USDA Food Assistance Programs (SNAP, the National School Lunch Program, and the School Breakfast Program) and Healthy Food Choices: Quasi-Experimental Evidence from Geographic Variation in Food Prices

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Motivation I

- While legislated maximum SNAP benefits are fixed across 48 states, food prices vary significantly across geographic locations.
- Deductions for costs of housing, medical care, and dependent care help may not be sufficient to equalize real value of SNAP benefits geographically.
 - Small scale study in Philadelphia (Breen et al., 2011).
 - Quarterly Food at Home Price Database (QFAHPD) price variation (35 market groups) shows a \$10 increase in food price leads to 2.7 percentage point (5%) increase in household food insecurity. (3.1 pp, 12% for children) (Gregory & Coleman-Jensen, 2013).

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Motivation II

- What fraction of recipients can actually afford the TFP locally?
- What does SNAP relative generosity do to nutrition?
 - Literature: SNAP overall leads to modest changes in diet quality (Gregory et al. 2014).
- Other data (QFAPHD): What does SNAP relative generosity do to child health? (Bronchetti, Christensen, Hoynes 2017)



Food prices-variation from national average

Retail food prices, on average, are highest in the East and lowest in the Midwest.





QFAHPD Visualization

Our data: At census block group level, but no map. Sorry!

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FoodAPS

"USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) is the first nationally representative survey of American households to collect unique and comprehensive data about household food purchases and acquisitions."

- FoodAPS lets us look at the relationship between food prices and SNAP adequacy at a much finer geographical level.
- Gunderson et al. use IRI InfoScan data at store (or regional chain) level to build basketprice measure.

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Index modeled after Thrifty Food Plan (TFP).

Basket Prices

Medians by Store-week, Store, County-week, and County



Nutrition: Overview

- Use local relative generosity of SNAP to measure nutrition impacts.
- Cross-sectional data: use Oster's 2016 improvement to Altonji, Elder, Taber 2005 method to compare with and without observable controls.
- National School Lunch Program and the School Breakfast Program as mediators.
- Outcomes:
 - Healthy Eating Index (total, fruit, veg)
 - Percent of calories from added sugar, solid fat, alcohol

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- Alcohol (Grams)
- Obesity

Healthy Eating Index

 Created by USDA's Center for Nutrition Policy and Promotion (CNPP) to assess conformance to the *Dietary Guidelines for Americans*. Updated every five years. (Guenther et al.).

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- ► Valid for age ≥ 2.
- Nine adequacy, three moderation components.
- Density approach (per 1000 calories).
- Zeros prevalent in component scores.
- National average 60/100.

Healthy Eating Index

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HEI-2010 Dietary Component	Max Score	Moderation
Total Fruit	5	
Whole Fruit	5	
Total Vegetables	5	
Greens and Beans	5	
Whole Grains	10	
Dairy	10	
Total Protein Foods	5	
Seafood and Plant Proteins	5	
Fatty Acids	10	
Refined Grains	10	Μ
Sodium	10	Μ
Empty Calories	20	Μ

Note: See CNPP factsheet for scoring standards.

Nutrition: Controlling for Observables

$$\textit{Nutrition}_{ij} = \alpha + \beta \ln(\frac{\textit{SNAPMAX}_h}{\textit{TFP}_{hr}}) + \textit{X}_{ihr}\theta + \textit{Z}_{hr}\gamma + \lambda_r + \epsilon_{irt}$$

- Focus on In(SNAPMAX_{ij}/TFP_{ij}) as independent variable of interest, though it could be log(TFP_{ij}), sufficiency[0/1], or gap[continuous].
- X, Z are rural, metro, income, college, trouble with bills, large expenditure, household size, car ownership, tobacco use, days since SNAP receipt, WIC eligibility, WIC use, age, race, sex, non-food CPI (9), HUD FMR, unemployment.

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(Potentially) state fixed effects

Methods: Controlling for Observables

- Individual level
 - Assume FAH consumed by all, assign FAFH to individual
- Primary sample: SNAP participants
 - Children and adults separately
- Placebo: > 300% Federal Poverty Level
- Regressions weighted according to complex survey design. User's Guide Pg 55

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Methods: Oster 2016

$$Y = \beta X + \Psi \omega^0 + W_2 + \epsilon$$

X is treatment of interest. ω observed, W is not.

What happens to our effect estimate if we assume the unobservables have a similar correlation to treatment as the observables?

Depends on relative degree of selection on observed and unobserved variables (δ), as well as R^2 resulting from controlling for unobservables, R_{max} .

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Oster 2016

Altonji, Elder, Taber (2005) implicitly assume $R_{max}=1$. Perhaps unlikely due to measurement error or idiosyncratic variation.

Bellows & Miguel 2009, Nunn & Wantchekon 2011 assume $R_{max} = \tilde{R} + (\tilde{R} - \mathring{R}).$

 R_{max} is a flexible parameter in Oster's method, but $1.3 \times \tilde{R}$ performs well in tests.

$$eta^* pprox ilde{eta} - \delta(\Boldsymbol{\mathring{\beta}} - ilde{eta}) rac{R_{max} - ilde{R}}{ ilde{R} - \Boldsymbol{\mathring{R}}}$$

Table: Summary Statistics

	(1)	(2)	(4)	(5)
	Adults	Adults	Kids 2-17	Kids 2-17
VARIABLES	SNAP	Non-SNAP	SNAP	Non-SNAP
Rural	0.15	0.20	0.14	0.23
Tobacco Use	0.55	0.28	0.54	0.28
WIC Categorical Eligibility	0.76	0.57	0.96	0.95
HH Size	3.78	2.91	4.86	4.56
HH Max Age	49.7	52.4	42.1	43.6
HH Min Age	19.3	31.3	5.83	7.22
HH Income/1000	2.90	6.83	2.60	7.26
Percent Federal Poverty Line	153	455	117	365
HH Has Earned Income	0.67	0.84	0.71	0.97
HH Has Car	0.73	0.94	0.74	0.98
HH Has College Degree	0.16	0.52	0.16	0.48
Low Food Security	0.24	0.074	0.26	0.11
Trouble Paying Bills	0.30	0.067	0.35	0.11

Table: Summary Statistics: Nutrition

	(1) Adults	(2) Adults	(4) Kids 2-17	(5) Kids 2-17
VARIABLES	SNAP	Non-SNAP	SNAP	Non-SNAP
HEI Total Score	48.0	54.9	47.9	52.2
HEI Total Veg	2.57	3.23	2.41	2.79
HEI Greens and Beans	1.30	2.29	1.09	1.82
HEI Total Fruit	1.85	2.43	2.08	2.40
HEI Whole Fruit	2.05	2.80	2.21	2.79
HEI Whole Grain	1.82	2.55	1.80	2.45
HEI Dairy	5.09	5.48	5.59	5.93
HEI Total Protein	3.95	4.02	3.82	3.96
HEI Seafood/Plant Protein	1.69	2.43	1.55	2.21
HEI Fatty Acids	4.93	5.02	4.79	4.58
HEI Sodium	5.97	6.03	6.31	6.51
HEI Refined Grains	6.09	6.46	5.81	5.81
HEI SOFA	10.7	12.1	10.5	10.9
SOFA as Percent	33.5	30.9	33.9	33.0
Alcohol(gm)	29.6	96.7	20.4	59.1
Self-reported Diet Status	3.30	2.74	3.36	2.89
Obese	0.39	0.26	0.31	0.21
Overweight	0.69	0.61	0.46	0.35
Ν	2141	4511	1106	1425

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Individual HEI Scores by SNAP Recipient Status



Total HEI for Children and Adults by SNAP Status









HEI Category Scores



SNAP Purchasing Power and Children's HEI Total Scores

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Sample: SNAP Children Ages 2-17					
	(1)	(2)	(3)	(4)	
In(SNAPmax/TFP)	-4.045	14.09***	15.09**	18.73	
	(5.662)	(5.123)	(6.226)	(11.25)	
School Breakfast			0.676		
			(1.853)		
School Lunch			-4.710		
			(4.414)		
Controls?	No	Yes	Yes	Yes	
State FE?	No	No	No	Yes	
Ν	1,225	1,225	824	1,225	
R^2	0.001	0.169	0.223	0.219	
Effect of 10% increase in SNAP PP	-0.385	1.343	1.438	1.785	
As a % of Mean	-0.8%	2.8%	3.0%	3.7%	
eta^* (Oster 2016; ${\it R}_{max}=1.3 ilde{R}$)		23.37	25.77	28.96	
δ (Oster 2016; $R_{max}^2 = 1.3 \tilde{R}$)		-0.933	-1.034	-1.019	

Table: SNAP Purchasing Power and Children's Nutrition Outcomes

(Sample: SNAP Children Ages 2-17)						
	(1)	(2)	(3)	(4)		
	HEI-	HÉI-	% Calories	Added		
	Vegetable	Fruit	From Sugar,	Sugar		
			Fat, Alcohol			
	1 407**	1 100	0.040	100.0		
In(SNAPmax/TFP)	1.497**	1.139	-8.049	-189.9		
	(0.696)	(0.867)	(6.393)	(368.3)		
School Breakfast	-0.187	0.224	1.288	77.59		
	(0.297)	(0.237)	(1.376)	(87.97)		
School Lunch	-0.660	1.116***	3.332	-688.4**		
	(0.528)	(0.211)	(2.800)	(272.9)		
Controls?	Yes	Yes	Yes	Yes		
Ν	903	903	903	903		
R^2	0.156	0.145	0.131	0.230		
Effect of 10% \uparrow in SNAP PP	0.143	0.109	-0.550	-111.8		
As a % of Mean	5.9%	5.2%	-2.3%	-14.5%		
β^* (Oster 2016: $R_{max} = 1.3 \tilde{R}$)	2.477	2.324	-14.68	-359.1		
δ (Oster 2016; $R_{max} = 1.3\tilde{R}$)	-1.365	-0.874	-1.160	-1.540		

Child HEI Results

- Total HEI result stable
- HEI subcomponents less so: sometimes total vegetable, sometimes Seafood/plant protein, dairy, whole fruit

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 Will probe school breakfast/lunch results more carefully—minimum age goes from 2 to 6

Table: SNAP Purchasing Power and Adults' Nutrition Outcomes

(Sample:	SNAP	Adults))
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	(1)	(2)	(3)	(4)	(5)	(6)
	HEI-	HEI-	HEI-	% Calories	Added	Alcohol
	Total	Veg.	Fruit	from Sugar,	Sugars	(grams)
				Fat, Alc.	(grams)	
In(SNAPmax/TFP)	6.851	0.836	-0.076	-6.050	293.4	-11.42
	(5.886)	(0.568)	(0.688)	(4.604)	(246.4)	(39.03)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Ν	2,145	2,311	2,311	2,311	2,311	2,311
R ²	0.120	0.053	0.139	0.091	0.212	0.049
Effect of 10% ↑ in SNAP PP	0.653	0.080	0.054	-0.577	27.96	-1.088
As a % of Mean	1.4%	3.1%	2.9%	-1.7%	5.0%	-3.7%
eta^* (Oster 2016; ${\it R}_{max}=1.3 ilde{R}$)	14.68	1.529	1.431	-10.81	351.3	-2.331
δ (Oster 2016; $R_{max} = 1.3 ilde{R}$)	-0.681	-0.756	-0.664	-0.993	-9.567	1.226

Table: SNAP Purchasing Power and Adult Incidence of Obesity and Overweight

(Sample: SNAP Adults)						
	Obese			Overweight		
	(1)	(2)	(3)	(4)	(5)	(6)
In(SNAPmax/TFP)	0.368***	0.304***	0.419*	0.085	0.108	0.138
	(0.127)	(0.0867)	(0.192)	(0.0642)	0.064)	(0.190)
Controls?	No	Yes	Yes	No	Yes	Yes
State FE?	No	No	Yes	No	No	Yes
Ν	2,350	2,289	2,289	2,350	2,289	2,289
R^2	0.008	0.080	0.108	0.000	0.070	0.095
Effect of 10% \uparrow in SNAP PP	0.035	0.029	0.040	0.008	0.010	0.026
As a % of Mean	9.0%	7.4%	10.3%	1.2%	1.5%	1.9%
β^* (Oster 2016; $R_{max} = 1.3 \tilde{R}$)		0.339	0.501		-1.438	-0.130
δ (Oster 2016; $R_{max} = 1.3\tilde{R}$)		-47.89	-7.025		-0.070	0.606

(Sample: SNAP Adults)

Table: Robustness Check: SNAP Purchasing Power and Children's Nutrition Outcomes

(Placebo Sample: Children Ages 2-17 with Household Income > 300% FPL)

	(1)	(2)	(3)	(4)	(5)
	HEI-	HEI-	HEI-	% Calories	Added
	Total	Veg.	Fruit	from Sugar,	Sugars
				Fat, Alcohol	(grams)
In(SNAPmax/TFP)	-36.74***	-1.022	-1.293	10.20	198.3
	(13.06)	(1.060)	(1.131)	(7.508)	(196.3)
Controls?	Yes	Yes	Yes	Yes	Yes
N	225	225	225	225	225
R^2	0.284	0.336	0.250	0.221	0.433
Effect of 10% \uparrow in SNAP PP	-3.502	3.205	2.556	0.972	18.90
As a % of Mean	-6.7%	12.0%	10.3%	2.9%	2.4%
eta^* (Oster 2016; $R_{max}=1.3 ilde{R}$)	-45.66	1.500	1.166	10.99	218.9
δ (Oster 2016; $R_{max} = 1.3\tilde{R}$)	-1.943	-1.598	-0.555	-37.07	-19.79

Table: Robustness Check: SNAP Purchasing Power and Adults' Nutrition Outcomes

(Placebo Samp	le: Adults w	th Household	Income >	300% FPL))
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	(1)	(2)	(3)	(4)
	HEI-	HEI-	HEI-	% Calories
	Total	Veg.	Fruit	from Sugar,
In(SNAPmax/TFP)	-3.711	-0.860*	-0.412	1.921
	(4.118)	(0.462)	(0.606)	(3.389)
Controls?	Yes	Yes	Yes	Yes
Ν	1,938	2,103	2,103	2,103
R^2	0.196	0.060	0.114	0.082
Effect of 10% \uparrow in SNAP PP	-0.354	-0.082	-0.039	0.183
As a % of Mean	-0.7%	-3.2%	-2.1%	0.5%

Table: Robustness Check: SNAP Purchasing Power and Adults' Nutrition Outcomes

(Placebo Sample: Adults with Household Income > 300% FPL)

	(5)	(6)	(7)	(8)
	Added	Alcohol	Obese	Over-
	Sugars	(grams)		weight
	(grams)			
In(SNAPmax/TFP)	199.5	32.06	0.006	0.205**
	(141.1)	(69.24)	(0.0734)	(0.0964)
	.,			
Controls?	Yes	Yes	Yes	Yes
N	2,103	2,103	2,080	2,080
R^2	0.016	0.088	0.072	0.128
Effect of 10% \uparrow in SNAP PP	19.01	3.055	0.001	0.020
As a % of Mean	3.4%	10.3%	0.19%	2.8%

Tentative conclusions

- Some suggestive evidence of improvements in child HEI with higher SNAP purchasing power.
- Sign indicates more fruit and vegetables, but no clear relationship with added sugar.
- For adults, similar (but insignificant) HEI and sugar/fat results.
- Significantly higher obesity among SNAP recipient adults with higher SNAP purchasing power.
- ► For omitted variable to be driving results, selection would have to be in the opposite direction, and equally large. In the case of adult obesity, 5-10 times as strong.

Tricky. Results built on price variation, assume benefit increase would counteract.

Modify benefits geographically by prices, or by age, or limit on purchaseable foods to reduce obesity, without harming child nutrition?

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Remaining

Still much to do:

▶ Use local cost of specific foods (e.g. fruit) with specific HEI.

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- Investigate food quantity (as opposed to percentage).
- School meals for children.
- Compare results to state-level IV method.

Thank You

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