Economic Contextual Factors and Adult Body Mass Index

Lisa M. Powell
University of Illinois at Chicago

Euna Han
University of Illinois at Chicago

International Society of Behavioral Nutrition and Physical Activity
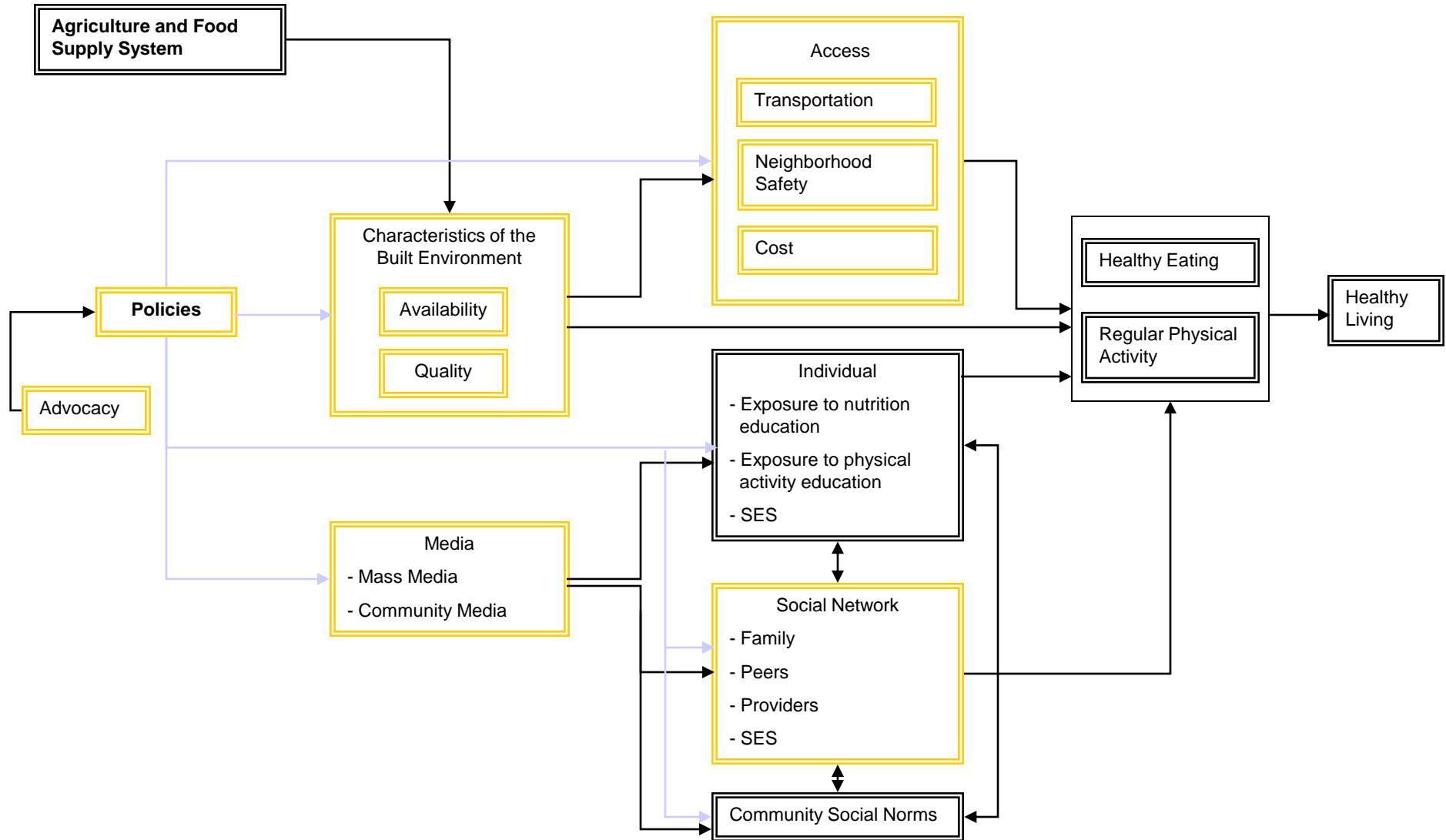**June 17th – 20th, 2009**
Lisbon, Portugal

Obesity Rates

Adults (20+): 32.2%			
Women		Men	
33.2%		31.1%	
White	African American	White	African American
30.2%	53.9%	31.1%	34.0%

Source: Ogden et al. (2006) JAMA -- The National Health and Nutrition Examination Survey 2003-04.

Contextual Influences on Physical Activity and Healthy Eating

Contextual Influences on Physical Activity and Healthy Eating

Contextual Influences on Physical Activity and Healthy Eating

Agriculture and Food Supply System

Access

Transportation

Neighborhood Safety

Cost

Policies

Characteristics of the Built Environment

Availability

Quality

Advocacy

Healthy Eating

Regular Physical Activity

Healthy Living

Individual

Genetics

Individual and Family Characteristics

SES

Media

- Mass Media

- Community Media

Social Network

- Family

- Peers

- Providers

- SES

Community Social Norms
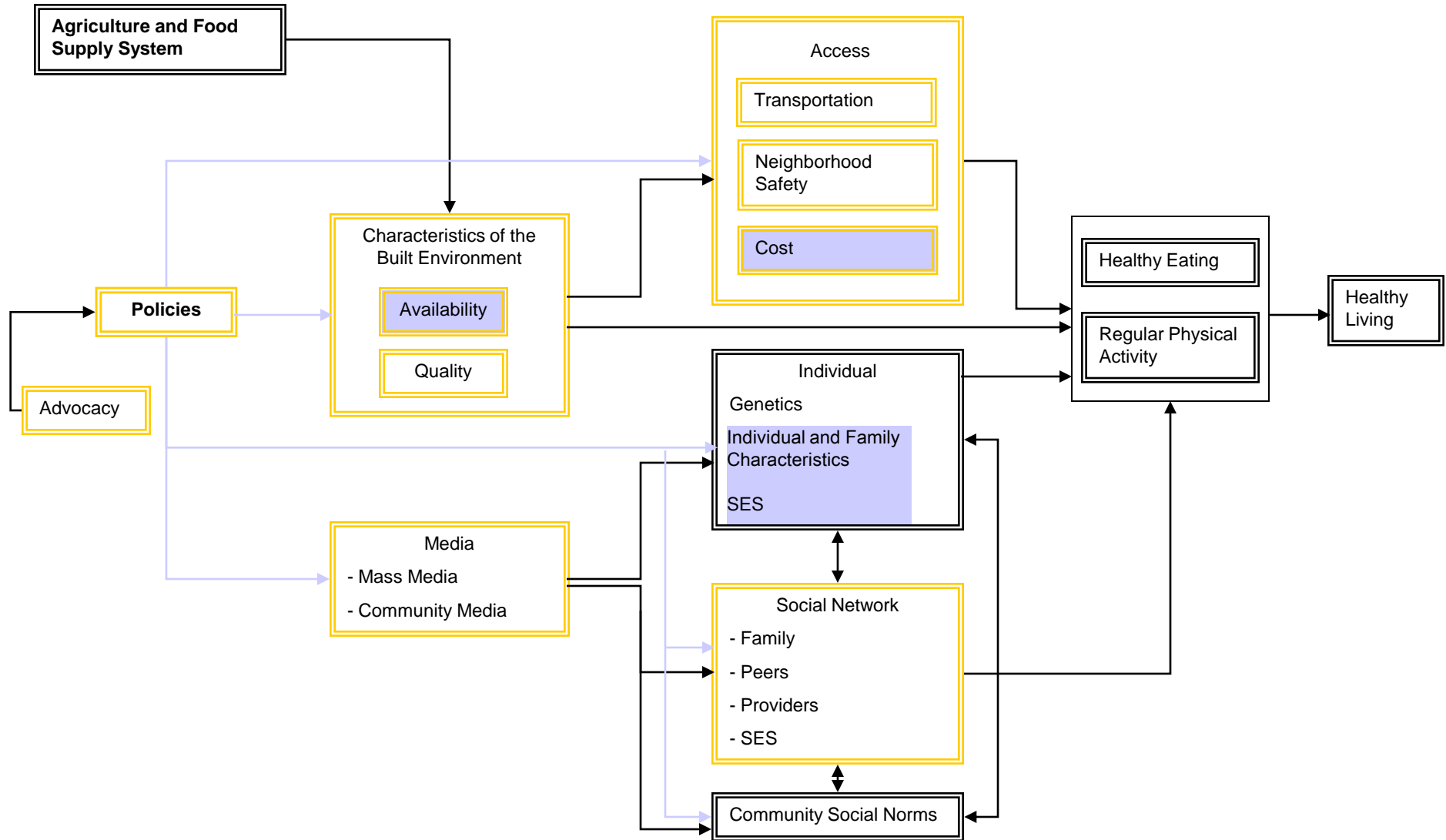
Contextual Influences on Physical Activity and Healthy Eating
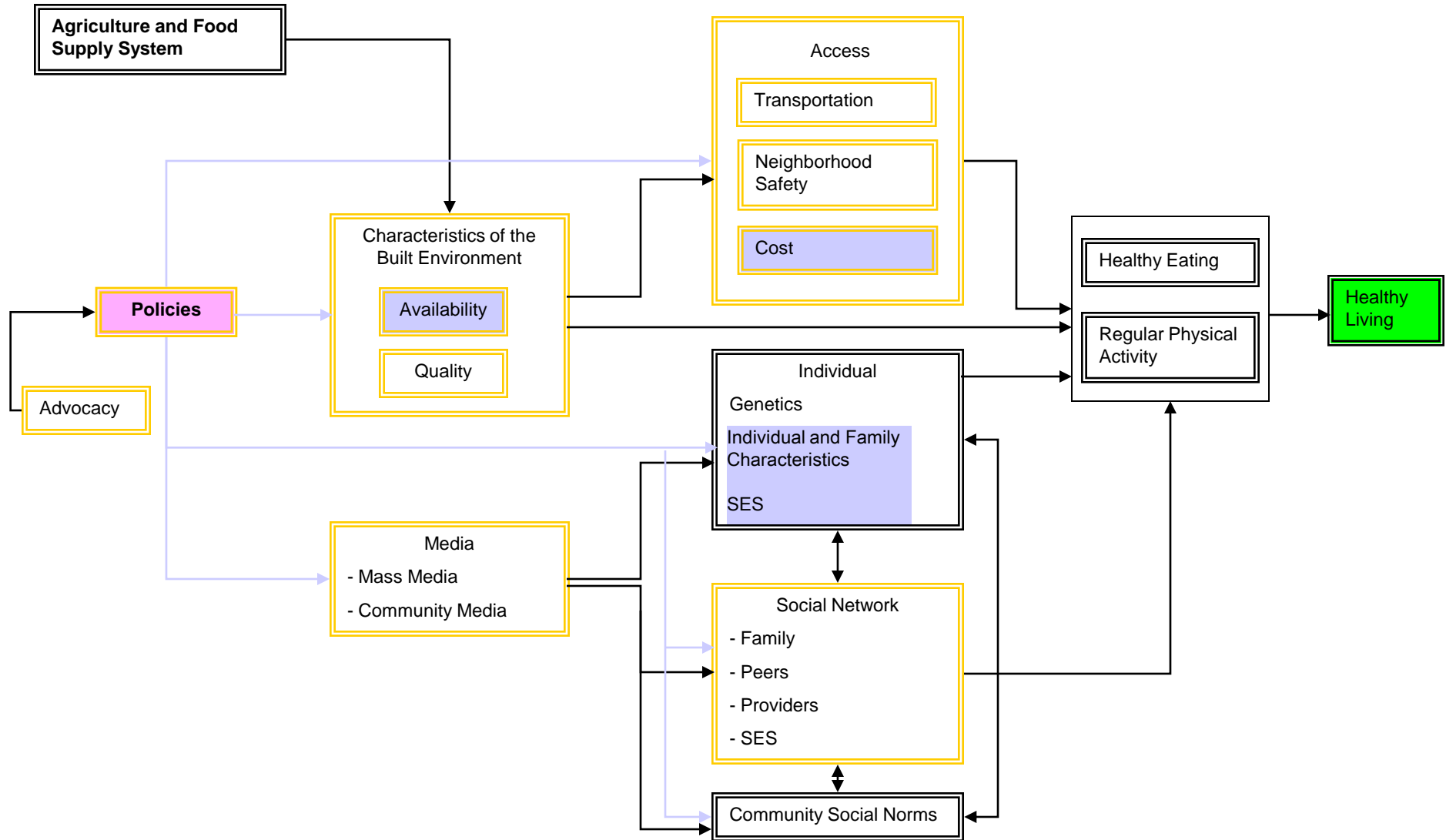
Objective

This study examines the importance of food prices, restaurant availability, and food store availability for adults' BMI using both cross-sectional and panel data estimation methods.

Background: Prices, Outlets and Adult Weight

Prices

• Limited and mixed evidence on the effect of food prices/taxes on adult weight outcomes, none using longitudinal data (i.e., Chou et al. 2004; Kim and Kawachi 2006; Beydoun et al. 2008; Miljkovic and Nganje 2008; Miljkovic et al. 2008).

Outlets

• Few studies provide evidence linking outlet availability to weight outcomes of adults (i.e., Chou et al. 2004; Morland et al. 2006).

• Although several studies have found positive associations between supermarkets and diet quality (i.e., Morland et al. 2002; Laraia et al. 2004; Zenk et al. 2005) whereas others find mixed results (i.e., Wrigley et al. 2003; Cummins et al. 2005)

Models

The relationship between adult BMI and:

- ❖ Fruit and Vegetable Prices
- ❖ Fast Food Prices
- ❖ Fast Food Restaurants
- ❖ Full-service Restaurants
- ❖ Supermarkets, Convenience Stores, and Grocery Stores
- ❖ Controls (gender, race, age, marital status, family income, education, and neighborhood characteristics)

Research Designs and Estimation Models

1) Cross-sectional Estimates
2) Individual Fixed Effects

Models

Naïve model:

$$BMI_{ist} = \beta_0 + \beta_1 PRICES_{st} + \beta_2 REST_{st} + \beta_3 FS_{st} + \beta_4 N_{st} + \beta_5 X_{it} + \varepsilon_{ist}$$

Models to account for unobserved individual-level heterogeneity:

$$BMI_{ist} = \beta_0 + \beta_1 PRICES_{st} + \beta_2 REST_{st} + \beta_3 FS_{st} + \beta_4 N_{st} + \beta_9 X_{it} + v_i + w_{ist}$$

❖ Fixed Effects Models: Assumes v_i and independent variables are correlated

The Panel Study of Income Dynamics

- Begun in 1968, PSID is a nationally representative longitudinal study of nearly 8000 U.S. families.
- It emphasizes, but not limited to, the dynamic aspects of economic and demographic behavior.
- From 1968 to 1996, PSID interviews took place annually. Since 1997, PSID has been following individuals from families in the core sample biennially.
- We use 1999, 2001, 2003, and 2005 waves of the PSID since the weight and height variables became available in 1999.
- We draw on a sample of 37,916 observations on 12,926 adults aged 18-65.

Contextual Data - Prices

Fruit/Vegetable and Fast Food Price data obtained from ACCRA:

- ❖ quarterly information on prices across more than 300 US cities
- ❖ 62 different prices are collected for a range of products
- ❖ to create indices, weights are available based on expenditure shares derived from the CES

Food Price Indices:

1) Fruit and Vegetable Price Index

(Based on 6 produce items, which are potatoes, bananas, lettuce, sweet peas, peaches, and sweet corn)

2) Fast Food Price Index

(McDonald's Quarter-Pounder with cheese, a thin crust regular cheese pizza at Pizza Hut and/or Pizza Inn, and fried chicken (thigh and drumstick) at Kentucky Fried Chicken and/or Church's Fried Chicken)

Contextual Data – Outlet Density

Outlet density measures obtained from D&B:

❖ data contain information on more than 14 million businesses
❖ data are available by SIC codes
❖ data are available by multiple geo code levels
❖ data are updated quarterly

Outlet density measures include:

1) Fast Food and Full-service Restaurants
2) Supermarkets, Grocery Stores and Convenience Stores

* Outlets were defined per 10,000 capita per 10 square miles per zip code.

Summary Statistics - Outcome and Key Exposure Variables By Year

Outcome and Key Exposure Variables	Mean				
	1999	2001	2003	2005	Total
Body Mass Index	26.61	26.97	27.30	27.56	27.12
Price of Fruits & Vegetables	0.75	0.75	0.80	0.76	0.77
Price of Fast Food	2.76	2.67	2.66	2.63	2.68
Fast Food Restaurants	3.24	2.93	3.11	4.52	3.46
Full-service Restaurants	17.44	14.65	16.60	16.15	16.21
Supermarket Stores	0.68	0.65	0.68	0.62	0.66
Convenience Stores	2.08	1.91	2.07	1.76	1.95
Grocery Stores	5.45	4.80	4.97	4.54	4.93
N	9,027	9,369	9,879	9,641	37,916

Summary Statistics – Control Variables By Gender

Control Variables	Mean / Frequency		
	Full Sample	**Male Sample**	**Female Sample**
Average Distance	24.43	24.84	24.08
Median Household Income (2000$)	43,484.46	44,242.26	42,836.33
Family Income (2000$)	66,289.80	70,535.32	62,658.78
Age	40.48	41.06	39.99
Male	46.10%		
White	61.88%	65.51%	58.77%
African American	28.91%	24.97%	32.28%
Hispanic	5.43%	5.63%	5.26%
Other Race	3.78%	3.89%	3.69%
Married	66.71%	72.30%	61.94%
Never Married	17.25%	15.48%	18.76%
Widowed	1.49%	0.55%	2.30%
Divorced	11.17%	9.14%	12.91%
Separated	3.38%	2.53%	4.10%
Completed Less Than High School	16.19%	16.04%	16.32%
Completed High School	31.26%	31.60%	30.96%
Completed Some College	24.25%	22.87%	25.42%
Completed College or More	22.47%	24.81%	20.46%
Education Missing	5.84%	4.67%	6.84%
Urban Area	68.45%	67.55%	69.23%
Suburban Area	12.46%	13.04%	11.95%
Rural / Farm Area	19.09%	19.41%	18.82%
N	37,916	17,479	20,437

Cross-sectional and Panel Estimates of BMI: Contextual Factors

Dependent Variable: BMI	Male (N=17,479)		Female (N=20,437)	
	Cross Sectional Estimates	Individual Fixed Effects Estimates	Cross Sectional Estimates	Individual Fixed Effects Estimates
Price of Fruits & Vegetables	0.2040 (0.4917)	0.2762 (0.2740)	0.8414 (0.5625)	0.5732* (0.3051)
Price of Fast Food	-0.2111 (0.3305)	0.0699 (0.1695)	-0.2246 (0.4080)	0.2666 (0.2179)
Fast Food Restaurants	0.0080 (0.0085)	0.0012 (0.0015)	0.0019 (0.0081)	0.0016 (0.0011)
Full-service Restaurants	-0.0010 (0.0006)	-0.0003 (0.0003)	-0.0001 (0.0001)	-0.0001 (0.0001)
Supermarket Stores	0.0078 (0.0075)	-0.0023 (0.0117)	-0.0051 (0.0083)	-0.0043 (0.0046)
Convenience Stores	0.0133 (0.0179)	0.0016 (0.0013)	0.0093 (0.0323)	0.0007*** (0.0002)
Grocery Stores	0.0012 (0.0029)	0.0011 (0.0014)	0.0013 (0.0038)	0.0007 (0.0006)

Cross-sectional and Panel Estimates of BMI: Control Variables

Dependent Variable: BMI	Male (N=17,479)		Female (N=20,437)	
	Cross Sectional Estimates	Individual Fixed Effects	Cross Sectional Estimates	Individual Fixed Effects
Near-Low Income	0.4677***	0.1432*	0.0624	-0.0675
Middle Income	0.4400**	0.2156***	-0.2827	-0.0896
Near-High Income	0.2895	0.2070**	-0.7725***	-0.1566
High Income	0.3071	0.2607***	-1.4393***	-0.1110
African American	1.3120***		2.6041***	
Hispanic	0.6590		0.8567*	
Other Race	-1.2412***		-0.6003	
Never Married	-0.5169**	-0.3458***	0.0361	-0.6612***
Widowed	-1.4225	-0.2685	0.3421	0.1893
Divorced	-0.8186***	-0.4024***	-0.2325	-0.2415**
Separated	-1.4300***	-0.6850***	0.7201*	-0.2868*
Completed high school	0.3397	0.0287	-0.2201	0.2040
Completed some college	0.0157	0.1109	-0.0956	0.3098
Completed college or more	-0.4785*	-0.0605	-0.9312***	-0.0030
Year 2001	0.3571***	0.3570***	0.3655***	0.5137***
Year 2003	0.5537***	0.6386***	0.6597***	0.9222***
Year 2005	0.7559***	0.8927***	0.9818***	1.4573***

Fixed Effects Estimates of BMI By Having Kids or Not

Dependent Variable: BMI	Male		Female	
	No Kids	**With Kids**	**No Kids**	**With Kids**
Price of Fruits & Veg.	0.1521	0.5448	-0.2203	0.9948**
Price of Fast Food	0.0156	0.1306	-0.0163	0.4676
Fast Food Rest.	0.0009	0.0340*	0.0048**	-0.0046
Full-service Rest.	-0.0002	-0.0020	-0.0003*	0.0014
Supermarket Stores	-0.0012	-0.0457	-0.0071**	-0.0083
Convenience Stores	-0.0002	0.0063***	0.0007***	0.0058
Grocery Stores	0.0004	0.0087	0.0012**	-0.0074
N	8,492	8,987	8,453	11,984

Fixed Effects Estimates of BMI By Weight Status

Dependent Variable: BMI	Male		Female	
	Normal Weight	**Overweight / Obese**	**Normal Weight**	**Overweight / Obese**
Price of Fruits & Veg.	0.1399	0.6218*	0.0976	0.3326
Price of Fast Food	-0.1080	-0.0363	-0.0208	0.5440
Fast Food Rest.	0.0025**	0.0145**	0.0006	0.0082*
Full-service Rest.	0.0001	-0.0010*	0.0000	-0.0001
Supermarket Stores	-0.0150**	0.0073	-0.0030	-0.0060
Convenience Stores	-0.0035	0.0020	0.0003	0.0048*
Grocery Stores	-0.0008	-0.0003	0.0002	0.0011***
N	5,037	12,442	9,927	10,510

Price Elasticities – Fixed Effects Estimates

Dependent Variable: BMI	Male		Female	
	All		**All**	
Price of Fruits & Veg.	0.0076		0.0165*	
Price of Fast Food	0.0068		0.0267	
	No Kids	**With Kids**	**No Kids**	**With Kids**
Price of Fruits & Veg.	0.0042	0.0150	-0.0064	0.0285**
Price of Fast Food	0.0015	0.0126	-0.0016	0.0467
	Normal Weight	**Overweight / Obese**	**Normal Weight**	**Overweight / Obese**
Price of Fruits & Veg.	0.0047	0.0161*	0.0034	0.0082
Price of Fast Food	-0.0127	-0.0033	-0.0026	0.0464

Summary and Policy Implications

- No evidence that fast food prices are related to adult BMI.

- Higher fruit and vegetable prices are related to higher BMI among women, in particular women with children. Also, weakly related to higher weight among overweight and obese men.

- For females, prices more important among those with children whereas outlet availability more important among those without children or those who are overweight/obese.

- For men, prices and outlet availability more important among those who are overweight/obese, although supermarket availability significant only for normal weight men.

- Results by subpopulations suggest that subsidies to fruits and vegetables may be somewhat effective in reducing weight. Evidence that fast food restaurant and food store availability is also important.

Policy Landscape - Subsidies

- Food in the U.S. is subsidized for low-income individuals and families through a number of programs such as *Food Stamps*, the *Women, Infant and Children Nutrition Program*, the *Child and Adult Care Food Program*, and the *National School Lunch and Breakfast Programs*, but food subsidies directed at the consumer do not generally exist for specific food items.

- However, California has recently passed legislation to conduct a "Healthy Purchase" pilot program where for each dollar of food stamps spent on fresh produce, participants will be subsidized a portion of the cost

Policy Landscape - Taxes

- Food taxes have not generally been introduced with the aim of modifying consumption behavior as they have been used in other public health areas such as tobacco.

- Food taxes are currently imposed on selected categories of food such as soft drinks, candy and snacks in grocery stores and vending machines but at quite low tax rates (e.g., mean rate for soda is 3.4% in grocery stores).

Where we are and what we need …

- We aren't doing much currently in terms of fiscal pricing interventions.

- The evidence base is still thin.

- Need further research using longitudinal data.

- Need better price measures.

- Need evaluations of pilot projects that subsidize healthful foods – link to weight outcomes.

- Evidence as we go … jurisdictions that adopt higher taxes on unhealthy energy dense foods will provide natural experiments for new research on the effectiveness of these efforts in promoting healthy eating and curbing the obesity epidemic.

Search   Favorites

Economic, Lifestyle, and Social
Influences on Obesity

USDA   CSREES   UIC

| Home | Overview | Research Products | News | Project Team | Members Only | Related Sites | Contact Us |

Project Overview

The overall goals of this integrated project are: 1) to provide a comprehensive empirical examination of the influences of economic, lifestyle, and social factors on obesity by combining detailed individual-level survey data with regional economic and environmental information on food and fast food prices, local area food store, eating places and physical activity-related outlet density measures, and area crime data and, 2) to provide an extensive outreach program that will use the findings from our research to inform both policy makers and households of which policies, programs, and practices are effective at combating obesity.

read more

Research Products

- Fact Sheets
- Tool Kits
- Policy Briefs
- Research Papers
- Conference Presentations

Research Products: Fact Sheets | Tool Kits | Policy Briefs | Research Papers | Conference Presentations
Project Overview | News | Research Team | Members Only | Related Sites | Contact Us | Home

Internet

Economic, Lifestyle and Social Influences on Obesity

http://www.impacteen.org/obesity