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A Model of Unorganized and Organized Retailing in Emerging Economies

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In the last two decades, organized retailing has transformed the retailing landscape in emerging economies, where unorganized retailing has traditionally been dominant. In this paper, we build a theoretical model of unorganized and organized retailing in emerging economies by carefully modeling key characteristics of the retailing environment, the retailers, the consumers, and product categories. The primary insight that we obtain is that in a competitive market comprising of only unorganized retailers, the advent of organized retailing injects efficiency into the market leading to a reduction in the number of unorganized retailers. This, in turn, makes the market less competitive. Building on this basic insight, we obtain a number of counterintuitive results. For instance, (i) the presence of organized retailing may increase the prices charged by unorganized retailers; (ii) as the consumers' transportation cost to the unorganized retailers increases, the market share of the unorganized retailing sector may increase; (iii) as the probability of bulk consumption increases and consumers prefer to purchase more from the organized retailer, prices and profits at the organized retailer may decrease; and (iv) the presence of organized retailing can lead to both consumer and social surplus being lower because consumers face higher prices at unorganized retailers and there is wastage in the economy due to bulk purchasing at organized retailers. Our model offers an explanation for certain surprising empirical observations related to retailing in emerging markets, such as why in the last few years in the Indian market the unorganized retailers who have survived the advent of organized retailing seem to be doing better. Implications from our research can provide guidance to policy makers grappling with issues related to the balanced growth of unorganized and organized retailing in emerging markets.

Keywords: unorganized and organized retailing; kirana shops; developing economies; multinational retailers; Salop model
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1. Introduction

The retailing sector contributes substantially to a country's gross domestic product. For example, total retail sales in the United States topped $4.5 trillion in 2013 (eMarketer 2014). Even in a developing country like India, retailing amounts to about US$500 billion and comprises 37% of the country's gross domestic product (Kohli and Bhagwati 2012). The retailing landscape in most developed countries is dominated by organized retailing, whereas unorganized retailing is the leading format in emerging economies. Organized retailing refers to trading activities undertaken by licensed retailers (e.g., supermarkets, corporate-backed hypermarkets, and retail chains). By contrast, unorganized retailing is characterized by small neighborhood stores selling groceries (mom-and-pop stores, also called *kirana* shops in India), typically run by individuals or families. The liberalization policies on foreign direct investments in developing economies coupled with the lure of huge growth prospects have led retailing giants from developed economies, such as Walmart and Carrefour, to foray into emerging markets. In addition, organized retailing is also growing organically in developing markets with national conglomerates and other large firms opening retailing chains in their respective countries.

In spite of the importance of this phenomenon, there is a lack of thorough understanding of the impact of organized retailing on unorganized retailing in emerging economies. In this paper, we take an initial step toward understanding the economic forces at play when both unorganized and organized retailers are present. To this end, we develop a game theory model of multiple competing unorganized retailers and one organized retailer. Using this model, we examine how consumers' accessibility to new retail formats affects equilibrium prices and profitability of local unorganized retailers. This investigation is of great practical significance to managers as well as policy makers because globalization of the retail industry is taking place rapidly.

Organized and unorganized retailers serve consumers in very different ways. These differences need to be carefully understood to develop insights into their coexistence in developing countries. A salient feature of the unorganized retailing environment is that family-run retailers operate on a small scale, with each store serving only a small number of households that reside in the near vicinity of the store. The size of such stores is typically limited by the prohibitive cost of real estate, financing, as well as management know-how. Because of their small size and the fact that the households that shop there are regular customers, the shopkeepers of the neighborhood stores are closely familiar with the preferences of the customers that they serve and therefore offer personalized service to the individuals who shop there (Child et al. 2015). For various reasons such as budget constraints, storage constraints, and prevention of wastage, consumers purchase frequently but in small quantities (often multiple times a week, as need arises for a product; Child et al. 2015).

By contrast, an organized retailer outlet typically serves several thousand households spread over a large area. Customers usually make a few shopping trips per month, often driving long distances, and purchase large quantities of products at low prices, which they store at home and consume over an extended period of time. There is little personal interaction involved during purchasing and individual-level service is almost nonexistent. Organized retailers operate large stores that are much fewer in number compared to unorganized retailer stores and are located farther away on average (typically in large shopping plazas). Purchasing from organized retailer stores involves various costs such as time planning to visit the store, costs of driving and parking, and other in-store costs (Child et al. 2015). However, organized retailers, by virtue of scale and logistical expertise and efficiency, often (but not always) offer lower prices than unorganized retailers.

Under the coexistence of organized and unorganized retailers, a key trade-off for a consumer is either purchasing from a small neighborhood store multiple times as and when uncertain demand is realized or incurring larger transaction costs while making fewer trips and purchasing larger quantities from an organized retailer. If a consumer purchases a larger quantity, she also runs the risk that she may not want all of the product in the future because demand for it may not arise, leading to either wastage or consumption with reduced utility. In addition, factors such as better service at unorganized retailers and consumers' ability (or inability) to store products for future consumption also influence the choice of retailer and the quantity purchased. These demand-side factors influence where consumers decide to shop and hence how both unorganized and organized retailers make their market-entry and pricing decisions.

Motivated by the above, in our theoretical model we incorporate salient characteristics of the retailing environment, of the retailers, of the product category, and of the consumers. We first model a scenario with only unorganized retailers present, and then a scenario with one organized retailer and multiple unorganized retailers. Comparing the two scenarios helps to understand the impact of the emergence of organized retailing on unorganized retailing. Consequently, our analysis allows us to shed light on the issues raised earlier and provide new insights on the interplay between organized and unorganized retailing. For instance, we find that the emergence of organized retailing will lead to a market shakeout in which some unorganized retailers will exit the market; however, counterintuitively, each surviving retailer will charge a higher price and make higher postentry profit compared to the scenario in which the organized retailer is not present. This is because the entry of an efficient organized retailer will reduce the number of unorganized retailers such that overall competition in the market can potentially be reduced. We note that this result is in agreement with the findings in a recent comprehensive study of developments in Indian retailing in the past decade (Kohli and Bhagwati 2012).

Our model also allows us to understand the different factors that impact the strategy choices and outcomes for the unorganized and organized retailers. For instance, we find that because a larger fraction of the population has the ability to purchase in bulk from the organized retailer for future consumption, prices are higher not only at the organized retailer (which is intuitive) but also at the unorganized retailers. Another result we obtain is that as the probability of future consumption increases and consumers prefer to purchase more from the organized retailer, prices and profits at the organized retailer are not monotonic; in fact, they first decrease and then increase. This is because as the probability of demand increases from a low level, the organized retailer faces more competition from unorganized retailers. However, when this probability is sufficiently high, consumers strongly prefer to purchase in bulk from the organized retailer, which leads to fewer unorganized retailers in the market and lesser competition, thus leading to higher prices. We also find that even though the presence of organized retailing can inject efficiency into the retailing environment, it can lead to both consumer and social surplus being lower compared with the scenario with only unorganized retailers, because consumers face higher prices at unorganized retailers, and there is wastage in the economy due to bulk purchasing at organized retailers.

There is a nascent academic literature on phenomena related to retailing in emerging markets. Narayan et al. (2015) investigate the adoption of modern retailing in India and find that consumers in the upper and lower middle classes have been the most responsive to modern retailing. Sudhir and Talukdar (2015) find that Indian retailers avoid modernization through IT enhancements to maintain limited transparency for regulators into their operations, at the cost of not being able to expand optimally. Zhang (2015) theoretically investigates the decision of firms from emerging markets to brand themselves in a manner that dissociates them from their origins in emerging markets to mitigate a negative reputation effect. To our knowledge, this is the first attempt to construct a theoretical model of retailing in emerging markets by carefully modeling characteristics of the retailing environment, the retailers, the consumers, and product categories.

A number of empirical research studies have focused on the impact of entry by large retailers such as Walmart on consumer purchase behavior (Singh et al. 2006), on retail prices and other aspects of the marketing mix (Basker 2005a, Ailawadi et al. 2010, Zhu et al. 2011), and on entry and exit by other retailers (Basker 2005b, Jia 2008). These studies, however, focus on the coexistence of large and small retailers in a developed economy; as we discussed earlier, market realities in developing economies can be different. There have also been a number of survey- and data-based research papers focusing on the retail environment in developing countries and on the impact of organized retailing from a model-free perspective (Joseph et al. 2008, Goyal and Aggarwal 2009, Kohli and Bhagwati 2012, Technopak 2007). Several of our model predictions (discussed in §3) are in line with the results of these surveys, which we shall discuss at appropriate points in this paper.

The rest of this paper is organized as follows. In §2, we outline the key features of our model. In §3, we analyze the model, derive our main results, and outline the intuition behind the main results. In §4, we extend our basic model in various ways to obtain new insights and to show the robustness of our results. In §5, we present the conclusions, limitations, and possible avenues for future research. In the appendix, we present the proofs of the propositions (§A1) and supporting analyses (§§A2 and A3).

2. Model

We use a Salop's circle (Salop 1979) as our basic setup, with a continuum of consumers of measure one distributed uniformly on the circumference of a circle with circumference of length one. A consumer is characterized by her location on the circle, which corresponds to her most preferred product. Consuming her most preferred product gives the consumer a utility of $V > 0$. We assume that the outside option is zero and V is sufficiently large for the market to be fully covered.[1]

Next, we incorporate characteristics from multiple aspects of retailing in emerging economies, namely, characteristics of the retailing environment, of the retailers, of the product category, and of the consumers.

Characteristics of the Retailing Environment. We model and compare two scenarios: the first in which only unorganized retailers exist in the market, and the second in which an organized retailer also exists in the market. Comparing the outcomes in the two scenarios allows us to isolate the impact of the presence of organized retailing in emerging markets. Frequently in emerging markets, the entry and presence of organized retailers is dependent on legislative and political processes, rather than on purely economic reasons. Therefore, for the purposes of this paper, we treat the absence or presence of the organized retailer as an exogenous component of the model.

We assume that there are N unorganized retailers located equidistantly from each other along the circumference of the circle. The number N is endogenously determined. When consumers purchase from an unorganized retailer not located at her ideal point, she incurs a per-unit-distance disutility (or transportation cost, or mismatch cost) denoted by $t > 0$. If the organized retailer is present, it is located centrally and serves customers from multiple different localities.[2] Consistent with this, we assume that the organized retailer is located equidistant from all consumers at the center of the circle and when a consumer buys from the organized retailer, she incurs a constant disutility denoted by $\mu > 0$, irrespective of her location. We assume that information about the locations of all consumers is available to all retailers in the market, and vice versa.

[1] If V is small, spatially distributed retailers may monopolize a small surrounding market area.

[2] The essential features that we want to capture here are that organized retailers are significantly fewer in number as compared to unorganized retailers and are located in locations that are broadly accessible by many consumers. We assume away competition between organized retailers.

Our modeling approach is related to that in other papers that look at competition between geographically dispersed firms selling a particular good and mail order or Internet providers for the same good. Balasubramanian (1998) studies a direct marketer that locates at the center of a circular market and competes with traditional retailers located on the perimeter. Madden and Pezzino (2011) look at the social optimality of the market outcomes in such a model. Cheng and Nault (2007) model the impact of fixed entry costs on the location choices of entrants and incumbents where the incumbent or the entrant can choose to locate at the center.

In our model, the two scenarios (without and with the organized retailer) may have a different number of unorganized retailers. We model the long-run equilibrium outcome of each scenario and then compare the key characteristics of the outcomes to understand the impact of the presence of the organized retailer. Given that we model long-run outcomes, we assume that the locations of the unorganized retailers will adjust to the market situation in each scenario, i.e., stores may close and open in the medium and long term to respond to market demand and structure, which we model. Note that we do not build a dynamic entry model in which the entry of the organized retailer leads to an immediate exit of some unorganized retailers and/or relocation of the remaining ones (i.e., there is no assumption of short-term relocation).

We have assumed a distance-based disutility of purchasing from an unorganized retailer. In emerging economies, unorganized retailers are located in close proximity to consumers (typically no more than a few hundred meters); consumers often simply walk over to make a quick purchase as the need for a product arises, and the transportation cost that they incur is significant (Child et al. 2015). However, we have assumed that the disutility of purchasing from the organized retailer is fixed and independent of location because of the following reasons. Organized retailers have large stores located in a central shopping area, typically at least a few kilometers away for most consumers. Visiting an organized retailer's store requires some advance planning and use of vehicular transportation. Upon reaching the shopping area, consumers have to find parking, and often pay a fixed amount for it. When in the store, consumers have to spend time to find the product they want to purchase in the aisles of the store. Subsequently, they have to wait in checkout lines to finish the purchase. All of the above activities primarily involve fixed costs of making the shopping trip, and the cost differences based on consumers' respective locations is negligible in comparison, which is reflected in our assumption.

Characteristics of the Retailers. For an unorganized retailer, we assume that it faces a constant marginal cost for the goods sold, given by $c \geq 0$. More importantly, it also incurs a fixed cost at the time of entry in the market, and the fixed cost depends on the number of customers that it expects to serve after entry. This cost has been shown in the literature as critically important in constraining the size of unorganized retailers, where it is argued that small firms (including unorganized retailers) find it progressively more difficult, especially in emerging markets, to set up and manage a larger store to serve more people (Evans and Jovanovic 1989, Tybout 2000, van Biesebroeck 2005, Kohli and Bhagwati 2012). Expanding the business to serve a larger clientele implies ready access to finances, dealing with progressively increasing logistical and planning complexities, etc. However, a large body of research has shown that small businesses in emerging markets find it very difficult to raise the capital needed to expand because they face severe credit limitations due to poorly functioning credit markets (e.g., see Paulson and Townsend 2004, McKenzie and Woodruff 2006, de Mel et al. 2008). In addition, small businesses in emerging markets also face constraints on access to nonfinancial inputs needed for expansion, such as hiring labor, operational, technical, managerial and marketing skills, and information, which limits their ability to grow (e.g., see Levy 1993, Karlan and Valdivia 2011, Bruhn et al. 2016, Drexler et al. 2014). McKenzie and Woodruff (2014) argue that the problems of small firms facing constraints on financial and nonfinancial inputs are more aggravated in emerging economies than in developed ones. Furthermore, many of the costs of running a store, such as real estate costs in crowded urban areas and the recurrent costs of utilities such as electricity, are characterized by quantity premia (Tabuchi 1996); this is especially true in urban areas in developing economies that are relevant to our study because this is where organized retailers are typically present.

To capture the reality that size expansion is increasingly difficult for an unorganized retailer, we assume that the fixed cost of entry, denoted by $F(s) > 0$, where s is the number of unique customers the unorganized retailer serves, is convex increasing in s. Specifically, the cost for a store that can handle up to s unique customers is given by fs^{η}, where $\eta > 1$ and f is an exogenous constant. The focal case that we study assumes $\eta = 3/2$, which implies that the fixed cost increases in a convex manner with the capacity of the store. Our main results hold for any $\eta > 1$ (for which the model is well behaved); the specific value $\eta = 3/2$ is used for analytical tractability. Note that since the fixed cost is an entry cost, it will impact the number of unorganized retailers that enter the market.

For the single organized retailer, the cost structure is not essential for our conclusions. For that reason, we simply assume its entry cost and marginal cost are both zero. By this assumption, we let the organized retailer's marginal cost be lower than the unorganized retailer's marginal cost.

We also model the extent of *personalized service*, provided by the unorganized retailers to customers and we use a parameter S to capture it in the model. Many of the unorganized retailers interact with customers to understand the tastes and preferences of their customers, and this may provide additional value to customers (Child et al. 2015). For instance, the unorganized retailer could inform the customer about how to use the product to better match her needs, leading to additional utility from the product. A consumer will not obtain this additional personalized service utility when she purchases the product at the organized retailer. We note that S will not matter for price competition when only unorganized retailers are in the market (because everybody offers it), but will matter when the organized retailer is present. We do not model personalized service in our main model, but model it in an extension in §4.1.

We assume all agents in the model to be risk-neutral utility maximizers.

Characteristics of the Product Category. For consumer demand, we consider a two-period model. In Period 1, each consumer needs to consume exactly one unit of the product. For Period 2, however, consumers are uncertain about their need, and a demand of one unit is realized with probability β;[3] β is a product category-specific parameter (which does not change based on the presence or absence of the organized retailer). In other words, β stays constant over time, but varies by product category. For some categories, β will be large (e.g., milk, flour, and other staples), whereas for other categories β may be small (e.g., chocolate, rare spices, and other products that may not be frequently used). Every consumer has to make a trip to a retail store in Period 1 to purchase the product to be consumed in Period 1. For Period 2 consumption, she may make a second trip in Period 2 only if demand is actually realized.

We note that we build a category-level model. However, if one considers that consumers make a trip to a retail store to purchase a basket of items from different categories, one can interpret β as an aggregate measure of the probability of demand in Period 2 for the entire basket of items purchased by the consumers. This can have implications for assortment decisions for retailers. Though we do not model this explicitly, we discuss this briefly in §5.

The benefit of purchasing multiple units of a product during a shopping trip also depends on whether the product has any residual value in case it is not consumed. When a consumer purchases multiple units of a product, there is a likelihood that demand may not arise in the second period and the product may lose some of its value. We use a parameter γ ($0 \leq \gamma \leq 1$) to capture the residual (or salvage) value of the product not consumed. The parameter γ will be lower for perishables compared to nonperishables. We do not model perishability in our main model, but model it in an extension in §4.2. One can expect that a more perishable product (smaller γ) will have a higher probability of demand in the second period (larger β); in other words, β and γ may be correlated. We discuss the implications of this in §4.2.

Characteristics of the Consumers. During her Period 1 trip, a consumer may purchase a second unit for Period 2 consumption to avoid travel costs in Period 2 (and risk letting this unit go to waste if not needed subsequently). Given that consumers have the option of buying one or two units, then their ability to buy and store the second unit for one period needs to be considered. A number of factors can influence this, including the availability of storage space, the availability of refrigeration for perishable products, and even the purchasing power or budget to purchase multiple units (Child et al. 2015). We assume that a fraction $0 < \alpha < 1$ of consumers in the market have the required ability to pay for multiple units and the space or refrigeration capability to store a unit. The remaining $(1 - \alpha)$ consumers do not have the storage capability or the budget, etc., and hence do not have the option to purchase two units in Period 1. Both segments of consumers are uniformly distributed along the circle.

The different components of the model correspond to the relevant characteristics of the retailing environment, the sellers, the product category, and the customers. Recent empirical research (Narayan et al. 2015) has studied the role of three attributes (price, location to store, and service) on differences in the adoption of modern retail across socioeconomic segments. We expand on the number of factors that may affect the competitive structure of modern retail in an emerging economy to derive normative implications for prices and profits due to the presence of an organized retailer.

Timeline of the Game: We now describe the timeline of the game. First, the retailers make their entry and pricing decisions, in that order. In the scenario in which both unorganized retailers and an organized

[3] Let there be n consumers with independent and identically distributed demand realization. For each consumer, there is a probability β that the demand is realized in the second period, i.e., the demand in the second for each consumer follows a Bernoulli process with parameter β. Then the joint distribution (across all consumers) is given by a binomial distribution with parameter $(n\beta)$. Therefore, $E(\text{Binomial}(n\beta))/n = \beta$.

retailer are present, this can be represented by the following stages of the game.

Stage 1—*Entry decisions.* The organized retailer is located at the center of the circle. There is an unlimited number of unorganized retailers who make their entry decisions simultaneously and have to pay an entry cost. Only some of them enter, and all unorganized retailers who enter locate equidistantly from each other on the circumference of the circle.

Stage 2—*Pricing decisions.* The organized and unorganized retailers simultaneously set their prices.

In the scenario in which only unorganized retailers are present, the stages of the game stay the same. In Stage 1, the unorganized retailers make their entry decisions simultaneously, and in Stage 2 they decide their prices simultaneously. After the two stages above are complete, Periods 1 and 2 of consumer consumption follow, and the prices that are set by the retailers stay unchanged in both periods. (We note that if we allow firms to change prices at the end of Period 1, different prices might indeed prevail in Period 2. However, there is no uncertainty in Period 1, so there will be no uncertainty about the price path either and all agents will be able to perfectly foresee it. Consequently, the main trade-offs that we focus on in the model and the insights that we want to convey will continue to hold.)

3. Analysis and Results

We first analyze the scenario in which only unorganized retailers are present. Following this, we analyze the scenario in which one organized retailer is also present. Note that we do *not* build a dynamic model of the entry of the organized retailer; rather, our idea is to model the long-run outcomes of the scenarios without and with organized retailing. We then compare the outcomes of the two scenarios to understand the impact of the presence of organized retailing on unorganized retailing. As discussed in §2, the variation in model parameters indicates differences in the characteristics of the retail environment, the retailers, the consumers, and the product categories. We focus on the impact of the model parameters on the organized and unorganized retailers' prices and profits, which helps us understand the retail market in emerging economies. To keep the expressions simpler, we analyze the base model without two parameters: (i) personalized service parameter (S) and (ii) the residual value parameter (γ). Subsequently, in §4, we incorporate these parameters in our analysis and discuss the implications of these two parameters.

3.1. Scenario 1: Only Unorganized Retailers

We use the subscript 1 to denote quantities in this case. In this scenario, N_1 identical unorganized retailers are located equidistantly from each other along the circumference of the circle (N_1 is decided endogenously), and there is no organized retailer. According to the demand structure, a consumer will need one unit of the product in Period 1 and may need one unit in Period 2. Consider a focal unorganized retailer charging price p_{U1}. The choices that a consumer, with storage capability, located x_1 has from this retailer are the following:

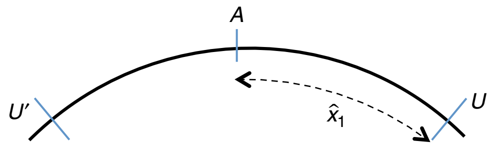
1. *Buy to consume* (*BTC*): Buy one unit in each time period as the need arises. In this case the consumer will have to make a second trip to the retailer in Period 2 if demand is realized. The total expected consumer utility associated with this option is $(1+\beta)(V-p_{U1}-tx_1)$.
2. *Buy to store* (*BTS*): Buy two units in Period 1 from the store the consumer visits, i.e., one unit for Period 1 consumption and the other in storage for Period 2 consumption if needed. The total expected consumer utility associated with this option is $\beta(2V)+(1-\beta)V-2p_{U1}-tx_1$, where you pay for two units of the product, but the second unit of the product may not be needed in the second period with probability $1-\beta$. This utility expression simplifies to $(1+\beta)V-2p_{U1}-tx_1$.

A consumer who does not have storage capability does not have the BTS option. The consumer has to jointly choose between BTC and BTS, and also the retailer that she will purchase from. We first discuss a consumer's decision between the BTC and BTS options at a focal retailer and then discuss the consumer's decision on which store to visit. Note that it is never optimal for a consumer to shop at two different retailers.

First, consider a consumer's decision between the BTC and BTS options at the focal unorganized retailer. A consumer will take the BTC option if she is located close enough to the unorganized retailer because the total travel cost to the retailer is small. The location of the marginal consumer choosing between BTC and BTS, denoted by distance x_1' from the focal retailer, is given by solving $(1+\beta)(V-p_{U1}-tx_1')=(1+\beta)(V)-2p_{U1}-tx_1'$, which gives the indifference point $x_1'=((1-\beta)/\beta)(p_{U1}/t)$. Thus, all consumers located at $x\le x_1'$ will take the BTC option, i.e., they will postpone purchasing a second unit, and purchase it if demand arises in Period 2.

A consumer will also optimally decide which store to visit. Since the unorganized retailers are symmetrically located, we focus on the consumers in a segment of length $1/N_1$ between two unorganized retailers, i.e., the focal unorganized retailer and the neighboring unorganized retailer, denoted by U and U', respectively; see Figure 1. Since consumers can choose BTC (or BTS, if applicable) at either of the two unorganized retailers, consider two types of indifferent consumers: (i) a consumer who is indifferent between choosing

Figure 1 (Color online) A Section of the Salop Circle When Only Unorganized Retailers Are Present



the BTC option at either retailer, given by $\hat{x}_1$, and (ii) a consumer who is indifferent between choosing the BTS option at either retailer. (After the discussion on these two types of indifferent consumers, we will discuss a third type of indifferent consumer, who chooses between the BTC option at one retailer and the BTS option at the neighboring retailer.)

Referring to Figure 1 and focusing on consumers who choose the BTC option, consumers in UA will take the BTC option from U, and consumers in $U'A$ will take the BTC option from U'; the consumer at A is indifferent between the focal unorganized retailer U and the neighboring unorganized retailer U', and the distance UA is given by $\hat{x}_1$. To solve for the symmetric price equilibrium, we set prices of all stores except the focal store to be equal to $p_{U'1}$. Thus, $\hat{x}_1$ is given by the indifference condition

$$(1+\beta)(V-p_{U1}-t\hat{x}_1) = (1+\beta)\left(V-p_{U'1}-t\left(\frac{1}{N_1}-\hat{x}_1\right)\right), \quad (1)$$

which gives $\hat{x}_1 = 1/(2N_1)+(p_{U'1}-p_{U1})/(2t)$.

Next, consider the indifferent consumer who takes the BTS option from both stores, and let this consumer be located at x_1''. If the consumer purchases from the focal store, her utility is $(1+\beta)V-2p_{U1}-tx_1''$; if the consumer purchases from the adjacent store, her utility is $(1+\beta)V-2p_{U'1}-t(1/N_1-x_1'')$. Equating the utility to solve for the marginal consumer, we find $x_1''=(1/(2N_1t))(t-2N_1p_{U1}+2N_1p_{U'1})$. All consumers located at $x \le x_1''$ will purchase from the focal store and otherwise purchase from the adjacent store.

We focus on the parameter space where, in the absence of the organized retailer, all consumers take the BTC option. The condition that we need to impose for this to hold is $x_1' > x_1''$, which gives

$$\beta < \frac{2N_1p_{U1}}{t+2N_1p_{U'1}}. \quad (2)$$

These consumers purchase from unorganized retailers only if demand is realized and in such a scenario, a consumer's ability or inability to store does not matter. To ensure that consumers take the BTC option from the neighboring unorganized retailer as well, we make the identical assumption for the neighboring unorganized retailer. This condition is given by

$$\beta < \frac{2N_1p_{U'1}}{t+2N_1p_{U1}}. \quad (2')$$

Note that these assumptions also rule out the existence of the third type of indifferent consumer who chooses between the BTC option at one retailer and the BTS option at the neighboring retailer.

Narrowing the parameter space by assuming (2) and (2′) reduces the complexity because in equilibrium consumers will only take the BTC option in this scenario (i.e., the BTS option is ruled out as an equilibrium choice). We note that we are not imposing any behavior on consumers, but only restricting the analysis to the parametric regions in which choosing the BTC option is the endogenous equilibrium behavior of the consumers. We express the restricted parameter space in terms of the endogenous variables p_{U1} and N_1 for simplicity; once we solve for these endogenous variables, we can substitute them into these expressions and obtain the parametric restrictions in terms of exogenous parameters only (see §A2 in the appendix). In §4.3, we confirm that the insights that we derive here continue to hold for a relaxed parameter space.

Under the above parametric restriction, the sales of the unorganized retailer are

$$2\hat{x}_1 = 2\frac{1}{2N_1}+\frac{p_{U'1}-p_{U1}}{2t},$$

where the factor of 2 appears because the unorganized retailer obtains customers symmetrically from both sides of its location. Under the conditions (2) and (2′), all consumers will buy to consume, so that the unorganized retailers' market consists of all of the consumers, i.e., of the segments with and without storage abilities. Therefore, the expected profit for the focal unorganized retailer, not considering the cost of entry, is given by

$$\pi_{U1} = (1+\beta)(p_{U1}-c)\cdot 2\left(\frac{1}{2N_1}+\frac{p_{U'1}-p_{U1}}{2t}\right). \quad (3)$$

Maximizing this with respect to p_{U1} and setting $p_{U1}=p_{U'1}$ due to symmetry, we obtain

$$p_{U1} = c+\frac{t}{N_1}. \quad (4)$$

From this expression for price, we can see that as the number of unorganized retailers, N_1, increases, price competition increases and price decreases.

We calculate the equilibrium number of unorganized retailers by imposing the zero expected profit condition in the entry stage. Each unorganized retailer faces the entry cost given by $F_1 = fs_1^{3/2}$, where s_1 is the number of unique customers served by the unorganized retailer after entry, and is given by $s_1 = 2\hat{x}_1 = 1/N_1$. Therefore, we set $\pi_{U1}-F_1$ equal to zero, which gives the number of unorganized retailers as

$$N_1 = \frac{t^2(1+\beta)^2}{f^2}. \quad (5)$$

Using this value of N_1, we obtain the price as

$$p_{U1} = c + \frac{f^2}{t(1+\beta)^2}. \tag{6}$$

We now state several interesting results from the analysis in the following proposition.

Proposition 1. *In a market populated by only unorganized retailers, the number of unorganized retailers in the market, N_1, increases in the probability of high demand, β, and the transportation cost, t. The price charged by an unorganized retailer, p_{U1}, decreases in β and t.*

We find that the price charged by an unorganized retailer, p_{U1}, decreases in the unit transportation cost, t, and the probability of Period 2 demand, β. Specifically, the first result is exactly the opposite of the result found from the standard Salop's model (Salop 1979), where the price charged increases in t. The reason for this difference lies in our assumption of the form of the fixed costs of entry. Note that the number of unorganized retailers in the market, N_1, is endogenously determined. In our model, the fixed entry cost that an unorganized retailer incurs is convex in the size of the market served by the unorganized retailer. In Salop (1979), however, entry costs are assumed to be independent of the market coverage of the firm (in our model, this translates to $\eta = 0$). When the fixed costs are convex in the size of the market served, N_1 increases in t (because consumers do not prefer to go far from their location and business is more "local" in nature) and in β (because expected demand increases). In the pricing stage, a larger N_1 implies a more competitive market, and therefore price, p_{U1}, decreases in t and β, which explains the results.

The above results also directly imply that the market coverage per unorganized retailer, $2\hat{x}_1 = 1/N_1$, will decrease in both t and β. We remind the reader that the net profit of every unorganized retailer in the market, after accounting for fixed costs, is zero.

3.2. Scenario 2: Unorganized Retailers and One Organized Retailer

We use the subscript 2 to denote quantities in this case. In this scenario, N_2 identical unorganized retailers are located equidistantly from each other along the circumference of the circle (N_2 is decided endogenously), and there is one organized retailer located at the center of the circle. By virtue of the fact that the organized retailer is at the center, it competes with all of the unorganized retailers. Let p_{U2} be the price at a focal unorganized retailer, and let p_{O2} be the price at the organized retailer. The choices (and the associated utilities) for a consumer located at x_2 who has storage capability are as follows.

1. *Buy to consume from an unorganized retailer* (*BTC-U*): Buy from the unorganized retailer offering the highest net utility in Period 1 and buy from the same unorganized retailer in Period 2 if required; the utility for this is given by $(1+\beta)(V - p_{U2} - tx_2)$.
2. *Buy to store from an unorganized retailer* (*BTS-U*): Buy two units from the unorganized retailer offering the highest net utility in Period 1 and waste the product if not required; the utility for this is given by $\beta(2V) + (1-\beta)V - 2p_{U2} - tx_2$. This utility expression simplifies to $(1+\beta)V - 2p_{U2} - tx_2$.
3. *Buy to consume from an organized retailer* (*BTC-O*): Buy from the organized retailer in Period 1 and from the organized retailer in Period 2 if required; the utility for this is given by $(1+\beta)(V - p_{O2} - \mu)$.
4. *Buy to store from an organized retailer* (*BTS-O*): Buy from the organized retailer in Period 1 for both periods and waste product if not required; the utility for this is given by $\beta(2V) + (1-\beta)V - 2p_{O2} - \mu$. This utility expression simplifies to $(1+\beta)V - 2p_{O2} - \mu$.

Given that there are four possible choices that each consumer can make,[4] we simplify the analysis by constraining the parameters to narrow down the consumers' decisions to focus on outcomes that (we believe) are most interesting and relevant in emerging markets. First, we impose parametric restrictions such that, in equilibrium, any purchases from an unorganized retailer are of the BTC type. Using a derivation similar to that in §3.1, this can be guaranteed by assuming, for BTC-U for the focal unorganized retailer

$$\beta < \frac{2N_2 p_{U2}}{t + 2N_2 p_{U'2}}, \tag{7}$$

and, for BTC-U for the neighboring unorganized retailer

$$\beta < \frac{2N_2 p_{U'2}}{t + 2N_2 p_{U2}}. \tag{7'}$$

These conditions have the same structure as derived in the scenario with only unorganized retailers.

Between Option 3 (BTC-O) and Option 4 (BTS-O), a consumer chooses BTS-O if $(1+\beta)V - 2p_{O2} - \mu > (1+\beta)(V - p_{O2} - \mu)$ or, equivalently, if

$$\beta > \frac{p_{O2}}{\mu + p_{O2}}. \tag{8}$$

Note that the equilibrium behavior of consumers is not imposed, but is endogenously derived. However, restricting the parameter space in the manner above

[4] There is a fifth choice: buy from the organized retailer in Period 1 and from the unorganized retailer offering the highest net utility in Period 2 if required; $(V - p_{O2} - \mu)\beta(V - p_{U2} - tx_2)$. However, this can never be an optimal decision from the consumers perspective because $(V - p_{O2} - \mu) > (V - p_{U2} - tx_2)$ for such a consumer (as she buys from the organized retailer in Period 1), which implies that it is not optimal in Period 2 to buy from the unorganized retailer if the consumer made a decision to buy from the organized retailer in Period 1.

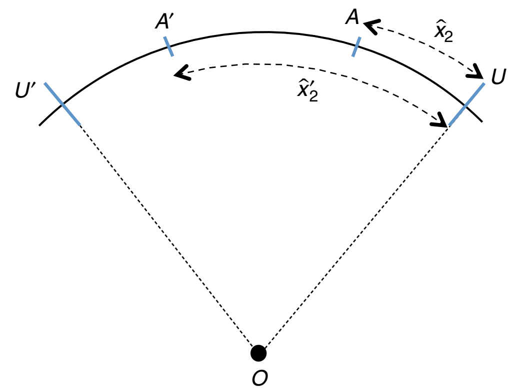
ensures that, in equilibrium, consumers who purchase from the unorganized retailer take the BTC-U option, and consumers who purchase from the organized retailer take the BTS-O option (i.e., the BTS-U and BTC-O options are ruled out as equilibrium choices). In other words, we focus on the outcomes where consumers who purchase from an unorganized retailer purchase one unit at a time but visit as often as needed, and consumers who purchase from an organized retailer purchase in bulk (i.e., two units) in one visit. In §4, we consider other regions of the parameter space in which equilibrium behavior of consumers may be different (e.g., choosing BTC-O and BTS-U) and show that the key insights obtained from our main analysis continue to hold.

Given the large number of parameters in the model ($\alpha, \beta, \mu, t, V, c$), we express the restricted parameter space in terms of the endogenous variables p_{U2}, p_{O2}, and N_2; once we solve for these endogenous variables, we can substitute them into these expressions and obtain the parametric restrictions in terms of exogenous parameters only (see §A2 in the appendix).

Since the unorganized retailers are symmetrically located, we focus on the consumers in a segment of length $1/N_2$ between two unorganized retailers. Since we have assumed that all of the consumers who purchase from unorganized retailers buy to consume (by condition (7)), the unorganized retailers' market consists of the segments of consumers with and without storage capabilities, of sizes α and $1-\alpha$, respectively).[5]

[5] We assume that, after entry, all unorganized retailers locate themselves symmetrically on the circumference of the circle and undertake symmetric actions in terms of which consumer segments to target. This allows us to focus on the actions of a focal unorganized retailer. In our analysis, we focus on the equilibrium in which unorganized retailers target both segments of consumers. Another possible equilibrium could be that unorganized retailers cater only to consumers with no storage capabilities (i.e., only one segment of consumers, of size $1-\alpha$), and the organized retailer caters to consumers with storage capabilities (note that, by assumption on the parameter values, we are ruling out the case in which a consumer without storage capability goes to the organized retailer). However, this strategy is not in the interest of unorganized retailers. To see this, assume that unorganized retailers follow the strategy of focusing only on consumers without storage capabilities. Consider a representative consumer with storage capability who buys from the organized retailer; this consumer has an expected utility of $(1+\beta)V-2p_{O2}-\mu$. Since there is no competition for these consumers, the organized retailer will price to extract the full consumer surplus, i.e., $(1+\beta)V-2p_{O2}-\mu=0 \Rightarrow p_{O2}=\frac{1}{2}V(1+\beta)-\frac{1}{2}\mu$. Now consider a consumer with storage capability who is colocated with the focal unorganized retailer. Her utility associated with buying in each period from an unorganized retailer is $(1+\beta)(V-p_{U2})$. For this consumer to not buy from the unorganized retailer, this utility should be (weakly) less than the utility this consumer obtains from buying from the organized retailer, i.e., $(1+\beta)(V-p_{U2}) \leq (1+\beta)V-2p_{O2}-\mu \Rightarrow (1+\beta)(V-p_{U2}) \leq 0 \Rightarrow p_{U2} \geq V$. This implies that the unorganized retailer will have no sales at all from the consumers without storage capabilities either. Therefore, we focus on the equilibrium in which the unorganized retailers target both segments.

Figure 2 **(Color online) A Section of the Salop Circle for Consumers with Storage Capability When Unorganized Retailers and an Organized Retailer Are Present**



Consider consumers with storage capability. Referring to Figure 2, consumers in UA and $U'A'$ take the BTC-U option, and consumers in AA' take the BTS-O option. Therefore, among the consumers with storage capability, we characterize two marginal consumers—the consumer indifferent between the focal unorganized retailer and the organized retailer (located at $\hat{x}_2$), and the consumer indifferent between the organized retailer and the neighboring unorganized retailer (located at $\hat{x}'_2$). The indifference condition for the marginal consumer at A is given by

$$(1+\beta)(V-p_{U2}-t\hat{x}_2)=(1+\beta)V-2p_{O2}-\mu, \qquad (9)$$

which gives $\hat{x}_2=(\mu+2p_{O2}-(1+\beta)p_{U2})/(t(1+\beta))$. The indifference condition for the marginal consumer at A' is given by

$$(1+\beta)V-2p_{O2}-\mu = (1+\beta)\left(V-p_{U2}-t\left(\frac{1}{N_2}-\hat{x}'_2\right)\right), \qquad (10)$$

which gives

$$\hat{x}'_2=\frac{1}{N_2}-\frac{\mu+2p_{O2}-(1+\beta)p_{U2}}{t(1+\beta)}.$$

We impose the constraint $\hat{x}'_2>\hat{x}_2$ to ensure that the organized retailer gets a positive share.

From the above, the total demand for the organized retailer is given by $N_2(2\alpha(\hat{x}'_2-\hat{x}_2))$ (where the factor of 2 accounts for the fact that every consumer who buys from the organized retailer buys two units in the first period), and its profit is given by

$$\pi_{O2}=p_{O2}(N_2(2\alpha(\hat{x}'_2-\hat{x}_2))). \qquad (11)$$

The analysis for the fraction $1-\alpha$ of consumers without storage ability stays the same as §3.1 because this consumer cannot consider purchasing multiple units from the organized retailer anyway. Therefore, the total demand for the unorganized retailer is given by $2\alpha(1+\beta)\hat{x}_2 + (1-\alpha)(1+\beta)(1/N_2 + (p_{U'2} - p_{U2})/t)$. The first part of the expression denotes demand from the α fraction of consumers with storage capabilities; the factor of 2 in the first part accounts for the fact that the unorganized retailer obtains consumers symmetrically from both sides around its position. The second part of the expression denotes demand from the $1-\alpha$ fraction of consumers without storage capability; these consumers do not consider the organized retailer at all, and the derivations for this part are as in Scenario 1.

The expected profit of the unorganized retailer, not considering the cost of entry, is given by

$$\pi_{U2} = (p_{U2} - c)\left(2\alpha\hat{x}_2(1+\beta) + (1-\alpha)(1+\beta) \cdot \left(\frac{1}{N_2} + \frac{p_{U'2} - p_{U2}}{t}\right)\right). \quad (12)$$

Solving for the equilibrium prices by maximizing the profit expressions (conditional on entry) and setting $p_{U2} = p_{U'2}$ (due to symmetry among unorganized retailers), we obtain

$$p_{U2} = \frac{2cN_2(1+\alpha)(1+\beta) + 2N_2\alpha\mu + t(2-\alpha)(1+\beta)}{2N_2(2\alpha+1)(1+\beta)}, \quad (13)$$

$$p_{O2} = \frac{2cN_2(1+\alpha)(1+\beta) - 2N_2(1+\alpha)\mu + t(3+\alpha)(1+\beta)}{8N_2(2\alpha+1)}. \quad (14)$$

We calculate the equilibrium number of unorganized retailers by imposing the zero expected profit condition in the entry stage. Each unorganized retailer faces the entry cost given by $F_2 = fs_2^{3/2}$, where s_2 is the number of unique customers served by the unorganized retailer after entry, and is given by $s_2 = 2(\alpha\hat{x}_2 + (1-\alpha)(1/N_2))$. We solve for $\pi_{U2} - F_2 = 0$, which gives

$$N_2 = \frac{t^2(2-\alpha)(1+\beta)^2}{2(t\alpha(1+\beta)(c(1+\beta)-\mu) + f^2(2\alpha^2+3\alpha+1))}. \quad (15)$$

Using this value of N_2, we obtain

$$p_{U2} = c + \frac{f^2(1+\alpha)}{t(1+\beta)^2}, \quad (16)$$

$$p_{O2} = \frac{2t(1+\beta)(c(1+\beta)-\mu) + f^2(\alpha^2+4\alpha+3)}{4t(2-\alpha)(1+\beta)}, \quad (17)$$

and

$$\hat{x}_2 = \frac{1}{N_2} - \hat{x}_2' = \frac{f^2(3\alpha^2+2\alpha-1) - 2(1-\alpha)(1+\beta)t((1+\beta)c-\mu)}{2(2-\alpha)(1+\beta)^2t^2}. \quad (18)$$

Before we proceed to discuss the results, we note that we have assumed that the marginal cost at the unorganized retailer (given by $c \geq 0$) is greater than that at the organized retailer (given by 0). This assumption is made for realism. However, if c is assumed to be 0, all our results and insights continue to hold qualitatively (as one can easily see from the expressions). Specifically, depending on c, the price at the organized retailer can be lower or higher than the price at the unorganized retailers—the condition for the price at the organized retailer to be lower is the following:

$$p_{O2} \leq p_{U2} \Leftrightarrow c \geq \frac{1}{3-2\alpha-\beta}\left(\frac{f^2(1+\alpha)(\beta(3+\alpha)-5(1-\alpha))}{2t(1+\beta)^2} - \mu\right). \quad (19)$$

In the following proposition, we now state several interesting results from the analysis.

Proposition 2. *In a market where unorganized retailers and an organized retailer coexist, the number of unorganized retailers in the market, N_2, decreases in the fraction of consumers with storage capability, α; increases in the probability of high demand, β (iff $\mu < 2f^2(2\alpha^2+3\alpha+1)/(\alpha(1+\beta)t)$); increases in the transportation cost to an unorganized retailer, t (iff $\mu < c(1+\beta) + 2f^2(1+3\alpha+2\alpha^2)/(t\alpha(1+\beta))$); and increases in the transportation cost to the organized retailer, μ. The price charged by an unorganized retailer, p_{U2}, decreases in β and t and increases in α.*

Given the results in Proposition 1, the interesting comparative statics that are new in the above proposition are with respect to the size of the consumer segment with storage capability, α. Under the specified condition, as the size of this segment increases (i.e., more consumers can purchase in bulk from the organized retailer), the price charged by the unorganized retailers increases. Following the logic in the explanation for Proposition 1, the reason is that as more consumers are eligible to purchase in bulk from the organized retailer, fewer unorganized retailers stay in the market. In the pricing stage, a smaller N_2 implies a less competitive market, and therefore price, p_{U2}, increases in α.

Another interesting result is that as β increases from a small value, N_2 increases in β, but for $\beta > 2f^2(2\alpha^2+3\alpha+1)/(t\alpha\mu) - 1$, N_2 decreases in β. This is because an increase in β generates two effects. First, consumers' expected purchases increase. Second, more consumers tend to purchase in bulk (two units in one trip in Period 1) from the organized retailer. As β increases from a small value, the first effect dominates—consumers purchase more, which implies that more unorganized retailers enter the market. However, above a threshold value of β, the second effect dominates and N_2 decreases in β.

Next, we state the following proposition that characterizes the results for the organized retailer.

Proposition 3. *In a market where unorganized retailers and an organized retailer coexist, the price charged by the organized retailer, p_{O2}, increases in the fraction of consumers with storage capability, α; decreases in the probability of high demand, β (iff $2(1+\beta)^2ct - f^2(\alpha^2+4\alpha+3) < 0$); decreases in the transportation cost to an unorganized retailer, t; and decreases in the transportation cost to the organized retailer, μ. The share of consumers with storage capability served by the organized retailer, ϕ_{O2}, decreases in β (iff $\mu > 2c(1+\beta)$), decreases in t (iff $\mu > c(1+\beta)$), and decreases in μ.*

Proposition 3 provides several expected results (which lends confidence in the validity of the model) and also provides interesting insights about what the organized retailer may experience in emerging markets. First, as α increases, i.e., more consumers have storage capabilities, the organized retailer is at an advantage because more consumers consider purchasing from it and it can charge higher prices. The ability of consumers to buy in bulk and store products across consumption periods has been improving in developing countries in the past three decades for various reasons, such as better refrigeration and higher purchasing power. This is welcome news for the organized retailer.

Second, lay intuition may suggest that as β increases, i.e., the probability of the consumers' demand realization in the second period increases (this could happen for a number of reasons, e.g., consumers may plan their future consumption better due to time constraints, there may be a change in consumer habits due to availability of longer lasting produce, etc.), prices of organized retailers should increase monotonically. However, we find that organized retailer's prices can decrease in β. This is because as β increases from a small value, consumers purchase more, which implies that more unorganized retailers enter the market, leading to more competition and lower prices. However, beyond a certain threshold value of β, specifically, for $\beta > f\sqrt{(\alpha^2+4\alpha+3)/(2ct)} - 1$, the opposing effect, that more consumers purchase in bulk from the organized retailer, starts to dominate, leading to the organized retailer's price increasing in β. We see a similar trend for the organized retailer's market coverage as well—ϕ_{O2} decreases as β increases from a small value, but it increases in β for $\beta > \mu/(2c) - 1$.

Third, a decrease in μ, i.e., a decrease in the transportation cost to the organized retailer, will favor the organized retailer in terms of profitability, pricing power, and market coverage, as expected. This also means, on the flip side, that a higher μ can be detrimental to the organized retailer in just as many ways. In many countries, the fixed cost of traveling to the organized retailer could be increasing as organized retail malls are appearing wherever real estate is available rather than where they are actually needed (KPMG 2009), and urban infrastructure development has not kept pace with the growth in retail, leading to lower penetration of organized retail. From a policy point of view, this result suggests that policy makers can cushion the impact of organized retailing with government zoning policies, whereby organized retailers are allowed to establish themselves only in certain geographical areas (or special economic zones), possibly on the outskirts of cities, which increases consumers' travel cost to organized retailers.

Fourth, a surprising result that we obtain is that as t increases, i.e., the per-unit-distance transportation cost to an unorganized retailer increases, the organized retailer's market coverage, prices, and profits may decrease. As stated in Proposition 2, as t increases, the number of unorganized retailers in the market, N_2, increases under certain conditions. Therefore, the market becomes more competitive, which implies that prices and profits at both types of retailers decrease as t increases. This implies that the financial success of the organized retailer can be greater for a lower t, and the probability that an unorganized retailer will remain in the market in the presence of an organized retailer may be greater for a higher t.

3.3. Comparison of Scenarios Without and With the Organized Retailer

After understanding the outcomes of the scenarios without and with the organized retailer, we now compare these outcomes with each other to understand the impact of the presence of the organized retailer. Before proceeding further, we note some important points here. First, for the comparison, we maintain identical exogenous parametric conditions, given by (2), (2′), (7), (7′), and (8), and compare the characteristics of the derived equilibria in both scenarios under these conditions. Second, the intersection of (2), (2′), (7), (7′), and (8), i.e., the parameter space in which the comparison is meaningful, is nonempty (see §A2 in the appendix). Third, the scenarios without and with the organized retailer may have a different number of unorganized retailers. As we noted earlier, we do *not* build a dynamic model of the entry of the organized retailer. Rather, we compare the long-run equilibrium outcomes of the two scenarios. Given that we model long-run outcomes, we assume that the locations of the unorganized retailers will adjust to the market situation in each scenario, i.e., unorganized retailers' stores may close, open, or relocate such that in the long term they are located equidistantly from each other on the circumference. Finally, the characteristics of each consumer stay the same in both scenarios, but their equilibrium behavior may change because of the differences in the industry structure, prices, etc.

We focus on the incentives of the unorganized retailers, who typically feel threatened by the emergence of organized retailing and oppose it. We consider the question of unorganized retailers resisting the presence of organized retailers. Our contention is that whenever there is an adverse effect on the collective profits of unorganized retailers, there is a greater likelihood of resistance. Therefore, we compare collective postentry profitability (i.e., treating fixed costs of entry of unorganized retailers in Stage 1 as sunk costs) and market coverage of unorganized retailers without and with the presence of the organized retailer. First, we consider the demand-side factors that influence the degree of resistance offered by unorganized retailers to the presence of organized retailers. In the presence of the organized retailer, market coverage of unorganized retailers drops. If consumers are more certain about their future consumption needs, i.e., if the probability that a consumer's demand will be realized in the second period, given by β, is sufficiently high, then the consumers have a greater incentive to visit the organized retailer and purchase two units. In other words, the market covered by unorganized retailers decreases with β, leading to a drop in unorganized retailers' profitability, and, consequently, the unorganized retailers resist the presence of the organized retailer.

From a supply-side perspective, the more cost disadvantaged the unorganized retailers are (i.e., c is larger), the greater their resistance to the presence of the organized retailer. Our analysis suggests that in countries in which the unorganized retailers have built more efficient supply chain infrastructure and thereby kept their cost disadvantages low relative to organized retailers, the resistance to organized retailing would be low. Our study also implies that government agencies could minimize resistance by unorganized retailers by formulating retail policy to allow foreign direct investment at a gradual pace, which would allow the local unorganized retailers to emulate best practices of the organized retailers and create efficient supply chain infrastructure, thereby competing more efficiently with the organized retailers. Not surprisingly, we also find that when the consumers' transportation cost to the organized retailer is sufficiently low, i.e., μ is sufficiently low, there is greater resistance by unorganized retailers.

Next, we study the pricing strategy of the unorganized retailers in the presence of the organized retailer. One would expect that competition between unorganized retailers and the organized retailer will lead to greater price competition. Interestingly, our analysis suggests otherwise, as summarized in the following proposition.

Proposition 4. *The price charged by an unorganized retailer is higher in the presence of an organized retailer than in its absence, i.e.,* $p_{U2} > p_{U1}$.

The intuition for why an unorganized retailer charges a higher price in the presence of an organized retailer is that the presence of the organized retailer takes away market share from the unorganized retailers, which leads some of the unorganized retailers to exit. This reduces price competition among the remaining unorganized retailers in equilibrium, thus leading to higher prices. Proposition 4 thus suggests that an unorganized retailer should not instinctively compete with the organized retailer with a lower price. Instead, it can optimally raise its price, recognizing the smaller number of surviving unorganized retailers. Note that past research conducted in the context of developed economies has found evidence of lower prices after the entry of an organized retailer like Walmart (e.g., Basker 2005a). Our results highlight the possibility that the retailing environment may play a significant role in the competitive price pressures faced by small retailers due to the entry of large retailers. Prior research has shown how an exit by some consumers can permit firms to charge higher prices in some markets (Pazgal et al. 2013); our paper suggests the role of entry and exit by firms in alleviating price competition among the unorganized retailers.[6]

Furthermore, we find that the price difference, $p_{U2} - p_{U1}$, increases as the fraction of consumers with storage capabilities, α, increases. This is because a larger α implies that more consumers purchase from the organized retailer, which implies that more unorganized retailers exit and market competitiveness decreases. Technological innovation and greater purchasing power has allowed more consumers in developing countries to own refrigerators and other storage gadgets, dramatically improving the shelf life of perishable products. This has supported the argument of setting up organized retailers and has been suggested as a possible cause for the downfall of the unorganized retail sector. Our modeling shows that the prices, profits, and coverage of each unorganized retailer can increase as storage capabilities increase.

In addition, we find that the price difference, $p_{U2} - p_{U1}$, decreases as the probability of demand in Period 2, β, increases, and decreases as the per-unit-distance transportation cost to the unorganized retailer, t, decreases. These effects can be explained in a similar manner as above.

[6] We also relate our result to that in Zhu et al. (2011), in which market entry by a large retailer increases the incumbent's price because the smaller incumbent and the entrant target different consumer segments based on the need for multicategory purchases. In our model, the consumers choose the retailer to purchase from based on storage ability and geographical location.

Given that the expansion of organized retailing seems inevitable in most emerging economies and, from the unorganized retailers' perspective, the most potent argument against organized retailing is that they will wipe out local businesses, we now turn our attention toward understanding some factors that influence the odds of survival of unorganized retailing, defined as the ratio of the number of unorganized retailers in the market with and without an organized retailer (i.e., N_2/N_1). We state these in the following proposition.

Proposition 5. *The number of unorganized retailers in the market in the presence of an organized retailer is always less than the number of unorganized retailers in its absence, i.e., $N_2 < N_1$. Furthermore, the ratio N_2/N_1 decreases in the fraction of consumers with storage capability, α; increases in the probability of high demand, β (iff $\mu > 2c(1+\beta)$); increases in the transportation cost to an unorganized retailer, t (iff $\mu > c(1+\beta)$); and increases in the transportation cost to the organized retailer, μ.*

We bring attention to the parts of the proposition that characterize the variation with transportation costs. Interestingly, as the per-unit-distance transportation cost along the circumference, t, increases, the survival probability of an unorganized retailer increases if μ is large enough. A larger value of t implies that consumers have a greater travel cost (i.e., the disutility associated with purchasing from a retailer not at the consumer's ideal location), leading to a larger number of unorganized retailers existing in the marketplace. Given this strong location disutility, consumers do not want to travel much, which implies that a larger number of unorganized retailers can exist in the market. Also, if the transportation cost to the organized retailer, μ, increases, then more unorganized retailers survive, as expected. In reality, the fixed cost of traveling to the organized retailer could indeed be increasing because organized retail malls are appearing wherever real estate is available rather than where they are actually needed KPMG (2009), and the urban infrastructure development has not kept pace with this growth. Furthermore, government zoning policies, whereby organized retailers can establish themselves only in certain geographical areas, lead to higher μ. Income and time constraints of consumers also play a role in increasing the "transportation cost" of the organized retail sector because, unlike unorganized retailers, organized retailers typically neither offer purchases on credit nor the option of home delivery.

3.3.1. Comparison of Consumer and Social Surplus. In this section, we examine the impact of the presence of the organized retailer on consumer and social surplus. First, we calculate the total consumer surplus in Scenario 1, denoted by CS_1. A consumer located at distance x from its closest unorganized retailer obtains a surplus of $(1+\beta)(V-p_{U1}-tx)$. Each unorganized retailer covers a market of size $1/(2N_1)$ on both sides of its location. Therefore, the total consumer surplus in Scenario 1 is given by

$$\begin{aligned} CS_1 &= N_1\left(2\left(\int_0^{1/(2N_1)}(1+\beta)(V-p_{U1}-tx)\,dx\right)\right)\\ &= (1+\beta)\left(V-p_{U1}-\frac{t}{4N_1}\right) \qquad (20)\\ &= V-c-\frac{5}{4}\frac{f^2}{t(1+\beta)^2}. \qquad (21)\end{aligned}$$

The expression for total consumer surplus shows that it increases in β and t. Note that because all unorganized retailers make zero profit, the social surplus in this scenario, denoted by SS_1, is equal to the consumer surplus derived above, i.e., $SS_1 = CS_1$.

Next, we calculate the total consumer surplus in this scenario, denoted by CS_2. First, consider the consumers who do not have storage capability, and take the BTC-U option. The total fraction of these consumers is $1-\alpha$. The total consumer surplus for these consumers can be calculated as in Scenario 1 and is given by

$$\begin{aligned} &CS_2^{1-\alpha,\,\text{BTC-U}}\\ &\quad= (1-\alpha)\left(N_2\left(2\left(\int_0^{1/(2N_2)}(1+\beta)(V-p_{U2}-tx)\,dx\right)\right)\right)\\ &\quad= (1-\alpha)(1+\beta)\left(V-p_{U2}-\frac{t}{4N_2}\right). \qquad (22)\end{aligned}$$

Second, consider the consumers who have storage capability, with total size α. Among these consumers, those up to a distance of $\hat{x}_2$ from the closest unorganized retailer take the BTC-U option and others take the BTS-O option. The total consumer surplus for the consumers with storage capability who take the BTC-U option, denoted by $CS_2^{\alpha,\,\text{BTC-U}}$, is given by

$$\begin{aligned} CS_2^{\alpha,\,\text{BTC-U}} &= \alpha\left(N_2\left(2\left(\int_0^{\hat{x}_2}(1+\beta)(V-p_{U2}-tx)\,dx\right)\right)\right)\\ &= \alpha(2N_2)(1+\beta)\left(V\hat{x}_2-p_{U2}\hat{x}_2-\frac{t\hat{x}_2^2}{2}\right). \qquad (23)\end{aligned}$$

The total consumer surplus for the consumers with storage capability who take the BTS-O option, denoted by $CS_2^{\alpha,\,\text{BTS-O}}$, is given by

$$\begin{aligned} &CS_2^{\alpha,\,\text{BTS-O}}\\ &\quad= \alpha\left(N_2\left(2\left(\int_{\hat{x}_2}^{1/(2N_2)}((1+\beta)V-2p_{O2}-\mu)\,dx\right)\right)\right)\\ &\quad= \alpha((1+\beta)V-2p_{O2}-\mu)(1-2N_2\hat{x}_2). \qquad (24)\end{aligned}$$

The total consumer surplus in Scenario 2 is given by $CS_2 = CS_2^{1-\alpha,\,\text{BTC-U}} + CS_2^{\alpha,\,\text{BTC-U}} + CS_2^{\alpha,\,\text{BTS-O}}$. Note that among the consumers with storage capability of size α, the quantity $N_2(2\hat{x}_2)$ is the share of consumers that all of the unorganized retailers serve together; we use the notation $\phi_{U2} = 2N_2\hat{x}_2$. The share of consumers that the organized retailer serves is given by $\phi_{O2} = 1 - \phi_{U2} = 1 - 2N_2\hat{x}_2$. Using this notation, CS_2 can be written as

$$\begin{aligned} CS_2 = (1-\alpha)\left[(1+\beta)\left(V - p_{U2} - \frac{t}{4N_2}\right)\right] \\ + \alpha\left[\phi_{U2}\left((1+\beta)\left(V - p_{U2} - \phi_{U2}\frac{t}{4N_2}\right)\right)\right. \\ \left. + \phi_{O2}\Big((1+\beta)V - 2p_{O2} - \mu\Big)\right]. \quad (25) \end{aligned}$$

To compute the social surplus, we note that all unorganized retailers make zero profit, but the organized retailer makes a positive profit given by $\pi_{O2} = \alpha\phi_{O2}(2p_{O2})$. (We have assumed the entry cost of the organized retailer to be less than π_{O2} and normalized it to zero.) Therefore, the social surplus is equal to $SS_2 = CS_2 + \pi_{O2} = CS_2 + \alpha\phi_{O2}(2p_{O2})$. We can substitute for p_{U2}, p_{O2} and N_2 in the expression above to obtain it in terms of exogenous parameters only.

We now state the following result regarding the consumer and social surplus in Scenarios 1 and 2.

Proposition 6. *Consumer surplus is always lower and social surplus can be lower or higher in the presence of the organized retailer than in its absence, i.e.,* $CS_2 < CS_1$ *and* $SS_2 \lesseqgtr SS_1$.

Three main effects decrease consumer surplus in the presence of the organized retailer: first, consumers who purchase at unorganized retailers pay higher prices; second, consumers who purchase at the organized retailer purchase two units but waste the second unit with positive probability; third, consumers without storage capability have to travel more on average to purchase due to fewer unorganized retailers. Social surplus is comprised of both consumer surplus and firm surplus. In the presence of the organized retailer, firm surplus is always higher. (In Scenario 1, all firms in the market, i.e., all unorganized retailers, make zero profit in equilibrium, but in Scenario 2 the organized retailer makes a positive profit after entry.) An interesting insight from the proposition above, therefore, is that the presence of the organized retailer can lead to such a drastic reduction in consumer surplus that social surplus can decrease even though firm surplus strictly increases. The result that social surplus decreases is in spite of the fact that the presence of the organized retailer brings efficiency into the environment—it has a lower marginal cost than the unorganized retailers, and we have assumed its entry cost to be zero and constant with its market share. This leads to an important implication for policy analysts—it is often taken for granted that introducing an efficient organized retailer into the market is good for the retailing environment. However, we find that this may not always be the case, and these decisions should be made carefully by policy makers.

4. Extensions

Our base model helped us to understand the impact of the presence of an organized retailer in an emerging market. To further generalize the results, we focus on additional characteristics related to sellers and product categories that influence the market outcomes. In addition, we expand the parameter space to consider regions where equilibrium customer behavior may be different from what has been considered in our main analysis.[7]

4.1. Personalized Service at Unorganized Retailers

A salient feature of unorganized retailers is that they typically offer personalized service to their customers. For instance, since the owner of a small unorganized retail store often knows his clientele personally and interacts with them while shopping, he could provide information to a consumer about how to use a product to better match her personal needs and tastes, thus increasing the utility from the product for the consumer. In terms of the model, we assume that personalized service offered by an unorganized retailer enhances the consumer's utility of purchasing the ideal product from V to $V + S$. We analyzed the base model without the personalized service parameter (S) to keep the expressions simpler. Here, we reanalyze the model by including personalized service. For Scenario 1, S does not matter for the final results because only unorganized retailers are in the market, and they all offer personalized service; we therefore obtain the same expressions for all quantities as in §3.1. For Scenario 2, the organized retailer does not offer personalized service, but the unorganized retailers offer it. Therefore, we obtain different expressions for certain quantities than in §3.2. Specifically

$$N_2 = \frac{t^2(2-\alpha)(1+\beta)^2}{2(t\alpha(1+\beta)(c(1+\beta)-\mu-S(1+\beta))+f^2(2\alpha^2+3\alpha+1))}. \quad (26)$$

For prices, we obtain

$$p_{O2} = \frac{2t(1+\beta)(c(1+\beta)-\mu-S(1+\beta))+f^2(\alpha^2+4\alpha+3)}{4t(2-\alpha)(1+\beta)}, \quad (27)$$

and for p_{U2}, we obtain the same expression as in §3.2. All other quantities of interest can be derived from these expressions. More details of the solution are available on request.

[7] We thank the review team for suggesting these three extensions.

From the above, we can obtain some important implications, which are as follows. As the level of personalized service offered by unorganized retailers increases, a greater number of unorganized retailers can be sustained in the market, i.e., $dN_2/dS > 0$. This suggests that a strategy that unorganized retailers can follow to survive in the face of the threat of organized retailing is to provide higher personalized service. In addition, the profits of the organized retailer reduce (i.e., $d\pi_{O2}/dS < 0$), and this is not only due to the lower share of the market but also the fact that when unorganized retailers offer personalized service, it forces the organized retailer to lower prices, i.e., $dp_{O2}/dS < 0$.

4.2. Product Perishability

In our model, consumers may or may not realize the need to consume the product in the second period. In such a case, the residual value of a product (denoted by γ), which measures how much value the product holds for consumers if demand for it is not realized in Period 2, comes into play. This residual value can vary across categories. For instance, high-perishability categories such as fruits, vegetables, milk, eggs, etc., if not consumed in the second period, cannot be stored for long beyond that; these categories will have low residual value, i.e., a small value of γ. On the other hand, low-perishability categories, such as biscuits, canned food, light bulbs, etc., can be stored for longer and will have relatively high residual value even if they are not consumed in Period 2, leading to a large value of γ. We note that when consumers are considering purchasing in bulk (i.e., buy to store, BTS) under uncertain Period 2 demand, the residual value of the product if not used in Period 2 will be an important factor, and as this value increases, they will lean more towards the BTS option.

We analyzed the base model without the residual value parameter, γ, to keep the expressions simpler. Here, we reanalyze the model by including the residual value. We note that for Scenario 1 γ will not matter for price competition when only unorganized retailers are in the market (because we only analyze the parameter space in which all consumers take the BTC option in equilibrium). However, γ will matter for Scenario 2 because consumers consider the buy to store option from the organized retailer (BTS-O). Therefore, we obtain different expressions for certain quantities than in §3.2. Specifically

$$N_2 = \frac{t^2(2-\alpha)(1+\beta)^2}{2(t\alpha(1+\beta)(c(1+\beta)-\mu+V\gamma(1-\beta))+f^2(2\alpha^2+3\alpha+1))}. \quad (28)$$

For prices, we obtain

$$p_{O2} = \frac{2t(1+\beta)(c(1+\beta)-\mu+V\gamma(1-\beta))+f^2(\alpha^2+4\alpha+3)}{4t(2-\alpha)(1+\beta)}, \quad (29)$$

and for p_{U2}, we obtain the same expression as in §3.2. All other quantities of interest can be derived from these expressions. More details of the solution are available on request.

Comparative statics analysis shows that $dN_2/d\gamma < 0$, $p_{O2}/d\gamma > 0$, and $\pi_{O2}/d\gamma > 0$; i.e., as γ increases (residual value increases or the product is less perishable), a smaller number of unorganized retailers are in the market, and the price and profit of the organized retailer increase. An implication of this analysis is that unorganized and organized retailers will want to focus on perishable and nonperishable product categories, respectively (though a formal investigation of this is beyond the scope of this paper).

Finally, one can expect that a more perishable product (smaller γ) will have a higher probability of demand in the second period (larger β). Propositions 2 and 3 show that as β increases, N_2 increases, and the prices and profits of the organized retailer decrease. Taken together with the comparative statics with respect to γ in this section, we can state that if both probability of high demand and perishability move together in the same direction, the comparative statics we show become stronger.[8]

4.3. Expanding the Parameter Space

In our main analysis, we restricted our study to the regions of the parameter space in which, in equilibrium, a consumer only buys to consume from an unorganized retailer and only buys to store from the organized retailer. Specifically, these parametric restrictions are ensured by conditions (2), (2′), (7), (7′), and (8). In this section, we relax these conditions to extend our analysis to regions of the parameter space in which other choices by consumers may also arise in equilibrium; specifically, the consumer may buy to store from an unorganized retailer and may buy to consume from the organized retailer. The primary aim of this analysis is to check that the important forces and trade-offs operative in the main analysis are present here as well, and that the main insights hold. We provide all of the analysis in §A3 of the appendix.

We confirm that the key insights from our main model continue to hold under these parametric relaxations as well. Specifically, we verify that, for different combinations of parameter values, the following results hold (in parentheses, we indicate the analogous propositions for the main analysis):

- (Propositions 1 and 2) The number of unorganized retailers increases in t and β (in both scenarios)

[8] Interpreted differently, if a new parameter ξ influences both β and γ and if an increase in ξ increases β and decreases γ, then the comparative statics of N_2 and prices and profits with respect to ξ are as in Propositions 2 and 3, but stronger.

and decreases in α (in Scenario 2). The price charged by an unorganized retailer decreases in t and β (in both scenarios) and increases in α (in Scenario 2).

- (Proposition 3) In Scenario 2, the organized retailer's prices and profits increase in α and decrease in β, t, and μ.
- (Proposition 4) The price charged by an unorganized retailer is higher in the presence of an organized retailer.
- (Proposition 5) The ratio N_2/N_1 can decrease in α and can increase in β, t, and μ.
- (Proposition 6) Consumer surplus is lower and social surplus can be higher or lower in the presence of an organized retailer.

To summarize, the primary insights that are identified in a restricted parameter space continue to hold when we consider an expanded parameter space in which consumers may buy to consume or buy to store from both unorganized and organized retailers.

5. Conclusions

The growth of organized retailing is changing the way unorganized retailers are competing in emerging economies. We study the important drivers influencing the performance of unorganized and organized retailers and the extent to which the presence of organized retailers impacts competition among unorganized retailers. Toward this end, we propose a theoretical model of retailing in emerging economies and consider two scenarios—one with only unorganized retailers and another with unorganized retailers and one organized retailer.

One of our major findings is that, under the assumption that unorganized retailers find it progressively difficult to increase their size and expand their market coverage (which can be justified for a variety of reasons), there are a large number of unorganized retailers in the market leading to high competition. The presence of an organized retailer injects efficiency into the whole market, which reduces the number of unorganized retailers in the market. This leads to reduced competitive intensity, which in turn leads to a number of interesting outcomes such as higher prices at the unorganized retailers. More specifically, our analysis helps to shed light on the following substantive points.

1. *What factors influence the performance of organized retailers in emerging economies?* We identify multiple factors that may influence the performance of organized retailers. First, we find that if a larger fraction of the population in an emerging economy has storage capability (which is a combination of storage space, refrigeration capability for some categories, budget to purchase in bulk, etc.), the profit of organized retailers will be higher because consumers can purchase in bulk from them. Second, we find that as the probability of consumers' demand realization in a shopping period conditional on consumption in the previous period increases (in other words, consumers' bulk consumption probability increases), the organized retailer's prices and profits first decrease and then increase. Third, the consumers' travel costs to retail stores play an important role in determining the market coverage and profit of organized retailers—organized retailers benefit from a small travel cost to their own stores and a large travel cost to the stores of unorganized retailers. Thus, differences in the characteristics of the retailing environment, the product category, the customers, and the sellers can all possibly explain why organized retailers expand more rapidly in some emerging economies but less so in others.

2. *What is the impact of organized retailing on unorganized retailers' profitability and market coverage?* The conventional view is that the presence of an organized retailer will lead to increased price competition because the organized retailer will bring efficiency to the market. We find that the presence of the organized retailer triggers the exit of some unorganized retailers, which, in turn, can increase the prices charged by the remaining unorganized retailers. We also find that as storage capability of consumers increases, the postentry profit of the surviving unorganized retailers is higher even though the overall market coverage of unorganized retailers goes down. Furthermore, if the per-unit travel cost to the unorganized retailers' stores is larger, then the total market covered by unorganized retailers as a whole is larger (even though the market covered by each unorganized retailer is smaller).

3. *What factors lead to an increase in the number of unorganized retailers that survive in the presence of organized retailing?* We find that if the transportation cost to the organized retailer is considerable, a greater number of unorganized retailers survive. Interestingly, if the per-unit transportation cost to the unorganized retailer increases, consumers are reluctant to travel far, leading to survival of a greater number of unorganized retailers. Furthermore, unorganized retailers can adapt to the presence of organized retailers by providing personalized service, which increases product valuation for consumers.

4. *What is the impact of organized retailing on consumer behavior, and consumer and social surplus?* The presence of organized retailing impacts consumer purchase behavior. For instance, some consumers purchase from the organized retailer in bulk at lower prices, making fewer trips and therefore saving on travel costs, but run the risk of not utilizing a product that they already paid for. In other words, there is more purchasing in the economy for the same consumption requirements, which implies that there is more wastage. Furthermore, the presence of organized retailing leads

to fewer unorganized retailers, which reduces competitive intensity and leads to higher prices at the unorganized retailers. Overall, this paints a somewhat dismal picture for consumers—those who purchase from the unorganized retailers pay a higher price, and those who purchase from the organized retailer risk wastage. Overall, consumer surplus decreases. This effect on consumer surplus is so strong that even though firm surplus increases (because the organized retailer is assumed to make a profit net of entry costs), social surplus may decrease. This is in spite of the fact that the presence of the organized retailer injects efficiency into the economy. Therefore, our research highlights that it is not a foregone conclusion that the advance of organized retailing in emerging markets is beneficial for the economy as a whole, and policy makers need to consider the impact of several countervailing factors carefully.

Limitations and Future Research. We take an initial step toward understanding the impact of the presence of organized retailing on unorganized retailing in emerging markets, and our research can be advanced in a number of ways. A key assumption that we make is that of entry costs being convex increasing in the size of the unorganized retailer's store. We support this assumption by invoking evidence from past literature that it is progressively difficult for small businesses (including unorganized retailers such as mom-and-pop stores) to expand the size of their businesses. However, in certain cases there may be scale economies from expansion, and our results do not apply to such settings. We have also assumed away entry costs for the organized retailer. Assuming this cost to be positive does not change our results much—if this cost is higher than the organized retailer's expected postentry profit, then it will not enter the market. However, conditional on entry, there are no changes in the outcomes reported in the paper because this is a sunk cost.

We assume that unorganized retailers locate symmetrically in the market. Since we focus on the long-run outcome, this seems appropriate (and is in line with previous work using similar modeling structures, e.g., Salop 1979, Balasubramanian 1998). In reality, however, there may be geographical restrictions or other constraints that do not allow retailers to locate perfectly symmetrically. In this case, retailers who end up closer to each other or to the organized retailer will compete more intensely, and the equilibrium will not be symmetric. Future research can relax these assumptions. However, the key insight that the presence of organized retailers leads to fewer unorganized retailers in the market, which in turn reduces competitive intensity, should still continue to hold. An important assumption that we make is that there is exactly one organized retailer in the market. If there are multiple organized retailers in the market, competition among them can lead to lower prices.

We focus on specific dimensions of retail competition, such as store size and price. Possibly the most important factor that we do not model is the assortment of products that a retailer offers. Previous work has looked at assortment decisions of retailers (Krishnan et al. 2002, Dukes et al. 2009), though this is not specifically in the context of emerging markets. Incorporating aspects of retail competition such as assortment will add richness to the model and may provide interesting insights; for instance, one might expect that unorganized and organized retailers differentiate by focusing on perishables and nonperishables, respectively. Related to this, retailers sell products in various categories that have different probabilities of future need (related to the parameter β in our model). Unorganized and organized retailers may choose different assortments of products such that the "composite β" (which can be interpreted as an aggregate measure of the probability of future demand for the entire basket of items purchased by the consumers) values of these stores are different, which may again allow them to differentiate and target diverse types of consumers. Organized retailers could also establish multiple retail formats (grocery, drugstore, department store, mass merchandisers, etc.), and modeling between-format competition among several organized retailers could be an interesting avenue for further research.

We have limited our analysis to the retail level. It has been found, however, that the advent of organized retailing has an impact at all levels of the supply chain. For instance, Joseph et al. (2008) found that the organized retailers typically attempt to source products directly from input suppliers (such as farmers and manufacturers), which makes them advantageous to input suppliers but hurts intermediaries such as wholesalers and distributors. Building a comprehensive model that takes into account the incentives of different members of the value chain may also be an exciting avenue for future research.

Finally, our model provides a number of testable hypotheses. One category of hypotheses predict the impact of the presence of an organized retailer on prices and profits of unorganized retailers. For instance, we find that prices and postentry profits of unorganized retailers can be higher in the presence of organized retailers. Another category of hypotheses predict the impact on prices, profits, and market coverage of unorganized and organized retailers with respect to category-level characteristics such as demand uncertainty and product perishability, travel costs to the different stores, storage capabilities of consumers, extent of service advantage of unorganized retailers over organized retailers, etc. For instance, we predict that as the fraction of the population with storage capabilities increases, the number of unorganized retailers in the market decreases, and the prices and profits of unorganized retailers increase. Future empirical research in this field can test these hypotheses.

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Appendix

A1. Proofs of the Propositions

Proof of Proposition 1. Using the expressions in (5), (6), and (20), the statements in the proposition can be verified to be true. □

Proof of Proposition 2. For N_2, using the expression for N_2 from (15), we can derive the following:

$$\frac{dN_2}{d\alpha}=\frac{(\beta+1)^2t^2((2\alpha^2-8\alpha-7)f^2-2(\beta+1)t(\beta c+c-\mu))}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}, \tag{30}$$

$$\frac{dN_2}{d\beta}=\frac{(2-\alpha)(\beta+1)t^2(2f^2(4\alpha^2+6\alpha+2)-\alpha(\beta+1)\mu t)}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}, \tag{31}$$

$$\frac{dN_2}{dt}=\big(t(2-\alpha)(1+\beta)^2\big(f^2(2+6\alpha+4\alpha^2)+t\alpha(1+\beta)(c(1+\beta)-\mu)\big)\big)\cdot\big(2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2\big)^{-1}, \tag{32}$$

$$\frac{dN_2}{d\mu}=\frac{(2-\alpha)\alpha(\beta+1)^3t^3}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}. \tag{33}$$

Using the above expressions, the statements in the proposition can be verified to be true. For the variation of N_2 with respect to α, we find that N_2 decreases in α iff $\mu<c(1+\beta)+f^2(7+8\alpha-2\alpha^2)/(2(1+\beta)t)$. However, it can be shown that $p_{O2}>0$ iff $\mu<c(1+\beta)+f^2(3+4\alpha+\alpha^2)/(2(1+\beta)t)$. Since $7+8\alpha-2\alpha^2>3+4\alpha+\alpha^2$ $\forall\,\alpha\in[0,1]$, we have that N_2 is strictly decreasing in α.

For p_{U2}, using the expression for p_{U2} from (16), the statements in the proposition can be verified to be true. □

Proof of Proposition 3. For p_{O2}, using the expression in (17), we can derive the following:

$$\frac{dp_{O2}}{d\alpha}=\frac{2(\beta+1)t(\beta c+c-\mu)+(-\alpha^2+4\alpha+11)f^2}{4(\alpha-2)^2(\beta+1)t}, \tag{34}$$

$$\frac{dp_{O2}}{d\beta}=\frac{(\alpha^2+4\alpha+3)f^2-2(\beta+1)^2ct}{4(\alpha-2)(\beta+1)^2t}, \tag{35}$$

$$\frac{dp_{O2}}{dt}=\frac{(\alpha^2+4\alpha+3)f^2}{4(\alpha-2)(\beta+1)t^2}, \tag{36}$$

$$\frac{dp_{O2}}{d\mu}=\frac{1}{2(\alpha-2)}. \tag{37}$$

Using the above expressions, the statements in the proposition can be verified to be true. For the variation of p_{O2} with respect to α, note that $dp_{O2}/d\alpha>0$ iff $\mu>(1+\beta)c+(11+4\alpha-\alpha^2)f^2/(2(1+\beta)t)$. However, it can be shown that if $\mu>(1+\beta)c+(11+4\alpha-\alpha^2)f^2/(2(1+\beta)t)$, then $p_{O2}<0$; therefore, this is ruled out, and we have $dp_{O2}/d\alpha<0$.

For ϕ_{O2}, the share of consumers with storage capability is given by $\phi_{O2}=1-2N_2\hat{x}_2$. Using the expressions in (15) and (18), we can derive the following:

$$\frac{d\phi_{O2}}{d\beta}=\big(f^2t(\alpha+1)^2(2-\alpha)(2c(1+\beta)-\mu)\big)\cdot\big((2f^2\alpha^2+3f^2\alpha+f^2+ct\alpha-t\alpha\mu+2ct\alpha\beta-t\alpha\beta\mu+ct\alpha\beta^2)^2\big)^{-1}, \tag{38}$$

$$\frac{d\phi_{O2}}{dt}=\big(f^2(2-\alpha)(1+\alpha)^2(1+\beta)(c(1+\beta)-\mu)\big)\cdot\big((2f^2\alpha^2+3f^2\alpha+f^2+ct\alpha-t\alpha\mu+2ct\alpha\beta-t\alpha\beta\mu+ct\alpha\beta^2)^2\big)^{-1}, \tag{39}$$

$$\frac{d\phi_{O2}}{d\mu}=-\big(f^2t(1+\alpha)^2(2-\alpha)(1+\beta)\big)\cdot\big((2f^2\alpha^2+3f^2\alpha+f^2+ct\alpha-t\alpha\mu+2ct\alpha\beta-t\alpha\beta\mu+ct\alpha\beta^2)^2\big)^{-1}. \tag{40}$$

Using the above expressions, the statements in the proposition can be verified to be true. □

Proof of Proposition 4. From (6) and (16), we obtain $p_{U2}-p_{U1}=f^2\alpha/(t(1+\beta)^2)$, which is clearly strictly greater than zero. □

Proof of Proposition 5. Using expressions for N_1 and N_2 from (5) and (15) respectively, we obtain

$$\frac{N_2}{N_1}=\frac{f^2(2-\alpha)}{2f^2(2\alpha^2+3\alpha+1)+2t\alpha(1+\beta)(c(1+\beta)-\mu)}. \tag{41}$$

Following this, we can derive the following:

$$\frac{d}{d\alpha}\left(\frac{N_2}{N_1}\right)=\frac{f^2((2\alpha^2-8\alpha-7)f^2-2(\beta+1)t(\beta c+c-\mu))}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}, \tag{42}$$

$$\frac{d}{d\beta}\left(\frac{N_2}{N_1}\right)=\frac{(\alpha-2)\alpha f^2t(2(\beta+1)c-\mu)}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}, \tag{43}$$

$$\frac{d}{dt}\left(\frac{N_2}{N_1}\right)=\frac{(\alpha-2)\alpha(\beta+1)f^2(\beta c+c-\mu)}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}, \tag{44}$$

$$\frac{d}{d\mu}\left(\frac{N_2}{N_1}\right)=\frac{(2-\alpha)\alpha(\beta+1)f^2t}{2(\alpha(\beta+1)t(\beta c+c-\mu)+(2\alpha^2+3\alpha+1)f^2)^2}. \tag{45}$$

Using the above expressions, the statements in the proposition can be verified to be true. For the variation of N_2/N_1 with respect to α, note that $(d/d\alpha)(N_2/N_1)>0$ iff $\mu>(1+\beta)c+(7+8\alpha-2\alpha^2)f^2/2(1+\beta)t$. However, it can be shown that if $\mu>(1+\beta)c+(7+8\alpha-2\alpha^2)f^2/(2(1+\beta)t)$, then $p_{O2}<0$; therefore, this is ruled out, and we have $(d/d\alpha)(N_2/N_1)<0$. □

Proof of Proposition 6. Using the expressions in §3.3.1, we obtain

$$CS_2-CS_1=(1+\beta)\bigg((p_{U1}-((1-\alpha)+\alpha\phi_{U2})p_{U2})+\frac{t}{4}\bigg(\frac{1}{N_1}-\frac{(1-\alpha)+\alpha\phi_{U2}^2}{N_2}\bigg)\bigg)-\alpha\phi_{O2}(2p_{O2}+\mu). \tag{46}$$

We can substitute for the relevant quantities in the above and obtain the following:

$$
\begin{aligned}
CS_2 - CS_1 &= (\alpha(\beta+1)(\mu^2 4t^2(\beta+1)(1-\alpha) - \mu 2t(4ct(\beta+1)^2(1-\alpha) - K_2) \\
&\quad - 2ct(\beta+1)(K_2 - 2ct(\beta+1)^2(1-\alpha)) - K_3)) \\
&\quad \cdot (8t(2-\alpha)(\beta+1)(K_1 - t\alpha\mu(1+\beta)))^{-1},
\end{aligned} \tag{47}
$$

where $K_1 = f^2(\alpha+1)(2\alpha+1) + ct\alpha(\beta+1)^2 > 0$, $K_2 = f^2(2\alpha^2 + 13\alpha - 4)$ and $K_3 = f^4(\alpha+1)(45\alpha - 7\alpha^2 - \alpha^3 + 21)/(1+\beta) > 0$.

Next, we show analytically that consumer surplus is always lower in the presence of the organized retailer, i.e., $CS_2 - CS_1 < 0$.

Since the organized retailer should get a positive share in Scenario 2, $\hat{x}_2' - \hat{x}_2 \geq 0$. In terms of the model parameters, this constraint can be written as

$$\frac{f^2(\alpha^2 + 4\alpha + 3) + 2ct(1 + 2\beta + \beta^2) - 2t\mu(1+\beta)}{t^2(1+\beta)^2(2-\alpha)} \geq 0. \tag{48}$$

Since the denominator is always positive, for the numerator to be positive it is required that

$$\mu \leq c(\beta+1) + \frac{f^2(3 + 4\alpha + \alpha^2)}{2t(1+\beta)} = \bar{\mu}. \tag{49}$$

Evaluating $CS_2 - CS_1$ at the upper bound on μ, i.e., at $\mu = \bar{\mu}$, we obtain

$$(CS_2 - CS_1)|_{\bar{\mu}} = -\frac{f^2\alpha(\alpha+6)}{4t(1+\beta)} < 0. \tag{50}$$

We also require that $\hat{x}_2 \geq 0$, so that the unorganized retailers share is positive. In terms of the model parameters, the constraint can be written as

$$\frac{f^2(3\alpha^2 + 2\alpha - 1) + 2t(1-\alpha)(1+\beta)(c(1+\beta) - \mu)}{2t^2(1+\beta)^2(2-\alpha)} \geq 0. \tag{51}$$

Since the denominator is always positive, the numerator is ≥ 0 if

$$\mu \geq c(1+\beta) + \frac{f^2(1 - 2\alpha - 3\alpha^2)}{2t(1+\beta)(1-\alpha)} = \underline{\mu}. \tag{52}$$

It is easily verified that $\bar{\mu} - \underline{\mu} = \frac{1}{2} f^2(2-\alpha)((\alpha+1)^2/(t(1+\beta)(1-\alpha))) > 0$. Evaluating $CS_2 - CS_1$ at the lower bound on μ, i.e., at $\mu = \underline{\mu}$, we obtain

$$(CS_2 - CS_1)|_{\underline{\mu}} = -\frac{f^2\alpha(\alpha+6)}{4t(1+\beta)} < 0. \tag{53}$$

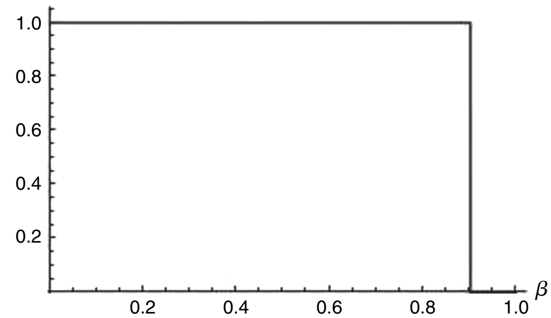
Since $K_1 - t\alpha\mu(1+\beta) = \frac{1}{2} f^2(2-\alpha)(\alpha+1)^2$ for $\mu = \bar{\mu}$ and $K_1 - t\alpha\mu(1+\beta)$ increases as μ decreases, the denominator of $CS_2 - CS_1$ is strictly positive for $\underline{\mu} \leq \mu \leq \bar{\mu}$. Furthermore, the numerator is a strictly convex function in μ, which implies that $CS_2 - CS_1 < 0$ in the entire range $\underline{\mu} \leq \mu \leq \bar{\mu}$.

Next, for social surplus, note that

$$SS_2 - SS_1 = (CS_2 - CS_1) + 2\alpha\phi_{O2}p_{O2}. \tag{54}$$

To prove that social surplus can increase or decrease in the presence of the organized retailer, we simply provide one example where $SS_2 - SS_1 > 0$ and one example where $SS_2 - SS_1 < 0$. An example of the former is $t = 2$, $\mu = 1$, $c = 0.5$, $\alpha = 0.6$, $\beta = 0.75$, $f = 0.7$, and an example of the latter is $t = 2$, $\mu = 1$, $c = 0.5$, $\alpha = 0.6$, $\beta = 0.5$, $f = 0.7$. □

Figure A.1 **Region Where Parametric Restrictions in (2) and (2′) Are Satisfied ($c = 1, t = 1, f = 1$)**



Note. $C_1 < 0$ where the value of the plot is 1.

A2. Interpreting Parametric Restrictions

Interpreting Parametric Restriction in (2) and (2′). After substituting for p_{U1} and N_1, both (2) and (2′) are given by

$$\frac{2(1-\beta)(1+\beta)^2 ct + (2-3\beta)f^2}{2(1+\beta)^2 ct + 3f^2} > 0. \tag{55}$$

The following discussion provides some insight into this condition. Denote $C_1 = \beta - 2N_1 p_{U1}/(t + 2N_1 p_{U1})$. The condition imposed in both (2) and (2′) is $C_1 < 0$. Straightforward analysis shows that $dC_1/d\beta > 0$, which implies that (2) and (2′) are satisfied if β takes small values. To illustrate this, consider the values $c = 1$, $t = 1$, and $f = 1$. At these values, Figure A.1 shows where $C_1 < 0$ is true; as one can see, this happens when β is small.

Interpreting Parametric Restrictions in (7), (7′), and (8). After substituting for p_{U2}, p_{O2}, and N_2, (7) and (7′) are given by

$$
\begin{aligned}
&\big((1+\beta)t\big(\alpha\beta\mu + (1+\beta)c(2-\alpha-2\beta)\big) \\
&\qquad + f^2(1+\alpha)\big(2-\alpha-(\alpha+3)\beta\big)\big) \\
&\quad \cdot \big((1+\beta)t(2(1+\beta)c - \alpha\mu) + f^2(\alpha^2+4\alpha+3)\big)^{-1} > 0,
\end{aligned} \tag{56}
$$

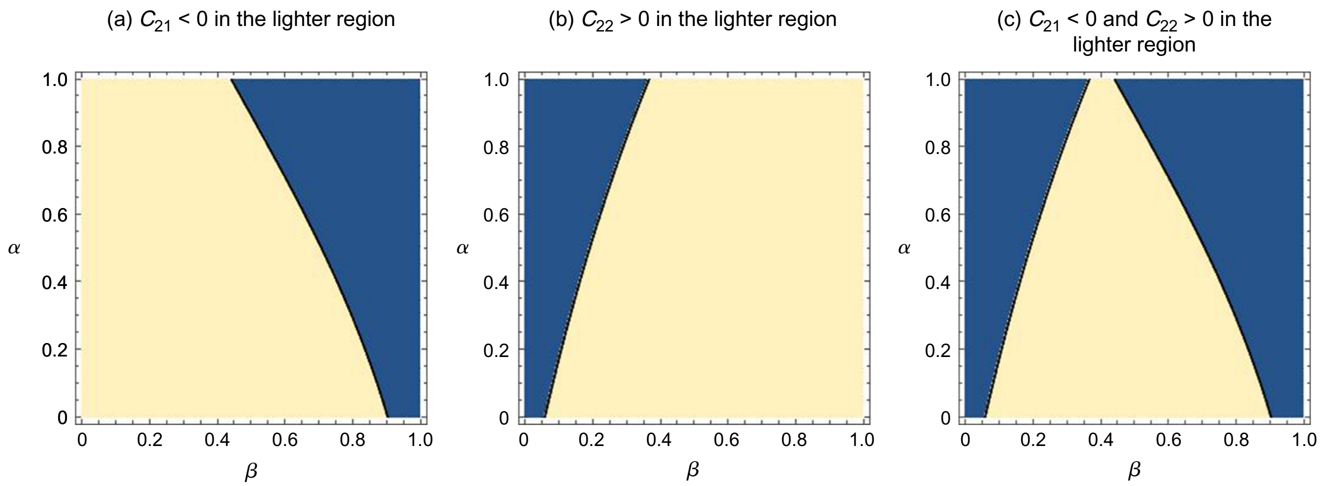
and (8) is given by

$$
\begin{aligned}
&\big(2(1+\beta)t\big(\mu(1+\beta(3-2\alpha)) - (1-\beta^2)c\big) \\
&\qquad - f^2(\alpha^2+4\alpha+3)(1-\beta)\big) \\
&\quad \cdot \big(2(1+\beta)t((1+\beta)c - (2\alpha-3)\mu) + f^2(\alpha^2+4\alpha+3)\big)^{-1} > 0.
\end{aligned} \tag{57}
$$

The following discussion provides some insight into these conditions. Denote $C_{21} = \beta - 2N_2 p_{U2}/(t + 2N_2 p_{U2})$ and $C_{22} = \beta - p_{O2}/(\mu + p_{O2})$. The condition imposed in (7) and (7′) is $C_{21} < 0$, and the condition imposed in (8) is $C_{22} > 0$. Straightforward (but cumbersome) analysis shows C_{21} is satisfied if β takes small values, and C_{22} is satisfied if β takes large values. To illustrate this, consider the values $c = 1$, $t = 1$, $f = 1$, $\mu = 2$. At these values, Figure A.2 shows the values of β and α for which $C_{21} < 0$ and $C_{22} > 0$ are true. For any given value of α, Figure A.2(a) shows that C_{21} is satisfied when β is small, Figure A.2(b) shows that C_{22} is satisfied when β is large, and Figure A.2(c) shows the intersection of the two regions.

Intersection of (2), (2′), (7), (7′), and (8). The intersection of (2), (2′), (7), (7′), and (8) is nonempty. As an illustrative example, consider Figures A.1 and A.2(c). The values of c, f, and t are the same in the two figures, and clearly there is overlap in the allowed values of β.

Figure A.2 (Color online) Region Where Parametric Restrictions in (7), (7′), and (8) are Satisfied ($c = 1, t = 1, f = 1, \mu = 2$)



A3. Expanding the Parameter Space

We first discuss Scenario 1 and then discuss Scenario 2. We provide an outline of the analysis and use the notation of the main model (any extensions of the notation are clear by context).

Scenario 1. In Scenario 1, N_1 unorganized retailers are located equidistantly on the circumference of the circle. First, consider consumers with storage capability (of size α). These consumers will choose from two options: buy to consume or buy to store from the closest retailer. Referring to Figure A.3(a), consumers in UA and $U'A'$ will take the BTC option from retailers U and U', respectively, and consumers in AB and $A'B$ will take the BTS option from retailers U and U' respectively. The consumers at A and B (located at x_1 and x_2, respectively) can be characterized by the following indifference equations:

$$x_1\colon\ (1+\beta)(V-p_{U1}-tx_1) = (1+\beta)V-2p_{U1}-tx_1, \tag{58}$$

$$x_2\colon\ (1+\beta)V-2p_{U1}-tx_2 = (1+\beta)V-2p_{U'1}-t\left(\frac{1}{N_1}-x_2\right). \tag{59}$$

For the unorganized retailer, the expected demand from the customers in UA is $(1+\beta)x_1$, and the (deterministic) demand from the customers in AB is $2(x_2-x_1)$.

Next, consider consumers without storage capability (of size $1-\alpha$). Referring to Figure A.3(b), the marginal consumer at A who is indifferent between U and U' (located at $\hat{x}_1$) is characterized by the following indifference equation:

$$\begin{aligned}\hat{x}_1\colon\ &(1+\beta)(V-p_{U1}-t\hat{x}_1)\\ &=(1+\beta)\left(V-p_{U'1}-t\left(\frac{1}{N_1}-\hat{x}_1\right)\right).\end{aligned} \tag{60}$$

The expected demand from these customers is $(1+\beta)\hat{x}_1$.

Using the above, we can write the expected profit function for the unorganized retailer U, which is given by the following:

$$\begin{aligned}\pi_{U1} = {}& 2(p_{U1}-c)\big(\alpha((1+\beta)x_1+2(x_2-x_1))+(1-\alpha)(1+\beta)\hat{x}_1\big)\\ &-F_1.\end{aligned} \tag{61}$$

The factor of 2 in front is to account for the customers on both sides of the retailer U.

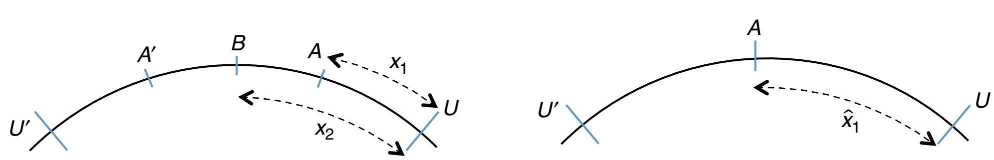
Scenario 2. In Scenario 2, N_2 unorganized retailers are located equidistantly on the circumference, and one organized retailer is located at the center of the circle. Consider a consumer at the circumference who has storage capability. For this consumer, the BTS-O option (buy to store from organized retailer) has the expected utility $(1+\beta)V-2p_{O2}-\mu$, and the BTC-O option (buy to consume from the organized retailer) has the expected utility $(1+\beta)\cdot(V-p_{O2}-\mu)$. The consumer will therefore take the BTS-O option iff

$$\begin{aligned}(1+\beta)V-2p_{O2}-\mu &\geq (1+\beta)(V-p_{O2}-\mu)\\ \Rightarrow\ \mu &\geq \frac{1-\beta}{\beta}p_{O2}.\end{aligned} \tag{62}$$

Note that the above condition is independent of the location of the customer, which implies that, depending on the parameter values, all customers will prefer the same option out of these two options (though they might prefer another option to both these options). We now consider two cases: In Case I, all consumers prefer the BTS-O option to the BTC-O option, and in Case II they prefer the reverse.

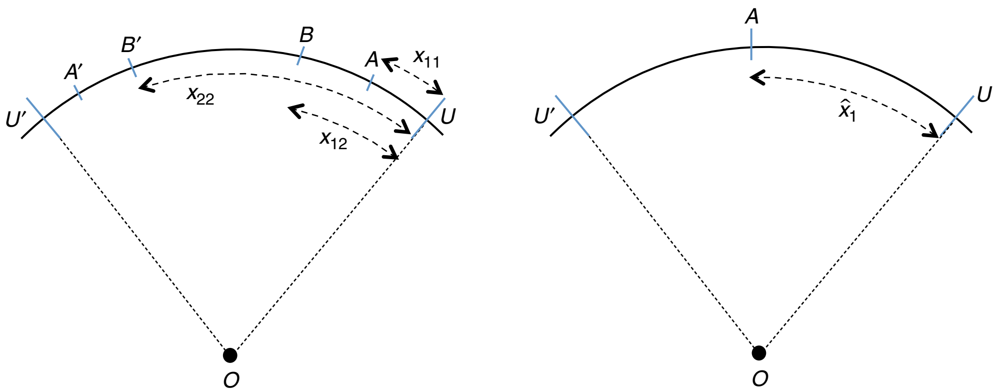
Case I—*Consumers who buy from O take the BTS-O option.* In this case, $\mu \geq ((1-\beta)/\beta)p_{O2}$. Consider consumers who

Figure A.3 (Color online) Section of the Salop Circle for Scenario 1 (Only Unorganized Retailers)



(a) Consumers with storage capability
(b) Consumers without storage capability

Figure A.4 (Color online) Section of the Salop Circle for Case I of Scenario 2 (Unorganized Retailers and One Organized Retailer)



(a) Consumers with storage capability (b) Consumers without storage capability

have storage capability (of size α). These consumers have the following options: BTC-U (buy to consume from the unorganized retailer), BTS-U (buy to store from the unorganized retailer), and BTS-O. Referring to Figure A.4(a), the consumers in UA and $U'A'$ will take the BTC-U option from U and U', respectively; consumers in AB and $A'B'$ will take the BTS-U option from U and U', respectively; and consumers in BB' will take the BTS-O option. The consumers at A, B, and B' (located at x_{11}, x_{12}, and x_{22}, respectively) are characterized by the following indifference equations:

$$x_{11}\colon\ (1+\beta)(V-p_{U2}-tx_{11}) = (1+\beta)V-2p_{U2}-tx_{11}, \tag{63}$$

$$x_{12}\colon\ (1+\beta)V-2p_{U2}-tx_{12} = (1+\beta)V-2p_{O2}-\mu, \tag{64}$$

$$x_{22}\colon\ (1+\beta)V-2p_{O2}-\mu = (1+\beta)V-2p_{U'2}-t\left(\frac{1}{N_2}-x_{22}\right). \tag{65}$$

For the unorganized retailer, the expected demand from the customers in UA is $(1+\beta)x_{11}$, and the (deterministic) demand from the customers in AB is $2(x_{12}-x_{11})$. For the organized retailer, the (deterministic) demand from the customers in BB' is $2(x_{22}-x_{12})$.

Next, consider consumers without storage capability (of size $1-\alpha$). Referring to Figure A.4(b), the marginal consumer at A who is indifferent between U and U' (located at $\hat{x}_1$) is characterized by the following indifference equation:

$$\hat{x}_1\colon\ (1+\beta)(V-p_{U2})-t\hat{x}_1 = (1+\beta)\left(V-p_2-t\left(\frac{1}{N_2}-\hat{x}_1\right)\right). \tag{66}$$

The expected demand from these customers is $(1+\beta)\hat{x}_1$.

Using the above, we can write the profit functions. The expected profit function for the unorganized retailer U is given by the following:

$$\pi_{U2} = 2(p_{U2}-c)\big(\alpha\big((1+\beta)x_{11}+2(x_{12}-x_{11})\big) + (1-\alpha)(1+\beta)\hat{x}_1\big) - F_2. \tag{67}$$

The factor of 2 in front is to account for the customers on both sides of the retailer U.

The profit function of the organized retailer is given by the following:

$$\pi_{O2} = N_2\big(p_{O2}(\alpha(2(x_{22}-x_{12})))\big). \tag{68}$$

The factor of N_2 in front is to account for N_2 segments between N_2 unorganized retailers.

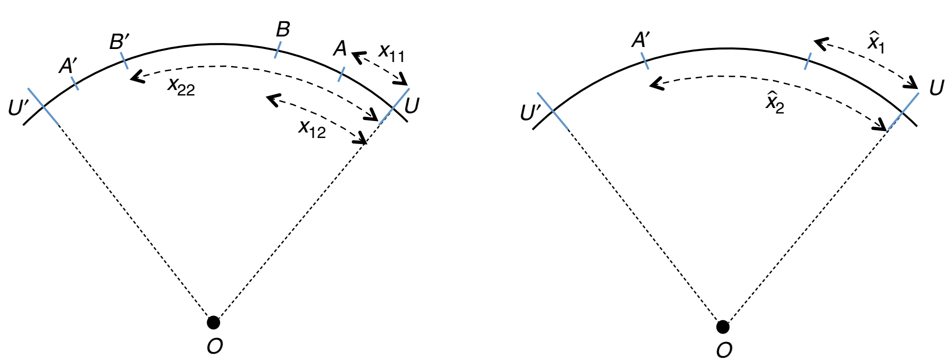
Case II—*Consumers who buy from O take the BTC-O option.* In this case, $\mu < ((1-\beta)/\beta)p_{O2}$. Consider consumers with storage capability (of size α). These consumers will have the following options: BTC-U, BTS-U, and BTC-O. Referring to Figure A.5(a), the consumers in UA and $U'A'$ will take the BTC-U option, consumers in AB and $A'B'$ will take the BTS-U option, and consumers in BB' will take the BTC-O option. The consumers at A, B, and B', (located at x_{11}, x_{12}, and x_{22}, respectively) are characterized by the following indifference equations:

$$x_{11}\colon\ (1+\beta)(V-p_{U2}-tx_{11}) = (1+\beta)V-2p_{U2}-tx_{11}, \tag{69}$$

$$x_{12}\colon\ (1+\beta)V-2p_{U2}-tx_{12} = (1+\beta)(V-p_{O2}-\mu), \tag{70}$$

$$x_{22}\colon\ (1+\beta)(V-p_{O2}-\mu) = (1+\beta)V-2p_{U'2}-t\left(\frac{1}{N_2}-x_{22}\right). \tag{71}$$

Figure A.5 (Color online) Section of the Salop Circle for Case II of Scenario 2 (Unorganized Retailers and One Organized Retailer)



(a) Consumers with storage capability (b) Consumers without storage capability

For the unorganized retailer, the expected demand from the customers in UA is $(1+\beta)x_{11}$, and the (deterministic) demand from the customers in AB is $2(x_{12}-x_{11})$. For the organized retailer, the expected demand from the customers in BB' is $(1+\beta)(x_{22}-x_{12})$.

Next, consider consumers without storage capability (of size $1-\alpha$). Referring to Figure A.5(b), the consumers in UA and $U'A'$ will take the BTC-U option, and consumers in AA' will take the BTC-O option. The consumers at A and A' (located at $\hat{x}_1$ and $\hat{x}_2$) are characterized by the following indifference equations:

$$\hat{x}_1\colon\ (1+\beta)(V-p_{U2}-t\hat{x}_1)=(1+\beta)(V-p_{O2}-\mu), \tag{72}$$

$$\hat{x}_2\colon\ (1+\beta)(V-p_{O2}-\mu)=(1+\beta)\left(V-p_{U'2}-t\left(\frac{1}{N_2}-\hat{x}_2\right)\right). \tag{73}$$

For the unorganized retailer, the expected demand from the customers in UA is $(1+\beta)\hat{x}_1$. For the organized retailer, the expected demand from the customers in AA' is $(1+\beta)\cdot(\hat{x}_2-\hat{x}_1)$.

Using the above, we can write the profit functions. The expected profit function for the unorganized retailer U is given by the following:

$$\pi_{U2}=2(p_{U2}-c)\big(\alpha\big((1+\beta)x_{11}+2(x_{12}-x_{11})\big)+(1-\alpha)(1+\beta)\hat{x}_1\big)-F_2. \tag{74}$$

The factor of 2 in front is to account for the customers on both sides of the retailer U.

The profit function of the organized retailer is given by the following:

$$\pi_{O2}=N_2\big(p_{O2}(\alpha(1+\beta)(x_{22}-x_{12})+(1-\alpha)(1+\beta)(\hat{x}_2-\hat{x}_1))\big). \tag{75}$$

The factor of N_2 in front is to account for N_2 segments between N_2 unorganized retailers.

Solving the model. The analysis of the model with expanded parameter space is significantly more complicated than the analysis of the basic model. For both scenarios, we solve the pricing stage analytically to obtain expressions for the prices and market coverage. Next, to determine the number of unorganized retailers, we substitute for the prices in the profit function of the unorganized retailer and solve the zero expected profit condition. The solution to this stage is analytically intractable, so we use numerical analysis. In the solution, besides ensuring that all margins are nonnegative, we ensure the following: for Scenario 1, $x_1\geq 0$, $x_2-x_1\geq 0$, $\hat{x}_1\geq 0$; for Scenario 2, Case I, $x_{11}\geq 0$, $x_{12}-x_{11}\geq 0$, $x_{22}-x_{12}\geq 0$, $\hat{x}_1\geq 0$; for Scenario 2, Case II, $x_{11}\geq 0$, $x_{12}-x_{11}\geq 0$, $x_{22}-x_{12}\geq 0$, $\hat{x}_1\geq 0$, $\hat{x}_2-\hat{x}_1\geq 0$. More details of the solution procedure are available on request. Our analysis confirms that the primary insights that are identified in a restricted parameter space continue to hold when we consider an expanded parameter space in which consumers may buy to consume or buy to store from both unorganized and organized retailers.

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