

Measuring Produce on the Peninsula

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Mapping the Price and Quality of Produce on the Peninsula

I. Introduction

Last September, researchers at the USDA released a troubling report. The title read, “Potatoes, tomatoes, and lettuce make up nearly 60% of U.S. vegetable and legume availability” (USDA 2015). The report went on to say that, although federal dietary guidelines recommend eating 2.5 to 3 cups of vegetables per person per day, only 1.7 cups are actually available for consumption. The majority of the average American’s vegetable intake comes largely through processed versions of potatoes and tomatoes in forms such as ketchup and fries, with as much as one-third of potatoes and two-thirds of tomatoes produced in the United States bound for processing (Moore and Thompson 2010).

This report is troubling for a number of reasons (not the least of which is that neither potatoes, tomatoes, nor lettuce is a legume). The findings point to the average American’s lack of adequate nutrition and, more tellingly, their lack of access to foods that provide good nutrition. This type of issue, found at the intersection of food quality and availability, broadly falls under the umbrella term “food security,” which is defined as “all people obtaining a culturally acceptable, nutritionally adequate diet, through non-emergency food sources at all times” (Curtis and McClellan 1995). A wide variety of social and structural programs exist to combat food insecurity in the United States, including the SNAP program, the National School Lunch Program, and agricultural research grants for farmers (Congressional Digest 2014, Arteaga and Heflin 2014, USDA n.d.a). However, 48.1 million people in the United States still qualify as food insecure (USDA 2014).

Food insecurity is a topic of interest because of its public health implications. A diet lacking in fresh fruits and vegetables has been linked to a greater risk of obesity, heart disease, diabetes, chronic kidney disease, and hypertension – many of which are on the rise or already epidemic in the United States (Johnson et al. 2014, Boeing et al. 2012). Adequate access to fresh and affordable produce is therefore a critical issue of public health and is a topic of interest for anyone in the fields of public health or public policy. This paper will specifically examine how the racial and socioeconomic status of a community affects that community's access to fresh produce at supermarkets, which is the primary type of venue for purchasing fresh, unprocessed produce.

Although the academic world has a lot to say about the relationship between food insecurity, poverty, and physical access to food stores, little research analyzes race as an additional factor. In addition, few papers analyze food insecurity outside of the contexts of food deserts – a term that decidedly does not describe the Charleston peninsula. Because few studies focus specifically on produce acquisition and even fewer focus on produce acquisition in a Southern city, which is the country's least studied region when it comes to food research, this paper will contribute to the larger body of knowledge regarding food insecurity and its determinants.

From this paper, I hope to formally assess the price and quality of produce at the supermarkets on the Charleston Peninsula and show how the price and quality vary by neighborhood demographics using a Geographic Information Systems (GIS) map. I will conclude by suggesting policy that could alleviate any inequalities. These objectives lead me to my research question:

How do income and race impact access to fresh produce in Charleston?

I predict that supermarkets located within wealthy, predominately white neighborhoods will offer more produce at a higher quality and at a higher price than supermarkets located within less wealthy, predominately black neighborhoods.

II. Literature Review

This year marks the 25th birthday of the term “food desert,” which traces its first recorded use to a Scottish public housing resident in 1990 (Cummins and Macintyre 2002). Since then, hundreds of scholars have explored the concept of food deserts, which are defined as “poor urban areas where residents cannot buy affordable, healthy food” (Cummins and Macintyre 2002). Although food deserts occur in varied physical environments, from urban to rural (Aviola, Nayga, Thomsen, and Wang 2013), they always share two key characteristics:

1. They qualify as low-income communities, meaning 20 percent or more of the population is below the poverty line or the median family income is at or below 80 percent of the area median family income; AND
2. They qualify as low-access communities based on the determination that at least 500 persons and/or 33 percent of the census tract’s population live more than one mile from a supermarket (USDA n.d.).

In other words, measures of poverty and access define food deserts. This literature review will look first at the issue of access, then poverty, and finally add a third variable mentioned in the literature but not by the USDA: race.

a) Access

In urban areas, “access” is defined relative to the specific area of study, with some sources citing as little as one-half mile as a constraint and others expanding up to one-and-a-half miles

(USDA n.d. and Gjesfjeld and Jung 2014, respectively). Others have created a range of distances to food stores to further classify access, from 1.4 kilometers in areas of poor access to 632 meters in areas of excellent access (Gould, Apparicio, and Cloutier 2012). These numbers are based on the distance a person can reasonably be expected to walk while carrying bags of groceries, and therefore assume that walking is the primary form of transportation for a significant number of food desert residents. Studies have shown that people who walk to food shops have poorer diets than people who use other forms of transportation, presumably because of the difficulty of carrying food home, and because those who have an added cost of transportation from public transit or taxis will likely spend less on groceries and therefore are more likely to buy cheap processed foods (Morland et al. 2002, Inagami et al. 2006). One study even specifically linked travel distance to the nearest food store to Body Mass Index, or BMI, finding that a travel distance of 1.76 miles or more weighed almost .8 BMI unit more than those who traveled 1.75 miles or less (Inagami et al. 2006). This finding suggests that the farther low-income people must travel to food stores, the less healthy food purchases they will make.

In addition to physical access to food stores by distance, some studies have pointed to the importance of access to transportation. As one author succinctly stated, “Living within 2.5 km of shops could be just as problematic as living in a food desert if access to private transport is not available” (Coveney and O’Dweyer, 2008). This research points to an important fact: Food access problems are not confined to food deserts. Lacking access to private transportation, people must rely on a network of family and friends to borrow vehicles or, if they are lucky, use public transportation to buy food. Even this option is not perfect, though, as some public transportation can turn a 20 minute drive into a 3 hour endeavor. Balancing the issue of time and distance leads

to “infrequent shopping trips and less fresh produce” as shoppers look for foods that will last between trips to the store (Bonanno and Li 2015).

A third dimension of access is access to affordable supermarkets. Increasingly across the country’s cities, “food mirages” are emerging. Food mirages occur in urban areas that have plenty of food stores within walking distance in a given neighborhood, but still contain a significant number of households that experience food insecurity because low-income residents are priced out of those markets (Breyer and Voss-Andreae 2013, Everett 2011). This phenomenon often coincides with the early phases of urban gentrification, where low and high income people reside in the same area. High-earners raise the median income of these neighborhoods about the poverty level, and they are therefore overlooked and automatically (and dangerously) classified as areas that do not experience food insecurity. Although this body of literature is still new and lacking in its quantity of data, its overall message is clear: Food deserts are multidimensional and cannot be constrained by measures of only access and poverty.

b) Poverty

Poverty plays a large role in defining food deserts, as well, and the poor themselves are often left the furthest behind in finding affordable food stores. As one article summarized, “The present system is failing the urban poor” (Roos, Ruthven, Lombard, and McLachlan 2012). This statement can be verified through two schools of thought: the constraint of not having enough money to buy high quality food, and the fact that communities below the poverty line often cannot attract grocery stores.

One 2014 study found that “food prices are the major determinants of food budget allocation,” a constraint that they found is somewhat alleviated through SNAP benefits, whose recipients tend

to buy healthier food than those without food assistance (Lin, Ploeg, Kasteridis, and Yen 2014). The implications of people not being able to afford healthy food go beyond BMI, though. As a 2004 study pointed out, “40% of respondents [with or at a high risk for diabetes] did not follow a diabetic diet because of financial constraints,” which could lead to more serious diseases such as Chronic Kidney Disease (Horowitz, Colson, Herbert, and Lancaster 2004). Those who did not follow a diabetic diet were found to have poorer health overall. Treating diabetes is a huge expense, with the average person diagnosed with diabetes spending \$13,700 per year in medical costs, further compounding issues of poverty (American Diabetes Association n.d.). Aside from health concerns, high food prices may contribute to food insecurity more generally. Food cost may contribute to food purchasing decisions, and “possibly the strong associations between food security and socioeconomic disadvantage” (Pollard et al. 2014). As people make decisions about which foods to buy on a constrained diet, they are more likely to buy cheaper and fewer items.

Communities living in poverty also have fewer options when it comes to where to shop. A 2007 study found that “low-income urban areas have significantly fewer available chain supermarkets with approximately three-quarters of the availability of middle-income urban areas” (Powell et al. 2007). Rather than attracting supermarkets, many low-income areas attract grocery stores or convenience stores. Supermarkets are characterized by possessing at least four cash registers, and at least two of the following: butcher, bakery, and deli (Powell et al. 2007). Grocery stores have fresh meat but do not meet the other supermarket criteria, and convenience stores have no fresh meat and a limited selection of staple food items (Powell et al. 2007). Based on similar criteria, a separate study came to the same conclusion, finding that “there are over three times as many supermarkets in the wealthier neighborhoods compared to the lowest-wealth areas” (Morland, Wing, Roux, and Poole 2002). The smaller grocery and convenience stores common in

low-income areas are often more costly than their large supermarket competitors and offer fewer fresh food options, which limits residents' ability to make healthy purchases. Despite the higher prices, convenience sometimes justifies shopping at those stores, causing people to spend more money on lower quality food for lack of a better option (Coveney and O'Dweyer, 2008).

Compounding physical access to supermarkets is the supermarkets' selection of foods. Supermarkets that are located in low-income areas do not offer the same variety of unprocessed foods as supermarkets in higher income areas. This is because supermarkets make a higher profit on processed food, and in low-income areas where people are spending less money on groceries, the stores tend to promote the processed foods and limit their shipments of fresh foods. One study found that the relative availability of healthy foods as a ratio to unhealthy foods decreased with neighborhood wealth, as low-income neighborhoods had a .1 difference between the availability of healthy and unhealthy foods while middle- and high-income neighborhoods had a .04 difference between healthy and unhealthy foods (Zenk et al 2014). This implies that finding healthy options in low-income areas is more difficult than finding healthy options in other areas. As one resident in a low-income neighborhood stated, "You hardly see a farmers' market or fresh produce stand, or even fresh produce in the supermarket. And as soon as you walk in the market the first thing you see is cakes, cookies, chips, cereal with loads of sugar" (Johnson et al. 2014). This shows that even with an increase in supermarkets in low-income areas, the issues of equal food access are not solved.

c) Race

To the officially recognized categories of access and poverty, I propose a third category that predicts areas of low non-perishable food availability: race. The same patterns that describe low-

income neighborhoods' access to fresh food apply to minority neighborhoods. One study found that "urban, low-income, and segregated communities lack access to supermarkets, which likely limits their access to fresh fruit, vegetables, low-fat milk, and high-fiber foods" (Bower, Thrope, Rohde, and Gaskin 2014). Multiple studies quantitatively support this finding. For example, a study conducted in Brooklyn found that a supermarket was located in approximately every third census tract in predominately white areas, every fourth census tract in racially mixed areas, and nonexistent in predominately black areas (Morland and Filomena 2007). A separate study found that supermarkets are four times more common in predominately white neighborhoods compared to predominately black neighborhoods, while yet another found that the availability of a large chain supermarket in African American urban zip codes is only 41% of that in White urban zip codes (Morland, Wing, Roux, and Poole 2002; Power et al. 2007).

Also like neighborhoods in poverty, supermarkets located in areas that are predominately black offer fewer fresh produce options. One study surveyed the availability of fruits and vegetables in different supermarkets and found that 64% of all fresh produce items had a higher presence in predominately white area stores, compared with 31% in racially mixed areas and 5% in predominately black areas, with the exception of bananas and yucca, which were both more prevalent in black areas (Morland and Filomena 2007). A further study in Los Angeles found that 70% of all food stores in African American communities sold fruits and vegetables, while 93% of all food stores in white communities sold fruits and vegetables (Sloane et al. 2003). In addition to the actual availability of fresh produce, the relative availability of healthy foods compared to less healthy alternatives also varied by race, with one study finding healthier food alternatives .08 units lower at stores located in Hispanic communities and .06 units lower in Black communities, showing that making healthy "swaps" can be difficult for people living in communities of color

(Zenk et al. 2014). This data shows that, although not recognized by the USDA as a constraint to accessing high quality, affordable food, race does play a role in predicting which neighborhoods will suffer from food insecurity.

III. Methods

This study will use a unique rubric to measure price and quality of produce at different stores:

Product type	# of varieties available	Lowest Price	Highest Price	Local variety available w/ price	Organic variety available w/ price	Overripe (as measured at 75% of produce)	Wilted	Discolored	Blemished
Lettuce	8	\$1.95	\$4.50	No	Yes - \$4.50	No	Yes – romaine costing \$2.00	No	No

I developed a scale to create a score representing the quality of produce sold at each store. Each store gets one point for each of the following categories: the total varieties of the measured produce items, the total number of local produce items, and the total number of organic produce items. Each store loses one point every time that about 75 percent of a produce item is overripe, wilted, discolored, or blemished. These criteria are based on the quality scale provided in a 2014 study of supermarket produce, but have been modified to better fit this paper’s interests (Pollard et al. 2014). This scale measures the same 20 produce items in each grocery store, which will be selected to represent a common “shopping basket.”

I will then collect the price information for each produce item, using the lowest price offered as a benchmark. Because the lowest price takes sale prices into consideration, I will survey each store 3 times to increase the validity of the price data. Each store will then be assigned a “price tag” for conventional produce items and for organic produce items. The conventional price tag is

simply the sum of the lowest prices for all 20 items at each store. This price is indicative of what a person might pay for produce in a given shopping trip. The final price tag is divided by 20 for each store to determine the average price of a single produce item in a typical shopping basket. This second number does not add data to the first, but is instead a way to reconceptualize price difference at a smaller level.

Then, each store will receive an “organic price tag.” Because the stores offer anywhere from 2 to 18 organic varieties of the measured produce, this score will be calculated in two ways. First, I will add the total cost of organic items and divide that cost by the total number of organic options surveyed. This price represents the average cost of organic produce at each store. Second, I will create a “shopping basket” representative of someone who would buy as much organic as available at the store and then fill in the rest with conventional prices. For example, if Bi-Lo offers 6 out of the 20 surveyed items in an organic variety, then the organic shopping basket would be the price of the 6 organic items plus the price of the 14 conventional items. I chose this methodology because it is representative of what someone who is trying to buy as organically as possible would pay.

I will survey Harris Teeter, Bi-Lo, and Food Lion. I chose these stores because they are the only major grocery stores downtown, and I am primarily interested in measuring food access downtown. Although there are smaller grocers downtown, supermarkets are a better measure of price and access because they offer the most produce items at the lowest cost. In addition, because all three supermarkets are around the same size, only using supermarkets will help maintain the validity of the data.

In order to fill in informational gaps about changes in prices, produce-buying decisions, and the total amount of produce sold at each store, I will interview the produce manager at each location and subsidize my data collection with their insight.

After calculating the quality and price scores, I will create a map that represents this information against racial and socio-economic demographics in Charleston. The maps will allow me to analyze if any differences exist in the quality and price of fresh produce available in different areas of the peninsula and to see if race and income affect access.

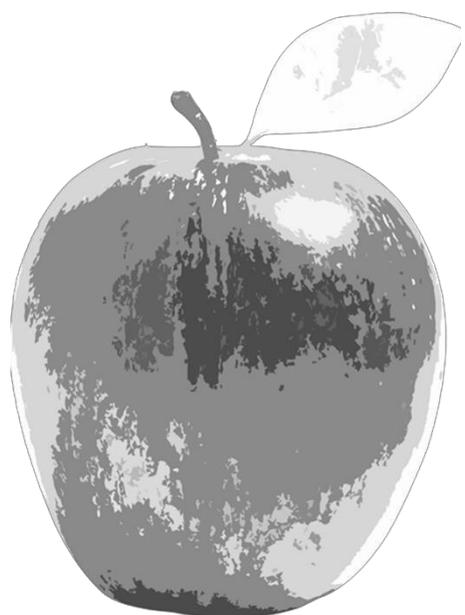
IV. Data

The data for this paper was collected in 3 rounds: first in December 2015, then February 2016, and lastly in April 2016. Collecting the data at three different times helped account for variations in pricing based on demand and seasonal availability. The price differences among the three survey collection time frames were negligible, as price variations in individual produce items frequently cancelled out. For example, collards were more expensive in April than December, but strawberries were cheaper. According to all three produce managers, the main factors affecting price are demand, weather, and seasons. For example, a manager mentioned that recent heavy rains in Florida and droughts in California are affecting the price of produce globally. Reflecting on the impact of seasons, one produce manager said at the beginning of April, “Watermelons were marked from \$9.95 last week to \$5.90 this week,” showing the speed and extent that natural cycles affect prices (Cohen 2016).

In general, the store managers noticed an increase in prices over the past few years. However, one qualified that the price of “everything else [needed to keep the store running] is going up, too” (Cohen 2016). All three managers also noticed an increased desire for local and organic produce among their clients in the past few years. Although the process for obtaining locally sourced food involves more risks and complications than obtaining food from large-scale commercial farms, the produce managers preferred the locally sourced produce because of its

enhanced freshness and quality for the consumer. As one manager said, “Everybody wants to buy local. It’s more fresh, and it helps people and the economy” (Cohen 2016). They try to buy as much local produce as possible within the limits of corporate quality and safety procedures and that demand will profitably allow. At Food Lion, though, obtaining local produce is not currently possible under corporate restrictions that ban individual stores from buying locally. Although some produce happens to be local, like “peaches in the summer,” the produce manager does not have the autonomy to make local purchases at this time, although she is hoping that will change in the future (Cohen 2016).

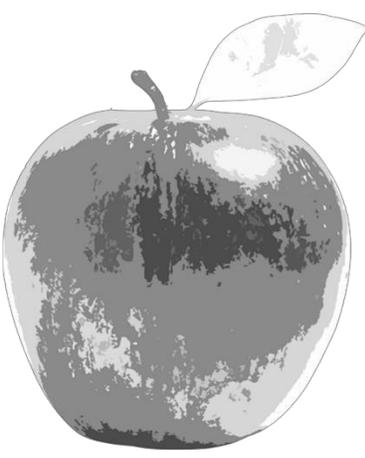
a) *Harris Teeter*



Harris Teeter had the highest score of any of the supermarkets at 137 points. They had 57 varieties of the 20

produce items surveyed, offered a total of 9 local varieties throughout the store, and offered a total of 80 organic varieties throughout the store. A total of 9 points was deducted over the course of all 3 surveys for

The proportional cost of organic(left) versus conventional (right) produce at Harris Teeter.



blemishes, wilted produce, overripe produce, or discolored produce. The

average price of a conventional produce item was \$1.95, and the average price of an organic produce item was \$2.88. A conventional “shopping basket” would cost \$37.14, and an organic “shopping basket” would cost \$53.82.

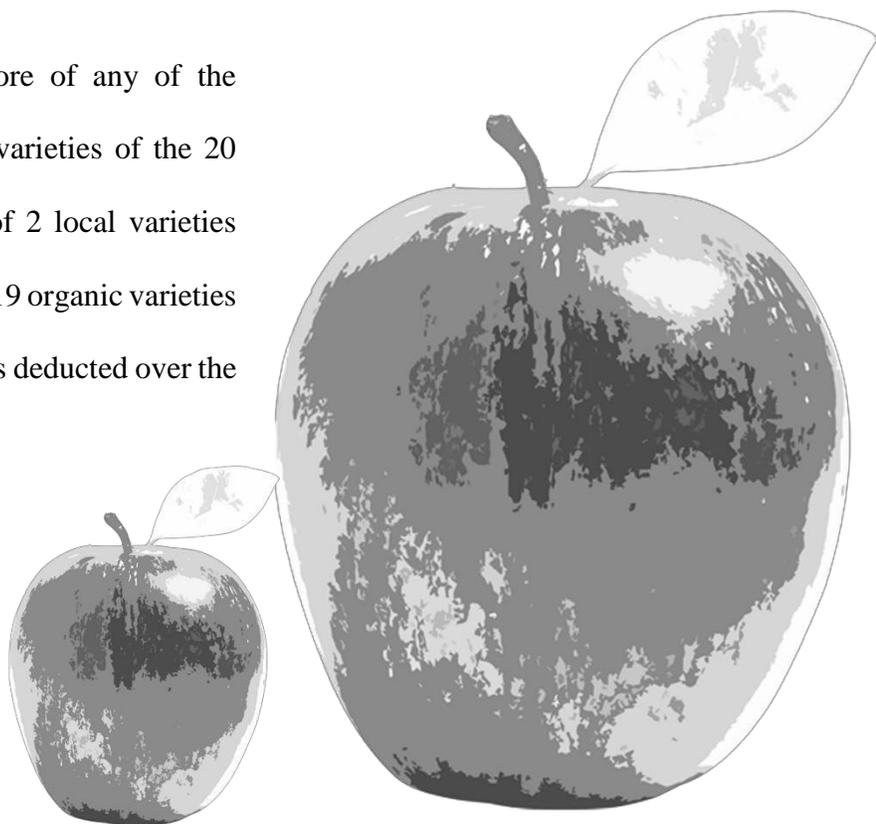
Harris Teeter is located within a census block that is 10 percent black, but less than a quarter mile from two census blocks that are approximately 0 percent black. The median annual household income in the Harris Teeter census block is \$39-53,000 which represents the national average. It is about a quarter mile east of a census tract that makes less than \$24,000, which is the lowest measure income bracket, and about a mile north from a census tract that makes \$82,000, which is the highest income bracket.

b) Bi-Lo

Bi-Lo had the second-highest score of any of the supermarkets at 52 points. They had 38 varieties of the 20 produce items surveyed, offered a total of 2 local varieties throughout the store, and offered a total of 19 organic varieties throughout the store. A total of 7 points was deducted over the course of all 3 surveys for blemishes, wilted produce, overripe produce, or discolored produce. The average price of a conventional produce item was \$1.71, and the average price of an organic produce item was \$3.82. A

conventional “shopping basket” would cost \$32.63, and an organic “shopping basket” of the 8 organic items surveyed plus the

additional 12 conventional items needed to fill the basket would cost \$47.15.



The proportional cost of organic(right) versus conventional (left) produce at Bi-Lo.

Bi-Lo is located in a census block that is 10 percent black, but it is less than a quarter mile south of a block that is 20 percent black and less than a quarter mile west of a block that is 40 to 60 percent black. It is within a group of census blocks where the predominant median household income is less than \$24,000 per year; however, it is also less than a quarter mile north of a block that makes \$24-39,000 per year.

c) Food Lion



The proportional price of organic (left) versus conventional (right) produce at Food Lion.

Food Lion had the lowest score of any of the supermarkets at 47 points. They had 40 varieties of the 20 produce items surveyed, offered no local varieties throughout the store, and offered a total of 9 organic produce items throughout the store. A total of 4 points was deducted over the course of all 3 surveys for blemishes, wilted produce, overripe

produce, or discolored produce. The average price of a conventional produce item was \$1.74, and the average price of an organic produce item was \$5.78. A conventional “shopping basket” would cost \$33.13, and an organic “shopping basket” would cost \$36.82. However, because Food Lion only offered two organic products, the majority of this basket is conventional fill and therefore represents the lack of organic options more than the price of organic options.

Food Lion is located exactly on the cusp of a census block that is 20 percent black and a block that is 30 percent black. It is about a quarter mile from a large swathe of census blocks that are 40 to 60 percent black. The median household income near Food Lion is again directly on the cusp of a block that makes less than \$24,000 per year and a block that makes \$24-39,000 per year. It is also less than half a mile from a group census blocks that make \$39-53,000 per year.

Black Population



Score

a measure of quality and quantity of produce available at each store

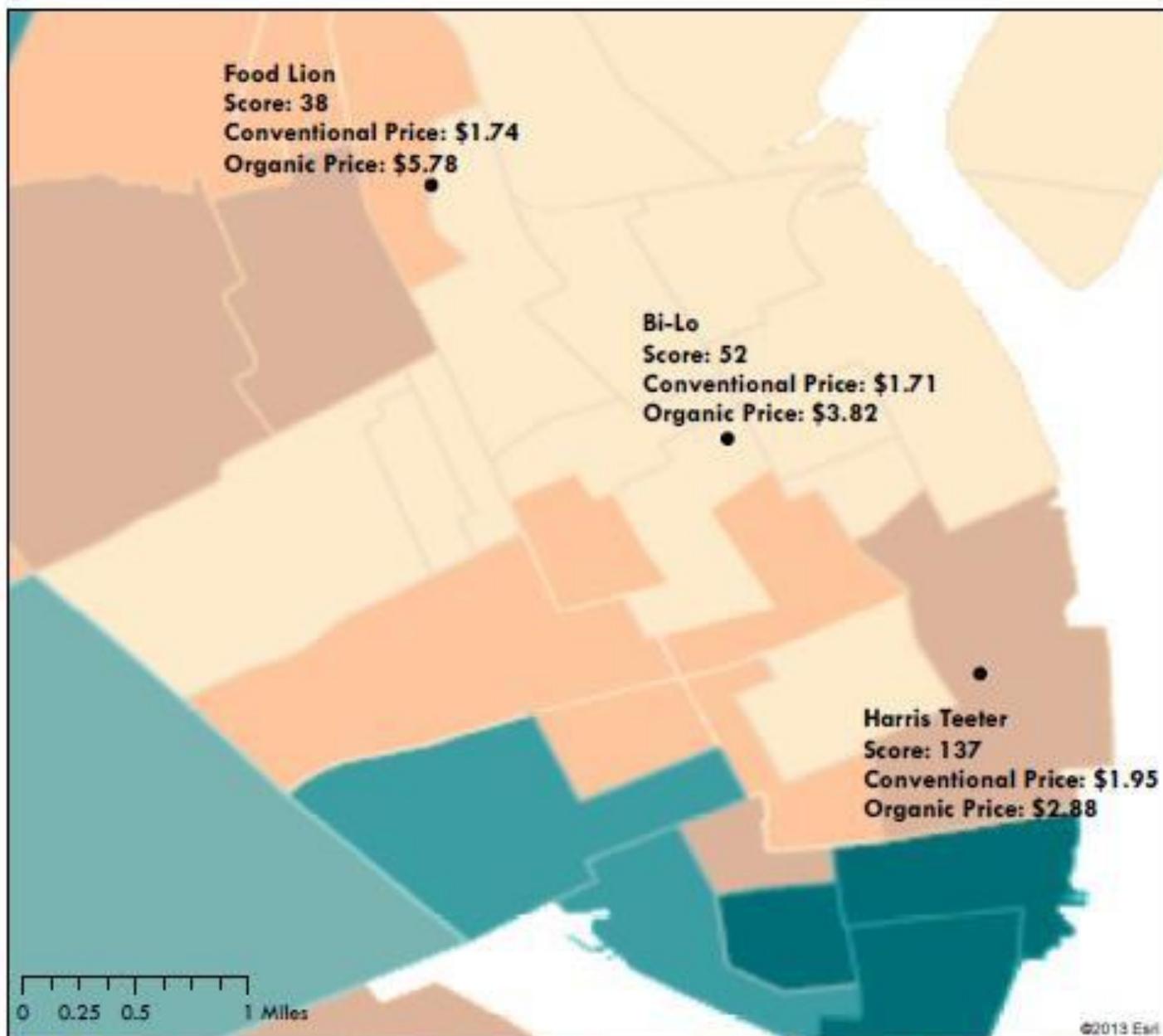
Conventional Price

an approximate measure of the cost of a single conventional produce item at each store

Organic Price

an approximate measure of the cost of a single organic produce item at each store

Median Income



2012 Median Household Income

- More than \$82,000
- \$68,001 to \$82,000
- \$53,001 to \$68,000
- \$39,001 to \$53,000
(US median: \$50,157)
- \$24,001 to \$39,000
- \$24,000 or less

Score
a measure of quality and quantity of produce available at each store

Conventional Price
an approximate measure of the cost of a single conventional produce item at each store

Organic Price
an approximate measure of the cost of a single organic produce item at each store

V. Analysis

a) Harris Teeter

Harris Teeter's quality score was two times higher than Bi-Lo's and over three times higher than Food Lion's. This dominance can largely be attributed to the quantity of produce offered. Although quantity does not directly indicate quality, it does indicate that consumers are ultimately likely to buy more produce. There are three reasons for this relationship. First, when more varieties are available, consumers have more control over the exact item that they purchase, making the purchasing decision more empowering and therefore more meaningful (Chernev 2003). Second, if a consumer has a product in mind, he or she is less likely to make purchase if the exact item is not available (Cherney 2003). In the context of produce, this means that if consumers are looking for cherry tomatoes and no cherry tomatoes are available, they will not buy any tomatoes. Therefore, having a larger variety of produce increases the likelihood that people will actually make a purchase. Finally, variety indicates that consumers have a better chance of choosing a high quality product. For example, at least 75 percent of Food Lion's green bell peppers were blemished during the December produce survey, and because they only offer one type of green bell pepper, consumers would have a hard time finding unblemished green bell peppers. At Harris Teeter, if one type of green bell pepper was blemished, consumers could buy a different type, again increasing the likelihood that they will ultimately eat more produce. Harris Teeter's score was also highest because they offered the most local options, including gem lettuce, mushrooms, and microgreens. This indicates that the demand for local produce is higher at Harris Teeter than the other stores. The same is true of organic options. Harris Teeter offered 80 organic options as of the April survey, far surpassing the number available at Bi-Lo and Food Lion and indicating high

demand. In terms of the physical appearance of produce at Harris Teeter, they also surpassed the other stores, although not by much. They had the most points deducted for low-quality produce, but considering the high amount of produce that they sell, they actually had the smallest percentage of low-quality produce at approximately 8 percent. In comparison, 9 percent of Bi-Lo's produce was low-quality and 10 percent of Food Lion's produce was low-quality, although they had the fewest deductions.

The quality of Harris Teeter's produce is reflected in its prices. The average price of one of the surveyed produce items is \$1.95, about 20 cents higher than the average item at Food Lion or Bi-Lo. When a customer buys 20 produce items, this difference adds up: A shopping basket at Harris Teeter costs \$4-5 more than the same basket at Bi-Lo or Food Lion. However, this difference does not come near the difference in quality. Were the same ratios of quality scores among the stores applied to price, a shopping basket at Harris Teeter would cost \$86 in comparison to Bi-Lo and \$119 in comparison to Food Lion. Of course such prices would be absurd, but the comparison shows that Harris Teeter's quality score is not directly reflected in its price. Despite the relative affordability of Harris Teeter for its high quality, for many low-income people, the quality still may not justify spending \$4-5 more per shopping trip.

What Harris Teeter charges in conventional produce, though, it discounts in organics. Because of the large number of organic options available, Harris Teeter could offer the lowest price on organics than any other store. The average price of a surveyed organic item at Harris Teeter was a full dollar cheaper than an average organic item at Bi-Lo and almost three dollars cheaper than at Food Lion. The large number of organic options implies that Harris Teeter's surrounding middle- to upper-middle class and largely white population demands organics more frequently than the less wealthy and less white populations surrounding Bi-Lo and Food Lion.

Ironically, the lack of current demand is keeping prices higher in low-income areas, blocking access to organic produce. If more shoppers at Bi-Lo and Food Lion were able to spend the initially high price of organic produce, in theory the prices would drop after a while. Precluding rampant gentrification, which comes with its own massive issues, this process is unlikely to occur.

Although all three stores serve a variety of populations, Harris Teeter is the only store on the peninsula within a mile of the 5 wealthiest census blocks located by the Battery. It also serves two of the four census blocks that make the median household income in the United States. The less wealthy blocks near Harris Teeter are likely populated by college students based on their locations near the College of Charleston and MUSC. Although college students technically have a lower measured income, they often have other sources of support from family and loans that may allow them greater economic access to Harris Teeter. This assumption cannot be directly supported by facts in this study, though. Regardless of the exact economic situation of Harris Teeter's shoppers, its racial profile is clear: Harris Teeter serves a white customer base. The store is surrounded by the census blocks with the lowest black population downtown. This data is also supported by personal observation. In all the hours I spent making observations at Harris Teeter, I hardly saw any black customers or employees. It is undoubtedly a white-dominated space.

The implications of these observations support my initial hypothesis. Harris Teeter has the highest quality produce at the highest prices of any store, and the people within the closest distance to Harris Teeter are more likely to be white and wealthy than at any other store. This shows that there is a link between quality, price, race, and income. Organics proved to be an exception to this hypothesis though because the higher demand and availability lowered the price.

b) Bi-Lo

Bi-Lo came between Harris Teeter and Food Lion in most measures. Its quality score, percentage of deductions, price of organics, number of local and organic items, and percent black population all fell between those of Harris Teeter and Food Lion. Physically, the store is located about halfway between Harris Teeter and Food Lion as well. The only measures that were not in the middle were its price on conventional produce and the median household income of surrounding census blocks. The price of an average surveyed conventional produce item at Bi-Lo was \$1.71, three cents cheaper than Food Lion's \$1.74. This amounts to less than a dollar's difference for all 20 produce items (\$33.13 at Food Lion versus \$32.68 at Bi-Lo). However, Bi-Lo's score was 14 points higher than Food Lion's. As a proportion of its quality score, a Bi-Lo shopping basket would cost \$45 compared to Food Lion and \$14 compared to Harris Teeter. The lower prices at Bi-Lo could be accounted for by the demographics of the surrounding area. More than any other store, Bi-Lo's neighbors makes less than \$24,000 per year, although it is also close to blocks making \$24-39,000 per year. Bi-Lo's central location on the peninsula allows it serve a wide variety of neighborhoods. Bi-Lo is located on Meeting and Spring St., making it closer to the historically black and low-income East Side neighborhood than any other store. In addition, Bi-Lo serves college students, many of whom live in the close-by Elliotborough neighborhoods, as well as some neighborhoods right above the Crosstown. Although these neighborhoods are not easily distinguishable by median income census blocks, they are distinguishable by racial demographics. Unlike Harris Teeter, which is located only near areas that are 0-10 percent black, Bi-Lo is proximate to areas ranging 10-60 percent black, making it a more diverse store. Again, I can attest to this range with personal observations. In the time I spent in Bi-Lo, I saw a diversity of people

in terms of race and age, from young white college students to older black residents. Many employees in Bi-Lo were black as well, unlike in Harris Teeter.

These observations partially support my hypothesis, but only as compared to Harris Teeter. Compared to Harris Teeter, Bi-Lo has lower quality produce, lower prices, and serves lower income and higher minority populations. However, this hypothesis does not remain valid when compared to Food Lion, as seen in the next section.

c) Food Lion

Food Lion proved to follow the hypothesized model the least of all three stores. It had the lowest quality score, but the median price on conventional produce items, going against the hypothesis that quality and price are positively correlated. However, it has been shown that grocery stores located near food deserts sometimes increase their prices because they know their clients have no other options, and Food Lion is the closest grocery store to the southern end of the food desert in the Neck. This relationship could explain the higher prices, although, as stated above, it is only a difference of three cents per item. Food Lion's high price on organics indicates that organic produce is in low demand among its consumers. If it is assumed that the connection at Harris Teeter between demand for organics, wealth, and race is valid, then the high price of organics at Food Lion would imply that few wealthy and white people shop there, or if they do, they do not buy organics there. Like Bi-Lo though, the typical Food Lion consumer is less obviously defined than at Harris Teeter. Food Lion is located exactly on the cusp of a census block with a 20 percent black population and one with a 30 percent black population, but it is within a mile of census blocks that range from 10 to 60 percent black, similarly to Bi-Lo. Unlike Bi-Lo though, which served a similar socio-economic class, the Food Lion consumer base ranges from those making less than \$24,000 per year to those making \$53,000 per year. The wealthy, whiter

census blocks are in the Hampton Park area, while the poorer, blacker census blocks are toward Meeting Street and the confluence of the highway systems. The demographic diversity of the area surrounding Food Lion makes it difficult to define exactly who shops there. My observations of Food Lion are equally difficult to box in, as I also noticed a wide variety of consumers.

The difficulty of fitting Food Lion into my hypothesis precisely is mitigated by the general trend of comparing Food Lion to Harris Teeter. Similarly to a comparison with Bi-Lo, a comparison with Harris Teeter generally reveals lower quality, lower prices, lower income, and higher black populations are connected. However, a comparison between Bi-Lo and Food Lion yields less solid results. Generally, Food Lion has lower quality produce, negligibly higher prices, and similar racial profiles, but very different socio-economic profiles. One factor that could explain this difference is if the wealthier neighbors do not shop at Food Lion, in which case the two stores would practically be identical on all measures except quality. Food Lion's lower quality score could be explained by a lower demand for produce items in general among its consumers, and particularly for local and organic items. Future studies more closely comparing the stores could reveal answers.

d) A Note on Organics

Although this research did not set out to measure variations in organic accessibility, it is worth noting that organic produce is less expensive at higher-quality stores. This can most likely be explained by the inclusion of organic produce availability as a factor in the quality scale. However, even if the organic element of the score is subtracted, this relationship holds true. This study did not directly reveal what factors go into organic pricing and availability, but it did reveal that supply is one of the most important pricing factors. It can therefore be assumed that stores with higher supply of organics can charge less. However, that explanation does not take into

account other quality factors nor demographic factors. An additional relationship regarding organics is the connection between the presence of organic and local produce. Although those terms are frequently used together, this study revealed that in fact, the stores with more organics also had more locals, but there is no obvious reason why aside from colloquial assumptions. A future study specifically examining the factors behind pricing and availability of organic and local produce could give clarity to these puzzles.

VI. Future Implications

This research supports the findings in other studies that, in general, there is a relationship between produce quality, race, and income in regards to food access on the peninsula. Although some disparities in access do exist, they are not extreme. The relationship among quality, race, and income is always changing, though. For example, the produce manager at Food Lion noted that with the development on King Street, they have started to carry more local and organic produce to suit the needs of their “more diverse clientele” (Cohen 2016). As Charleston continues to develop, more research needs to be completed to determine other factors affecting food accessibility downtown. With a more holistic understanding of the factors that affect price, quality, and access and the people who are affected by those factors, Charleston can work to ensure that all people have the option of buying fresh, affordable produce in their neighborhood.

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