An Economic View of Food Deserts in the United States

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Abstract. Considerable policy and academic attention has been focused on the topic of food deserts. In this paper, we consider this topic from an economic perspective. First, we consider how the components of a standard economic analysis apply to the study of food deserts. Second, we discuss several implications of this economic analysis for measuring whether food deserts exist and why they might exist. Third, we critically review the existing literature on food deserts from this economic perspective. Overall, despite several studies documenting the existence of food deserts in local areas, shortcomings in available data have not allowed researchers to convincingly document the presence of an analysis of a national scale.

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1. Introduction

Over the last two decades, numerous papers have been written about the existence of "food deserts" in a variety of different social science disciplines and with data from several different developed countries. The concern of these studies is that there may be insufficient quantity and/or quality of food or systematically higher food prices in particular geographic areas. For example, Lewis, Sloane, et al. (2005) find that there are fewer healthy restaurant options in poor Los Angeles neighborhoods when compared to more affluent Los Angeles neighborhoods. Powell, Slater, et al. (2007), using national data, find that poor and minority neighborhoods have fewer chain supermarkets than do more affluent, whiter neighborhoods. Rose and Richards (2004) find that food stamp recipients who live closer to supermarkets consume more fruit and vegetables. White (2007) reviews numerous studies that examine whether food deserts exist in the United Kingdom (UK).

These studies have attracted the attention of policy makers. In the UK, a government commission issued a report a decade ago stating that food deserts were a problem, which in turn led to the introduction of a bill to study and eradicate the problem (the 2001 Food Poverty Eradication Bill). See Cummins and Macintyre (2002) and Wrigley (2002) for a discussion of this policy debate in the UK. In the United States (US), the 2008 Farm Bill defined a food desert as "an area in the United States with limited access to affordable and nutritious food, particularly such an area composed of predominately lower-income neighborhoods and communities." The 2008 Farm Bill further commissioned a report from the US Department of Agriculture (USDA) that would assess the prevalence of food deserts in the US and recommend measures to address their causes and effects.

Despite the existence of numerous empirical studies of food deserts and the interest these studies have attracted from policy makers, we are not aware of a systematic economic analysis of food deserts. This absence of an economic analysis is somewhat surprising given that economics is typically defined as the study of the allocation of scarce resources.

In this paper, we examine the public policy issue of food deserts by undertaking two tasks. First, we provide a systematic discussion of the economics of food deserts, paying particular attention to features that economic theory suggests would be important to establishing whether and why they exist. Second, we revisit the existing empirical literature on food deserts to assess the progress that has been made regarding whether food deserts are problematic in the US.

Overall, the food desert literature has made much progress at understanding several key issues regarding the assessment of whether food deserts exist and have clearly documented that some local areas can usefully be thought of as food deserts. However, these local area studies also point to numerous problems that exist with the data that have been used in large-scale studies. Additionally, little progress has been made in either the local area or the national studies on identifying the causes of food deserts, even if one were to accept that they exist. These data issues and identification challenges are sufficiently problematic that there is little basis to make general statements about the existence of food deserts in the US at the present time.

2. An Economic View of Food Deserts

The premise behind the term food deserts is that there exist geographic areas with insufficient quantity or quality of food or where healthy food is available only at

relatively high prices. Perhaps the most basic insight economics brings to such an issue is that the availability of a product is the result of the interaction of supply and demand forces, and these forces together determine what products are available, where they are available, and at what price they are available. We first discuss the components of such an economic view, and then we discuss their implications for food desert research and policy.

2a. The basics

Our economic analysis of food deserts is comprised of four components: issues related to defining the relevant products, issues that mainly apply to consumers (the demand side), issues that mainly apply to food retailers (the supply side), and then the interactions of these factors (the market).

Defining the relevant products. The starting point for an economic analysis of product availability is the definition of the product. In the case of food deserts, the product of primary concern is "healthy and nutritious food", but this definition is far from complete and making it more complete is a challenge.

First, one must define more precisely what products are to be included as "healthy and nutritious food." This is difficult for several reasons. A healthy and nutritious diet includes more than just fresh fruits and vegetables. Rather, a healthy and nutritious diet is comprised of an appropriate mix of nutritious food servings from several food groups.¹ In addition, within a particular food group, the designation of healthy and nutritious food items falls along a continuum. For example, white bread is generally more nutritious

¹ See <u>www.mypyramid.gov</u> for the USDA's current guidance on what constitutes a nutritious diet. We also discuss USDA's Healthy Eating Index below in Section 2b. The nutrition literature assesses such issues (e.g., Gao, Wilde et al., 2006). No matter the source, definitions include many more foods than fruits and vegetables.

than donuts, but less nutritious than whole grain bread. Moreover, even within a food group and at a given level of nutritional content, healthy and nutritious food servings can come in many forms. For example, a nutritious serving of vegetables might be comprised of fresh vegetables, canned or frozen vegetables, vegetables in prepared dishes from supermarkets, or certain vegetable dishes purchased in restaurants. These forms of nutritious food vary in their location of availability (where one could buy them), in their perishability (how long they remain useful), in time costs associated with their preparation and consumption, and in their prices.

Second, as is clear from the name "food desert", a key attribute of the product is place: healthy and nutritious food must be geographically close enough to a consumer to be useful. A precise characterization of proximity is unlikely to be fixed, either across region or within region, because proximity will be affected by factors such as transportation availability (e.g., access to private or public transportation and congestion) and individual travel patterns (e.g., the relative location of one's residence and workplace). For example, if one examines the correlation between the density of stores and individuals who live in a particular geographic area, then important food sources may be missed, such as those near where people work or near their children's schools.

Third, assessing the availability of any particular product in a type of store necessarily entails understanding the availability of other products and food sources. For example, our inference about whether the lack of fresh fruits and vegetables in grocery stores is problematic will be influenced by whether other sources of fresh fruits and vegetables, such as gardens and farm stands, are widely available.

Demand. The most basic determinants of the demand for healthy food are income and prices. Standard economic theory suggests that the quantity of healthy food demanded is decreasing in its own price and increasing in the price of substitute foods. Assuming healthy food is a normal good, the demand for healthy food will increase with income levels. Such a simple observation implies that we would expect there to be more food stores in high income areas when compared to low income areas, even if there were sufficient food stores in both.

Because the primary concern with the existence of food deserts is access for the poor, it is worth noting that the social safety net could appreciably affect the demand for food among the poor. For example, several programs seek to alleviate the negative effects of low income by increasing income for the poor (e.g., Temporary Assistance for Needy Families and Supplemental Security Income), while other programs provide food assistance directly through vouchers (now electronically provided in most states) that can be redeemed for certain food items (the Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)) or through direct provision (e.g., the National School Lunch and Breakfast Programs and the Senior Farmers' Market Nutrition Program).

This basic model of food consumption overlooks several issues that are often put forward as relevant for food choice among the poor (e.g., Bhattacharya and Currie 2001). First, the potential time cost of obtaining ingredients and preparing meals could be important. Such time constraints could be more binding for families with children. This issue becomes relevant when one decides to purchase relatively unhealthy prepared food

(e.g., certain foods obtained from fast food restaurants) versus relatively healthier ingredients that then must be prepared. Second, individuals may have inadequate information about the relative merits of different food choices.² Although either factor could explain why the poor are more likely to eat relatively unhealthy, processed food, the appropriate policy interventions suggested by our economic framework differ for each factor.

Many economic analyses of demand allow for heterogeneity in preferences. Although simply allowing for differences in tastes for healthy food by race/ethnicity or educational level has the potential for "assuming" away the problem, heterogeneity in preferences is an important possibility that should be carefully considered.³ For example, ethnic cuisines often differ in key ingredients and cooking methods, and these differences can directly influence the extent to which canned, frozen, and fresh ingredients are regarded as substitutable, as well as the types of retail outlets one frequents (that is, one likely frequents the stores that stock the desired ingredients).

Heterogeneity may also exist in discount rates, the formal way that economic models incorporate how individuals value the future. Some theorize that lower socioeconomic status (SES) individuals have worse health in part because they are less willing to invest in their health by seeing the doctor regularly and by avoiding unhealthy behaviors due to higher discount rates (e.g., Fuchs 1982). In our context, such heterogeneity might imply that lower SES individuals are less likely than others to invest in their health by cooking and consuming healthy foods.

 $^{^{2}}$ For example, obesity may be associated with poor food choices (e.g., Bhattacharya and Currie 2001).

³ One could always assume that, in places where healthy food is not available, the demand for healthy food is low because individuals in that area do not like healthy food. If such a situation existed, there would be less scope for policy intervention.

Supply. The most basic determinants of supply are the input costs to running a retail food outlet, which include labor, land, capital, transportation costs, and wholesale product costs. Supply declines as each of these costs increase.

If the prime concern is with the availability of food for poor people, it would seem that land and labor costs should not be expected to be relatively important in many settings: the poor often live in areas with low wages, high unemployment, and low land prices (we discuss the counter-example of certain urban settings below). To the extent that retail food outlets require initial investments, capital may be scarce among the poor, although it would remain an open question why larger retailers who had access to capital would not open a store in low-income areas unless other factors were important (e.g., existing distribution networks). This latter question is also relevant for considering wholesale costs: even if small scale grocers are unable to secure low wholesale product prices because they do not make bulk wholesale purchases, it would remain an open question why large-scale retailers who can purchase in bulk would not locate in lowincome areas.

Another important feature that can affect firm behavior is fixed costs. These fixed costs could operate at the level of the retail outlet or at the level of offering particular products. In the face of the former type of fixed costs, a firm must charge higher prices to be profitable. In the face of the latter type of fixed costs, firms will limit the spectrum of goods that will be produced (Tirole 1997). In both cases, the effects of fixed costs on the firm will be greater for low-volume firms when compared to high-volume firms. However, to the extent that we systematically see a lack of nutritious foods available in

poor areas, fixed costs would only be relevant if one could ascertain why such fixed costs are systematically more important in poor areas.

There is also an industrial organization literature on endogenous fixed costs and the location decisions of firms (e.g., Sutton 1991). Such models suggest that firms, in response to competition or the threat of competition, can undertake strategic actions (e.g., advertising) to force out or keep out competitors. In the case of retail food outlets, these endogenous fixed costs could include investing in larger stores, offering more and higher quality product variety, and investing in prime retail locations. Ellickson (2006, 2007) suggests endogenous fixed costs can explain why the retail food market has moved towards having a few large high quality chains and a large fringe of smaller stores.

Issues with similar implications to those associated with fixed costs are economies of scales, economies of scope, and economies of agglomeration. Each type of cost structure would suggest a concentration of product availability. Economies of scale refer to when the cost of operating a store declines with the size of a store. Economies of scope refer to when the cost of operating a store declines with the product variety offered there. Economies of agglomeration refer to when the cost (/benefits) of operating a store are lower (/higher) when a store is located near other stores. Each of these factors could cause there to be some areas of concentrated product availability, and thus other areas that could lack product availability.

Although all of the above factors could lead to the spatial concentration of firms, economies of agglomeration deserve special note because they have been central to the economic geography literature (e.g., Krugman 1991). This literature uses economic models to explain the spatial concentration of manufacturing firms and agricultural firms,

and such issues are likely to be relevant to retail outlets as well. However, once again, such models will be relevant to the extent they provide insight as to why any spatial concentration of outlets occurs away from the poor.

The market. At its most basic level, the market is where firms and consumers meet to exchange goods for money. It is interactions among suppliers (the retail outlets that sell food) and demanders (consumers) in the market that then determines observed product availability and prices.

It is usually assumed that consumers in the retail food market have little market power, an assumption that would seem to be natural even in rural food markets.⁴ This assumption implies that any one individual consumer can have little effect on the quantities, prices, and variety of products that are offered. Thus, individuals are "price takers," simply purchasing those products that make them the best off.

The typical starting place for the analysis of firm behavior is also that firms have little market power. In such circumstances, the standard predictions of perfect competition result: the availability of goods and price is determined by the direct interaction of supply and demand, with the long-run price being determined by the long-run average total cost of healthy food and all products being offered that do not lead to negative economic profits. Moreover, under the usual assumptions regarding perfect competition (e.g., perfect information, buyers and sellers are price takers, no increasing returns to scale or scope, no transaction costs or externalities, and free entry), lower demand results in lower prices and higher demand result in higher prices. We depict the long run static

⁴ Market power is usually defined as the ability of a seller of a good (the firm in a product market) or buyer of the good (the consumer in the product market) to affect the price or quantity of goods being sold.

equilibrium in this situation in Figure 1 starting with the demand curve D^{High} , and then imagining small shifts to the left (lower demand) and to the right (higher demand).⁵

Perhaps the simplest economic model that captures the essence of food deserts arises from a slight modification of this standard model. In particular, suppose that the long-run supply curve remained as depicted in Figure 1, but instead demand was so much lower that it intersected the supply curve to the left of the minimum average total cost. This situation is depicted in Figure 1 by the demand curve D^{Low}. In this situation, small shifts of demand to the left of demand (lower demand) increase price instead of lowering price. Moreover, if the demand curve were to shift sufficiently far to the left, it would no longer intersect with the supply curve, implying that the market would be left completely unserved. Thus, one economic rationalization of a food desert is the situation where demand in a market is sufficiently low that the relevant long run average total costs are declining.⁶

It may well be the case that food stores have market power, especially in settings where there is little product availability. Thus, an important departure from the perfectly competitive model to consider is market power of the firm. A firm with market power has the incentive to increase price and restrict quantity with respect to the competitive price and quantity level in order to increase profits. However, even if it were established that the lack of food availability and high food prices were related to supplier market power, the question would remain why such market power exists. Several of the supply-side factors mentioned in the previous section could lead to market power, including fixed

⁶ Of course, this model is a long run equilibrium model and may not hold either in the short run or when the various other assumptions do not hold. For a more complete discussion of downward sloping supply curves, see Nicholson (2002), p. 386–8.

costs, economics of scale, economies of agglomeration, and economics of scope. In terms of this picture presented in Figure 1, all of these factors would make it more likely that the long-run supply curve is downward sloping where it intersects the demand curve.

A rich economics literature examines the spatial aspect of competition directly (e.g., Capozza and Van Order 1978). These models do not require the definition of specific geographic markets, but instead directly incorporate transportation costs that effectively make far-away products undesirable to a consumer. These models show that the combination of fixed costs and transportation costs can lead to the spatial distribution of consumers being important determinants of market prices.

Modern industrial organization provides a rich and nuanced understanding of firm decision making and firm interactions. Perhaps one of the central implications of modern industrial organization theory, which carefully considers the strategic interactions of firms, is the importance of firms trying to avoid the "Bertrand Paradox". This paradox follows from the simple insight that the existence of even two firms, when offering the same product, can lead to "unbridled price competition" (Tirole 1997, p. 278). To avoid such competition, firms have a strong incentive to differentiate themselves from each other. In the case at hand, this suggests retail outlets should try to locate in places where other retail outlets are not locating, and when locating near other retail outlets, they should offer different products. Such considerations imply that firms should locate where other firms have not or at least offer different products when such competitive forces are important. Modern industrial organization also has developed complicated models of

differentiated products and dynamic interactions that may have implications for modeling food deserts, but we do not pursue these ideas here.

The careful consideration of the interaction of supply and demand factors has led to the development of rich models to explain observed behavior. For example, Waldfogel (2008) develops a model in which the existence of different preferences across groups and large fixed costs in production can result in some goods being available in only certain locales. This model predicts that such factors could lead to the geographic sorting of firms and consumers. This model might be relevant for explaining why certain types of food stores and restaurants may only appear in ethnic enclaves (e.g., in situations where an ethnic cuisine requires unique ingredients that can be made available only with sufficiently high fixed costs). Similarly, this model might be relevant for explaining the existence of specialty food shops in relatively wealthy neighborhoods.

2b. Implications for identifying whether food deserts exist

The preceding discussion has several important implications for identifying whether food deserts exist. We first discuss the general implications of our economic discussion, and then consider factors that are specific to rural, suburban, and urban areas.

General implications. First, the data requirements for identifying the existence of food deserts are many and may not be satisfied with existing data sources. As noted previously, nutritious food is better thought of as one end of a continuum rather than a specific category, can come in a variety of forms (e.g., fresh vegetables, frozen vegetables, and prepared foods containing vegetables), and can be obtained at many places (e.g., large grocers, small grocers, restaurants, convenience stores, food stands, and private gardens). Standard data sources on the location and characteristics of firms

selling food often include either only broad industry classifications or have detailed information only on a subset of the retail outlet types, leading researchers to focus on a rather small subset of outlet types. For example, quantitative studies using private-sector firm data often focus on the geographic distribution of supermarkets, ignoring many other potential retail food outlets and heterogeneity in offerings across supermarkets.⁷ Thus, even the most comprehensive data from sources like TDLinx will miss sources of food such as farmer's markets, home grown vegetables, and food from restaurants.

Standard data sources on consumers, in contrast, often collect detailed information on food consumption, regardless of where or how the food is purchased. Examples of this type of data include the National Health and Nutrition Examination Survey (NHANES) and the Continuing Survey of Food Intakes by Individuals (CSFII). Alternatively, the Consumer Expenditure Survey (CEX) collects detailed information on expenditures on food, including raw ingredients, prepared foods for home consumption, and food away from home. Data such as these are useful for assessing consumption because they include all sources of food or food expenditures, not just those purchased at particular retail outlets. At the same time, for use in studying food deserts, they have the drawback of reflecting individual preferences. Thus, in typical consumer data, it is difficult to discern whether a respondent with a poor diet has limited access to healthy and nutritious food or

⁷ Several studies rely on firm level data sources such as TDLinx data on retail tenants (formerly offered by Trade Dimensions, and currently offered by Neilsen). TDLinx collects store level data from all retail food stores in the US for use in retail measurement. Such data identify different classes of retail trade establishments along with detailed information on locations, sales, number of SKUs and other information (not all of which is available for each retail class). In these data, supermarkets are defined as self-service grocery stores with annual sales volume of \$2 million per year and include all super centers, chains, and independent stores that meet these requirements. Some of the other categories include the following: superettes or small groceries, which are stores with \$1-\$2 million in sales; convenience stores, which are stores with 500–1500 SKUs and 800–3000 square feet and include stores selling gasoline or fast food; drug stores, which are health and beauty care stores or independent pharmacies; and mass, general merchandiser, or dollar stores, which are another category. Although some stores that would fall into these other categories carry a broad line of healthy and nutritious food, many others would not.

lives next to a supermarket and simply chooses not to consume healthy and nutritious food. Moreover, these data are often unavailable at detailed levels of geography.

Another data challenge arises from the fact that most data are collected about where people live, while food can also be purchased in places where people work and enjoy leisure. For example, decennial census data are commonly used in food desert research to characterize the neighborhood in which people live, measuring factors such as median household income or the percent poor. Publicly available data from the decennial census only report information about one's commute time to work, not the location of where people work. Thus, most studies will only be to describe food availability for where people live, not capturing true food availability.⁸

Second, it is useful to consider explicitly whether a "food desert" is meant to be an absolute concept, implying that an area has an insufficient quantity of nutritious food, or a relative concept, implying that an area has appreciably less nutritious food than do other areas.⁹ Such a distinction has many implications for studying whether food deserts exist. Perhaps the most important implication rests with defining the relevant product. If one were interested in studying whether relative food deserts exist, then one would primarily need a definition for healthy and nutritious food that could be applied consistently across areas. For example, if the definition were "too narrow" in the sense that only the most nutritious foods were included (e.g., fresh fruits and vegetables), then such a systematic

⁸ For example, recent tabulations of the American Time Use supplement to the Current Tabulation survey suggest that 26% of adult's waking time is spent at work.

⁹ Very similar issues arise in the measurement of poverty. See Citro and Michael (1995) for a useful discussion of these issues in the context of poverty measurement.

"mistake" might be innocuous to a relative measure because the similar "too narrow" measure would be applied to all areas.¹⁰

If instead one were interested in absolute food deserts, then one must develop a measure that meaningfully corresponds to nutritional deprivation. This is a very difficult task, even if the data constraints detailed above did not exist. As mentioned above, a proper definition of healthy and nutritious food is multi-faceted, and a healthy and nutritious diet can be achieved with a variety of food items. As a further complication, such a stringent notion of a healthy and nutritious diet may not be as relevant to daily food choices as we would like. For example, the USDA uses the Health Eating Index (HEI) to monitor whether Americans are meeting appropriate nutrition targets (e.g., Basiotis et al., 2002). According to this 2002 report, in 1999–2000, only 10% of the population 2 and older had a good diet, 16% had a poor diet, and the rest had a diet that needed improvement. In the end, these concerns might suggest that absolute food deserts are too hard to identify, but it is likely that absolute food deserts are the primary concern of policy makers.

<u>Third, the study of food deserts usually defines a geographic area as the relevant</u> <u>market, and there is unlikely to be an answer that is uniformly correct across areas or</u> <u>even within areas.</u> For example, commuting times would suggest that the appropriate geographic area would typically be larger in rural and suburban areas than in urban areas. However, the appropriate relative geographic sizes of rural, suburban and urban markets might be reversed in rank for individuals in rural areas who lack private transportation

¹⁰ We do not mean to imply that the precise measure does not matter if one is interested in relative food deserts. For example, if the measure includes only some types of equally nutritious food but not other types and the consumption of particular types is related to income, then focusing only on a subset of nutritious foods might lead us to erroneously identify income differences in consumption patterns. We discuss this issue more fully in the next subsection.

when compared to individuals in urban areas with well-developed public transportation systems. Sources such as Neilsen provide their own definitions that might be of use in defining markets.

Despite these difficulties, it is useful to recognize that different mistakes in the definition of the size of geographic markets are likely to cause different types of errors. If the area of geography is too small, then some areas will be defined as food deserts despite there being food readily available in a nearby geographic area. If the area of geography is too large, then some areas might inappropriately be deemed as having sufficient food available, when in fact some parts of the geographic area have insufficient food.

As discussed previously, economic models of spatial competition generally do not require the definition of specific geographic markets, but instead directly incorporate transportation costs that effectively make far-away products undesirable to a consumer (e.g., Capozza and Van Order 1978). These models shift the focus from product availability in a geographic area to the "full price" of product availability for an individual, where "full price" includes the list price of a product and the individual-level transportation costs to purchase it. Thus, these models reduce the analytic burden of defining a geographic market, but increase the data burden in that individual-specific transportation costs must be evaluated for every product.

Fourth, examining geographic variation in one aspect of nutritious food, whether that aspect is related to the type of food or where the food is purchased, may or may not identify true food deserts. If the particular food aspect studied was indicative of other food availability (complements in economic terms), then studying the one aspect would

be sufficient. However, in many cases, we would expect one aspect of food availability to be a substitute for other aspects. For example, with all else equal, the simplest models predict that there would be fewer small grocers in an area that is served by larger grocers and fewer grocers in areas that have many restaurants. In such situations, the focus on only part of the spectrum of nutritious food may be identifying differences in shopping and consumption patterns rather than the real lack of nutritious food.

Fifth, examining price variation in addition to availability is likely to be very informative to the study of food deserts. Because the typical definition of food deserts includes areas in which nutritious food is available only at prohibitively high prices, the focus on availability alone could miss many food deserts. Despite the obvious importance of price, there are at least two practical difficulties in incorporating price into large-scale quantitative studies. The first is related to price data being relatively less available. One possible source of price information is the underlying data on prices for specific items used to create the Consumer Price Index. These data are collected by a large staff of Bureau of Labor Statistics field representatives for a large number of specific items (including fresh ingredients and prepared foods) from a wide variety of outlets. However, one drawback of these data for analyzing food deserts is that they are collected for urban areas only. Other possibilities include Neilsen Homescan data and other store scanner data sets, although Neilsen Homescan data are somewhat limited geographically in coverage and other store scanner data often cover only specific chains.

The second is related to measurement. If price is to be monitored, then an operational definition of "prohibitively high" must be adopted. A useful starting place in considering

price levels is likely to be the food costs incorporated in the Thrifty Food Plan and SNAP benefit levels.¹¹

Specific implications by population density. The predominant features of rural areas, of course, are the relative scarcity of people and long distances to all sorts of establishments and services. Such areas lead to several specific issues for the measurement of food deserts. First, the non-market or informal market availability of healthy food is likely to be more prevalent, both through the increased possibility of home grown food and through more access to informal farmers' markets and produce stands. Such non-market or informal market healthy foods are not easily captured in the existing data discussed above, and thus, some rural areas might incorrectly be deemed food deserts if one were only to consider more formal market measures of food availability. At the same time, another potential source of healthy food—prepared healthy food—may be less of an issue than for urban areas. Thus, for a study of rural areas, firm level data on grocery stores might be best supplemented with individual level data on food consumption. In contrast, for the study of food deserts in urban areas, firm level information on restaurant locations and menu offerings is likely to be more important.

A second issue for rural areas is the relevant geographic size of the market. Quite simply, it is likely to be much larger than that relevant for other areas. Such a conclusion is based on the likely travel patterns related to work, school, or other shopping needs, as well as the ubiquity of cars in such settings. For urban areas, the relevant geographic

¹¹ The maximum level of food stamp benefits is tied to the cost of the Thrifty Food Plan, which chooses quantities of food to be similar to average consumption of low-income individuals while being sufficiently low in cost and reflecting certain nutritional recommendations such as the Recommended Daily Allowances, Adequate Intakes, and Acceptable Macronutrient Ranges; Dietary Guidelines for Americans, and the food pyramid.

area is likely to be smaller, and the access to public and private transportation is likely to be much more important. Urban and suburban households are more likely to rely on public transportation options, and such reliance can greatly restrict access to stores. Moreover, one's transportation options are also likely to affect shopping behavior along the dimension of shopping frequency, the quantity of goods bought per shopping trip, and the substitutability of restaurants and other food outlets.¹²

2c. Implications for identifying why food deserts exist

Even if it were established that certain areas lacked nutritious food, we must still understand why this scarcity exists to determine whether a policy intervention is warranted and what sort of policy intervention might be effective. In this section, we discuss the implications of our economic discussion for assessing why food deserts exist.

General implications. First, if one were to find evidence that food deserts exist, ascertaining why they exist will likely require even more data. Once again, monitoring the price of relevant food products is as important as is monitoring availability. Just as price is fundamental to identifying whether food deserts exist, price is also fundamental to identifying why food deserts exist. Quite simply, if any existing nutritious food or near substitutes (or even other products that face similar input costs to those faced by food retailers) are available cheaply, then this would be important evidence that insufficient demand may be the explanation. Similarly, it is important to collect data on costs in order to understand price variation. For example, data could be collected on the costs of operating food stores in an area, including wholesale costs, labor costs, land costs, and fixed costs.

¹² Shopping behavior is also likely to be affected by storage space available, which is likely also less substantial in urban than rural areas.

Second, it is important to separate between supply and demand factors that may cause food deserts. Simply noting that certain places have little nutritious food available tells us nothing about whether the underlying causes are related to supply, demand, or both. Although most researchers who study food deserts are undoubtedly aware of this distinction, separating the effects of supply and demand factors is rarely addressed directly, presumably due to the many empirical difficulties involved. Specifically, not only must all of the measurement issues discussed so far be handled effectively, but one must then further identify exogenous changes in supply and demand. This identification problem represents perhaps the most fundamental empirical difficulty in economic research.

To see the importance of the distinction between supply and demand to designing "effective policy interventions," consider the following scenario.¹³ Suppose there were little nutritious food available in an area primarily comprised of the working poor. Further, suppose the local population valued nutritious food but was unable to afford regular nutritious, home-cooked meals because of the ingredient and time costs needed to produce the meal. If the government mandated the opening of retail outlets in poor areas that sold fresh fruits and vegetables at the same prices as those charged by large-scale suburban grocery stores, it might not affect the food purchases of the working poor because budget and time constraints would be unaffected. Instead, given that the reason

¹³ For now, we use the phrase "effective policy intervention" only in the very narrow sense of a policy that increases the consumption of healthy and nutritious food, without considering issues of economic efficiency. In the next subsection, we discuss policies interventions in terms of economic efficiency.

why the food desert exists in this example is related to low income, it is likely that increasing SNAP benefit levels or cash assistance to the poor might be more effective.¹⁴

In contrast, if the existence of food deserts were driven by supply factors, then government interventions on the supply side might be effective. For example, suppose that wholesale prices were systematically higher in poor areas or that the fixed costs of operating a retail outlet were higher in poor areas. Regarding this latter possibility, a trade association publication (Food Marketing Institute 1998) lists various challenges faced by firms looking to locate in urban areas, including infrastructure, zoning, crime, and traffic patterns. Such factors might deter firms from locating in certain areas even when demand is no different there than in other areas. In these circumstances, a government program that subsidizes the higher operating costs may be effective at increasing the consumption of nutritious food.¹⁵

Another interesting policy lever that could affect the supply of nutritious food is government mandated requirements such as required food offerings for those stores that participate in food assistance programs. For example, current policy requires that stores can participate in food assistance programs such as SNAP or WIC only if they offer a sufficient variety of food types.¹⁶ Such a policy might be useful to overcome supply constraints (e.g., fixed costs) that lead a store to offer a limited selection of nutritious

¹⁴ SNAP (formerly the Food Stamp Program) and similar programs are often referred to as "in kind transfer" programs because the transfer must be spent on specific items. Cash assistance to the poor, on the other hand, does not restrict the items that may be purchased. Of course, standard economic theory suggests there is no distinction in practice whenever the food stamp benefits are less than what the household would otherwise spend on the designated item (e.g., Gunderson and Ziliak 2003).

¹⁵ In a study of stores that redeem food stamps, King, Leibtag, and Behl (2004) find that overall operating costs for stores with Food Stamp redemption rates are not significantly different from stores with moderate Food Stamp redemption rates.

¹⁶ Specifically, to participate in SNAP by accepting food stamp benefits, a store must offer at least three varieties of each staple food group (breads and grains; dairy; fruits and vegetables; and meat, poultry and fish) for daily, with two categories including perishables. Stores that have a majority of their sales in a specific staple category are exempt.

food. At the same time, such a policy might also make it harder for stores to operate profitably in low income neighborhoods, inducing less availability.

Third, standard economic theory suggests that government intervention may increase "economic efficiency" in the presence of an externality or market failure. This celebrated and powerful result of standard economic theory deserves discussion because it is often misunderstood by non-economists. The narrow objective of "economic efficiency" is the appropriate starting point for general policy evaluation because it does not require one to make tradeoffs among different individuals: by definition, the movement from an inefficient outcome to an efficient outcome is one where some individuals benefit from the change and no individuals are harmed. In the presence of an externality or market failure, markets tend to lead to inefficient outcomes. Thus, it is possible that government interventions could be adopted that would move the market towards being more efficient and making everyone better off (or at least no one worse off and some better off).¹⁷

As an example of considering economic efficiency, consider the transfer policy to the working poor discussed under the previous implication. In this example, we did not suggest there was any sort of externality or market failure that existed, but simply noted that the working poor were not consuming enough nutritious food. It may be possible to induce the working poor to consume more nutritious food by expanding an existing transfer program, but it also well-known that such programs can induce some individuals to work less (e.g., Moffitt 1992). Thus, adopting such a policy might induce individuals to consume more healthy food, while reducing their overall income levels. Such a

¹⁷ Often, such improvements also require that cash transfers can be made that may not be feasible in this setting. Moreover, it is also important to note that, in the presence of many distortions from an efficient outcome, addressing only one of the distortions may not make the market more efficient. Thus, even in the presence of externalities or market failures, there may be no *feasible* policy intervention that can improve the efficiency of the market.

situation leads to economic inefficiencies in that the size of the overall economy has declined (the poor are working less).

To justify a policy intervention in terms of economic efficiency, one must identify the externality or market failure that exists. A supply side externality or market failure is likely to be more directly observable. For example, the supply issues discussed above from the trade publication (e.g., fixed costs related to infrastructure and zoning) could lead to barriers to entry in poor, urban areas. These barriers to entry could lead to market failures, and then there might be reasonable scope for government intervention from an efficiency perspective. Demand-side externalities and market failures may be more difficult to identify. One potential demand-side market failure already discussed is the lack of information, and there may be a role for the government to intervene if too little nutritious food were being demanded because the poor systematically misunderstood the importance of nutritious diet. However, in this situation, it would seem the most natural intervention would be a public health intervention targeted at providing better information on the importance of a good diet, although evidence is mixed on whether information provision changes diet.¹⁸

It is also important to recognize the limits of economic efficiency for policy evaluation. Although standard economic theory puts forward economic efficiency as its objective, policy makers need not, and often do not, use economic efficiency as its only objective. For example, there can often be a trade-off between economic efficiency and equity, and the government may determine that equity deserves consideration. It is exactly this sort of argument about equity that was put forward to justify the New Deal's

¹⁸ For example, Lee (2006) reviews a number of studies of workplace and community interventions to affect obesity, concluding that there is little systematic evidence that information provision is effective.

rural electrification program (e.g., Nye 1990, Chapter 7) and the more recent Universal Service Fund to provide affordable internet and telecommunications access to schools and libraries.¹⁹ Economic theory in no way precludes valuing these other objectives, but rather, economists recognize that economic theory is generally silent on how heavily these other objectives should be weighted.

Fourth, it is important to differentiate between general issues about low income neighborhoods and issues that only are relevant to assessing the adequate supply of healthy foods. For example, generally high costs of running a business (infrastructure, zoning, access to suppliers, etc.) could also mean a dearth of other products and services like medical care, banking, and housing options. In such cases, poor quality food may not be the most important problem facing a neighborhood, and it may be more efficient to tackle the source of high business costs more generally. For example, government policies such as tax abatements and the federal Empowerment Zone and Enterprise Communities programs could encourage general development in such areas.²⁰

Specific implications by population density. If fixed costs related to the retailing of healthy and nutritious food are important, then these fixed costs would raise food prices more in rural areas to the extent that there are fewer people to spread these costs over. For example, if there are fixed costs to stocking a variety of goods, smaller retailers might need to restrict the variety of goods that are offered and/or offer a similar variety at higher prices. Many of the other supply factors discussed above, such as economies of scope, economies of scale, and economies of agglomeration, could also appreciably affect

¹⁹ See the Universal Service Fund website (<u>http://www.usac.org/sl/about/overview-program.aspx</u>) for more information.

²⁰ For example, recent work by Neumark and Kolko (2009) suggests little effect of enterprise zones on employment in California.

the product price and product variety in rural areas. Understanding such aspects of the cost structure will provide important information regarding what the causes of rural food deserts might be and what the effects of policy interventions might be.

A different set of supply side factors are likely to be important in urban and suburban areas. As mentioned above, the Food Marketing Institute (1998) lists several common challenges faced by urban retailers, including infrastructure costs, zoning costs, possible crime costs, and traffic patterns. Another challenge for urban areas put forward by this publication is the paucity of large parcels of land. This factor can affect both the existence of retail food outlets, but also the type of food outlets that exist. This latter issue again points to the danger of only looking at one source of nutritious food at a time.

An important demand side factor that deserves special consideration for urban and suburban markets is transportation. The possibility that transportation is problematic for the poorest individuals has been well-explored in the "spatial mismatch hypothesis" literature that examines the access to jobs for poor and minority populations.²¹

3. What Have We Learned about Food Deserts?

Providing a systematic review of all food desert research is beyond the scope of this paper.²² Rather, we provide a discussion of the literature that centers around the implications developed in the previous section, focusing on empirical studies from the United States.

3a. Do Food Deserts Exist?

²¹ See Wilson (1987) and Holzer (1987) for prominent examples from this literature.

²² For useful reviews of this literature, see the other papers in this volume.

Data that have been used. The types of and sources for data that are used in food desert research vary tremendously. Perhaps the most important determinant of the type of data is the geographic scope of the study. National studies tend to use commercial databases of private businesses. For example, Powell, Slater, et al. (2007) use Dun and Bradstreet data that allows one to identify businesses that are classified as chain supermarkets, non-chain supermarkets, grocery stores, and convenience stores. The benefits of these data are that they are readily and uniformly available at the national level. As discussed previously, these data often suffer from several drawbacks: they may include only a crude classification of store type, they may miss many places where nutritious food can be obtained, and they may be out of date.

Studies of a more local level often are able to use much more complete data on food availability. Two useful examples of this type of study are Rose, Bodor et al. (2009) and Sharkey and Horel (2009). Rose, Bodor et al. (2009) examines food deserts in New Orleans. They began with a listing of retail outlets that are used in some national studies (lists of retail food outlets produced by InfoUSA, which are compiled from phone books, annual reports, business directories, and public records such as USPS change of address files), and then sent out teams to verify the accuracy of the listing by driving on all streets in New Orleans. They found that about 20 percent of the stores located in InfoUSA were no longer in business and about another 30 percent of stores were found.²³ Moreover, for about a third of the stores, they sent research teams into the store to document the availability of pre-defined fruits, vegetables, and energy-dense snack foods, even measuring the shelf-space devoted to these items. Similarly, Sharkey and Horel (2009)

²³ These numbers should not be taken as representative of the InfoUSA data quality overall. Part of the motivation of the Rose, Bodor et al. (2009) study is to examine food availability in New Orleans in the wake of Hurricane Katrina, an event that clearly could have affected their data quality.

sent out research teams to drive all roads in their study of 6 rural counties in Texas. Of course, such collection-intensive methods are not feasible for national studies.

An important contribution of these smaller scale studies is that they can provide important information about the quality of the data that are often used in the national studies. An important example of this type of analysis is Kowaleski-Jones, Fan et al. (2009). This study uses two business registries that are often in used in national studies (Dun and Bradstreet and ReferenceUSA²⁴) and state-level government data for Salt Lake County, Utah. They show that the three registries have many discrepancies, with about one-third of businesses being unique in each registry. They then show that the identification of food deserts by geographic area is sensitive to the data source used, but statistical analyses of what determines food deserts is not sensitive to the database. Another useful example of such a sensitivity analysis is provided in Rose, Bodor et al (2009). They show that the number of tracts that would be characterized as food deserts in New Orleans declines by almost two-thirds when actual fruit and vegetable availability information for small stores is included.²⁵

Overall, much data have been utilized to study food deserts, and much progress has been made at understanding data quality issues. Several local area studies have collected remarkably detailed information on the food environment and carefully compared these detailed food access measures to what would be available in national level data sets. Unfortunately, the data typically available at the national level are shown to have fairly serious deficiencies in that much of the actual food available is missing.

²⁴ ReferenceUSA is a database of businesses and people produced by InfoUSA, also used by Rose, Bodor et al. (2009).

²⁵ They compute that 46% of census tracts are food deserts based on a definition of there being no grocery store within 2 kilometers and at least 20% of the population is poor (Table 2). When they include the shelf-space devoted to fruits and vegetables in smaller stores, this percentage declines to 17% (Table 4).

Absolute vs. relative food deserts. Most studies of food deserts use a measure of food access that is, at least to some extent, relative in nature. For example, Powell, Slater et al. (2007) find that there are fewer chain supermarkets in low income zip codes when compared to higher income zip codes and that this relationship holds in a multiple regression analysis when a variety of other factors are controlled for (race/ethnicity, population size, urbanicity, and region). However, such a conclusion does not imply that there are insufficient chain supermarkets in low income areas, just that there are fewer chain supermarkets in low income areas. Similarly, Neckerman, Bader et al. (2009) document how the density of food stores varies across the racial and income characteristics of neighborhoods, again showing relatively less access in poor neighborhoods, not insufficient access in poor neighborhoods.

Some studies specify an absolute measure of access, usually specifying the distance within which a store needs to be present (e.g., a store within 1 or perhaps 2 kilometers). Perhaps the most sophisticated of such measures is developed in Rose and Bodor et al. (2009). This study calculates absolute access to a subset of of goods necessary to meet the USDA's Thrifty Food Plan, thereby allowing them to effectively aggregate across store types in a way that recognizes both differences in store types and an absolute measure of dietary quality. Of course, such an absolute measure of access requires much more data than is typically available to researchers.

Overall, several sophisticated measures of food access have been developed, and several studies provide detailed comparisons of these measures. Importantly, researchers have not routinely been clear in delineating whether these measures are absolute or relative measures, but this distinction is likely to be very important to policy makers.

Definitions of geographic area. It is common in the literature to focus on access to food outlets within geographic entities defined by the Census Bureau (census tracts or census block groups) or alternatively within radial or network buffers. For example, Powell et al. (2007), Morland et al. (2002), and Sparks, Bania, and Leete (2009) focus on census tracts, and Fan, Kowaleski-Jones et al. (2009) and Rose, Bodor et al. (2009) focus on census block groups. Census block groups contain between 600 and 3000 people and never cross state or county borders, and census tracts are made up of one or more block groups. Census tracts are designed to be relatively homogeneous with respect to population characteristics, economic status, and living conditions and on average contain about 4000 people (Iceland and Steinmetz, 2003). Use of these definitions to delineate the relevant geographic areas is due in part to data constraints: it is exceedingly difficult to obtain national data on neighborhood characteristics at finer levels than those of block groups due to confidentiality requirements. There are at least two drawbacks to these census definitions for geographic access: using such a specific boundary ignores stores just outside the boundary and, particularly for census tracts, there could be substantial variation in the distance to retail food outlets within the geographic area.

A related method for defining the relevant retail outlets is to calculate radial or network buffers around the centroid of a census tract (e.g., Rose, Bodor et al. 2009 and Neckerman, Bader et al. 2009). Either method entails specifying that the relevant retail outlets are within a fixed distance of the tract centroid (e.g., within 1 kilometer), with the radial method measuring this distance as a fixed Euclidean distance (e.g., straight line distance) and the network method measuring this distance along existing roads. Network methods approximate actual travel time better than radial methods, but network methods

are also more costly to compute and diverge from radial methods very little when streets follow a regular, gridded pattern as is common in urban areas (Neckerman, Bader et al. 2009). Such methods can improve upon a census unit based definition of geographic access because the size of the boundary can be varied fairly easily, thereby examining the extent to which there are stores just outside any given boundary. However, radial and network buffers around a tract centroid could still overlook important variation within a tract and the relevant distance to consider must still be chosen.²⁶

The choice of the relevant distance can be challenging, particularly when within-tract heterogeneity is considered. Conceptually, the relevant distance for defining access might be quite different for households without cars than for those with cars within tracts. Using larger geographic units will further obscure important within-area differences, especially to the extent that people with different tastes and incomes live in the same areas.²⁷ On the other hand, using too small an area could lead to the underestimation of availability of retail outlets. As pointed out in Sharkey and Horel (2009), this issue may be particularly important for rural areas.

Overall, much progress has been made in developing sophisticated measures of geographic area, as well as understanding the benefits and drawbacks of these methods. However, two issues regarding these methods are in need of additional research. The first issue is that the appropriateness of the radial and network measures clearly hinge on the distance that is chosen to define access. There exists suggestive evidence that

²⁶ Additional challenges arise because neighborhood characteristics are only available nationally by place of residence and only for specific geographic entities. For example, Hellerstein, Neumark, and McInerney (2008) show that only about one third of workers work in the same or adjacent zip codes to the one where they live in 2000 census data.

²⁷ For example, Goodman (1977) shows differences in the correlation between neighborhood characteristics and housing prices according to whether block groups or tracts are used.

distances closely linked to easy walking access, as is standard in many studies, may be too small for the US context.²⁸ Future research should systematically collect information on the distances people travel to obtain food and where they shop. The second issue is that all of these methods ignore variation in food access within the geographic areas because they assume all individuals within an area have similar access. However, the spatial demand models (e.g., Capozza and Van Order 1978) provide an explicit method to incorporate such variation (by computing "full price" for individuals, reflecting both the purchased price and transportation costs), although progress on this issue will likely be difficult due to data constraints.

Completeness of nutritious food definitions. As discussed above, a complete definition of nutritious food availability is certainly more expansive than simply the availability of fresh fruits and vegetables or the access to a supermarket. Of course, such narrow definitions of nutritious food access are often due to data limitations. However, several studies clearly document that inferences about the existence of food deserts vary according to the definition of healthy foods. For example, Rose, Bodor, et al. (2009) define availability to be within a set distance of a New Orleans census tract centroid and consider several different measures of healthy food availability, including (1) the presence of a super market, (2) the presence of each of 6 groups of fruits and vegetables contained in the Thrifty Food Plan in any type of store, and (3) the cumulative shelf space devoted to fresh fruits and vegetables in any type of store. Rose, Bodor, et al. (2009) find that the share of tracts identified as food deserts varied considerably depending on the

²⁸ Ohls, Ponza, et al. (1999) find that, even among food stamp recipients or eligible non-participants, more than 75% use a car to shop, with 31% getting a ride from someone else. Cole (1997) reports that a large share of food stamp participants bypass the nearest store of a particular type. Both findings suggest that using a measure tied to walking to the nearest store may be too short.

definition of healthy food access. Similarly, Sharkey and Horel (2008) consider fresh, canned, and frozen fruit and vegetable availability for a rural area in Texas. They find all three sources of fruits and vegetables are almost always available at traditional food retailers (supercenters, supermarkets, and groceries), while there is a much wider availability of canned and frozen items than of fresh ones at nontraditional food stores like convenience stores, dollar stores, mass merchandisers, and pharmacies.

There is fairly consistent evidence that one type of food availability is a substitute for other types of food availability. In their detailed literature review, Neckerman, Bader, et al. (2009) conclude, "Neighborhoods with higher income levels and higher proportions of white residents tend to have greater access to supermarkets or large chain food stores, although poorer neighborhoods and those with higher proportions of blacks or Hispanic residents may have greater access to small grocery stores. A few studies consider access to convenience stores, with most finding that low-income or predominantly minority neighborhoods are more likely to have access to such stores." This empirical regularity is echoed in the empirical results Neckerman, Bader, et al. (2009) present. Specifically, they find differences in the associations between neighborhood characteristics and density of healthy food establishments depending on whether they look at only supermarkets or whether they incorporate fruit and vegetable market and farmer's markets. Similarly, Raja, Ma, and Yadav (2008), in a study of Erie County, NY, find that a focus on supermarkets would suggest minority neighborhoods have less access to healthy food, but the inclusion of small grocery stores overturns this initial finding.

Overall, there is substantial empirical evidence that, due to the substitutability of retail food outlets, examining only a piece of food availability will likely provide

misleading results regarding food deserts. This conclusion implies even further limitations of typical national studies to date.

The inclusion of price information. Comparatively few studies examine price. There is evidence that price varies by type of retail outlet, but the evidence is very mixed about whether prices are higher in poor neighborhoods. A useful national level study of urban areas on this topic is Hayes (2000), which finds that the poor pay less. Useful examples at the local level include Andreyeva, Blumenthal et al. (2008), Block and Kouba (2006), and Chung and Myers (1999).

Overall, there seems to be very little concrete evidence that the poor pay more for food on average. Such a conclusion, however, does not imply that all poor people pay the same as everyone else. Future studies should carefully pay attention to food prices and heterogeneity in food prices.

3b. Why Do Food Deserts Exist?

In this section, we review the progress that has been made at understanding why, again focusing our discussion around the implications discussed above. Overall, very little progress has been made at understanding why food deserts exist. This overall conclusion should not be surprising given the substantial difficulties to establishing whether food deserts even exist.

Additional data that have been used. Relatively little information has been used to shed light on why food deserts exist. There would seem to be many research opportunities related to exploiting the type of data discussed in the implications section above. *Delineating between supply and demand factors.* We have also pointed out the importance of determining whether supply or demand side factors are the cause of food deserts, should one conclude they exist. An implicit assumption in much of the existing research is that supply side factors cause food deserts to exist. While there may be supply side explanations for the existence of food deserts (e.g., higher costs for firms that locate in some low income areas), there are also demand side explanations, including the simple explanation that healthy food is a normal good. We are unaware of any study that has systematically examined whether supply or demand factors explain the existence of food deserts.

Establishing the basis for policy intervention. Discussions about the appropriate policy response in fact rely heavily on the identification of the causes of food deserts. Without knowing the underlying causes, policy runs the risk of being ineffective. Several studies discuss existing and potential policy responses (e.g., Rose, Bodor et al. 2009 and Neckerman, Bader et al. 2009). However, these studies do not directly consider the underlying cause of food deserts or the economic arguments that motivate the policy responses.

Delineating between food-specific issues and general issues of access. Another important issue associated with analyzing the causes of food deserts is separating between those that primarily affect food access versus those that affect access to all sorts of goods and services. We are not aware of food desert studies that try to ascertain whether the causes of inadequate availability are food specific.

4. Conclusion and Discussion

Considerable policy and academic attention has been focused on the topic of food deserts. In this paper, we consider this topic from an economic perspective. First, we consider how the components of a standard economic analysis apply to the study of food deserts. Second, we discuss several implications of this economic analysis for measuring whether food deserts exist and why they might exist. Third, we critically review the existing literature on food deserts from this economic perspective.

We draw seven intermediate conclusions based on our analysis and selective literature review. The first five conclusions pertain to the assessment of whether food deserts exist.

- The data requirements for identifying whether food deserts exist are many and may not be satisfied with existing data sources. Researchers have made tremendous progress on data issues by carefully comparing what can be learned from a variety sources. Unfortunately, the results suggest that the data typically available at the national level have serious deficiencies in that many of the sources of healthy food actually consumed are missing.
- One should explicitly consider whether the food desert concept of interest is absolute or relative. Many researchers use definitions of food deserts that are best thought of as relative measures, and these definitions may be appropriate for their research purposes. However, policy makers are likely to be interested primarily in a food desert concept that is absolute.
- Food desert research often defines geographic areas as the relevant market, but any definition is unlikely to be uniformly correct across areas or even within areas. Researchers have made much progress in assessing the sensitivity of

- Examining geographic variation in one source of nutritious food may or may not identify true food deserts, depending on whether that one source is a substitute or complement for the other relevant sources. Unfortunately, much research suggests that food sources are often substitutes, implying studies that focus only on one food source (e.g., supermarkets) will provide a misleading view of food deserts.
- Food desert research should routinely monitor price. Of the studies that do, there is little evidence that the poor pay more for food on average.

The second set of intermediate conclusions pertain to the assessment of why food deserts might exist.

- To formulate appropriate public policy, it is very useful to understand why food deserts exist, especially in terms of supply factors, demand factors, and/or potential market failures. Determining why food deserts exist likely requires even more data and even more sophisticated econometric methods.
- The literature on food deserts has made little progress on assessing why they exist.

Overall, the food desert literature has made much progress. There are numerous innovative studies that collect detailed data at the local level and provide insightful analyses of key issues regarding the assessment of whether food deserts exist. These studies have clearly documented that some areas have less access to nutritious food than other areas, and at least in some studies (e.g., Rose, Bodor, et al. 2009), it has been shown that this access is sufficiently low that it could be difficult to purchase an objectively-

defined healthy diet. However, these studies also point to numerous problems that exist with the data that have been used in large-scale studies, so much so that there would seem to be little basis to make any general statements about the existence of food deserts in the US. Moreover, very little progress has been made on understanding why food deserts exist. Taken together, these overall conclusions imply that it would be difficult to formulate policy well-supported by research.

We stress two points about this overall conclusion. The first point is that our conclusion should not be mistaken for being that food deserts do not exist in the United States. Several small-scale studies suggest there are areas that are usefully described as food deserts, and numerous studies have shown the poor tend to eat unhealthy diets (e.g., Bhattacharya and Currie 2001 and Basiotis, Carlson, et al. 2002). Our conclusion is that we do not have sufficient evidence to determine whether food deserts are systematically the cause of the larger problem, making it difficult to formulate an effective policy. For example, if poor diets among the poor were generally caused by insufficient resources to purchase nutritious food rather than insufficient access to nutritious food, a more effective policy change might be to increase SNAP or WIC allotments or other needs-based transfers. We do not believe sufficient evidence exists to definitively choose either of these two policy recommendations.

The second point is that our conclusion should not be mistaken for implying that there is no need for additional research. Indeed, we find the progress on understanding food deserts to be impressive, and we believe there are numerous fruitful avenues for additional research. One example of such an avenue is further research on price variation, perhaps directly linked to explicit models of spatial demand. Another example is direct research on those factors that are thought to lead to high food prices, such as high wholesale costs, labor costs, land costs, or entry costs. A final example is direct research targeted at resolving some of the ambiguities in measurement, such as those related to shopping and travel patterns. Of course, additional research on any of these topics will require the collection of more data.

References

- Andreyeva, Tatiana, Daniel M. Blumenthal, Marlene B. Schwartz, Michael W. Long and Kelly D. Brownell. 2008. Availability and Prices Of Foods Across Stores And Neighborhoods: The Case Of New Haven, Connecticut. Health Affairs 27(5):1381-1388.
- Basiotis, P.P., Carlson, A., Gerrior S.A., Juan W.Y., and Lino M. 2002. The HealthyEating Index: 1999–2000. Center for Nutrition Policy and Promotion Paper No. 12.Washington, DC: U.S. Department of Agriculture, Center for Nutrition Policy andPromotion.
- Bhattacharya, Jayanta and Janet Currie. 2001. Youths and Nutritional Risk:Malnourished or Misnourished? In Risky Behavior among Youths: An Economic Analysis (Jonathon Gruber, ed.). Chicago: University of Chicago Press.
- Block D and J. Kouba. 2006. A Comparison of the Availability and Affordability of a Market Basket in Two Communities in the Chicago Area. Public Health Nutrition 9(7):837-845.
- Capozza, Dennis R. and Robert Van Order. 1978. A Generalized Model of Spatial Competition. American Economic Review 68(5):896-908.
- Chung CJ and SL Myers. 1999. Do the Poor Pay More for Food? An Analysis of Grocery Store Availability and Food Price Disparities. Journal of Consumer Affairs 33(2):276-296.
- Citro, Constance Forbes and Robert T. Michael. 1995. Measuring Poverty: A New Approach. Washington, DC: National Academies Press.

- Cole, Nancy. 1997. Evaluation of the Expanded EBT Demonstration in Maryland: Patterns of Food Stamp and Cash Welfare Redemption. Abt Associates Report.
- Cummins, Steven and Macintyre, Sally. 2002. "Food Deserts"—Evidence and Assumption in Health Policy Making. British Medical Journal 325:436–438.
- Ellickson, Paul. 2006. Quality Competition in Retailing: A Structural Analysis. International Journal of Industrial Organization 24(3):521–540.
- Ellickson, Paul. 2007. Does Sutton Apply to Supermarkets? RAND Journal of Economics 38(1):43–59.
- Food Marketing Institute. 1998. Urban Supermarkets. Washington, DC: Food Marketing Institute.
- Fuchs, V. R. 1982. Time Preference and Health: An Exploratory Study. In Economic Aspects of Health (V. R. Fuchs, ed.). Chicago: University of Chicago Press.
- Gao, Xiang, Wilde, Parke, Lichtenstein, Alice, and Tucker, Katherine. 2006. The 2005 USDA Food Guide Pyramid Is Associated with More Adequate Intakes within Energy Constraints than the 1992 Pyramid. Nutritional Epidemiology 136:1351– 1346.
- Goodman, A. C. 1977. A Comparison of Block Group and Census Tract Data in a Hedonic Housing Price Model. Land Economics 53(4):483-487.
- Gundersen, Craig and Ziliak, James P. 2003. The Role of Food Stamps in Consumption Stabilization. Journal of Human Resources 38(S):1051-79.
- Hayes, Lashawn Richburg. 2000. Do the Poor Pay More? An Empirical Investigation ofPrice Dispersion in Food Retailing. Princeton Industrial Relations Working PaperNo. 446.

- Hellerstein, Judy, Neumark, David, and McIrerney, Melissa. 2008. Spatial Mismatch or Racial Mismatch? Journal of Urban Economics 64(2):464–479.
- Holzer, Harry. 1987. Informal Job Search and Black Youth Unemployment. American Economic Review 77:446-52.
- Iceland, John and Erica Steinmetz. 2003. The Effects of Using Census Block Groups instead of Census Tracts when Examining Residential Housing Patterns. US Census Bureau Working Paper.
- King, Robert P., Ephraim Leibtag, and Ajay Behl. 2004. Supermarket Characteristics and Operating Costs in Low-Income Areas. Agricultural Economics Report No. 839.
 Washington, DC: United States Department of Agriculture-Economic Research Service.
- Kowaleski-Jones, Jessie X. Fan, Ikuho Yamada, Cathleen D. Zick, Ken R. Smith, and
 Barbara B. Brown. 2009. Alternative Measures of Food Deserts: Fruitful Options or
 Empty Cupboards? National Poverty Center Working Paper.
- Krugman, Paul. 1991. Increasing Returns and Economic Geography. The Journal of Political Economy 99(3):983–99.
- Lee, Helen. 2006. Obesity among California Adults: Racial and Ethnic Differences. San Francisco: Public Policy Institute of California.
- Lewis, L.B., D.C. Sloane, L.M. Nascimento, A.L. Diamant, J.J. Guinyard, A.K. Yancey,G. Flynn. 2005. African Americans' access to healthy food options in south LosAngeles restaurants. American Journal of Public Health 95(4):668–73.
- Moffitt, Robert. 1992. Incentive Effects of the U.S. Welfare System: A Review. Journal of Economic Literature 30(1):1-61.

Morland, Kimberly., Steve Wing, Ana Diez Roux, and Charles Poole. 2002. Neighborhood Characteristics Associated with the Location of Food Stores and Food Service Places. American Journal of Preventive Medicine 22(1):23–29.

- Neckerman, Kathryn M., Michael Bader, Marnie Purciel, and Paulette Yousefzadeh. 2009. Measuring Food Access in Urban Areas. National Poverty Center Working Paper.
- Neumark, David and Kolko, Jed. 2009. The Effect of Enterprise Zones on Job Creation: Evidence from California. Mimeo.
- Nicholson, Walter. 2002. Microeconomic Theory: Basic Principles and Extensions (8th Edition). South-Western Press.

Nye, David. 1990. Electrifying America. Cambridge, MA: MIT Press.

- Ohls, James, Michael Ponza, Moreno, Lorenzo, Zambrowski, Amy, and Cohen, Rohda.. 1999. Food Stamp Participants' Access to Food Retailers. Mathematica Policy Research.
- Powell, Lisa M., Sandy Slater, Donka Mirtcheva, Yanjun Bao, and Frank Chaloupka.
 2007. Food store availability and neighborhood characteristics in the United States.
 Preventive Medicine 44:198–95.
- Raja, Samina, Changxing Ma, and Pavan Yadav. 2008. Beyond Food Deserts:Measuring and Mapping Racial Disparities in Neighborhood Food Environments.Journal of Planning Education and Research 27:469-82.
- Rose, Donald, J. Nicholas Bodor, Chris M. Swalm, Janet C. Rice, Thomas A. Farley, and Paul L. Hutchison. 2009. Deserts in New Orleans? Illustrations of Urban Food Access and Implications for Policy. National Poverty Center Working Paper.

- Rose, Donald and Rickelle Richards. 2004. Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. Public Health Nutrition 7(8):1081–8.
- Sharkey, Joseph R., and Scott Horel. 2009. Characteristics of Potential Spatial Access to a Variety of Fruits and Vegetables in a Large Rural Area. National Poverty Center Working Paper.
- Sparks, Andrea, Laura Leete, and . 2009. Finding Food Deserts: Methodology and Measurement Food Acess in Portland Oregon. National Poverty Center Working Paper.
- Sutton, J. 1991. Sunk Cost and Market Structure: Price Competition, Advertising, and the Evolution of Concentration. Cambridge, MA: MIT Press.

Tirole Jean. 1997. The Theory of Industrial Organization. Cambridge, MA: MIT Press.

Waldfogel, Joel. 2008. The Median Voter and the Median Consumer: Local Private Goods and Residential Sorting. Journal of Urban Economics 63(2):567-82.

White, Martin. 2007. Food access and obesity. Obesity Reviews 8(1):99–107.

- Wilson, William J. 1987. The Truly Disadvantaged. Chicago: University of Chicago Press.
- Wrigley, Neil. 2002. 'Food Deserts' in British Cities: Policy Context and Research Priorities. Urban Studies 30(11):2029–2040.





Note: This picture depicts the long-run equilibrium in a competitive market. The traditional analysis is depicted by the high demand curve (D^{High}), with the demand curve intersecting the long-run supply curve (S^{LR}) where it is upward sloping. In this situation, small declines in demand lead to lower prices. A potential interpretation for food deserts is depicted by the low demand curve (D^{Low}), with the demand curve intersecting the long-run supply curve where it is downward sloping. In this situation, small declines in demand lead to higher prices.