smaller firms who are likely to have a smaller number of main customers. In addition, in our context, big firms or firms selling in a standardized segment typically sell to supermarkets whose worker do not often come to the market. The model that we present in the Appendix is not likely to apply to such firms, thus externality from shopping would be less for these firms. For these reasons, in our analysis, we first present our results based on the comparison between large firms (multi-shop firms) and small firms (single-shop firms). Then, we proceed to the analysis whether specialization matters.

3.3 Empirical Strategy

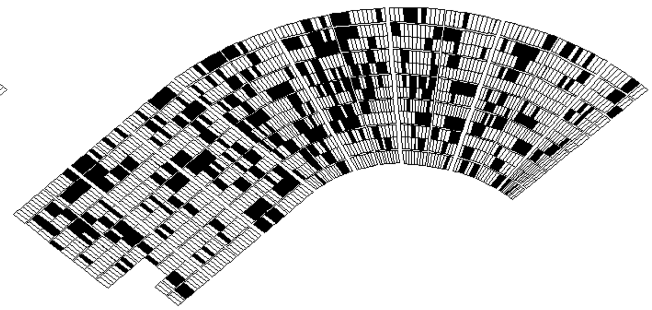
We test the hypotheses by regressing firm i's performance on its neighborhood characteristics. To construct neighborhood characteristic variables, first, we define neighborhood region as the unit of the areas in which neighborhood effects arise. We define a neighborhood region as a set of stalls consisting of two rows and column blocks of stalls between large vertical streets and stalls sharing one horizontal corridor. An example of a neighborhood region is shown in Figure 8a. The black-colored area is a neighborhood region. We assume that neighborhood effects on firm i's operate within the neighborhood region in which the firm is located.

Based on the neighborhood region, we investigate how the neighborhood characteristics

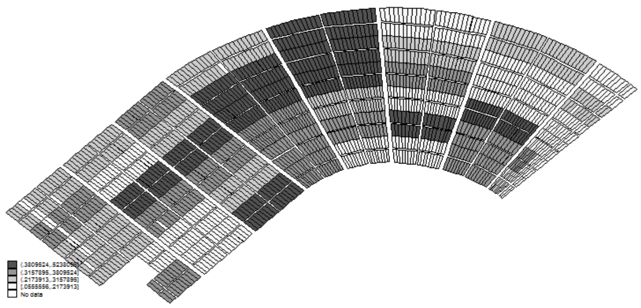
[37] This type of model does not have an explicit cost of traveling, but the situation satisfying the relation mentioned among the three elasticities can be regarded as a situation where the trip cost between the regions is high (Matsuyama 1995).



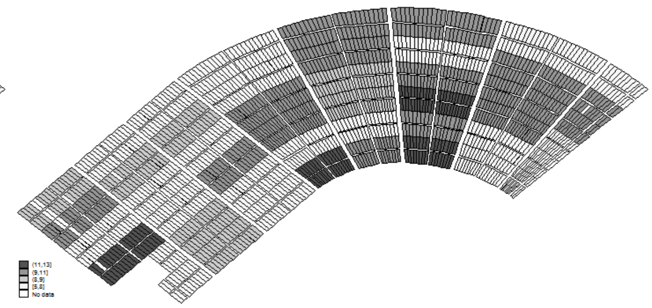
(a) Example of a neighborhood region



(b) Locations of Tuna shops in 1990



(c) Fraction of Tuna shops in neighborhood regions in 1990



(d) Diversity of neighborhood regions in 1990

Figure 8: Neighborhood region and neighborhood characteristics

determined by the 1990 lottery affect firm performance from 1990 to 1995, the next lottery year. That is, we regress changes in firm i's performance from 1990 to 1995 by the firm's neighborhood characteristics in 1990. The estimation equation is as follows,

$$\triangle y_{igr} = \beta_0 + \beta_1 Diversity_r + \beta_2 MultiOwn_i + \beta_3 Diversity_r * MultiOwn_i + (\gamma X_{igr}) + \lambda_g + \varepsilon_{igr},$$

where $\triangle y_{igr}$ is the measure of the changes in the performance of firm i in trade group g located in neighborhood region r from 1990 to 1995; $Diversity_r$ is a measure of neighborhood diversity in neighborhood region r in 1990; $MultiOwn_i$ is a dummy indicating whether firm i is a multi-shop firm, which is our measure of size of the firm; X_{igr} is the set of other characteristics of the firm in 1990; λ_g is trade group fixed effects; and ε_{igr} is stochastic disturbance. Below, we explain our measures of performance, neighborhood variables, and firm and location characteristics.

Measures of firm performance

As for firm i's performance, we use the number of shops the firm owns. As we mentioned, firms can extend their shops by buying right of stall-holding from other firms. The number of shops can be considered a measure of a firm's performance. We confirmed that the number of shops is strongly positively correlated with sales, sales per worker, and sales per shops, using the subset of the firms that can be linked to the Census of Commerce 1997. Given that the micro-data of the Census of Commerce is available to researchers only since 1997, the number of shops is the only variable we can use to analyze the effect of the 1990 lottery.

Specifically, we construct a dummy variable for exit, $exit_{igr}$, that takes one if firm i exits from the market and zero otherwise. We also construct $\triangle Shops_{igr}$, which is the difference between the number of shops a firm applied in the 1990 lottery and the number in the 1995 lottery, conditional on survival. As a variable that captures both dimensions of the two variables, we use $Dincrease_{igr}$, a dummy variable taking one if firm i increased its number of shops from the 1990 lottery application to the 1995 application, and zero otherwise (including exit).

As we mentioned, a firm's decision of extending shop is typically conducted just before the lottery under the large uncertainty of its future location. Two features are noteworthy. First, at the time of a lottery, firms can extend the number of shops by buying stall holding rights from firms with far-away stores. In normal times, firms would need to buy stall holding rights from directly neighboring firms to extend their shops. Thus, the analysis of the changes in the number of shops between a lottery time and some point of time far before the next lottery would be problematic as there would be a mechanical negative correlation of the changes in the number of shops among the firms in a neighborhood region. This problem does not exist in our analysis using the changes in the number of shops between two time of lottery applications. Second, if a firm's current better performance comes from better location by the lottery, the location benefit will decline once the next lottery assigns a worse location to the firm. Then, one may consider that there might be no incentive to extend shop even for firms with currently better performance, and thus the extension of shops might not be an appropriate measure for firm performance. Anecdotes tell that regular customers of a shop tend to continuously visit the shop after the lottery. Thus, once a better location increases the regular customers, shop owners increase their shops expecting that at least some fraction of these increased customers will continuously visit their shops after the lottery. Furthermore, we use sales after the second lottery as an alternative measure of performance in Section 5.4, to show that the beneficial neighborhood effects are persistent.

Diversity and other neighborhood variables

We use the total number of unique trade groups to which neighborhood firms belong as the neighborhood diversity variable.[38] Since we conjecture that the diversity effects differ by firm size, we consider the interaction term between the diversity variable and a dummy variable indicating whether firm i is a multi-shop firm, $MultiOwn_i$. We expect $\beta_1 > 0$ and $\beta_3 < 0$.

Furthermore, several anecdotes suggest that other neighborhood characteristics which may be correlated with the neighborhood diversity may also affect firm performance. We control two such other neighborhood characteristics. The first one is agglomeration effect of the same trade group. The presence of other firms belonging to the same trade groups makes a neighborhood more attractive, because it makes it more likely that buyers can find exactly what they are looking for (their ideal variety). Therefore, it positively affects the performance of the firm in such a neighborhood. We use the fraction of other shops in region r belonging to the same trade group as firm i to capture the agglomeration effect of the same trade group. We should emphasize that the faction of the firms from the same trade group is a store-group specific variable, thus is not necessarily perfectly negatively correlated with the diversity. For example, if the neighboring shops of a shrimp shop are all tuna shops, then both the diversity and the fractions of the firms of the same group for this shrimp shop are minimal.

The second one is presence of high performing shops in neighborhood. It is natural to think that the presence of other larger or more-productive firms makes areas more attractive (through "Tsuidegai") or more competitive. Theoretically, this would be related to the anchor store theory (e.g., Konishi and Sandfort, 2003). We use the fraction of other shops owned by multi-shop firms to capture the spillover effects from productive firms or firms competing in standardized products.

An example of the actual location of shops and the neighborhood variables we defined

[38] In Section 5.2, we use an alternative measure of diversity. See the Appndix for justification of these measures.

are visually shown in Figure 8. Figure 8b shows the location of shops selling tuna in black as the result of the 1990 lottery. The density of Tuna shops varies across different parts of the market. Figure 8c shows the fraction of Tuna shops for each neighborhood region we defined, with darker colors representing larger fractions, which confirms that there is a substantial variation. Figure 8d shows the diversity of neighborhood regions in 1990. Darker colors represent larger diversity. These figures illustrate the type of variations we use in our estimation.

Initial firm characteristics (control variable X_{igr})

As for the initial firm characteristics, X_{igr}, to control for firm and physical location characteristics, we include the following variables. We include a corner dummy indicating whether firm i is located on the corner of a large vertical street. We also include 1990 lottery block fixed effects as the locations are random with blocks. Furthermore, to control for local characteristics (e.g., areas nearby the entrance may attract more buyers), based on the neighborhood region, we construct two coordinate variables, one capturing the horizontal distance from the right end of the map of the market, another one capturing the vertical distance from the top end of the map of the market. To control for the size of firms, we include a multiple-shop dummy, as mentioned above. To control for specialization (or lack of it), we control the number of trade groups to which firm i belongs, which we call "own diversity".

Summary Statistics

Table 2 shows the summary statistics of the key variables. We also show the summary statistics of each key variable by single- and multi-shop firms and conduct a t-test for the mean of the variables of each firm. There is a significant mean difference in the dummy for exit, the dummy for increasing the number of shops, and changes in the number of shops conditional on survival. These imply that multi-shop firms are more likely to increase the number of shops more and to have a lower exit rate. However, conditional on survival, single-store firms increase more the number of shops, although this has a mechanical component, as this variable cannot take a negative number for single-store firms. Also, the probability of owning a store on the corner is higher for multi-store firms. However, this is mechanically true in the sense

Table 2: Summary statistics

	Single Store	Multi Store	Total
Dummy for Exit	0.13***	0.06***	0.11
	[0.01]	[0.01]	[0.01]
Dummy for Increasing the Number of Shops	0.09*	0.13*	0.1
	[0.01]	[0.02]	[0.01]
Changes in the Number Shops Conditional on Survival	0.12***	0.00***	0.08
	[0.02]	[0.05]	[0.02]
Dummy for Owning a Store on the Corner	0.09***	0.28***	0.15
	[0.01]	[0.02]	[0.01]
Number of Trade Group Affiliations (Own diversity)	1.03***	1.32***	1.13
	[0.01]	[0.03]	[0.02]
Number of Trade Groups in the Neighborhood Region	9.24	9.08	9.19
(Neighborhood diversity)	[0.07]	[0.09]	[0.06]
Fraction of the Firms from the Same Trade Groups	0.18***	0.25***	0.2
in the Neighborhood Region	[0.01]	[0.01]	[0.01]
Fraction of Firms Owning Multi-Stores	0.36	0.35	0.36
in the Neighborhood Region	[0.00]	[0.00]	[0.00]

Notes: Standard errors of means in brackets. ** and *** indicate significance at the 5% and 1% level, respectively.

that the more shops a firm owns, the greater the probability the firm owns at least one shop with a certain characteristic that has to be increased. The number of trade group affiliations is higher for multi-shop than single-shop firms, suggesting that firms tend to extend their shops with the increase of their own diversity. Note that the fraction of the firms from the same trade groups in the neighborhood region is higher for the multi-shop firms, but this should not be interpreted as evidence of a violation of the randomization assumption. A firm would be likely to find a higher fraction of firms of the same type if it belongs to trade groups with more affiliated firms and if the firms themselves belong to more trade groups, even under a completely random assignment of locations. In the following section, we provide the formal test of randomization taking these factors into consideration.

4 Validity of Randomization

The key assumption for our identification strategy is that the assignment of locations is random. In this section, we provide several types of test to confirm the assumption.

4.1 Balance Test

The random assignment of locations predicts that the neighborhood variables should not be systematically correlated with firm i's characteristics within the lottery blocks.[39] We check this correlation by OLS. The left-hand-side variables are the key neighborhood variables, namely, neighborhood diversity, fraction of firms in the same trade group, and fraction of multi-shop firms,. The right-hand-side variables are firm i's characteristics. Note that the neighborhood characteristics could be correlated with firm i's characteristics mechanically, especially with the fraction of firms in the same trade group.

Since the number of firms in each trade group is different, the probability that firm i's neighborhood has firms from the same trade group depends on the total number of firms in the trade group as a whole, even if the location assignment is purely random. To control for this mechanical correlation, we include the market-level (not region-specific) fraction of the firms of the trade group of firm i over all the firms in the market as a predicted neighborhood variable. The results are shown in Table 3. In Column (1), we regress neighborhood diversity on the characteristics of the firm. The coefficient on the dummy indicating whether firm i belongs to the Sushi trade group is negative and statistically significant at the 10 percent level. Other than this variable, none of the key firm characteristics are correlated with the diversity of the neighborhood regions. In Columns (2) and (3), we use the fraction of multi-shop firms and that of firms in the same trade group as the dependent variable, respectively. In both estimation results, there is no variable that significantly correlates with the neighborhood variables. These results reassure us of the randomness of the location assignment.[40]

4.2 Dartboard Approach

We check the validity of randomization in another way. If the shop location allocation is random, it should be indistinguishable from that generated by the "Dartboard approach". If shops are randomly assigned over the space in the market, there should be no agglomeration of a specific type of shop in the market. We show that shop locations in the market are

[39]Neighborhood variables can be correlated with firm characteristics across the lottery blocks because many firms can choose a block unless they did not get the desired block at the preliminary lottery.

[40]Another implication of random assignment is that neighborhood variables do not exhibit spatial auto-correlation at the neighborhood region level. We confirm this implication. The results are available upon request. See also Figures 8 (c)(d).

Table 3: Balance test results

Dependent	(1) Neighborhood diversity	(2) Fraction of firms of the same trade group	(3) Fraction of multi-store firms
Dummy for multiple shops	-0.105	0.00493	-0.00739
	(0.112)	(0.00736)	(0.0104)
Corner	-0.0966	0.0115	-0.00529
	(0.0967)	(0.00786)	(0.00475)
Own diversity	0.661	0.0542	0.0257
	(0.594)	(0.0383)	(0.0361)
Enkanmono	-0.287	0.0259	0.00642
	(0.626)	(0.0380)	(0.0291)
Octopus	0.524	0.0155	-0.0341
	(0.651)	(0.0461)	(0.0465)
Aimono	-0.197	-0.00176	-0.0289
	(0.521)	(0.0393)	(0.0331)
Enkai	-0.264	0.00396	-0.0134
	(0.387)	(0.0289)	(0.0220)
Enyo	-0.0563	0.0372	-0.0188
	(0.976)	(0.0615)	(0.0465)
Kinkai	-0.673	-0.00344	0.00456
	(0.416)	(-0.0300)	(0.0273)
Sushi	-0.371*	0.0159	-0.0109
	(0.215)	(0.0263)	(0.0118)
Renseihin	-0.0722	0.0105	-0.032
	(0.560)	(0.0366)	(0.0323)
Tansui	-0.151	0.0216	-0.0291
	(0.779)	(0.0521)	(0.0377)
Hokuyo	-0.435	0.0648	-0.0174
	(0.514)	(0.0398)	(0.0288)
Shrimp	-0.0785	0.0257	-0.00909
	(0.471)	(0.0407)	(0.0316)
Iseebi	-0.596	-0.026	-0.0457
	(0.849)	(0.0552)	(0.0412)
Predicted neighborhood variable	yes	yes	yes
Block dummy	yes	yes	yes
N	1064	1064	1064

Note: Standard errors are clustered at the region level and shown in parentheses. * indicates significance at the 10% level.

randomly assigned by using the agglomeration index proposed in the literature on urban economics. Specifically, we use the bilateral distance approach proposed by Duranton and Overman (2005).[41] Duranton and Overman (2005) propose a way of testing the agglomeration of an industry. Intuitively, we first calculate the distribution of the bilateral distances between all the pairs of firms in the industry (in our case, trade group); then, we compare the obtained distribution with counterfactual distributions of bilateral distances generated by the random location assignment of firms.

Formally, let n be the number of shops belonging to the focusing trade group A, and we have $n(n-1)/2$ unique bilateral distances between shops in the trade group. Let d_{ij} be the linear distance between shops i and j.[42] The K-density estimator of bilateral distances at any distance d is

$$\hat{K}_A(d) = \frac{1}{n(n-1)h} \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} f\left(\frac{d - d_{ij}}{h}\right),$$

where h is the bandwidth set as the optimal bandwidth as proposed by Silverman (1986), and f is the Gaussian kernel function.

Then, we consider the case where shops are randomly assigned on the market by simulation. In the simulation, we randomly assign n shops' locations on overall sites of shops in the market and estimate the bilateral distance distribution under the simulated location distributions. By iterating this trial 1000 times, we construct global confidence bands, i.e., an upper confidence band $K_A^U(d)$ and lower confidence band $K_A^L(d)$ so that of the 1,000 randomly drawn K-densities, 95% lie below the upper band and the other 95% lie above the lower band over the entire distance range we focus on, $[0, d_{max}]$.[43] If $\hat{K}_A(d) > K_A^U(d)$ for at least one $d \in [0, d_{max}]$, trade group A is defined as globally localized at the 5% confidence level. On the other hand, if

[41]The Dartboard approach was initially developed by Ellison and Glaeser (1997). It calculates an agglomeration index using a fixed geographical unit. We calculated their agglomeration and coagglomeration indices using our neighborhood region as the unit. All the indices are close to zero. We report the results from the bilateral distance approach proposed by Duranton and Overman (2005) because this approach allows us to test the random allocation hypothesis as the null hypothesis and because the approach is the standard technique to test the concentration using micro-geographic data, as we do now.

[42]The distance here is calculated based on the unique x and y coordinates on stalls. From right to left, we assign an integer from one to a maximum number of stalls in rows as the x coordinate. From outside to inside, we similarly assign integers as the y coordinate for each stall. Based on these x and y coordinates, we calculate the Euclidean distance as the bilateral distance between shops.

[43]We set the threshold value of the maximum distance d_{max} as the median distance between all pairs of all the industries as Duranton and Overman (2005) suggested.

$\hat{K_A}(d) < K_A^L(d)$ for at least one, and trade group A is not defined as localized, we define trade group A as globally dispersed at the 5% level. In other words, if the estimated K-density is located between the upper and lower confidence bands, we can state that the null hypothesis that the shops in trade group A are randomly allocated is not rejected at the five percent level.

Neighborhood effects might arise not only within the same trade group but also across pairs of different trade groups. For example, as the anecdotal episodes mentioned, Sushi shops may benefit from Tuna shops being located nearby. If so, Sushi shops may choose their locations close to Tuna shops by applying the lottery jointly. To test the possibility of a concentration of shops between trade groups, we also conduct the test for coagglomeration proposed by Duranton and Overman (2005).

To test the coagglomerations, consider trade group A with n_A firms and trade group B with n_B firms. We calculate all the bilateral distances between firms in trade groups A and B. Thus, the K-density estimator is modified as follows,

$$\hat{K}_{AB}(d) = \frac{1}{n_A n_B h} \sum_{i=1}^{n_A} \sum_{j=1}^{n_B} f\left(\frac{d - d_{ij}}{h}\right).$$

Similar to the single trade group concentration, we can construct the confidence bands by counterfactual simulations that the locations of shops in trade groups A and B are randomly assigned.

As we mentioned, the location lotteries are conducted in two steps. In the first step, shops can choose their preferable blocks. In this sense, the choice of blocks cannot be random. To address this issue, we conduct the analysis within the lottery block. That is, we restrict shops in a trade group in a block, and then we test their agglomeration. Thus, the results are obtained by the combination of trade groups and blocks.

As the results, on agglomeration, there are 31 testable combinations of trade groups and block.[44] There is no trade group significantly agglomerated at the five percent level. Similarly, on coagglomeration, there are 192 testable combinations of trade group and block, and there is no trade group significantly coagglomerated at the five percent level. Both in agglomeration and coagglomeration, there is no deviation from random assignment of locations.[45]

[44] Some combinations have the number of observations too small for this test to be feasible.

[45] We conducted additional analysis where we run the regressions of a dummy indicating if there is a shop of trade group g within next K shops on the set of trade group dummies and block fixed effects. We find almost

Furthermore, to check the overall tendency of the allocation of shops, we also conduct an analysis pooling the trade groups. That is, we calculate the bilateral distances between firms in each trade group, and then we pool all the calculated bilateral distances and estimate the K-density. The K-density for agglomeration is modified as follows.

$$\hat{K}_{\text{agg}}(d) = \frac{1}{h \sum_{A \in \mathfrak{A}} n_A(n_A - 1)} \sum_{i=1}^{n_A - 1} \sum_{j=i+1}^{n_A} f\left(\frac{d - d_{ij}}{h}\right),$$

where $\mathfrak{A}$ is the set of trade groups. On the counterfactual simulation, we reshuffle all shops in all the trade groups simultaneously in each trial.

Similarly, we conduct an analysis for coagglomeration pooling the pairs of trade groups. In this case, we calculate bilateral distances between firms in each pair of trade groups. Then, we pool all the calculated bilateral distances and estimate the K-density as follows,

$$\hat{K}_{\text{coagg}}(d) = \frac{1}{h \sum_{\{A,B\} \in \mathfrak{A} \times \mathfrak{A}} n_A n_B} \sum_{i=1}^{n_A} \sum_{j=1}^{n_B} f\left(\frac{d - d_{ij}}{h}\right).$$

The results are shown in Figure 9.

Figure 9a shows the result of agglomeration, and Figure 9b shows the result of coagglomeration. In both figures, the estimated K-densities are located inside the confidence bands. This implies that the actual location distribution of shops in the Tsukiji fish market does not differ from counterfactual random allocations.

5 Results

5.1 Baseline Results

We show the results from our baseline regressions in Table 4.

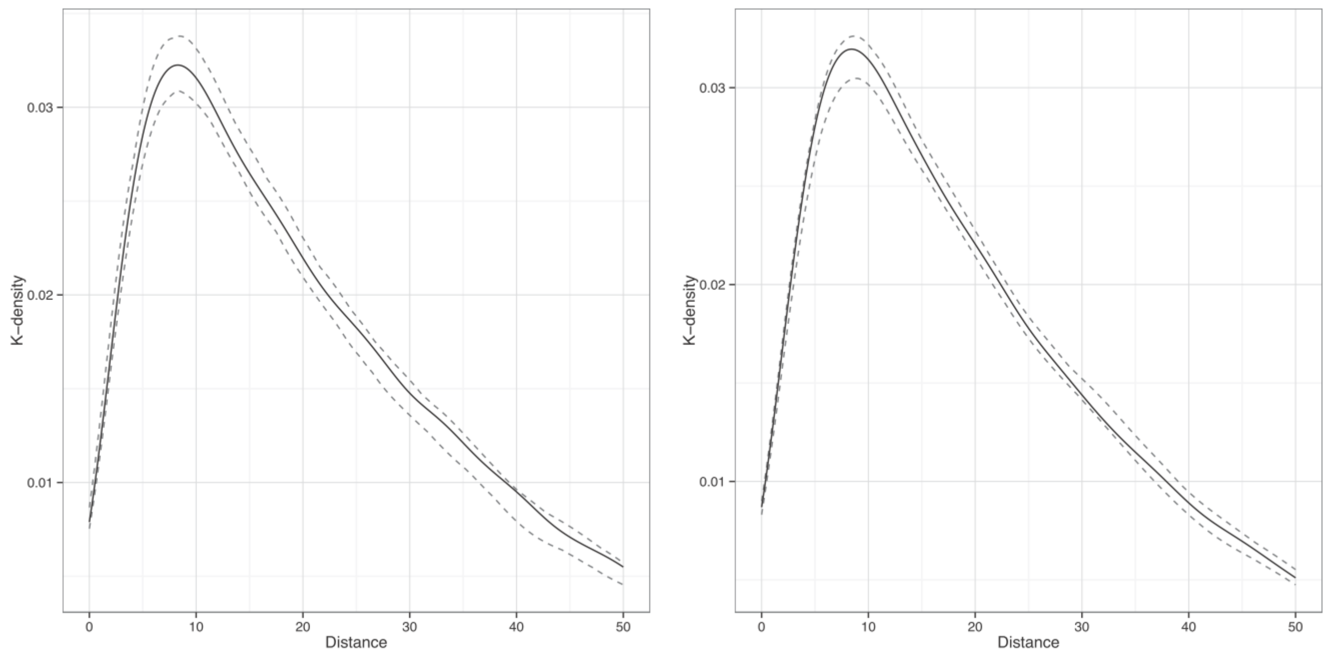
In Column (1), we use the change in the number of shops as the dependent variable. The coefficient on the neighborhood diversity variable is positive and statistically significant. This implies that neighborhood diversity has a positive effect on single-shop firms. On the other hand, the coefficient on the interaction term between neighborhood diversity and the multi-shop dummy is negative and statistically significant. The magnitudes of the two imply that

no statistically significant coefficients for any group g and for K between 1 and 10. The results are available upon request.

Table 4: Results on all the neighborhood variables

	(1) Δ no. of shops	(2) Exit	(3) Shop increase dummy
Neighborhood diversity	0.024**	-0.007	0.022***
	(0.012)	(0.008)	(0.006)
Neighborhood diversity	-0.061***	-0.012	-0.032***
× Multi-shop dummy	(0.019)	(0.014)	(0.011)
Fraction of firms of the same trade group	0.130	0.047	0.260**
	(0.248)	(0.087)	(0.122)
Fraction of firms of the same trade group	-0.167	-0.162	-0.286*
× Multi-shop dummy	(0.392)	(0.136)	(0.158)
Fraction of multi-shop firms	0.432**	-0.211	0.315***
	(0.170)	(0.162)	(0.095)
Fraction of multi-shop firms	-1.109**	0.327	-0.507***
× Multi-shop dummy	(0.447)	(0.323)	(0.172)
Multi-shop dummy	0.828***	-0.049	0.778***
	(0.232)	(0.141)	(0.143)
Own diversity	-1.276**	0.042	0.019
	(0.568)	(0.089)	(0.103)
Corner dummy	0.145**	-0.027	0.045*
	(0.070)	(0.021)	(0.026)
Block fixed effects	Yes	Yes	Yes
Area fixed effects	Yes	Yes	Yes
Trade group fixed effects	Yes	Yes	Yes
Year	1990	1990	1990
N	943	1040	997

Note: Clustered standard errors by neighborhood region are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.
Own diversity is defined as the number of trade groups that a firm belongs to.
Neighborhood diversity is defined as the total number of unique trade groups of other firms in the same neighborhood region.



(a) Agglomeration (b) Coagglomeration

Figure 9: Results of pooled analysis

the diversity of neighborhood firms negatively affects the performance of multiple-shop firms. These together suggest that the diversity of neighborhood firms has positive effects, through consumers' love of variety preference, on single shop firms who would be specialized in a certain fish specialties, while the negative effect of competition from such small and specialized firms dominates this positive neighborhood effect for multi-shop firms who would be diversifying their fish specialties.

On the other neighborhood characteristics, the coefficient on the fraction of same trade group is positive, and the coefficient for the interaction term between fraction of same trade group and multi-shop dummy is negative, but either coefficient is not statistically significant. Thus, for this particular dependent variable, the effect of the agglomeration of the same type of firms does not seem to be important. The coefficient on the fraction of multi-store firms in the neighborhood region is positive and statistically significant, while the coefficient on its interaction term with the multi-shop dummy is negatively and statistically significant. These together suggest that multi-shop firms intensively compete each other, but single-shop firms likely being specialized in a certain fish specialty can benefit from the presence of multi-shop firms through the demand spillover.

In Column (2), we use the exit dummy as the dependent variable. No coefficient of interest is significant, suggesting that the neighborhood diversity and other neighborhood effects we consider are not big enough to affect exit, which is the most extreme outcome for firms. One reason may be that the most common reason for exit in this market is the retirement of an aging owner, some of which may happen independently of the performance of shops.

Finally, in Column (3), we use the shop increase dummy as the dependent variable. Results are similar to that in Column (1), but all the three types of the neighborhood effects, including the effect of the fraction of the same type of firms, are statistically significant. In addition to the neighborhood effects we have documented, we should note that having a shop on the corner significantly helps firms to increase the number of shops, which is consistent with the perception of the intermediate wholesalers.

Using the coefficients from the regression result shown in Column (3), we calculate the magnitude of the impacts of the neighborhood diversity as follows. The baseline probability of expanding the number of shops for single-store firms is 9 percent. The coefficient on the neighborhood diversity (0.022) implies that adding one unique fish specialty in the neighborhood region would increase the probability of expanding the store by 2.2 percentage point, which corresponds to around 25% increase from the baseline. The standard deviation of the neighborhood diversity is 1.8, which would imply that one standard deviation increase in the neighborhood diversity would increase the probability of expanding the store by 4 percentage point, which would correspond to around 45% increase from the baseline.

The magnitudes of the neighborhood diversity is substantial comparing to the physical characteristics of the shop location. In our estimation, getting the corner would increase the probability of expanding the store by 4.5 percentage point. This is mostly similar impact of the one standard deviation increase of either of the two neighborhood variables. However, the probability of getting corner for a single shop firm is around 8.6%, while the fraction of single-shop firms that are located in a neighborhood of at least 11 unique fish specialty (one standard deviation increase from the mean) is around 30%. In this sense, the neighborhood effects would be more realistically important determinants of the performance for single-store firms than this particular physical characteristics of the location, shops at a corner, which is perceived as the most important physical location characteristics of the market.

Overall, we find strong support for the diversity effect: the diversity of firms positively affects the performance of single-shop firms, who are likely to be specialized, because of the love of variety channel. These together provide evidence that certain neighborhoods with less search cost for buyers help firms to grow. The results also suggest the existence of strong competition among multi-shop firms.

5.2 Alternative Measures of Neighborhood Diversity

Next, we use an alternative measure of neighborhood diversity in order to show that our results are not due to the use of a particular neighborhood diversity variable. Specifically, instead of using the number of unique trade groups that neighborhood firms affiliate, we use Herfindahl Hirschman Index (HHI) of the number of shops by trade groups of neighborhood firms as an inverse measure of diversity. The correlation coefficient between the HHI index and the number of unique trade groups is -0.7. The results are shown in Table 5. Results are unchanged from the baseline results even if we use the HHI as an alternative (inverse) measure of neighborhood diversity. Thus, our results that the effect of neighborhood diversity is positive for small-sized firms are robust to the choice of the neighborhood diversity measure.

5.3 Alternative Definitions of Neighborhood Regions

In the analysis so far, we have used the neighborhood region as two rows and columns of stalls between large streets and share the same horizontal corridor, as shown in Figure 8a. We believe that this neighborhood region captures a relevant geographic unit for buyer flow. However, by considering alternative ways to define neighborhood regions, not merely can we increase the confidence in the robustness of our results, but we can further shed light on the mechanism through which neighborhood effects arise in this market. We present the results from two types of such analysis in the following subsections.

5.3.1 Front and Back Neighbors

As we mentioned in the institutional background of the location lottery, a part of horizontal neighbors might be endogenously determined because of joint applications. Though we do not detect a sign of endogeneity in our analysis of the validity of randomization, we provide an

Table 5: Results on using HHI as a measure of diversity

	(1)	(2)	(3)
	Δ no. of shops	Exit	Shop increase dummy
Neighborhood diversity (HHI)	-0.706*	0.287	-0.739***
	(0.378)	(0.254)	(0.242)
Neighborhood diversity (HHI)	1.883*	0.395	0.809**
× Multi-shop dummy	(0.984)	(0.465)	(0.382)
Fraction of firms of the same trade group	0.143	0.040	0.303**
	(0.250)	(0.087)	(0.132)
Fraction of firms of the same trade group	-0.140	-0.133	-0.279*
× Multi-shop dummy	(0.372)	(0.139)	(0.154)
Fraction of multi-shop firms	0.363**	-0.204	0.244***
	(0.160)	(0.162)	(0.086)
Fraction of multi-shop firms	-0.905**	0.365	-0.427**
× Multi-shop dummy	(0.446)	(0.334)	(0.173)
Multi-shop dummy	-0.103	-0.197	0.099
	(0.242)	(0.132)	(0.127)
Own diversity	-1.213**	0.054	0.046
	(0.577)	(0.089)	(0.112)
Corner dummy	0.141*	-0.026	0.045*
	(0.070)	(0.021)	(0.027)
Block fixed effects	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes
Trade group fixed effects	Yes	Yes	Yes
Year	1990	1990	1990
N	943	1040	997

Note: Clustered standard errors by neighborhood region are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.
Own diversity is defined as the number of trade groups that a firm belongs to.
Neighborhood diversity is defined as Herfindahl Hirschman Index (HHI) of
the number of shops by trade groups of neighborhood firms.

Table 6: Results using the neighbors restricted to the ones in the front and back

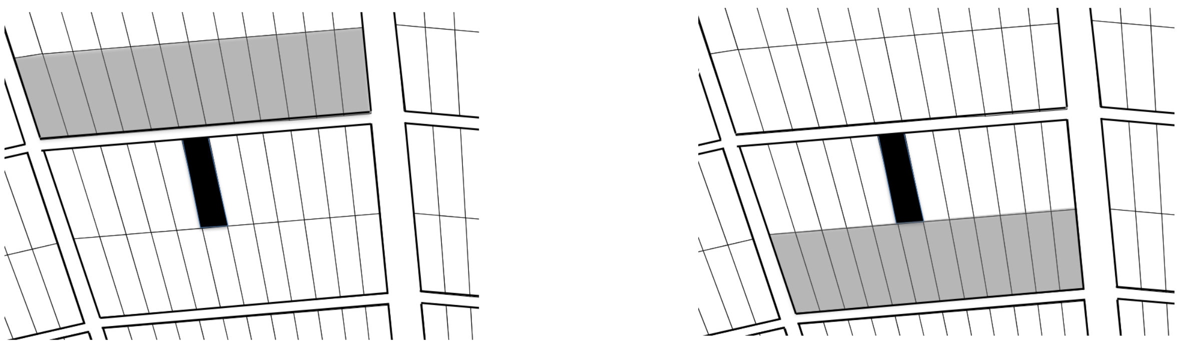
	(1)	(2)	(3)	(4)	(5)	(6)
	Front			Back		
	Δ no. of shops	Exit	Shop increase dummy	Δ no. of shops	Exit	Shop increase dummy
Neighborhood diversity	0.026**	-0.011	0.025***	0.001	-0.012	0.013
	(0.012)	(0.009)	(0.008)	(0.010)	(0.010)	(0.008)
Neighborhood diversity	-0.018	-0.001	-0.035***	-0.006	0.002	-0.014
× Multi-shop dummy	(0.022)	(0.014)	(0.012)	(0.029)	(0.017)	(0.015)
Fraction of firms of the same trade group	0.266*	0.014	0.208***	-0.152	-0.006	-0.060
	(0.136)	(0.073)	(0.077)	(0.170)	(0.089)	(0.095)
Fraction of firms of the same trade group	-0.188	0.006	-0.311***	0.188	0.037	-0.101
× Multi-shop dummy	(0.265)	(0.122)	(0.104)	(0.292)	(0.110)	(0.110)
Fraction of multi-shop firms	0.150	0.081	0.154**	-0.056	0.125	-0.020
	(0.119)	(0.061)	(0.074)	(0.087)	(0.088)	(0.071)
Fraction of multi-shop firms	-0.203	-0.088	-0.128	0.047	-0.091	0.106
× Multi-shop dummy	(0.240)	(0.114)	(0.114)	(0.168)	(0.157)	(0.112)
Multi-shop dummy	0.202	0.006	0.570***	-0.083	-0.028	0.084
	(0.160)	(0.112)	(0.182)	(0.174)	(0.109)	(0.131)
Own diversity	-0.106	0.070	-0.048	-0.039	-0.001	-0.053
	(0.101)	(0.049)	(0.054)	(0.092)	(0.073)	(0.079)
Block fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Trade group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year	1990	1990	1990	1990	1990	1990
N	932	1027	984	790	875	811

Note: Clustered robust standard errors by neighborhood region are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.
Own diversity is defined as the number of trade groups that a firm belongs to.
Neighborhood diversity is defined as the total number of unique trade groups of other firms in the same neighborhood region.

additional analysis in which we restrict neighborhood regions to only neighboring firms facing across the horizontal corridor. This means that we throw away firms on the same raw from the neighborhood region (see Figure 10a. For the black colored firm, gray shaded firms are the firms in front). As we write before, the characteristics of neighboring firms facing across the horizontal corridor has almost no room for being endogenous for a firm because they are typically far apart in lottery numbers.

The results are shown the first three columns in Table 6. Columns (1) and (3) show that the diversity of neighborhood positively affects firm performance only if they are single-shop firms. Thus, our main findings on diversity are still observed for the definition of a neighborhood region for which we can be sure about exogeneity. This result is reassuring.

Next, we provide a type of "placebo test" for our mechanism, exploiting the background information on the structure of the market. That is, firms share their customer flow through the horizontal corridor they face each other. On the other side of the stalls, which is the back side of the shops, there is no corridor where customers walk around. Firms share only backyards of the stalls in the next row. Figure 10 shows the neighboring firms in front and back. Figure 10a shows the neighboring firms in front. For the black colored firm, gray shaded



(a) Firms in front

(b) Firms in back

Figure 10: Map of front and back

firms are the firms in front. They are facing across the horizontal corridor, and can share the buyer flows through corridor. On the other hand, firms in the back shows in Figure 10b. For the black colored firm, gray shaded firms are the firms in back. These firms are connected through backyards, and there is no corridor where buyers can walk around between these firms. It is difficult to share buyer flow between these firms. The contrast between corridor-side and backyard-side are shown in Figure 11. Figure 11a is a picture of firm's corridor side. There is no blockade for buyer flows and buyers easily visit both sides of shops. On the other hand, as Figure 11b shows, the backyard are blocked by cases and turret trucks, and thus it is difficult for buyers to visit both sides of shops by walking around there. Actually, as we mentioned in Section 2.4, buyers' typical trip behavior is after visiting a few main sellers, then, briefly looking around the surrounding stores through horizontal corridor. This implies it is rare to bother visit to the back neighbors using vertical corridor without strong purpose (e.g., there being another main seller). This front and back feature means that for each firm there is a set of firms that with whom it shares (or competes for) buyers and there is another set of firms

(a) Corridor-side (front) (b) Backyard-side (back)

Figure 11: Picture of corridor- and backyard-side of a firm

equally close with much less tendency of sharing (or competing for) buyers. Thus, we predict that there is no neighborhood effect from neighborhood firms in the back if the neighborhood effects come from the buyer flow sharing mechanism. If other mechanisms like knowledge spillovers are the source of the neighborhood effects that we have found so far, we may still observe the neighborhood effects even from neighboring firms in the back, because through the backyards, firm owners and workers contact with each other. The results are shown in Columns (4)-(6) of Table 6.

The results suggest that we have no evidence of neighborhood effects using this alternative definition of neighborhood. This result is consistent with the mechanism of the neighborhood effects we consider. Namely, the diversity of the neighborhood as well as other neighborhood characteristics such as the fraction of firms from the same trade group or the fraction of multi-shop firms in the neighborhood affect firm performance because of buyer flow.

5.3.2 Firm specific neighborhood areas

Next, we define a neighborhood region in a different way. Namely, instead of imposing a fixed area, we make a neighborhood region specific to each firm by taking N closest neighboring shops both to the right and left from either the front row (firm-specific front neighbors) or the row at the back (firm-specific back neighbors).

We report the results when we set N is 10. 10 would make the horizontal length of a firm specific region similar to the region we use because each region we use for our main analysis has either 16 or 24 shops horizontally in one row. The results from the regressions using firm-specific neighbor regions are shown in Table 7. The basic patterns are the same as Table 6. Namely, the neighborhood diversity and the fraction of the firms belonging to the same trade group is beneficial only for single-shop firms, and these effects come from front neighbors, not from back neighbors. The results from this section confirms that the results we obtain are robust to using alternative definition of neighborhood regions.[46]

5.4 Specialization and Analysis using Census of Commerce (Preliminary)

In all the hypotheses, specialization plays a role: firms specialized are likely to benefit from the neighborhood diversity and agglomeration of similar type of firms as themselves. In this section, we analyze the role of specialization. We separate the firms into two groups, specialized and non-specialized. Based on our institutional knowledge, we regard a firm as a specialized firm if all of the following three conditions are satisfied. First, a firm should belong to at most one trade group. Given the fact that the trade groups are associated with fish specialties, it is plausible to assume that the more number of trade groups a firms belongs to, it operates in more lines of business. Second, a firm should belong to a trade group that is not a popular fish category, i.e. Kinkai or Enkai. This is based on the fact that the number of the variety of fish handled is different across trade groups and that Kinkai and Enkai trade groups handle a very wide variety of fish. Finally, if a firm belongs to the Sushi trade group, the firm has to belong to one of the committees dealing with specialized fish whose quality is sensitive. The Sushi trade group has internal committees dedicated to certain fish whose quality is particularly important. These committees negotiate with the wholesale traders and ports regarding logistics to maintain quality. We classify firms that belong to one of these committees as more-specialized firms.[47] [48]

The first two columns in Table 8 show that our main results hold only for specialized

[46]We check the robustness of varying N from 1 to 20 and find similar results if N is at least 8. N less than 8 does not seem to create large enough variations in neighborhood characteristics, in particular when we restrict the neighborhood to front or back neighbors as we do now.

[47]This may be capturing not only specialized firms, but also firms who handle high quality fish. Right now, the internal document we used is the only source available for us to categorize firms in the Sushi trade group.

[48]Before proceeding to the next analysis, we confirm that the main results hold when we replace multi-shop dummy with a dummy indicating firm is not specialized. Also, we confirm that the following analysis is robust to varying the definition of a specialized firm. The results are available upon request.

Table 7: Results using firm specific neighborhood

	(1)	(2)	(3)	(4)	(5)	(6)
		Front			Back	
	Δ no. of shops	Exit	Shop increase dummy	Δ no. of shops	Exit	Shop increase dummy
Neighborhood diversity	0.0255**	0.00564	0.0199**	-0.0103	-0.00735	-0.000683
	(0.00984)	(0.00839)	(0.00827)	(0.0106)	(0.00715)	(0.00767)
Neighborhood diversity	-0.0460**	-0.0221**	-0.0257**	-0.0264	-0.00776	-0.00454
× Multi-shop dummy	(0.0199)	(0.00997)	(0.0101)	(0.0270)	(0.0125)	(0.0116)
Fraction of firms of the same trade group	0.293	0.00215	0.258*	-0.0274	-0.00305	-0.0254
	(0.268)	(0.109)	(0.138)	(0.264)	(0.0768)	(0.130)
Fraction of firms of the same trade group	0.119	-0.122	-0.217	0.352	-0.140	-0.00162
× Multi-shop dummy	(0.346)	(0.153)	(0.150)	(0.368)	(0.124)	(0.138)
Fraction of multi-shop firms	0.139	-0.143	0.141	-0.0650	-0.0143	0.0554
	(0.175)	(0.181)	(0.101)	(0.149)	(0.0848)	(0.120)
Fraction of multi-shop firms	-1.016*	0.321	-0.383**	0.196	-0.0951	0.114
× Multi-shop dummy	(0.537)	(0.304)	(0.173)	(0.257)	(0.156)	(0.145)
Multi-shop dummy	0.632***	0.0336	0.615***	-0.108	0.0577	0.0150
Own diversity	(0.235)	(0.146)	(0.162)	(0.282)	(0.136)	(0.124)
Own diversity	-0.566**	0.0103	-0.164*	-0.299	-0.0432	-0.108
	(0.239)	(0.0924)	(0.0896)	(0.220)	(0.115)	(0.116)
Corner dummy	0.171**	-0.0278	0.0682**	0.159*	-0.0349	0.0634*
	(0.0729)	(0.0241)	(0.0295)	(0.0842)	(0.0252)	(0.0331)
Block fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Trade group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year	1990	1990	1990	1990	1990	1990
N	951	1040	1005	786	865	810

Note: Robust standard errors are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.
Own diversity is defined as the number of trade groups that a firm belongs to.
Neighborhood diversity is defined as the total number of unique trade groups of other firms in the same neighborhood region.

firms but not for specialized firms. Thus, the neighborhood characteristics are particularly important for specialized firms.

Next, we proceed to the analysis of the sales using the Census of Commerce. As the information from the Census of Commerce is available only since 1997, we cannot analyze the changes in the sales before and after the 1990 lottery. Therefore, caution is necessary as we cannot check if sales before the 1990 lottery is not systematically correlated with neighborhood characteristics that the lottery generated. However, if the 1990 neighborhood characteristics generated by the lottery are random, which we have shown using other variables, we could attribute the differences in sales 1997 to the neighborhood characteristics. Furthermore, the analysis of 1997 sales is useful for at least two related reasons. First, so far our performance measure has been restricted to the variables that are functions of the changes in the number of shops, which is somewhat indirect, while sales is a direct measure of performance. Although there is a significant correlation between the number of shops and sales, it is useful to see that our analysis hold for sales. Second, the analysis of 1997 sales would reveal whether the neighborhood effects are persistent.[49] The persistent effect on sales would justify the decision of firms to extend the shops in the application of the 1995 lottery as the results of the increase in the performance due to neighborhood effects from the 1990 lottery.

The Census of Commerce aims to survey all the establishments in wholesale and retail industries in Japan. However, the response rate is not extremely high for small-sized firms, like those in our setting.[50] Using names and telephone number, we were able to link all the firms in the Census who report having stores in the Tsukiji market to our main data, which corresponds to around 70% of the firms in the main data. Given this sample issue, we first replicate our results of this section for the shop increase dummy for this restricted sample. The results are shown in Columns (3) and (4). We confirm that our main results hold only for specialized firms but not for specialized firms. Finally, in Columns (5) and (6) we show the results using the sales in 1997 as the dependent variable. We confirm that the single-shop specialized firms that were assigned by the 1990 lottery to the regions with firms of more diverse fish specialties keep having a huger level sales of 1997. Such effects are absent for non-specialized firms. The set of the results we present in this section together suggests that

[49]We are currently compiling later waves of census to explore more how persistent the effects are.
[50]The average number of employees in our Census of Commerce sample in 1997 is 8.3.

the effect of diversity is stronger and persistent for specialized firms.

6 Implications for Retail Clusters Outside this Context (in progress)

The results of the analysis of the Tsukiji market suggest that the diversity of surrounding stores improve the performance of small or specialized stores. What does this imply for urban agglomeration in general? We argue that the complementarity we identify allows us to understand the forces behind the nature of shopping areas, including shopping districts and shopping malls. In particular, it offers a way to understand what types of sellers do or do not form retail clusters.

First, a shopping district is characterized by a cluster of diverse and specialized stores. Our results suggest that these diverse and specialized stores benefit from one another because of complementarity. Therefore, they have incentives to cluster together to form a shopping district. We could also understand a shopping mall as a device to achieve a more centralized way of realizing of complementarity of diverse stores, since the presence of the externality implies the potential room for internalizing it in a centralized way. Henkel, Stahl and Walz (2000) analyze theoretically the sub-optimality of spatial equilibrium due to externality and how to internalize it. Pashigian and Gould (1998) provide empirical evidence of internalizing externality showing that the rents for anchor stores are heavily discounted in shopping malls. Konishi and Sandfort (2003) analyze the role of anchor stores theoretically. Furthermore, it is a known fact in Japan that shopping districts (in particular those outside metropolitan areas) perform worse that shopping malls. This may be because the former has more difficulty in managing the externality.[51]

Furthermore, our results show that large stores selling more standardized products do not benefit from diversity, which seems consistent with a casual observation that supermarkets and convenience stores are located in an isolated from (or not only at) shopping districts

In the rest of this section, using the observations of all the retail stores in the whole Tokyo prefecture from the Census of Commerce data set in 1999, we confirm some of these casual observations with data. We do not aim to uncover causality here. Rather, our aim is to

[51] Analyzing how decentralized shopping districts and centralized shopping malls differ in the evolution in their types of shops is in progress.

Table 8: Results on specialization and sales as alternative outcome

	(1) Shop increase dummy	(2) Shop increase dummy	(3) Shop increase dummy	(4) Shop increase dummy	(5) ln(Sales)	(6) ln(Sales)
Specialization	Yes	No	Yes	No	Yes	No
Sample	All	All	Census	Census	Census	Census
Neighborhood diversity	0.028***	0.014	0.031***	-0.002	0.061**	-0.061
	(0.009)	(0.013)	(0.011)	(0.023)	(0.029)	(0.038)
Neighborhood diversity	-0.033**	-0.023	-0.049***	-0.002	-0.080	0.027
× Multi-shop dummy	(0.016)	(0.018)	(0.018)	(0.022)	(0.050)	(0.045)
Fraction of firms of the same trade group	0.316*	0.050	0.363*	-0.069	1.005*	0.423
	(0.161)	(0.214)	(0.202)	(0.275)	(0.538)	(0.635)
Fraction of firms of the same trade group	-0.242	-0.016	-0.459	0.064	-0.288	0.067
× Multi-shop dummy	(0.259)	(0.235)	(0.286)	(0.346)	(0.775)	(0.606)
Fraction of multi-shop firms	0.467***	0.203	0.481***	0.383	0.646	1.384**
	(0.138)	(0.256)	(0.173)	(0.389)	(0.578)	(0.592)
Fraction of multi-shop firms	-0.553*	-0.559	-0.594*	-0.478	-0.657	-0.833
× Multi-shop dummy	(0.284)	(0.356)	(0.351)	(0.420)	(1.001)	(0.764)
Multi-shop dummy	0.537***	0.416**	0.725***	0.182	1.693**	0.732
	(0.169)	(0.199)	(0.202)	(0.266)	(0.705)	(0.492)
Own diversity	-	0.226	-	-0.007	-	-0.321
	-	(0.154)	-	(0.078)	-	(0.531)
Corner dummy	0.044	0.052	0.047	0.084	0.138	0.172
	(0.043)	(0.051)	(0.059)	(0.060)	(0.113)	(0.154)
Block fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Trade group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year	1990	1990	1990	1990	1990	1990
N	635	421	408	270	408	270

Note: Clustered standard errors by neighborhood region are in parentheses.
** and *** indicate significance at the 5% and 1% level, respectively.
Own diversity is defined as the number of trade groups that a firm belongs to.
Neighborhood diversity is defined as the total number of unique trade groups of other firms in the same neighborhood region.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

provide novel facts about what types of firms constitute retail clusters to suggest that the complementarity mechanism we identity may be more generally relevant in understanding the force behind the formation of retail clusters outside Tsukiji market. Specifically, we run the following two types of regressions:

$$LogTotalSales_{ijz} = \beta_0 + \beta_1 \#Firms_z + \beta_2 \#ProductTypes_z + \beta_3 LogTotalSales_z + \lambda_j + \varepsilon_{ijz}$$

$$\#ProductTypes_{ijz} = \beta_0 + \beta_1 \#Firms_z + \beta_2 \#ProductTypes_z + \beta_3 LogTotalSales_z + \lambda_j + \varepsilon_{ijz}$$

where i, j, z denote store, main product of the store, and zip-code, respectively. A type of product corresponds to 4-digit industry in Census of Commerce. There are about 70 4-digit industries in the retail sector. We take a zip-code as our regional unit.[52] The main independent variables are the total number of retail stores in a zip-code, the total number of unique product types that sellers in each zip-code sell, which we take as the diversity of stores in a zip-code, and the sum of sales of all the retailers in a zip-code, which we take as the market size. The main dependent variables are the total sales at the store level, and the number of product types that stores sell. The Census of Commerce asks the sales for each product type, up to ten product types. We are primary interested in the coefficient on $\#ProductTypes_z$, which show how the sales and number of varieties at the store level are correlated with the number of varieties at the market level.

Table 9 shows the results. Column 1 shows that firms are on average smaller (having lower sales) in a market with a larger number of types of products. This is consistent with the idea that small firms comprise a shopping district. Column 2 shows that the result is robust to the inclusion of industry fixed effects. Column 3 shows that the number of types of products that each store sells is lower in a more diverse market and one with more sellers. This suggests that stores tend to specialize in areas with more diverse types of stores, which is likely to be shopping districts. Column 4 shows that the result is robust to the inclusion of industry fixed

[52]Using a zip-code as the regional unit is clearly not ideal. We are planing to work on properly identifying shopping areas.

Table 9: Results on the location of retail sector in Tokyo

	(1) Log(sales)	(2) Log(sales)	(3) No. of products	(4) No. of products
No. of firms/1000 in the same zip-code	-0.4484***	-0.0524	-0.2178***	-0.1309***
	(0.0934)	(0.0840)	(0.0428)	(0.0349)
No. of product types in the same zip-code	-0.0474***	-0.0433***	-0.0113***	-0.0100***
	(0.0020)	(0.0018)	(0.0011)	(0.0007)
Log(total sales in the same zip-code)	0.4455***	0.4384***	0.0154*	0.0327***
	(0.0194)	(0.0163)	(0.0093)	(0.0062)
Industry fixed effects	No	Yes	No	Yes
Adj. R^2	0.040	0.184	0.008	0.294
N	128483	128483	128483	128483

Note: Standard errors are clustered at the zip-code level and shown in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

effects.

In addition, we conduct the same exercise using all retail store data in entire Japan. The results are shown in Table 10.

Table 10: Results on the location of retail sector in entire Japan in 1999

	(1) Log(sales)	(2) Log(sales)	(3) No. of products	(4) No. of products
No. of firms/1000 in the same zipcode	-0.9191***	-0.5335***	-0.1794***	-0.2569***
	(0.0750)	(0.0681)	(0.0307)	(0.0281)
No. of product types in the same zipcode	-0.0599***	-0.0449***	-0.0157***	-0.0107***
	(0.0006)	(0.0005)	(0.0003)	(0.0003)
Log(total sales in the same zipcode)	0.5631***	0.4925***	0.0301***	0.0436***
	(0.0030)	(0.0026)	(0.0016)	(0.0014)
Industry fixed effects	No	Yes	No	Yes
City fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.108	0.248	0.031	0.336
N	1371404	1371404	1371404	1371404

Note: Standard errors are clustered at the zip-code level and shown in parentheses.
*, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

In all the specifications, we include city fixed effects. Columns (1) and (2) use the log of sales as dependent variables, and Columns (3) and (4) use the number of types of products that each store sells as dependent variables. Columns (2) and (4) include industry fixed effects. The results are consistent with the results in Tokyo. The number of product types in the same zip code is negatively correlated to store sales and the number of types of products that each store sells. The results in Tokyo are robustly observed in retail sectors in entire Japan.

Overall, the results of this section suggest that the pattern of co-location of retailers is consistent with our results. Smaller or/and specialized stores cluster together to form a shopping district, while larger or/and non-specialized stores do not tend to cluster because only the former type of stores benefit from complementarity of diverse neighboring stores.

7 Conclusion and Plan for Future Analysis

This paper empirically investigates neighborhood effects among intermediary wholesalers in the Tokyo Tsukiji Fish Market. We address the identification difficulty originating from the self-selection of firm location by exploiting a unique feature of their locations within the market; their locations are determined every 4-10 years by relocation lotteries. Using this feature, that the location of firms is randomly determined, we estimate the causal effect of the diversity of neighboring firms on firm performance. We find that the diversity of the neighboring firms positively affect the performance of small-scale firms, in particular for specialized firms. Then, we demonstrate that our results are robust when we use alternative measures of neighborhood diversity. Finally, we present the analysis changing the definition of the neighborhood. We show that firm performance is influenced by the characteristics of other firms facing it across a corridor (i.e., sharing buyers) but not by the characteristics of other firms equally close but on a different corridor from the firm (i.e., not sharing buyers). This finding confirms that the neighborhood effects we find arise from the interaction of firms through their buyers. Finally, to illustrate the general applicability of the complementarity mechanism due to shopping behavior, using the census of commerce covering all the retailers in Tokyo, we confirm that smaller and more specialized retailers are more likely to be located together while larger and standardized ones are isolated. Overall, our analysis shows that the complementarity of products between specialized diverse stores is an important factor behind urban agglomeration.

We plan to extend our analysis to more years with more cycles of the lotteries (and thus, shop relocations). The analysis of the 1995 and 2004 lotteries would allow us to exploit better the Census of Commerce. We also plan to improve substantially the analysis in Section 6, by improving a measure of relevant market, and by adding more relevant control variables, and by adding the analysis how decentralized shopping districts and centralized shopping malls fare differently.

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Appendix A: Theoretical Background of the Impact of Diversity

In this section, we present a model to show that the diversity of neighboring stores positively affect the performance of stores under realistic assumptions.

Setup

To understand the mechanism of neighborhood effects in Tsukiji fish market, we apply Matsuyama's (1992) monopolistic competition model with three-tier CES preference. We assume that the fish market can be divided into R subareas ($i \in \{1, \ldots, R\}$). Fishes in the market are categorized to M groups ($g \in \{1, \ldots, M\}$), like tuna, octopus, and so on. Furthermore, fishes are continuously differentiated within a group. For example, tunas are differentiated by type, origin, size, raw/frozen, and so on.

Suppose a representative buyer has three-tier CES preference as follows,

$$W = \left[\sum_{i=1}^{R} V_i^{1-\frac{1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}} \tag{1}$$

where

$$V_i = \left[\sum_{g=1}^{M} X_{ig}^{1-\frac{1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon-1}}, \tag{2}$$

where

$$X_{ig} = \left[\int_0^{n_i^g} [x_{ig}(z)]^{1-\frac{1}{\sigma}} \, dz \right]^{\frac{\sigma}{1-\sigma}}. \tag{3}$$

The first-tier represents the preference for subareas. The variable V_i represents the purchase amount of the composite of fishes obtained in subarea i. The second-tier represents the preference for fish group. The variable X_{ig} is the purchase amount of the composite of fish varieties in group g in region i. The third-tier represents the preference for varieties within a group. The variable $x_{ig}(z)$ is the purchase amount of variety z in group g in region i.

We suppose that these subareas are indifferent for consumers ex ante, but it is costly to move back and forth across subareas. This can be represented by high elasticity of substitution (nearly infinite) across subareas. Furthermore, we suppose that the elasticity of substitution across groups is lower than that across varieties within a group. Those mean that the sizes of the elasticities of substitution holds $\gamma > \sigma > \epsilon > 1$.

Then, demand function for variety z in trade group g in region i can be written as follows,

$$x_{ig}(z) = \left[\frac{P_i^{\sigma-\epsilon} R_i^{\epsilon-\gamma} I}{\sum_{i=1}^{R} R_i^{1-\gamma}} \right] p_i(z)^{-\sigma}, \tag{4}$$

where

$$P_{ig} = \left[\int_0^{n_i^g} [p_{ig}(z)]^{1-\sigma} dz \right]^{\frac{1}{1-\sigma}}, \tag{5}$$

where

$$R_i = \left[\sum_{g=1}^{M} P_{ig}^{1-\epsilon} \right]^{\frac{1}{\epsilon-1}}. \tag{6}$$

We consider the monopolistic competition across shops specialized in a specific fish variety. We suppose that technology is the same for all varieties, groups, and shopping areas and one unit of output requires one unit of labor which is taken to be numeraire. Thus, a shop's optimal mark up is $\sigma/(\sigma-1)$ and the price of fish variety in group g in subarea i is $p_{ig}(z) = \sigma/(\sigma-1)$. Therefore, the price index P_{ig} can be rewritten as $P_{ig} = n_{ig}^{\frac{1}{1-\sigma}} \frac{\sigma}{\sigma-1}$.

We represent profit of a shop selling a variety in group g in subarea i by π_i^g. Then, the relative profit between areas i and k for a shop selling a variety in group g can be represented as follows,

$$\frac{\pi_i^g}{\pi_k^g} = \left[\frac{n_i^g}{n_k^g} \right]^{\frac{\sigma-\varepsilon}{1-\sigma}} \left[\frac{\sum_{g=1}^{M} \left(n_i^g\right)^{\frac{1-\varepsilon}{1-\sigma}}}{\sum_{g=1}^{M} \left(n_k^g\right)^{\frac{1-\varepsilon}{1-\sigma}}} \right]^{\frac{\varepsilon-\gamma}{1-\varepsilon}}. \tag{7}$$

Impact of diversity

The determinant of the relative profit is number of firms in the same group and that in the other groups. To show how diversity of neighboring shops affects a shop performance, we focus on the number of shops in the other groups, that is, numerator of the second term of the right hand side: $\sum_{h=1}^{M}(n_i^g)^{\frac{1-\varepsilon}{1-\sigma}}$. To simplify the notation, we change the notation n_i^h to x_h and $\frac{1-\varepsilon}{1-\sigma}$ to α. The assumption for size of elasticity of substitutions ($\gamma > \sigma > \epsilon > 1$) implies that $0 < \alpha < 1$. Furthermore, we use m for total number of groups instead of M, and use i for the index of group instead of h. Then, the numerator of the second term of the right hand side of relative profit function can be written as follows,

$$\sum_{i=1}^{m} x_i^{\alpha} \qquad (0 < \alpha < 1). \tag{8}$$

Profit of a shop in a region increases if the above object increases. However, total number of shops in a region is restricted, because the shop spaces in a region is limited in the fish market. Thus, the shop profits are determined by the above object with the limited shop space condition as follows,

$$\sum_{i=1}^{m} x_i = N, \tag{9}$$

where N is the number of shop spaces.

We obtain three claims on the relationships between the variety and diversity of neighboring shops and shop profit.

Claim 1: Having the same number of shop from each group, i.e., $x_i = \frac{N}{m} = \mu$, maximizes the above expression.

Proof: By solving maximization problem of eq. (8) with constraint of eq. (9), we obtain the result that $x_i = \frac{N}{m}$ is the solution of the problem.

Claim 2: For any group i, increasing the number of shops from zero to one (from $x_i = 0$ to $x_i = 1$) increases $\sum_{i=1}^{m} x_i^{\alpha}$.

Proof: The first derivative of eq. (8) with respect to x_i is $\alpha x_i^{\alpha-1}$. This is positive in the range of $0 < x_i < 1$ and $\lim_{x_i \to 0} \alpha x_i^{\alpha-1} = \infty$.

Claim 2 gives some (but not perfect) justification of our use in Section 5.1 of the unique number of trade groups as the measure of the diversity of neighborhood shops.

Claim 3: When the variance of the number of shops from each group in a subarea,$Var(x_i)$, increases, $\sum_{i=1}^{m} x_i^{\alpha}$, thus the profit for each store in the subarea decreases.

Proof: Consider the case that the number of shops are the random variable. Specifically the number of shops from each trade group i is expressed as the mean number of shops μ and deviation from it ϵ_i, which follows a normal distribution.

$$x_i = \mu + \epsilon_i$$

$$\epsilon_i \sim N(0, s^2)$$

There are two remarks with this setting, one specific to our empirical setting, and another more general. The first one is that the number of total shops is different across trade groups in actual data, then, the variance will not be same across groups actually. The second one is the constraint of the total number of shops per region will be satisfied only in expectation in this set up.

Setting $p_i = \frac{1}{m}$ (so $\sum_{i=1}^{m} p_i = 1$), $f(x) = x^{\alpha}$, $\sum_i^n p_i x_i^{\alpha}$ moves same as $\sum_i^n x_i^{\alpha}$ with respect to x_i, so our problem can be considered how we can increase $E[f(x)]$. Then, the second order Taylor expansion of $f(x)$ at μ gives:

$$f(x) \approx f(\mu) + f'(\mu)(x-\mu) + \frac{1}{2}f''(\mu)(x-\mu)^2$$
$$= \mu^\alpha + \alpha\mu^{\alpha-1}(x-\mu) + \frac{1}{2}\alpha(\alpha-1)\mu^{\alpha-2}(x-\mu)^2$$
$$E[f(x)] = \mu^\alpha + \alpha\mu^{\alpha-1}E[x-\mu] + \frac{1}{2}\alpha(\alpha-1)\mu^{\alpha-2}E[x-\mu]^2$$
$$= \mu^\alpha + \frac{1}{2}\alpha(\alpha-1)\mu^{\alpha-2}s^2$$

Thus, we have $\frac{\partial E[f(x)]}{\partial s^2} < 0$, and $E[f(x)]$ is maximized when s is zero. This is because $0 < \alpha < 1$.

In addition, we introduce the normalized deviation from the optimal (μ^α) in the following way.

$X = \frac{E[f(x)]-\mu^\alpha}{\mu^\alpha} = \frac{1}{2}\alpha(\alpha-1)\mu^{-2}s^2 = \frac{1}{2}\alpha(\alpha-1)(CV)^2$

where CV is the coefficient of variation (s/μ). It is easy to see that

$\frac{\partial X}{\partial (CV)^2} = \frac{1}{2}\alpha(\alpha-1) < 0$. Thus, the deviation from the equal division of shops across group in a subarea decreases the profit of each store in the subarea. Claim 3 gives some (but not perfect) justification of our use in Section 5.2 of the HHI index as the measure of (the inverse of) the diversity of neighborhood shops.

Appendix: Retail clusters outside Tsukiji Fish market

This appendix further investigates the external implication of our findings in Tsukiji Fish Market using the Census of Commerce data on all the retail stores in Tokyo prefecture in the different years and those in entire Japan.

Tables 11 and 12 show results using retail store data in Tokyo in 2002 and 2007, respectively. Columns (1) and (2) use the log of sales as dependent variables, and Columns (3) and (4) use the number of types of products that each store sells as dependent variables. Columns (2) and (4) include industry fixed effects. Similar to the results shown in Table 9, the number of product types in the same zip code is negatively correlated to store sales and the number of types of products that each store sells. The results in Tokyo are robust in different years.

We also conduct the same robustness checks for the results using all retail store data in entire Japan. Tables 13 and 14 show results using retail store data in entire Japan in 2002

Table 11: Results on the location of retail sector in Tokyo in 2002

	(1) Log(sales)	(2) Log(sales)	(3) No. of products	(4) No. of products
No. of firms/1000 in the same zipcode	-0.3942***	0.0253	-0.5774***	-0.1128*
	(0.0710)	(0.0870)	(0.0886)	(0.0576)
No. of product types in the same zipcode	-0.0307***	-0.0251***	-0.0129***	-0.0052***
	(0.0012)	(0.0010)	(0.0015)	(0.0007)
Log(total sales in the same zipcode)	0.4815***	0.4349***	0.0477**	0.0104
	(0.0189)	(0.0153)	(0.0218)	(0.0093)
Industry fixed effects	No	Yes	No	Yes
Adj. R^2	0.053	0.266	0.010	0.491
N	118653	118653	124316	118653

Note: Standard errors are clustered at the zip-code level and shown in parentheses.
*, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

Table 12: Results on the location of retail sector in Tokyo in 2007

	(1) Log(sales)	(2) Log(sales)	(3) No. of products	(4) No. of products
No. of firms/1000 in the same zipcode	-0.2284*	0.1856	-0.9687***	-0.2398***
	(0.1223)	(0.1518)	(0.0928)	(0.0543)
No. of product types in the same zipcode	-0.0358***	-0.0285***	-0.0169***	-0.0047***
	(0.0013)	(0.0013)	(0.0021)	(0.0009)
Log(total sales in the same zipcode)	0.5235***	0.4600***	0.1418***	0.0307***
	(0.0197)	(0.0173)	(0.0292)	(0.0119)
Industry fixed effects	No	Yes	No	Yes
Adj R^2	0.064	0.275	0.010	0.505
N	101748	101748	114190	101748

Note: Standard errors are clustered at the zip-code level and shown in parentheses.
*, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

and 2007, respectively. Our findings from the data in 1999 are consistently observed in both years.

Table 13: Results on the location of retail sector in entire Japan in 2002

	(1) Log(sales)	(2) Log(sales)	(3) No. of products	(4) No. of products
No. of firms/1000 in the same zipcode	0.0616	0.2624***	-0.1600***	-0.1916***
	(0.0977)	(0.0878)	(0.0523)	(0.0382)
No. of product types in the same zipcode	-0.0388***	-0.0254***	-0.0192***	-0.0064***
	(0.0005)	(0.0004)	(0.0004)	(0.0002)
Log(total sales in the same zipcode)	0.5406***	0.4213***	0.1039***	0.0427***
	(0.0028)	(0.0025)	(0.0030)	(0.0018)
Industry fixed effects	No	Yes	No	Yes
City fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.121	0.327	0.033	0.452
N	1359957	1359957	1436144	1360413

Note: Standard errors are clustered at the zip-code level and shown in parentheses.
*, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

Table 14: Results on the location of retail sector in entire Japan in 2007

	(1) Log(sales)	(2) Log(sales)	(3) No. of products	(4) No. of products
No. of firms/1000 in the same zipcode	0.0751	0.2897***	-0.2952***	-0.1720***
	(0.1083)	(0.1014)	(0.0939)	(0.0336)
No. of product types in the same zipcode	-0.0483***	-0.0334***	-0.0341***	-0.0101***
	(0.0005)	(0.0005)	(0.0006)	(0.0003)
Log(total sales in the same zipcode)	0.5827***	0.4769***	0.1998***	0.0510***
	(0.0026)	(0.0024)	(0.0038)	(0.0022)
Industry fixed effects	No	Yes	No	Yes
City fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.130	0.323	0.029	0.480
N	1124665	1124665	1272726	1124665

Note: Standard errors are clustered at the zip-code level and shown in parentheses.
*, **, and *** indicate significance at the 10%, 5% and 1% level, respectively.
The source of store-level data is Census of Commerce provided by Ministry of Economy, Trade, and Industry.

These results suggest that the implication of our results to the pattern of co-location of retailers—smaller or/and specialized stores cluster together to form a shopping district, while larger or/and non-specialized stores do not tend to cluster—is robustly observed.