

# Will Long Term Food Desert Consumers Purchase Fresh Fruits and Vegetables?

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Food deserts are places where healthy food is absent or, when available, in limited supply, expensive and usually of poor quality. Detroit, Michigan is one of the most severe food deserts in the United States in terms of size and duration. Some areas of Detroit have had limited access to nutritious foods since the 1969 riots and certainly for most of the city, since the closing of the last supermarket chain in the city in 2007—Farmer Jack, an A&P subsidiary (Smith and Hurst, 2007). There is a debate about whether food deserts emerge because consumers do not purchase healthy foods, or whether the limited availability of healthy food determines consumer purchasing patterns.

The objective of this article is to illuminate consumer behavior after healthy foods are reintroduced into a food desert. Empirical evidence from a natural experiment is used to analyze how food desert consumers respond to the introduction of a small store that sells competitively priced, normal quality fresh fruit and vegetables (FFV). We take advantage of this experiment by collecting and analyzing the sales receipt data since the store's opening. In addition, this information is supplemented with survey data collected in the neighborhood.

## Detroit Overview

In 2007 Detroit had an estimated 500,000 people, with more than half of the city's population, living in food deserts (Gallagher, 2007). Most inner-city Detroit residents rely on convenience, liquor, or other nonmainstream grocery stores for food (Gallagher, 2007). These "fringe retailers" focus on high-calorie, high-fat and/or salty snack foods and sugary drinks, and are located on average 0.2 miles

from households. However, mainstream grocers, including small independent grocers, are on average two to three times that distance (Gallagher, 2007) and in food desert neighborhoods can be substantially farther. In addition, 49% of those surveyed in our target population did not own a vehicle. Proximity to grocery stores is further complicated by abandoned buildings and vacant land that constitute 40% of the land area in Detroit—a sub-city the size of San Francisco has been abandoned (Gallagher, 2009).

## Piety Hill Neighborhood, the Natural Experiment

The Piety Hill community is a predominantly African-American neighborhood—which represents the racial demographic of Detroit—where most of the residents are elderly, low income—median household income in 2008 was \$20,150 for this zip code which expands beyond the boundary of the Piety Hill neighborhood, (City Data, 2012) and lack personal transportation (Weatherspoon et al., 2012a). This neighborhood is plagued by abandoned and/or burned-out buildings, which by most standards are uninhabitable, but typically provide shelter for squatters. A few years ago, Piety Hill was serviced by a local grocer that had limited FFV selections and approximately 27 liquor/convenience stores. Prior to the opening of the nonprofit retailer, Peaches & Greens in Fall of 2008, Piety Hill was a food desert due to the poor quality and high prices of nutritious goods.

Peaches & Greens operates a small produce store that sells only FFV and limited refrigerated items such as milk, water and so on; and a truck that sells FFV in the streets similar to how an ice cream truck would circle a

neighborhood. They primarily focus on providing good quality FFV at a competitive price to a previously underserved, poor, inner city neighborhood. We partnered with this nonprofit in the early stages of their project; our role has primarily been data analysis which they use for management purposes.

## Data

Two data sets are used to illuminate consumer behavior in this neighborhood, a household survey and daily cash-register receipt data. The Piety Hill Household Food Preferences Survey was implemented in November and December 2009 at community centers, a street corner, and Peaches & Greens. All individuals entering the community centers, the Peaches & Greens store, and walking by a street corner with busy pedestrian traffic—across from both Peaches & Green and the local liquor store—were asked to complete the survey and offered as an incentive a \$5 gift coupon to Peaches & Green. There were a total of 161 individual respondents in the sample population of which 90% did not shop at Peaches

& Green. Of the respondents, 85.3% were African American, 76.6% were female and 51.8% were between 35 and 54 years of age—children were excluded from the survey, and only one respondent per household was interviewed. The survey respondents represented a slightly younger demographic than the community as a whole, although the survey instrument was designed to capture information about household purchasing patterns and thus also represents purchasing patterns of adult children caring for their parents, relatives or other elderly. The survey population also had a higher proportion of female respondents than that for Detroit, which may reflect in part larger numbers of female-headed households in lower socio-economic strata and females with primary responsibilities for household food purchases. These primary data were complemented by secondary data from Peaches & Greens cash-register data, national scanner data from Nielsen representing national fruit and vegetable purchasing habits, and published community food security data.

## Fresh Fruit and Vegetable Preferences in Piety Hill

The cash register and survey data verify that food desert respondents have preferences similar to the rest of the nation. Seven of the top ten most purchased FFV are also in the top ten most purchased FFV nationally as shown in Table 1. The most purchased fruit (bananas) and vegetable (tomatoes) were the same for both populations. In the Piety Hill community lemons, plums, kiwi, garlic, sweet potato and celery make the top 10 list, but are not in the top 10 nationally—on average approximately 15-20 fresh fruit and 10-20 vegetables are available at the store when open. The fruits and vegetables that are nationally ranked but not in the top 10 for these consumers are: watermelon, pineapple, onion, green beans and broccoli. Within this community, 75% of sales revenue and 79% of units sold come from fruit, meaning that fruit purchases were approximately 3.8 times as large as vegetable purchases in terms of units sold (Weatherspoon et al., 2012b). Additionally, Table 1 shows the estimated national average per pound

**Table 1:** Fruit and Vegetable Ranking by Daily Frequency of Purchase at Peaches & Greens, National Rank, Quantity and Pricing.

Rank	Fruit					Vegetable				
		National Rank <sup>a</sup>	Q	\$/unit	National \$/lb <sup>c</sup>		National Rank <sup>a</sup>	Q	\$/unit	National \$/lbs <sup>c</sup>
1	Banana (one)	1	21.93	0.27	0.45	Tomato (lbs)	1	1.68	0.76	0.99
2	Apple (one)	2	7.59	0.53	1.07	Pepper (one)	9	1.01	0.56	2.13
3	Orange(one)	4	8.85	0.46	0.57	Lettuce ( one head/ bunch)	3	1.93	1.18	2.94
4	Grape (lbs)	5	4.89	1.78	1.68	Cucumber (one)	8	1.62	0.5	N.A.
5	Pear(one)	9	5.95	0.55	1.04	Garlic (one clump)	<sup>b</sup>	1.04	0.33	N.A.
6	Lemon (one)	<sup>b</sup>	5.46	0.43		Sweet potato (one)	<sup>b</sup>	1.67	0.73	0.9
7	Plum(one)	<sup>b</sup>	9.13	0.52	1.24	Carrot(1 lb bag)	6	2.08	1.36	0.77
8	Strawberry(1.25 lb bag)	6	2.37	2.31	2.28	Cabbage (one)	10	2.51	0.58	0.62
9	Peach (one)	7	10.82	0.48	1.84	Celery (2 lb bag)	<sup>b</sup>	1	1.27	0.9
10	Kiwi (one)	<sup>b</sup>	5.53	0.37	1.8	Corn (one ear)	5	2.9	0.34	1.8

<sup>a</sup>National Rank is from A.C. Neilson 2004–2006. <sup>b</sup>These items were not nationally ranked. <sup>c</sup>USDA, Economic Research Service (2012), 2008 estimated average prices

price of each item. When compared relatively, the Peaches & Greens FFV prices rival the national averages. It is important to note that a unit at Peaches and Greens refers to an individual fruit/vegetable. If we were to compare a pound for pound price, we would see that they are closely related. This is an indication that Peaches & Greens tries to competitively price their products in an attempt to make them affordable to their clientele.

### Will Price and Income Changes Affect Purchases?

Fruit and vegetable price and income elasticities—quantity responsiveness to small changes in price or income—were calculated from Peaches & Greens register-tape data and are shown in Table 2 (Weatherspoon et al., 2012a and b). The Detroit fruit price elasticities are compared to the Dunham and Eales (2010) meta-analysis of the prior studies that utilized market level data along with their own estimates from two Northwestern U.S. supermarket locations; vegetable price elasticities were compared to You, Epperson and Huang (1996). Dunham and Eales (2010) suggest that elasticities calculated from retail level data are more elastic than elasticities from market level data, hence, their results were elastic for all fruit with the exception of bananas. Our results show that all price elasticities for FFV were inelastic, meaning that given a price change, consumers were less responsive than the Dunham and Eales (2010) population but similar to the nationally estimated level. In terms of vegetables, the estimates are inelastic and larger than the You, Epperson and Huang (1996) estimates meaning that consumers were more responsive than the national estimates. These findings have major implications for the effectiveness of price based programs to influence consumers to purchase more FFV in a food desert. An effective program would have to heavily subsidize the

**Table 2: Food Desert Own-Price and Income Elasticity Comparisons to Regional and National Estimates.**

Fruit & Vegetable Product	Piety Hill Price Elasticity <sup>a</sup>	Regional & National Price Elasticities	Piety Hill Income Elasticity <sup>a</sup>	National Estimated Income Elasticities <sup>c</sup>
Banana	-0.529	-0.24 - -0.98 <sup>b</sup>	1.18	0.63
Orange	-0.721	-0.27 - -1.37 <sup>b</sup>	1.74	0.9
Apple	-0.504	-0.16 - -1.19 <sup>b</sup>	2.15	-0.19
Tomato	-0.1	-0.41 <sup>c</sup>	1.6	0.8
Pepper	-0.08	-0.25 <sup>c</sup>	1.5	0.39
Lettuce	-0.05	-0.01 <sup>c</sup>	0.63	0.64

<sup>a</sup>Piety Hill elasticities were estimated with a Rotterdam model and were significant at the  $\alpha = 0.01$  level, Weatherspoon et al., 2012a and 2012b. <sup>b</sup>Dunham and Eales, 2010. <sup>c</sup>You et al., 1996.

price to attain a large increase in the consumption of fruit but may not be effective with vegetables.

Income elasticities calculated from the cash-register data (Weatherspoon et al., 2012a and b) are compared with elasticities calculated from national data (You, Epperson and Huang, 1996)—income elasticities were calculated based on expenditure levels in a demand systems model, see Weatherspoon et al., 2012a for details). The three Piety Hill fruit and two vegetable income elasticities are greater than one. For every one percent increase in expenditure on fruit and vegetables, there will be more than a one percent increase in dollars spent on bananas, apples, oranges, tomatoes, and peppers, making them luxury fruits and vegetables in this community. These elasticities are notably higher than the national estimates, none of which are greater than one. Given that the average income in Piety Hill is less than half the national average and that the income elasticity for certain FFV are higher than the national average, substantial gains in FFV consumption could be achieved with increased income. Although the causes of poverty/low income are complex and likely beyond the reach of food policy, there are ways for food policy to deal with FFV

expenditure. In particular, the Double-Up Bucks program in Michigan provides coupons worth up to \$20 that can be redeemed only for FFV at specified retailers and only on a matching basis: for example, for a \$2 purchase the consumer would pay \$1 and the coupon would match that \$1. This program essentially doubles the amount of income available for FFV purchases. The effect of the Double-Up Bucks program can be seen in comparing data from June and July 2010, when Peaches & Greens participated in a trial run of the Double-Up Bucks program, and data from June and July 2011, when the program operated at scale—no other Piety Hill retailers were eligible. Fruit purchases in value terms increased by 67% year-over-year, vegetable purchases increased by 6%, and combined purchases increased by 56%—includes cash and coupon value. In contrast, in the May and August year-over-year comparisons, combined FFV purchases increased only nominally. Thus, it appears that the Double-Up Bucks program had an important impact in this inner-city community, and it seems reasonable that other programs with meaningful income effects would also have impact—the Double-Up Bucks dummy was not significant in the model.

This raises the policy question: what other factors constrain healthy eating and can food policy help to significantly reduce these constraints?

### **Other Factors Constraining Healthy Eating and Potential Policy Responses**

According to the Piety Hill Household Food Preferences Survey, approximately 49% of respondents consumed FFV one to six times per week, which is below the USDA 2009 Food Guide Pyramid recommendations for health of three cups of vegetables and two cups of fruit per day for most adults and below the 2009 CDC estimate of 32.5% of U.S. adults consuming fruit two or more times per day (Grimm et al., 2010). This suggests that greater knowledge would be important to increasing FFV consumption which is critical for improving the health of this vulnerable population.

Survey respondents revealed that they faced major constraints to purchasing certain food products, particularly FFV that are extremely perishable, heavy and/or require time for preparation. These constraints are exacerbated by a lack of: transportation—less than 50% of those surveyed had access to a vehicle; cooking facilities; safe storage; and utilities which were the top reasons why easy to consume products were preferred. Additionally, 41% of respondents indicated that they did not have access to FFV for the following reasons: cannot carry FFV—they were old, injured, or otherwise unfit to carry a ten-pound bag of groceries a half mile to one mile from the nearest grocer to their residence; cannot get to a grocery store; local store does not have FFV they liked; and the local store does not have any FFV at all. This survey was conducted several months after Peaches & Greens was opened on a full time basis. The majority of respondents had not been to the store yet—3.7% indicated Peaches

& Greens as their primary shopping location, 5% as their secondary shopping location, 1.2% as their tertiary shopping location and 90% never shopped at Peaches & Greens—suggesting that increased knowledge of local food options may be an important policy target.

### **Summary**

Detroit's food desert consumers respond to the same economic stimuli in determining FFV consumption as the rest of the nation, even after living in a community largely devoid of quality, competitively priced FFV for several decades. In particular, FFV consumption is very responsive to income, and thus income-based incentives could make a significant difference on purchase and consumption patterns. FFV purchases are mildly responsive to price changes with estimated elasticities in the middle of national estimates for fruit and above the national estimates for vegetables. Lack of knowledge about nutritious levels of FFV consumption and access are also important constraints to consumption, and can be addressed through policy interventions. However, the issues are complex and additional factors may be influential. Thus there is a need for more detailed research on food desert consumers to develop a comprehensive set of policy interventions.

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