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Food Deserts: Demand, Supply, and Economic Theory

Alessandro Bonanno

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The 2008 U.S Farm Bill defines food deserts as areas with limited access to affordable and nutritious food, particularly composed of lower-income neighborhoods and communities—for other definitions see USDA, 2009). Identifying and measuring food deserts is not easy, as it depends upon what food stores one decides to consider, on how "neighborhoods and communities" are defined and on the meaning given to "affordable and nutritious food" (see USDA, 2009).

Essentially, the food deserts concept links supply of nutritious food, and the availability of food outlets providing it, to the cost low-income consumers face in obtaining it. Even though larger stores (supermarkets and supercenters) appear able to sell food at lower prices than smaller ones, empirical evidence that larger stores' presence improves consumers' diet is mixed. While supermarket access is associated with increased daily consumption of fruits and vegetables among food stamp recipients (Rose and Richards, 2004), at least one study (Cummins, et al. 2005) found no significant changes in consumption habits after entry of a large food retailer.

However, limited access to large food stores may result in higher search and transportation costs for low-income individuals and failure to adopt economizing strategies (Leibtag and Kaufman, 2003). This is in addition to the higher prices consumers may face because isolated stores can act as local monopolies or because smaller ones, which can be accessed with lower transportation and search costs, operate inefficiently. Thus, some studies have focused on the lack of supermarkets and supercenters as the characterizing aspect of a food deserts (Morton and Blanchard, 2007).

Not much attention has been given to establish an economic framework that could justify food deserts' existence. The two most relevant examples are chapter 5 of the 2009 USDA report to Congress on the issue—which summarizes some of the concepts also illustrated here—and Bitler and Haider (2011). This article illustrates the role played by different demand and supply drivers of retail location which could contribute to the emergence of food deserts, and how different economic frameworks can explain their existence. In doing so, we keep the distinction between "large" and "small" food stores made above.

Drivers of Food Retail Location

The interaction of demand and supply forces determines the number and types of food store that consumers have access to, and the quality and type of food products available to them. This section illustrates how some of these factors can play a role in the food desert phenomenon. Demand-side factors will be discussed first; supply-side ones follow.

Demand-side Factors

Market size: The size of a market is a key determinant of retail outlets' location: simply put, for a food (as well as non-food) retailer to be profitable, the market served must be large enough to ensure that costs are covered and a profit is made. This means that there should be enough consumers interested in patronizing the store and that these consumers need to have enough purchasing power to buy the goods sold. From a conceptual standpoint, as Bitler and Haider (2011) suggest, if nutritious food is a normal good, demand for it will increase with income; thus, demand for stores supplying nutritious food will be lower in

low-income areas (note that this argument works if population is held constant).

Population and income growth: Opening a new food store requires investments in fixed cost, which can be considerable in the case of large stores—see more on this point in the "Supply-side Factors" subsection below. Growing markets are appealing as they give assurance of longer-term returns for the investments made and a longer livelihood of the store; not surprisingly, some studies (for example, Morton and Blanchard, 2007) find food deserts more likely in areas with declining or aging population.

Poverty rate and rate of adoption of income support programs: A high poverty rate can be a deterrent for most stores, due to a larger portion of the population having low purchasing power. However, the possibility of accessing support programs such as the Supplemental Nutrition Assistance Program (SNAP) or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) could represent alternative sources of income for poorer households and a source of demand which could appeal to some food stores. Thus, although areas with higher poverty rates may be characterized by lower food access, areas with similar poverty rates but with more effective assistance programs may be less likely to become a food desert (Bonanno, Chenarides, and Goetz, 2012). Also, the quality of the food products offered may improve for those stores benefiting from program participation: for example a case study found WIC approved small stores to have adapted the level of "healthfulness" of the products offered in response to changes in program requirements (Andreyeva et al., 2012).

Consumers' preferences (taste heterogeneity): Differences in preferences driven by consumers' heterogeneity (related to education level, ethnicity, etc.) may lead to different demand for nutritious food across areas. Disparities in food access across ethnic and income groups have been documented in more than one occasion (see for example Powell et al. 2007). While the market size argument can explain the lack of food stores in prevalently low-income areas, more complex mechanisms may be in place. Less-educated consumers may also show lower levels of nutrition education and lower demand for nutritious food. Also, markets which are predominately inhabited by homogeneous ethnic groups may be targeted by some particular types of food stores with focused offering, which may result in lower product varieties and, arguably, less availability of healthy options.

Supply-side Factors

Fixed (investment) cost: For food retailers, the main investment costs are associated with building facilities, refrigeration installments, and to the provision of square footage (both selling area and not) to supply the basic retail function to consumers as well as delivering additional variety and services (from parking lots to salad bars). The higher the price of property, land, or facilities' rent, the more unlikely a store will open its doors, particularly in areas where the demand is low. As, arguably, low-income areas are usually characterized by lower property prices, the trade-off between the profitability of the investment and its magnitude lead investment decisions to favor areas where profitability is higher (more on this point in the next section).

Sourcing, sorting and distribution costs: the main function of retailing is to acquire, sort, and resell goods to consumers. Therefore, logistics and distribution play pivotal roles in the activities of a food retailer (particularly in the case of perishable goods). These costs can become prohibitive in areas where transportation infrastructures (for example road conditions, presence of highways, etc.) are poor, or where retailers need to build new logistics structures (i.e. excessive distance from pre-existing distribution centers). Similarly, isolated areas, distant from wholesale hubs, may not be appealing as sourcing cost may be higher.

Other factors: Other important variable inputs for food retailing, such as energy (mainly electricity for refrigeration, heating, and illumination) and labor, may not be as relevant for food deserts' creation as those discussed above; in the case of labor, in particular, this is likely to be cheaper in low-income areas. However, in areas where mostly unskilled labor is available, additional cost of personnel training may be required; although it may possibly lower long-run costs, it may still play the role of a deterrent. Other factors impacting food store location decision are local/state-level tax regimes, zoning laws, retail image, crime rates, presence of public transportation and others, whose detailed discussion are beyond the scope of this article.

Can Different Economic Frameworks Explain Food Deserts?

This section discusses how different economic frameworks can explain how food deserts can be one of the possible outcomes of the interaction of demand and supply factors—an equilibrium outcome. The frameworks illustrated include perfect competition and more complex ones where food retail firms' decisions take place in multiple stages and consider also heterogeneity in consumers and stores.

Perfect Competition

In a perfectly competitive world, both consumers and food retailers are homogeneous, no one in the market can withhold information from others, retailers do not have pricing power, there are no transaction costs, the goods sold across retailers are substantially identical, and there are no barriers to enter or exit the market. In this context (as Bitler and Haider

illustrate in more detail) areas experiencing a sizeable decline in population and/or income, under the assumption of nutritious food being a normal good, could show a shrinking demand curve that will intersect the long-run average cost of retailing food in its downward-sloping portion, leading to a downward sloping long-run supply curve and a resulting reduction in the number of stores over time. This implies that, in this framework, the food desert phenomenon is driven primarily by a shrinking market size; under the assumption of no barriers of store entry and exit, fewer and fewer stores will operate in a market as demand shrinks.

Variable Profits vs. Fixed Cost

Realistically, in order to enter a market, food retailers need to invest in fixed costs—entry and exit is not costless. Thus, food retailers decide first whether or not to enter and then they compete with the other entrants for consumers' dollars. This is an exemplification of the "entry threshold crossing" model presented by Bresnahan and Reiss (1991). The entry decision for each food retailer takes place considering whether its expected future variable profit, proportional to the size of the market, exceeds the fixed costs needed to enter and operate. As the number of entrants increases, the market is split between more stores and variable profits decrease. In this case, a food desert will emerge if a very limited number of, or no, food stores find it profitable to enter the market, either because of the large fixed cost, or the small expected variable profits, or both. In other words, the difference between short-term profitability and fixed cost determines the likelihood of observing entry.

Food Stores Providing Different Quality Levels

Consider now a scenario where food retailers' decisions follow a three-stage process: first, stores decide whether or not to operate in a market; then, those which have entered the market set the level of quality—assortment and level of service—offered to consumers; last, they compete with one another. Since quality, which is a food retailers' choice variable, comes with fixed costs, this framework treats the level of investment as a choice variable (in the vein of Sutton's Endogenous Fixed Cost model, as in Sutton, 1991). Ellickson (2006, 2007) shows that modeling the food retailing industry this way leads food retailers to separate "naturally" into two different groups: one made of "low-quality" small stores, such as some small independents and convenience stores; and one made by larger "high-quality" ones, such as supermarkets and supercenters, needing more investments to provide the quality that some consumers demand. While one can expect the number of small stores to grow with market size, the number of large stores does not increase endlessly with it. A similar argument can justify a limited number of entrants of the "low quality" type—if market size is small, only a small number of firms' variable profits will exceed fixed costs. For the "high quality", large stores, the equilibrium number of firms in the market is a function of the size of the market, investment costs, and the relative costliness of investing in quality to satisfy quality-valuing consumers. In this case, a small number of firms in the market can be an equilibrium outcome only if market size is small and large stores make minimal quality investments. Also, the two features of the market that allow for the absence of "high-quality" food stores are a very high cost of quality investment—for example, a prohibitively high price of land—and/or extremely small market size (result obtained manipulating some of the formulas in Ellickson (2006, 2007)). In other words, according to this economic model, variable retailing costs no longer plays a role in observing areas with limited food access.

Heterogeneous Food Retailers and Consumers

By combining different assortments of physical products and levels of service offered to consumers (Betancourt and Gautschi, 1990), food retailers assume the characteristics of differentiated products. The level of fixed cost necessary to provide such services or to expand stores are internally determined because owners decide strategically to create "better" stores, offering more features and higher quality products so that competition in price is softened and they can gain higher profits by becoming attractive to less price-sensitive consumers (Bonanno and Lopez, 2009). As a result, such stores will likely shy away from low-income areas. The existence of fixed costs to obtain this "vertical" store differentiation, where food stores can be ranked in function of the services and the quality of the products offered, and consumers' heterogeneity across markets, leads both food stores and consumers to sort themselves according to their respective store-features and preferences. The outcome of this process is that stores of different types—and therefore the different quality of foods they carry on their shelves—will not to be available in all markets. Consequently, some areas will not have large, or "better", stores providing food products which could be healthier. Also, as these types of food stores may be targeting higher-income consumers and may charge higher prices—perhaps necessary to recover the additional costs sustained—their presence would not help low-income consumers to purchase as much nutritious food as they need, which may result in a food desert. For a more thorough discussion of the concepts in this section please refer to Bitler and Haider (2011) and their references.

Concluding Comments

As illustrated above, several demand and supply factors may play a role in

the creation of food deserts. Also, as food deserts could emerge in scenarios where the market works efficiently, as in perfect competition, or in others where retailers may benefit from some pricing power due to product differentiation. Interpreting food deserts as resulting from market failures may not be accurate. Across all frameworks, and as economic intuition suggests, the lack of market potential, or the small market size, is one of the most important determinants for food store location. Issues related to structural economic problems—for example, lack of employment opportunities resulting in high unemployment and/or poverty rates—may explain shrinking markets which can be a combined result of migration, aging population etc. However, the effectiveness of initiatives that help the existing low-income population acquire food, such as SNAP and WIC programs, might provide enough market demand to attract more and/or better quality stores. Also, the magnitude of retail costs, in particular fixed costs, used by retailers to deliver "quality" to consumers seems to be another factor playing a role in the observance of food deserts. Flexible financing programs releasing funds, either in the form of grants or low-interest loans, to cover different types of investment costs needed to bring food stores into underserved low-income areas may prove effective to help curb the issue. One example of such flexible financing programs is the Pennsylvania Fresh Food Financing Initiative which allows funds' requests for different uses, such as feasibility studies, construction grants, infrastructure improvements, security improvements, and personnel training.

For More Information

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Alessandro Bonanno (abonanno@psu.edu) is an Assistant Professor of Agricultural Economics, Department of Agricultural Economics, Sociology, and Education, The Pennsylvania State University.