

Guidelines or Subsidies: Promoting Dietary Fiber Intake through Policy in the United States

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Workshop Session presented at the Northeast Agricultural and Resource Economics Association (NAREA) Pre-Conference Workshop, Philadelphia, PA; June 9-10, 2018

Importance of Dietary Fiber

Dietary fiber is a nutrient of public health concern because low intakes are associated with health concerns

Dietary fiber provides important health benefits. Reduce risk of

- cardiovascular disease, hypertension
- stroke, diabetes
- gastrointestinal diseases

May be an association between eating more whole grains, those high in dietary fiber, and a lower body weight.

Current Consumption and Problem

Dietary Guidelines for Americans recommend

- Women - 25 grams of fiber per day
- Men - 38 grams per day,

Average intake in the U.S. is 16 grams per day

Fiber rich foods include most fruits/vegetables, beans, whole grains, and nuts.

Problem

Consumers do not purchase enough foods high in dietary fiber.

Consumers purchase too few whole grain products (higher dietary fiber) and too many refined grain products (lower dietary fiber) than suggested.

Purpose of this Research

Understanding the factors influencing consumers' demand for fiber from:

- Bread, pasta, tortilla
- Fresh, Frozen, and Canned vegetables
- Fresh, Frozen, and Canned fruit

Determine whether the recent U.S. dietary guidelines have had any effect on fiber consumption.

Determine the effect on dietary fiber consumption from a 20% subsidy (price reduction to consumers) on canned, fresh, and frozen fruit and vegetables.

Empirical Model

To account for zero instances of fiber intake and the panel nature of the data, a random effects panel Tobit model is used to estimate fiber demand

Panel Tobit: y_{it}^* be a continuous latent variable described by the following equation with panel-level random effects:

$$y_{it}^* = \mathbf{x}_{it} \beta + v_i + \varepsilon_{it},$$

Data

Quarterly panel of households from Nielsen Homescan, 2004-2014 (44 quarters), consisting of 9,896 households

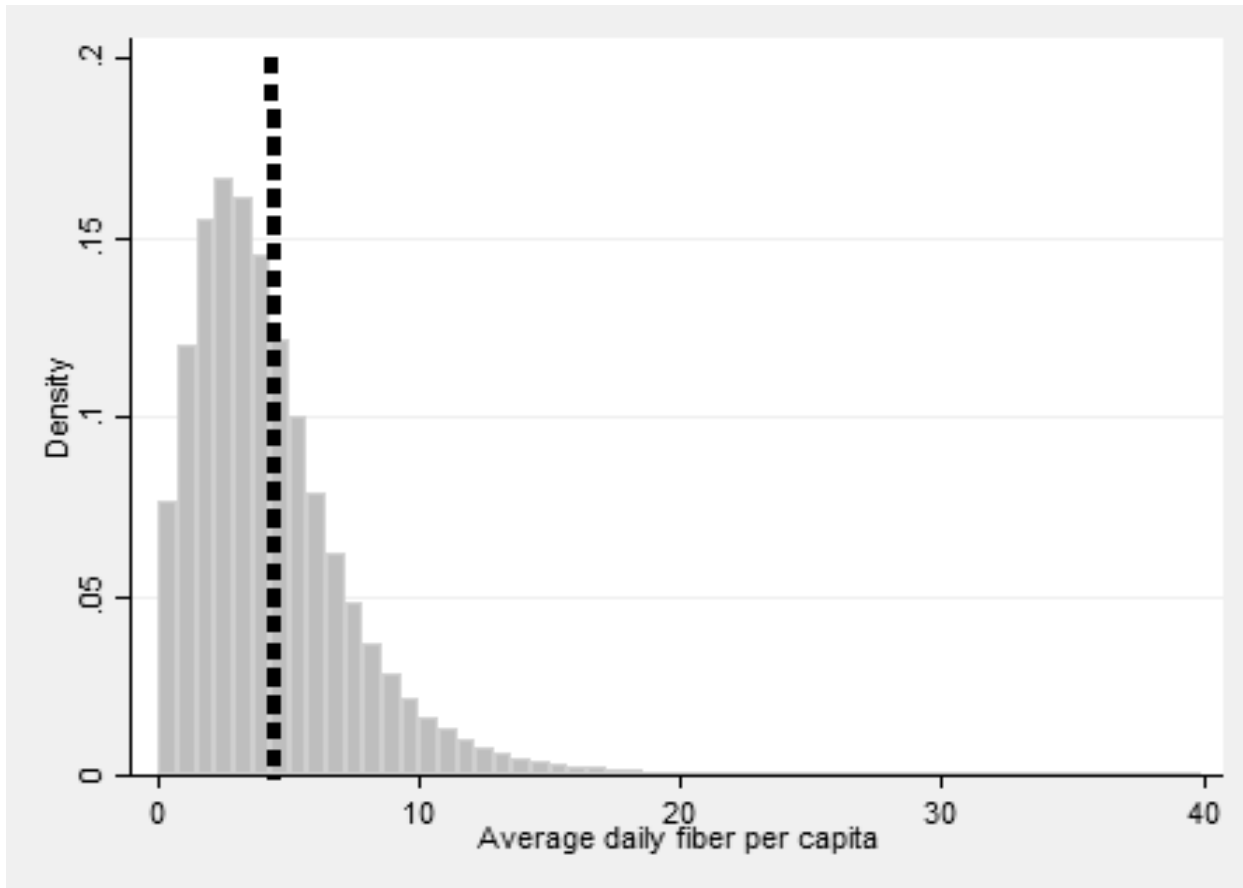
Create daily per capita fiber consumption for each household for 9 categories:

- Bread, pasta, tortilla, Fresh/Frozen/Canned vegetables and beans, Fresh/Frozen/Canned fruit

For each UPC, an estimate is made of the product's fiber content by using a keyword search over UPC descriptions

Fiber content taken from USDA National Nutrient Database for Standard Reference

Average Daily Fiber per Capita Consumption



Black dashed vertical line at 4.38 represents the sample average daily fiber consumption.

Summary Statistics Dependent Variables

	Bread	Pasta	Tortilla	Canned Fruit	Fresh Fruit	Frozen Fruit	Canned Vegetables	Fresh Vegetables	Frozen Vegetables
Sample Mean (std. dev.)	1.15 (1.14)	0.40 (0.45)	0.33 (0.66)	0.34 (0.51)	0.93 (1.32)	0.23 (0.52)	1.06 (1.43)	0.95 (0.98)	0.62 (0.81)
Percent Zero	10.8	40.1	70.3	43.4	29.1	87.4	19.4	11.8	28.0

Summary Statistics Explanatory Variables

Variable	Mean	Std. Dev.
Real Unit Prices (\$/100 grams)		
Bread	0.18	0.02
Pasta	0.15	0.02
Tortilla	0.21	0.03
Canned Fruit	0.13	0.01
Fresh Fruit	0.19	0.04
Frozen Fruit	0.30	0.02
Canned Vegetables	0.11	0.02
Fresh Vegetables	0.17	0.05
Frozen Vegetables	0.17	0.01

Summary Statistics Explanatory Variables

Variable	Mean	Std. Dev.
<u>Demographic characteristics</u>		
White	0.84	0.36
Black	0.09	0.29
Asian	0.03	0.16
Other	0.04	0.19
Hispanic origin (any race)	0.05	0.21
Age of oldest head of household	60.19	11.47

Missing Price Imputation

Price regressed on income, household size, location, and time variables

	Observed Price (\$/gram)		Imputed Price (\$/gram)		Correlation Observed & Imputed	Prob. > r under H0: Rho=0
	Mean	Std. Dev.	Mean	Std. Dev.		
Canned Fruit	0.00126	0.00059	0.00129	0.00045	1.00	<.0001
Fresh Fruit	0.00181	0.00154	0.00187	0.00130	1.00	<.0001
Frozen Fruit	0.00291	0.00109	0.00303	0.00043	1.00	<.0001

Summary Statistics Explanatory Variables

Variable	Mean	Std. Dev.
<u>Economic Characteristics</u>		
Real household income	25,963	13,277
Income below 130% of poverty line	0.07	0.26
Income below 185% of poverty line	0.16	0.16
<u>Education</u>		
Less than HS degree	0.01	0.12
HS degree	0.20	0.40
Some college	0.28	0.45
Bachelor's or higher degree	0.50	0.50

Summary Statistics Explanatory Variables

Variable	Mean	Std. Dev.
<u>Family Characteristics</u>		
At least one child present	0.13	0.33
Household Size	2.08	1.10
<u>Place of residence</u>		
Northeast	0.17	0.38
Midwest	0.26	0.44
South	0.35	.048
West	0.22	0.42

Conditional Own-Price Elasticities for Fiber

Product	OPE
Bread	-0.099
Pasta	-0.298
Tortilla	-0.399
Canned Fruit	-0.254
Fresh Fruit	-0.269
Frozen Fruit	-0.551
Canned Vegetables	-0.333
Fresh Vegetables	-0.245
Frozen Vegetables	-0.173

All significant at the 1% level

Interpretation: The percent change for fiber consumption from that products given a one percent increase in the price of the product.

Canned Fruit most inelastic fruit

Frozen vegetables most inelastic vegetable

Select Conditional Cross Price Elasticities for Fiber

Price \ Quantity	Fruit			Vegetables		
	Canned Fruit	Fresh Fruit	Frozen Fruit	Canned Vegetables	Fresh Vegetables	Frozen Vegetables
Canned Fruit		-0.012	-0.008			
Fresh Fruit	-0.031		-0.012			
Frozen Fruit	0.056	0.008				
Canned Vegetables					-0.026	-0.007
Fresh Vegetables				-0.042		-0.025
Frozen Vegetables				-0.019	-0.023	

Bold represents significance at the 1% level

Mostly weak effects.

Example: Frozen fruit fiber a gross substitute for canned fruit fiber.

Mostly negative (complements) within group

Select Conditional Marginal Effects

	Bread	Pasta	Tortilla	Canned Fruit	Fresh Fruit	Frozen Fruit	Canned Vegetables	Fresh Vegetables	Frozen Vegetables
Guidelines 2010	-0.067	-0.003	0.008	-0.024	0.051	0.005	-0.031	-0.008	-0.016
185% Poverty Level	-0.022	-0.006	-0.006	-0.001	-0.030	-0.003	-0.018	-0.024	-0.015
Child present	-0.157	-0.021	-0.006	-0.014	-0.062	-0.005	-0.133	-0.141	-0.045

Bold represents significance at the 1% level

Indicator for the 2010 Dietary Guidelines shows mixed results. Six fiber categories show negative effects while three show a positive effect.

For mean household, results imply at 5.5% decrease in fiber in the time period after the dietary guidelines were released

Percent Change in Grams/Day Fiber Consumed from a Proposed 20% Subsidy

	Bread	Pasta	Tortilla	Canned Fruit	Fresh Fruit	Frozen Fruit	Canned Vegetables	Fresh Vegetables	Frozen Vegetables	<u>Total Percent Change</u>
Scenario 1	1.48	0.29	0.28	6.33	5.51	11.16	7.73	6.46	3.91	<u>4.80</u>
Scenario 2	0.64	0.38	0.04	5.75	0.33	0.08	7.32	0.81	0.48	<u>2.06</u>
Baseline grams/day	0.90	0.22	0.09	0.16	0.75	0.04	0.82	0.83	0.42	

Scenario 1: all forms of fruit and vegetables.

Scenario 2: only canned fruit and vegetables.

Average of last 4 quarters is increased or decreased by the corresponding own and cross price elasticities to find the percent change for each category.

Percent Change in Grams/Day Fiber Consumed from a Proposed 20% Subsidy

	Bread	Pasta	Tortilla	Canned Fruit	Fresh Fruit	Frozen Fruit	Canned Vegetables	Fresh Vegetables	Frozen Vegetables	<u>Total Percent Change</u>
Scenario 3	0.83	0.69	0.25	1.36	5.53	0.21	1.44	5.54	0.81	<u>2.69</u>
Scenario 4	0.01	-0.77	-0.01	-0.77	-0.35	10.87	-1.03	0.10	2.61	<u>0.05</u>
Baseline grams/day	0.90	0.22	0.09	0.16	0.75	0.04	0.82	0.83	0.42	

Scenario 3: only fresh fruit and vegetables.

Scenario 4: only frozen fruit and vegetables.

Average of last 4 quarters is increased or decreased by the corresponding own and cross price elasticities to find the percent change for each category.

Summary and Conclusions

For the mean household there is a 5.5% decrease in per capita dietary fiber purchased in the time period after the 2010 dietary guidelines were released compared to before the release.

A proposed 20% subsidy applied to all categories of fruits and vegetables would result in an increase in the average per capita consumption of fiber per day by 4.8%.

Subsidy when applied to only canned products results in a 2.1% increase, applied to only fresh products would result in a 2.7% increase, and applied only to frozen would result in a 0.05% increase in per capita average daily fiber consumption.

Summary and Conclusions

A subsidy of 1064% applied to all type of fruits and vegetables would be necessary to get 25 grams per day. Alternatively a subsidy of 2755% applied to only fresh fruits and vegetables would be necessary to meet the guideline.

Thus, subsidies alone would not be easily able to encourage consumers to meet the daily fiber intake guideline.

Approach to estimate the fiber content could be more refined.

Only considers food purchased for at home consumption. This may not be a major problem as eating meals away from home is usually associated with less healthy and this might not change overall fiber totals.