Effects of Distance and Local Food Environment on Shopping Frequency and Food Purchases

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Introduction

- Concern regarding dietary choices of American households and resulting health outcomes
- Policies aimed at improving health
    - Nutrition Education: MyPlate
    - Food labeling: Nutrition Facts Panel, others
    - Food access: Healthy Food Financing Initiative, others
- Problem of 'food deserts' has garnered much attention in research and popular media
    - Economic Research Service original definition of food desert (from 2009 report to Congress *Access to Affordable and Nutritious Food – Measuring and Understanding Food Deserts and Their Consequences*): low income areas that also have poor access to food retailer offering range of healthy items
        - Rural access definition: greater than 10 miles
        - Urban access definition: greater than 1 mile

Research Question

- Does distance traveled to shopping outlet affect household food purchases?
- Is the effect different for households living in food deserts as compared to those with nearby grocery store options?
- Do the results provide support for improving access to retailers as a way of improving household food choices?

Background

- Disparities in food access coincide with disparities in health outcomes
    - Socioeconomic and demographic characteristics
        - Minority, low income, less educated neighborhoods have worse access to large supermarkets
        - Same populations have higher prevalence of obesity, overweight and related diseases
- Link between access and health outcomes
    - Better access to supermarkets correlated with lower levels of obesity and overweight
- Link between access and diet quality
    - Some studies show low access correlated with inadequate fruit and vegetable consumption, poorer diet quality overall
    - Other studies find no relationship between access and diet quality

Data

- Nielsen Homescan Panel, 2010
    - 27,422 households
    - All food-at-home purchases
    - Household demographics and location
    - Shopping outlet name/information
- TDLinx, 2010
    - All food retailers
    - Supermarket, club, convenience stores
    - Location
- ERS Food Desert Report, 2009
    - Nationwide study of food access
    - Urban and rural food deserts
- Purchases grouped into 15 categories using ERS Quarterly Food at Home Price Database (QFAHPD) guidelines
- Observations grouped into household-store pairs, designated with food desert or non-food desert status based on household location
- Households living in food deserts are poorer, less educated, more diverse and less likely to be married. They pay less for all food categories.

Household Demographics and Shopping Distance

	Mean or Proportion	
Variable	Food Desert	Non-Food Desert
Income	$50,095	$67,867
Less than high school	0.016	0.007
College graduate	0.434	0.544
Black	0.176	0.070
Asian	0.022	0.022
Hispanic	0.058	0.053
Married	0.587	0.743
Children, 0-6 years old	0.081	0.096
Children, 7-12 years old	0.173	0.181
Children, 13-17 years old	0.153	0.170
Household size	2.654	2.792
Shopping trip distance, miles	4.113	5.811

Average Prices and Expenditure Shares

	Price, $/ounce		Expenditure Share	
Food Category	Food Desert	Non-Food Desert	Food Desert	Non-Food Desert
Vegetables	0.062	0.065	0.072	0.079
Fruits	0.070	0.074	0.078	0.080
Sweets	0.115	0.114	0.113	0.111
Oils & Nuts	0.150	0.161	0.024	0.025
Eggs	0.062	0.062	0.010	0.010
Regular Meat	0.189	0.201	0.050	0.043
Lowfat Meat	0.255	0.256	0.011	0.011
Fish	0.229	0.248	0.012	0.014
Poultry	0.156	0.161	0.007	0.007
Processed Foods	0.122	0.127	0.344	0.336
Grains	0.112	0.117	0.071	0.073
Regular Dairy	0.098	0.111	0.086	0.088
Lowfat Dairy	0.060	0.057	0.026	0.032
Diet Drinks	0.043	0.042	0.048	0.047
Non-Diet Drinks	0.024	0.026	0.047	0.042
Number of household-store pairs	2,410	82,570	2,410	82,570

Estimation Strategy

- Estimate demand using Exact Affine Stone Index (EASI) Implicit Marshallian Demand system Lewbel and Pendakur AER, 2009 because of the following advantages over classical models such as AIDS:
    - Allows easy incorporation of demographic variables in the demands system
    - Accounts for unobserved preference heterogeneity
    - Allows highly non-linear Engel curves

$$\underbrace{w^j}_{\substack{\text{budget}\\ \text{shares}}} = \underbrace{\sum_{r=1}^{R} b_r^j (y_{n-1})^r}_{\text{Implicit Utility}} + \underbrace{\sum_{t=1}^{T} g_t^j z_t}_{\substack{\text{Demographic}\\ \text{variables}}} + \underbrace{\sum_{k=1}^{J} a_n^{jk} \ln p^k}_{\text{prices}} + \varepsilon^j$$

$$y_n = \ln x - \sum_{j=1}^{J} w^j \ln p^j + \frac{1}{2} \sum_{j=1}^{J} \sum_{k=1}^{J} a_n^{jk} \ln p^j \ln p^k.$$

- Estimate budget share equations via 3SLS.
- The unit of observation is the household-shopping channel (e.g. club store, grocery store, supercenter, convenience store) adding all purchases for 2010. We weigh each observation by the share of total expenditures a household spends in that shopping channel.
- Three specifications to examine effects of food environment and distance on purchasing decisions
    - Model 1: Binary indicator for food desert households
    - Model 2: Shopping trip distance (miles) and binary indicator
    - Model 3: Shopping trip distance (miles), binary indicator and interaction term

Results

Selected Estimation Results

		Vegetables	Fruits	Sweets	Regular Meat	Lowfat Meat	Processed Foods	Regular Dairy	Lowfat Dairy	Diet Drinks	Non-Diet Drinks
Model 1	Income, thousand $	0.009	0.001	-0.009	-0.008	-0.001	0.020	-0.005	0.000	0.003	-0.006
	College Graduate	1.805	0.205	-0.773	-0.849	0.046	-0.586	0.331	0.598	-0.473	-0.722
	Black	1.109	-0.487	-0.188	1.789	-0.336	1.023	-2.382	-1.201	-1.853	1.035
	Hispanic	0.998	-0.202	-1.066	-0.041	0.273	0.740	-0.213	-0.632	-0.646	-0.567
	Food Desert	-0.219	-0.045	-0.260	0.193	-0.006	0.817	-0.214	-0.135	0.211	0.035
Model 2	Income, thousand $	0.009	0.001	-0.009	-0.008	-0.001	0.019	-0.005	-0.000	0.003	-0.006
	College Graduate	1.761	0.220	-0.815	-0.829	0.041	-0.608	0.351	0.580	-0.447	-0.709
	Black	0.957	-0.439	-0.312	1.863	-0.359	0.954	-2.321	-1.270	-1.772	1.086
	Hispanic	0.867	-0.160	-1.177	0.021	0.254	0.679	-0.159	-0.690	-0.574	-0.524
	Food Desert	-0.249	-0.036	-0.285	0.208	-0.010	0.803	-0.201	-0.149	0.228	0.046
	Shopping trip distance	-0.026	0.008	-0.022	0.012	-0.004	-0.012	0.011	-0.012	0.014	0.008
Model 3	Income, thousand $	0.009	0.001	-0.009	-0.008	-0.001	0.019	-0.005	-0.000	0.003	-0.006
	College Graduate	1.761	0.220	-0.815	-0.829	0.041	-0.607	0.351	0.580	-0.447	-0.709
	Black	0.960	-0.435	-0.313	1.862	-0.360	0.963	-2.324	-1.271	-1.776	1.083
	Hispanic	0.868	-0.159	-1.177	0.021	0.254	0.682	-0.160	-0.690	-0.575	-0.525
	Food Desert	-0.378	-0.173	-0.245	0.223	0.034	0.422	-0.057	-0.142	0.404	0.176
	Shopping trip distance	-0.027	0.007	-0.022	0.013	-0.003	-0.015	0.012	-0.011	0.016	0.010
	Desert*Distance	0.032	0.034	-0.010	-0.004	-0.011	0.095	-0.036	-0.002	-0.044	-0.032

Expenditure shares in percentage points

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Discussion

- Begin with comparison of expenditure shares between food desert and non-food desert households
    - Food desert lower expenditure shares:
        - Vegetables
        - Fruits
        - Lowfat dairy
    - Food desert higher expenditure shares:
        - Sweets
        - Processed foods
        - Non-diet drinks
- Prices paid by food desert households typically lower across all food categories
- All coefficients small but statistically significant
- Demographic effects similar across all specifications
    - Higher income households spend larger portion on healthy foods
        - Except processed foods – time crunched?
    - Education has stronger positive effect on healthy food spending
    - Minority households – no consistent effect across healthy and unhealthy food categories
- Model 1
    - Food desert households spend smaller portion on some healthy foods
        - Fruits, vegetables, lowfat meat, lowfat dairy
    - Food desert households spend larger portion on some unhealthy foods
        - Processed foods, regular meat, non-diet drinks
- Model 2
    - Food desert effect very similar
    - Shopping trip distance has very small effect, no clear direction with healthy or unhealthy foods
- Model 3
    - Households that reside in food desert purchase healthier foods when they travel further away from home.
- There is some evidence that increasing access to grocery stores would slightly improve the healthfulness of household purchases.