Optimal Taxation and Junk Food

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Abstract

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This paper uses the Quadratic Almost Ideal Demand System (Quaids) model of Banks, Blundell, and Lewbel to 1) estimate a household demand model for food and 2) analyze how incorporating health considerations affects the optimal design of taxes on food consumption. Standard economic theory argues that consumer preferences are sovereign. However research on nutrition education finds that nutrition knowledge is not sufficiently widespread. Moreover, nutrition knowledge is correlated with education levels. Therefore government policies to promote a healthy diet are motivated by the notion of paternalism. Data on household consumption is from the Diary Survey component of the Consumer Expenditure Survey. The demand model is estimated separately for high-educated households and low-educated households. The optimal tax regime is calculated twice to examine how health considerations affect the design of taxes. The preferences of all households are respected in the first set of tax calculations. The tax regime is only concerned with optimal tax considerations. However the second set of tax calculations only respects the preferences of high-educated households. The tax regime is now also motivated by health considerations.
Keywords: Commodity taxation, incidence, junk food tax

1 Introduction

Concern about the obesity crisis in America has led to the use of tax policy as an instrument to discourage consumption of unhealthy foods such as sodas and junk foods. Taxes on unhealthy foods are also seen as an additional source of needed revenue. Several states have proposed a soda tax and the Rivlin-Domenici deficit reduction report also recommends using a soda tax to raise revenue. However nutrition education research finds that nutrition knowledge is not widespread and is correlated with education levels. Therefore government intervention, via tax policy, is motivated by the notion of paternalism. Separate household demand models are estimated for both high-educated and low-educated households. These preferences are then used to examine how the inclusion of health considerations affects the design of an optimal tax regime, which is traditionally focused on the efficiency costs of taxation.

Demand for food is determined by individual preferences. If consumers are well-informed and understand the health consequences of their food choices, then the notion of cosumer sovereignty states these preferences should be respected.[1] However research on nutrition education finds that although consumers are well aware of the link between diet and health, they either do not correctly understand the relationship between diet and health or they are not able to properly apply this knowledge. Therefore even though consumers may desire to eat healthy, it is not clear they are able to do so. This deficiency in nutrition knowledge is correlated with education levels. This creates a rationale for government intervention based on a paternalistic perspective.

The research on the effect of taxes on food demand is not as developed or as extensive as the research on food demand in general. Blanciforti, Green, and Lane (1981) estimate Engel curves using a Box-Cox transformation to examine how expenditures on more nutritious and less nutritious food varies over the life-cycle. Hawkins (2002) uses the Almost Ideal Demand System

[1] This assumes that externalities, especially negative externalities, are not present. Unlike smoking, where there is a clear negative externality due to second-hand smoke, the health consequences of obesity-related illnesses are internalized and born by the individual. The increase in health care costs from treating obesity-related illnesses does potentially create a fiscal externality. However many insurance companies offer price incentives to encourage healthy behavior such as gym memberships and regular physicals. Therefore it is not clear that the private marketplace is unable to account for these fiscal externalities.

(Aids) model of Deaton and Muellbauer (1980) to estimate the excess burden of the general sales tax. Although the model does include expenditures on food consumed at home, it is more focused on overall household consumption as opposed to food consumption. Health policy experts such as Jacobson and Brownell (2000) argue for taxes on soft drinks and snack foods, however they do not estimate elasticities. Heien and Wessells (1988) use the Aids model to estimate demand for dairy products, however their focus is estimating food demand and therefore do not address the question of taxing unhealthy food. Chouinard, Davis, LaFrance, and Perloff (2007) do estimate a generalized-Aids model on proprietary grocery store data to examine the effect of a tax. However their focus is on dairy products and taxing the fat in dairy products. They find demand for dairy products to be price inelastic.

Data on household food consumption is from the Diary Survey component of the Consumer Expenditure Survey. The 1996-2010 Diary surveys are pooled together to create a cross-sectional data set. The Quadratic Almost Ideal Demand System (Quaids) model of Banks, Blundell, and Lewbel (1997) is used to estimate household demand for food. The demand model consists of the following food categories – bread and cereal, meats, fruits and vegetables, dairy products, unhealthy foods, sodas and fruit juices, and miscellaneous foods. The unhealthy food category consists of desserts, sugars and other sweets, and fats and oils. The demand model is estimated separately for high-educated households and low-educated households. Both high-educated and low-educated households are assumed to desire a healthy diet. However it is assumed that only high-educated households have correct preferences for food since the nutrition literature finds that nutrition knowledge is correlated with education levels.

Elasticity values are calculated from the parameter estimates. The results show that the behavior of high-educated households differs from that of low-educated households. The uncompensated own-price elasticity of unhealthy foods is –2.7811 for high-educated households and –1.5633 for low-educated households. The elasticity values indicate that low-educated households will bear a larger share of the burden of a tax on unhealthy foods because high-educated households are more responsive to the price change. The uncompensated own-price elasticity of sodas and fruit juices is –1.2240 for high-educated households and –1.4581 for low-educated households. Taxing sodas and fruit juices will reduce consumption by all households, however this also reduces the ability of a tax to raise revenue. This is true of all taxes; the greater the reduction in quantity demanded then the less tax revenue is collected.

The parameter estimates are then used to inform the design of the tax regime. The optimal tax regime is calculated twice. The government respects the preferences of all households in the first set of calculations. Therefore the tax regime is determined by optimal tax considerations only; taxes are set to minimize the efficiency costs which arise from distorting household consumption. However if the government is concerned about whether households consume a healthy diet, then the optimal tax regime should be determined by the preferences of high-educated households. Therefore the optimal tax regime is re-calculated and now the government only respects the preferences of high-educated households. The differences in the marginal social cost of the last "dollar" raised by taxing good j motivates how the government should respond to health considerations.

2 Motivation

Medical research finds a clear link between obesity and health problems such as coronary heart disease, diabetes, cancer, and hypertension. Data from the Center for Disease Control and Prevention shows how the obesity problem has recently worsened. No state had an obesity prevalence rate in excess of 30% as recently as 2000. By 2010, no state has an obesity prevalence rate less than 20% and twelve states have a rate of 30% or higher.[2] The Surgeon General, in a 2003 speech to the Subcommittee on Education Reform, described the obesity crisis as the "fastest growing cause of disease and death in America."

This rise in obesity-related health problems imposes a clear cost on society in the form of higher health care spending and lost productivity. In the same speech, the Surgeon General reported the total annual cost of obesity to be $117 billion in 2000. The Center for Disease Control cites a 2009 report by Finkelstein, Trogdon, Cohen, and Deitz which estimates the annual medical costs of obesity to be $147 billin in 2008. The Society of Actuaries released a study in December of 2010 which estimates that the annual total cost of obesity has risen to $270 bilion.[3]

[2] www.cdc.gov/obesity/data/adult.html

[3] The study lists the total annual costs of obesity to be $300 billion, however this is for both the U.S. and Canada. The study attributes 90% of that cost, or $270 billion, to the United States.

Politicians and health officials have begun advocating for taxes on unhealthy foods in an effort to combat the obesity crisis. Mayor Michael Bloomberg of New York City proposed a penny-per-ounce tax on soda (New York Times 2010). The state of California was one of 12 states in 2010 that debated some form of a tax on sodas (LA Times 2010). Taxes on unhealthy foods, such as sodas, are an attractive policy option because they are seen as a means to both limit consumption and raise new tax revenue.

The popularity of taxes on sodas and other unhealthy foods does raise the question of what is the appropriate role for goverment in regulating the food consumption choices of households. Demand for food, as well as other goods, is determined by consumer preferences. If consumers are well-informed and rational then economic theory argues these preferences should be respected; consumer preferences are sovereign. If consumers understand the link between diet and health, and are comfortable with the health risks associated with their diet choice, then they should not be penalized for their food preferences.

Strnad (2005) examines three different rationales for taxes on unhealthy foods – 1) behavioral failures, 2) informational failures, and 3) cognitive failures. Cigarette addiction is an example of a behavioral failure. The individual wants to quit smoking, however is unable to commit to quitting. Informational failures are based on the idea of bounded rationality. Economic theory assumes individuals are rational; they have full information and are able to properly evaluate the information. Informational failure, or bounded rationality, occurs when either of these two assumptions fails. In the case of cognitive failures, the individual is able to process the information needed to create a diet and is able to commit to this diet. However the individual lacks perfect foresight and therefore does not correctly anticipate future preferences, such as tastes for food adapting to the healthier diet.[4]

This paper focuses on the second rationale, information failure. The notion of consumer sovereignty assumes individuals are well-informed. If this assumption fails, then consumer preferences are not correct. Research on nutrition education finds consumer knowledge of proper nutrition to be deficient. The U.S. Department of Agriculture released a publication in 1999

[4] Strnad suggests the presence of fiscal externalities and thus taxes on unhealthy foods can plan an important role within the health insurance system.

titled “America’s Eating Habits: Changes and Consequences.” This bulletin summarizes the results of several nutrition education surveys.[5] The surveys assess nutrition knowledge which is measured along three lines: 1) awareness, 2) knowledge of principles, and 3) how-to knowledge. There is strong awareness of the relationship between diet and disease, however this neither leads to deeper levels of understanding nor does it lead to the ability to apply this knowledge on a daily basis.

Consumers are aware of important relationships between diet and disease such as the link between sodium consumption with hypertension or the link between fat consumption and cholestrol levels with heart disease. However awareness of the link does not automatically translate to proper knowledge about nutrition. The surveys show that consumers are concerned about fats and cholestrol and even pay attention to fat and cholestrol levels in food. However the surveys also find that actual knowledge about fats and cholestrols is limited. When asked about saturated and polyunsaturated fats, only 25% of respondents knew they had the same number of calories. Knowledge about cholestrol is also limited since only 28% know that cholestrol is only found in animal products. Similarly, while 75% of individuals know it is important to be at a healthy weight, there is low interest in the actual caloric content of foods.

Nor does awareness of the relationship between diet and disease guarantee the knowledge is applied correctly. Of the set of households who believed they consumed the proper amount of calcium, only 38% of households actually consumed the correct amount. Health education campaigns do improve awareness of the relationship between diet and disease. However simpler health messages resonate better because nuanced messages only serve to complicate the decision-making process.

Conflicting nutrition information, credible or otherwise, only serves to worsen the problem. The USDA bulletin cites the American Dietetic Association’s 1995 Nutrition Trends Survey where 21% of respondents agreed with the statement that “there are so many conflicting studies they don’t know what to believe.” This inability to properly process and apply nutrition knowledge can lead to harmful choices. The U.S. News and World

[5]The surveys include the Food and Drug Administration’s Health and Diet Survey, the U.S. Department of Agriculture’s Diet and Health Knowledge Survey, the Food Marketing Institute’s Trends Survey, and the American Dietetic Association’s 1995 Nutrition Trends Survey.

Report (2011) recently ranked the nutritional completeness and safety of 20 popular diets. The Atkins diet, which gained popularity in the nineties, is one of three diets that received a healthiness score below 3 which indicates a diet that is "overtly unsafe or severely deficient nutritionally."

This deficiency in nutrition education provides the government, motivated by paternalism, with a rationale for including health considerations in the design of tax policy. The surveys do consistently find that nutrition knowledge is correlated with education levels; consumers with higher education levels have better nutrition knowledge.[6] Assuming that all households want to eat healthy, the research indicates that high-educated households are better able to achieve this goal. Therefore the preferences of high-educated households are used to inform the design of tax policy.

3 Data Set and Food Categories

Data on food consumption is from the Consumer Expenditure Survey. The CEX data set consists of an Interview Survey component and a Diary Survey component. The Interview Survey interviews households for five consecutive quarters on large purchases and purchases that occur regularly. The Diary Survey collects daily expenditures on small items, such as food and beverages or personal care products, over a two-week period.[7] The Interview Survey does contain data on aggregate food expenditures, however it is the Diary Survey that has detailed food expenditure data. Therefore the 1996-2010 Diary Surveys are used for the analysis.

The Diary Survey is released on a quarterly basis. Unlike the Interview Survey which interviews households for up to five consecutive quarters, households only report their expenditures for one two-week period. The different quarters are pooled together to create a cross-sectional data set. The unit of observation is the household and the age of the adults in the household is between 18 and 65. The observation is dropped if the occupation of the working spouse is either armed forces, self-employed, or farming, forestry and fishing.

[6] Parmenter, Waller, and Wardle (2000) survey the patients of family physicians in England and also find a strong link between education levels and nutrition knowledge.

[7] The Interview Survey and Diary Survey are separate surveys so there is no intentional overlap in the households surveyed. Therefore expenditure data from the two surveys cannot be matched at the household level.

The Diary Survey reports expenditures on aggregate food categories such as bakery products, beef, poultry, fresh fruits, processed fruits, sugar and other sweets, or fats and oils. The Diary Survey also reports expenditures on the specific food items that comprise the aggregate food categories. For instance, expenditure data is available on white bread, other bread, cakes, cookies, and the other goods that comprise bakery products. Similarly, data is available for expenditures on apples, bananas, oranges and other fresh fruits, which are the goods that comprise the fresh fruits category.

The household demand model for food consists of seven goods: 1) bread and cereal products, 2) meats, 3) fruits and vegetables, 4) dairy products, 5) unhealthy foods, 6) sodas and fruit juices, and 7) miscellaneous foods. The seven food goods are constructed from both the aggregate food categories and the individual food expenditures. The Diary Survey food category bakery products consists of both healthy foods, such as bread and crackers, as well as unhealthy foods such as cakes, cookies, doughnuts, and pies (desserts). The healthy foods portion is combined with cereal products to create the bread and cereal food good. The unhealthy foods portion, desserts, are combined with sugars and other sweets and fats and oils to create the unhealthy food good. The meats category consists of beef, poultry, other meats, seafood, and eggs. The demand model consists only of food consumed at home; food away from home and alcoholic beverages are excluded.

Data on prices is from the Bureau of Labor Statistics Consumer Price Index data base, all-urban-consumers (current series). The price indices are available monthly on a national basis. The price indices are chosen to match the composition of the seven goods and their values are divided by 100 so their values correspond to actual prices. The data on food expenditures is reported on a weekly basis.

Table 1 reports summary statistics. The high-educated sample consists of households with a bachelor's degree or higher, while the low-educated sample consists of households with no HS diploma, a HS diploma, or some college. The total sample size is 20,920 households with 37.65% of households in the high-educated sample (7,876) and 62.35% of households in the low-educated sample (13,044). The age of the reference person responding to the survey is reported and high-educated households are slightly younger at 41.63 years vs. 42.76 years for low-educated households. High-educated households also have slightly fewer children with an average of 0.73 vs. 0.84

for low-educated households.

Data on food expenditures indicate that high-educated households spend more on bread and cereal products, \$4.31 vs. \$3.73, fruits and vegetables, \$6.39 vs. \$5.01, dairy products, \$4.92 vs. \$4.15, and miscellaneous foods, \$9.57 vs. \$7.83. They also spend less on meats, \$8.23 vs. \$8.83, and sodas and fruit juices, \$3.09 vs. \$3.17. Data on budget shares confirms the expenditure data, with the exception of unhealthy foods. High-educated households spend more on unhealthy foods, \$4.47 vs. \$4.12, however they devote a smaller share, 10.71% vs. 10.91%. This is because high-educated households spend more money on food, \$40.98 vs. \$36.84. This is also why even though low-educated households spend only slight more on meats or sodas and fruit juices, the difference in budget shares is much larger. Low-educated households devote 23.10% of their food budget to meat and 9.41% to sodas and fruit juices vs. 19.18% to meat and 8.19% to sodas and fruit juices for high-educated households.

A simple difference-in-means regression procedure is used to test whether the difference in sample average values between the two samples is significant. The results are reported in Table 2. The dependent variable is either expenditures or budget shares and the independent variable is a dummy variable indicating the household is in the high education subsample.

$$y_i = \beta_0 + \beta_1 \times \text{high education}.$$

β_1 is the difference in sample average values between the two samples. $\beta_1 = 0.5850$ for bread and cereal, where high-educated households spend \$4.31 and low-educated households spend \$3.73 on average. Similarly $\beta_1 = 0.7646$ for dairy products, where high-educated households spend \$4.92 and low-educated households spend \$4.15. The regression results find the difference in sample average values between the two samples to be significant for all goods except for unhealthy foods (budget shares). This is prima facie evidence that consumption behavior differs between the high education and low education samples.

Table 1: Summary Statistics

	Overall Sample		High Education		Low Education	
	Mean	Std Error	Mean	Std Error	Mean	Std Error
Age	42.33	(11.51)	41.63	(10.95)	42.76	(11.82)
Married (%)	0.68	(0.46)	0.66	(0.47)	0.70	(0.46)
Family Size	2.52	(1.46)	2.42	(1.39)	2.58	(1.50)
# Children	0.80	(1.14)	0.73	(1.07)	0.84	(1.18)
Education Levels (%)						
No HS Diploma	8.48	(27.85)	–	–	13.59	(34.27)
HS Diploma	23.48	(42.39)	–	–	37.66	(48.46)
Some College	30.39	(46.00)	–	–	48.74	(49.99)
Bachelor Degree	24.99	(43.30)	66.38	(47.24)	–	–
Graduate Degree	12.66	(33.25)	33.62	(47.24)	–	–
Food Expenditures ($)						
Bread & Cereal	3.95	(3.10)	4.31	(3.35)	3.73	(2.91)
Meats	8.60	(7.70)	8.23	(7.71)	8.83	(7.69)
Fruits & Vegetables	5.53	(4.84)	6.39	(5.44)	5.01	(4.35)
Dairy Products	4.44	(3.44)	4.92	(3.79)	4.15	(3.18)
Unhealthy Foods	4.25	(4.06)	4.47	(4.30)	4.12	(3.91)
Soda & Fruit Juices	3.14	(2.97)	3.09	(2.93)	3.17	(2.99)
Miscellaneous Foods	8.49	(7.23)	9.57	(7.85)	7.83	(6.74)
Total Expenditures	38.40	(21.68)	40.98	(22.77)	36.84	(20.84)
Budget Share (%)						
Bread & Cereal	10.74	(7.32)	10.94	(7.39)	10.62	(7.27)
Meats	21.62	(14.62)	19.18	(13.82)	23.10	(14.89)
Fruits & Vegetables	14.13	(10.01)	15.51	(10.68)	13.30	(9.48)
Dairy Products	12.11	(8.20)	12.44	(8.08)	11.92	(8.27)
Unhealthy Foods	10.84	(8.91)	10.71	(9.00)	10.91	(8.86)
Soda & Fruit Juices	8.95	(8.93)	8.19	(8.37)	9.41	(9.23)
Miscellaneous Foods	21.60	(13.97)	23.02	(14.27)	20.75	(13.71)

The data is from the 1996-2010 CEX Diary Surveys. The total sample size is 20,920 households with 13,044 households in the low education subsample and 7,876 in the high education subsample.

Table 2: Sample Mean Tests

	Expenditures		Budget Shares	
	(I)	(II)	(III)	(IV)
	High Education	Std. Error	High Education	Std. Error
Bread & Cereal	0.5850‡	(0.0440)	0.0033‡	(0.0010)
Meat Products	–0.5909‡	(0.1098)	–0.0392‡	(0.0021)
Fruit & Vegetables	1.3780‡	(0.0684)	0.0221‡	(0.0014)
Dairy Products	0.7646‡	(0.0489)	0.0052‡	(0.0012)
Unhealthy Foods	0.3502‡	(0.0579)	–0.0020	(0.0013)
Soda & Fruit Juices	–0.0845†	(0.0423)	–0.0122‡	(0.0013)
Miscellaneous Foods	1.7367‡	(0.1024)	0.0228‡	(0.0020)

Difference-in-means regression results. Left-hand side is either food expenditures (col. I and II) or budget shares (col. III and IV). ‡ indicates significance at 1% level and † indicates significance at 5% level.

4 Model

Household preferences are assumed to follow the Quadratic Almost Ideal Demand System model of Banks, Blundell, and Lewbel (1997).[8] The Quaids model is a more general specification of Deaton and Muellbauer's (1980) Almost Ideal Demand System. The Aids model assumes linear Engel curves. Banks et al. test this assumption and find that it is only true for some goods. Therefore they specify a model that not only incorporates nonlinear income effects but is also flexible enough to not impose the higher-order income terms on all goods. The result is the Aids model is nested within the Quaids model. If income effects are indeed linear, then the nonlinear income term disappears and the Quaids model reduces to the Aids model.

The indirect utility function for the Quaids model is:

$$\ln v = \left\{ \left[\frac{\ln m - \ln a(P)}{b(P)} \right]^{-1} + \lambda(P) \right\}^{-1}, \tag{1}$$

where m is aggregate expenditures and $\ln a(P), b(P)$, and $\lambda(P)$ are price

[8]There are a number of studies of demand systems in the literature that follow Banks et al. (1997) and use Quaids. See, among others, Blundell and Robin (1999), Moro and Sckokai (2000), Fisher and Fleissig (2001), and Gil and Molina (2008).

indices defined as follows:

$$\ln a(P) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{i,j} \ln p_i \ln p_j, \tag{2}$$

$$b(P) = \prod_{i=1}^{n} p_i^{\beta_i}, \tag{3}$$

$$\lambda(P) = \sum_{i=1}^{n} \lambda_i \ln p_i. \tag{4}$$

The following restrictions ensure that the model satisfies the demand theory properties of 1) adding up of the budget constraint, 2) homogeneity of degree zero in prices and income, and 3) Slutsky symmetry:

$$\sum_{i=1}^{n} \alpha_i = 1, \qquad \sum_{i=1}^{n} \beta_i = 0, \qquad \sum_{i=1}^{n} \gamma_{i,j} = 0; \tag{5}$$

$$\sum_{j=1}^{n} \gamma_{i,j} = 0; \tag{6}$$

$$\gamma_{i,j} = \gamma_{j,i}. \tag{7}$$

The Quaids demand model estimates expenditure shares rather than demand equations. The Quaids expenditure share equation is derived using Roy's identity:

$$w_i \equiv \frac{p_i x_i}{m} = \frac{p_i}{m} \left(\frac{-\partial v / \partial p_i}{\partial v / \partial m} \right) = -\frac{p_i}{m} \frac{\partial \ln v / \partial p_i}{\partial \ln v / \partial m},$$

where w_i is expenditure share for good $i = 1, 2, \ldots, n$. One arrives at the system of expenditure share equations by differentiating equation (1) with respect to p_i and m and then simplying through equations (2)-(4):[9]

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{i,j} \ln(p_j) + \beta_i \ln \frac{m}{a(P)} + \frac{\lambda_i}{b(P)} \left[\ln \frac{m}{a(P)} \right]^2. \tag{8}$$

[9]If $\lambda_i = 0 \ \forall i = 1, 2, \ldots, n$, then both the indirect utility function and the Quaids expenditure share equation reduces to the Aids model. In this case Engel curves are linear in $\ln m$.

5 Estimation Procedure

The Quaids expenditure share equation is nonlinear in prices. Blundell and Robin (1999) suggest an iterated-linear-least-squares estimator approach which takes advantage of the conditional linearity of the Quaids equation; the equation is linear conditional on values for $\ln a(P)$ and $b(P)$. The price indices are calculated using initial guesses for the parameter values.[10] The now linear demand system is estimated using a seemingly-unrelated regression model which accounts for the possible correlation in error terms across equations; the right-hand side variables are identical. The price indices are updated using the new parameter estimates and the Quaids model is then re-estimated. This process continues until the parameter estimates converge.

The estimation model also includes the following demographic variables: age, age squared, gender, marital status, education dummy variables, ethnicity dummy variables, number of children, and state and month fixed effects. The sample includes both single and married households. The demand model is estimated separately for high-educated and low-educated households. The miscellaneous food good equation is dropped in the estimation procedure. The parameters for the miscellaneous food good equation are calculated by imposing the cross-equation restrictions.

Table 3 reports the parameter estimates for the high education sample and Table 4 reports the estimates for the low education sample. The parameter estimates measure how a change in log of price affects budget shares, however the primary purpose of the parameter estimates is to calculate the elasticity values. Nevertheless comparing the parameter estimates between samples does show that the behavior of high-educated households differs from low-educated households. Consider the parameter estimates for the fruit and vegetable equation. The price of bread has a larger effect on fruit and vegetable consumption for high-educated households, –0.1087, than for low-educated households, –0.0615. However an increase in the price of meat

[10] The initial parameter estimates are from estimating the Aids model, or more specifically the linear-approximate, LA-Aids, model. The Aids model is also nonlinear in prices, however Deaton and Muellbauer suggest linearization by using Stone's Index as a proxy for $\ln a(P)$. This method became known as the linear-approximate Aids model to differentiate it with estimation of the true Aids model. The formula for Stone's Index is:

$$\ln P = \sum_{i=1}^{n} s_i \ln p_i.$$

will decrease the share devoted to fruit and vegetable consumption for high-educated households, –0.0153, but increase it for low-educated households, 0.0137.

The behavior of high-educated and low-educated households differs for the unhealthy food good also. The price of bread again has a larger impact on unhealthy food consumption for high-educated households, 0.1115, than it does for low-educated households, 0.0387. Similarly, increasing the price of meat again decreases the share devoted to unhealthy foods for high-educated households, –0.0068, but increases it for low-educated households, 0.0332. The difference in behavior is even larger for a change in the price of fruits and vegetables. A price increase has a large positive effect for high-educated households, 0.0999, but a large negative effect for low-educated households, –0.0305. The response to price changes is different between households in the high education sample and low education sample.

6 Elasticities

The elasticity formulas are derived from the Quaids expenditure share equation, (8) by making use of the relationship between budget shares and quantity demanded. The income elasticity formula is derived as follows:

$$\frac{\partial w_i}{\partial \ln m}\bigg|_p = m\frac{\partial w_i}{\partial m}\bigg|_p = m\frac{\partial}{\partial m}\left(\frac{p_i x_i}{m}\right).$$

Solving for the partial derivatives and after some further calculations, the income elasticity formula is:

$$\eta_i = 1 + \frac{1}{w_i}\left[\beta_i + \frac{2\lambda_i}{b(P)}\ln\frac{m}{a(P)}\right]. \tag{9}$$

A similar procedure is used to derive the uncompensated elasticity formula:

$$\frac{\partial w_i}{\partial \ln p_j} = p_j\frac{\partial w_i}{\partial p_j} = p_j\frac{\partial}{\partial p_j}\left(\frac{p_i x_i}{m}\right),$$

which after further calculations becomes:

$$\begin{aligned}\epsilon_{i,j} \quad = \quad & \frac{1}{w_i}\left\{\gamma_{i,j} - \left[\beta_i + \frac{2\lambda_i}{b(P)}\ln\frac{m}{a(P)}\right] \times \left[\alpha_j + \sum_{k=1}^{n}\gamma_{k,j}\ln p_k\right]\right. \\ & \left. -\frac{\lambda_i\beta_j}{b(P)}\left[\ln\frac{m}{a(P)}\right]^2\right\} - \delta_{i,j},\end{aligned} \tag{10}$$

Table 3: Parameter Estimates High Education Sample

	Bread	Meat	Fruit	Dairy	Unhealthy	Soda	Misc.
Constant	0.2116‡	0.0133	0.0953‡	0.2262‡	0.0463	0.1660‡	0.2414
	(0.0217)	(0.0329)	(0.0266)	(0.0210)	(0.0254)	(0.0249)	–
Bread Price	–0.0387	–0.0693†	–0.1087‡	0.0615†	0.1115†	0.1264‡	–0.0826
	(0.0562)	(0.0332)	(0.0302)	(0.0273)	(0.0472)	(0.0371)	–
Meat Price	–0.0693†	–0.1225†	–0.0153	0.0539	–0.0068	–0.1129‡	0.2728
	(0.0332)	(0.0543)	(0.0367)	(0.0310)	(0.0391)	(0.0333)	–
Fruit-Veg Price	–0.1087‡	–0.0153	–0.0417	–0.0109	0.0999‡	–0.0157	0.0926
	(0.0302)	(0.0367)	(0.0401)	(0.0266)	(0.0363)	(0.0294)	–
Dairy Price	0.0615†	0.0539	–0.0109	–0.0354	–0.0774†	0.0349	–0.0265
	(0.0273)	(0.0310)	(0.0266)	(0.0326)	(0.0311)	(0.0270)	–
Unhealthy Price	0.1115†	–0.0068	0.0999‡	–0.0774†	–0.1905‡	–0.0647	0.1279
	(0.0472)	(0.0391)	(0.0363)	(0.0311)	(0.0648)	(0.0389)	–
Soda Price	0.1264‡	–0.1129‡	–0.0157	0.0349	–0.0647	–0.0227	0.0546
	(0.0371)	(0.0333)	(0.0294)	(0.0270)	(0.0389)	(0.0456)	–
Misc. Food Price	–0.0826†	0.2728‡	0.0926‡	–0.0265	0.1279‡	0.0546	–0.4388
	(0.0398)	(0.0404)	(0.0341)	(0.0322)	(0.0409)	(0.0372)	–
Real Income	–0.0344‡	0.0111	0.0362‡	–0.0166†	0.0053	–0.0474‡	0.0458
	(0.0061)	(0.0111)	(0.0085)	(0.0066)	(0.0073)	(0.0068)	–
Real Income Sq	0.0050‡	0.0034	–0.0084‡	0.0001	–0.0002	0.0073‡	–0.0072
	(0.0015)	(0.0028)	(0.0021)	(0.0016)	(0.0018)	(0.0017)	–
Age	–0.0004	0.0034‡	–0.0008	–0.0021‡	0.0006	0.0002	0.0009
	(0.0006)	(0.0012)	(0.0009)	(0.0007)	(0.0008)	(0.0007)	–
Age Squared	0.0000	–0.0000†	0.0000	0.0000‡	–0.0000	–0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	–
Male	–0.0003	0.0106‡	–0.0131‡	–0.0011	–0.0048†	0.0113‡	0.0026
	(0.0017)	(0.0031)	(0.0024)	(0.0019)	(0.0021)	(0.0019)	–
Married	0.0014	0.0176‡	0.0126‡	0.0013	0.0048†	–0.0119‡	0.0259
	(0.0020)	(0.0037)	(0.0029)	(0.0022)	(0.0025)	(0.0023)	–
Graduate Degree	0.0009	–0.0151‡	0.0165‡	0.0075‡	–0.0032	–0.0018	0.0048
	(0.0018)	(0.0033)	(0.0025)	(0.0019)	(0.0021)	(0.0020)	–
Black	–0.0019	0.0804‡	0.0035	–0.0349‡	–0.0101‡	0.0165‡	0.0534
	(0.0032)	(0.0058)	(0.0045)	(0.0035)	(0.0038)	(0.0036)	–
Asian	–0.0062	0.0214‡	0.0749‡	–0.0295‡	–0.0147‡	–0.0159‡	0.0300
	(0.0034)	(0.0063)	(0.0049)	(0.0037)	(0.0041)	(0.0039)	–
Other	0.0071	–0.0042	0.0009	0.0006	–0.0048	–0.0109	–0.0112
	(0.0099)	(0.0181)	(0.0140)	(0.0108)	(0.0119)	(0.0112)	–
# Children	0.0040‡	–0.0019	–0.0074‡	0.0073‡	0.0022	0.0002	0.0044
	(0.0010)	(0.0018)	(0.0014)	(0.0011)	(0.0012)	(0.0011)	–

† indicates significance at 5% level and ‡ indicates significance at 1% level.

Table 4: Parameter Estimates Low Education Sample

	Bread	Meat	Fruit	Dairy	Unhealthy	Soda	Misc.
Constant	0.1751‡	0.0124	0.0735‡	0.1760‡	0.1190‡	0.1565‡	0.2874
	(0.0149)	(0.0231)	(0.0165)	(0.0144)	(0.0177)	(0.0187)	–
Bread Price	0.0094	–0.0628†	–0.0615‡	0.0602‡	0.0387	0.0622	–0.0461
	(0.0424)	(0.0251)	(0.0227)	(0.0208)	(0.0363)	(0.0291)	–
Meat Price	–0.0628†	–0.1765‡	0.0137	0.0053	0.0332	–0.0978‡	0.2848
	(0.0251)	(0.0422)	(0.0267)	(0.0242)	(0.0303)	(0.0271)	–
Fruit-Veg Price	–0.0615‡	0.0137	–0.0040	–0.0379	–0.0305	0.0144	0.1057
	(0.0227)	(0.0267)	(0.0286)	(0.0199)	(0.0279)	(0.0232)	–
Dairy Price	0.0602‡	0.0053	–0.0379	0.0260	–0.0497†	0.0374	–0.0413
	(0.0208)	(0.0242)	(0.0199)	(0.0256)	(0.0242)	(0.0220)	–
Unhealthy Price	0.0387	0.0332	–0.0305	–0.0497†	–0.0608	–0.0329	0.1020
	(0.0363)	(0.0303)	(0.0279)	(0.0242)	(0.0513)	(0.0312)	–
Soda-Juice Price	0.0622†	–0.0978‡	0.0144	0.0374	–0.0329	–0.0469	0.0637
	(0.0291)	(0.0271)	(0.0232)	(0.0220)	(0.0312)	(0.0378)	–
Misc Food Price	–0.0461	0.2848‡	0.1057‡	–0.0413	0.1020‡	0.0637†	–0.4687
	(0.0297)	(0.0312)	(0.0249)	(0.0249)	(0.0316)	(0.0300)	–
Real Income	–0.0385‡	0.0517‡	0.0400‡	–0.0435‡	–0.0013	–0.0347‡	0.0264
	(0.0041)	(0.0082)	(0.0054)	(0.0046)	(0.0051)	(0.0052)	–
Real Income Sq	0.0059‡	–0.0069‡	–0.0086‡	0.0058‡	0.0018	0.0040‡	–0.0020
	(0.0011)	(0.0022)	(0.0014)	(0.0012)	(0.0013)	(0.0014)	–
Age	–0.0002	0.0041‡	–0.0002	0.0006	–0.0002	0.0001	0.0041
	(0.0004)	(0.0008)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	–
Age Squared	0.0000	–0.0000‡	0.0000	–0.0000	0.0000	–0.0000	–0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	–
Male	0.0012	0.0123‡	–0.0112‡	–0.0015	–0.0065‡	0.0039†	–0.0018
	(0.0013)	(0.0026)	(0.0017)	(0.0014)	(0.0016)	(0.0016)	–
Married	–0.0036†	0.0183‡	0.0047†	0.0017	0.0026	–0.0084‡	0.0152
	(0.0016)	(0.0031)	(0.0020)	(0.0018)	(0.0019)	(0.0020)	–
No HS Diploma	0.0003	0.0217‡	0.0106‡	–0.0054†	–0.0078‡	0.0017	0.0211
	(0.0020)	(0.0040)	(0.0026)	(0.0022)	(0.0024)	(0.0025)	–
Some College	0.0001	–0.0182‡	0.0016	0.0031†	0.0001	–0.0015	–0.0149
	(0.0014)	(0.0028)	(0.0018)	(0.0015)	(0.0017)	(0.0017)	–
Black	–0.0007	0.0665‡	0.0010	–0.0258‡	–0.0079‡	0.0010	0.0341
	(0.0021)	(0.0041)	(0.0027)	(0.0023)	(0.0025)	(0.0026)	–
Asian	0.0079	0.0326‡	0.0511‡	–0.0377‡	–0.0142‡	–0.0155‡	0.0243
	(0.0044)	(0.0089)	(0.0058)	(0.0050)	(0.0054)	(0.0056)	–
Other	0.0019	0.0316‡	0.0054	–0.0133†	–0.0091	–0.0009	0.0156
	(0.0052)	(0.0104)	(0.0068)	(0.0059)	(0.0064)	(0.0066)	–
# Children	0.0042‡	–0.0025	–0.0020†	0.0032‡	0.0028‡	–0.0029‡	0.0027
	(0.0007)	(0.0013)	(0.0009)	(0.0008)	(0.0008)	(0.0008)	–

† indicates significance at 5% level and ‡ indicates significance at 1% level.

where $\delta_{i,j}$ is the Kronecker delta.

Table 5 reports the elasticity values for the high education sample and Table 6 reports the values for the low education sample. The income elasticity values are relatively similar. Both samples find bread, dairy, and sodas and fruit juices to be necessities due to their income elasticity values being less than one. The uncompensated cross-price elasticity values provide clear evidence that the behavior of high-educated households differs from low-educated households.

First, consider the own-price elasticity estimates for dairy products and unhealthy foods. The own-price estimate for diary products is –1.2583 for high-educated households and –0.7481 for low-educated households, while the unhealthy foods estimate is –2.7811 for high-educated households and –1.5633 for low-educated households. The low education elasticity estimate is inelastic for dairy products and elastic for unhealthy foods, however in both cases the elasticity estimate is relatively more inelastic for low-educated households than high-educated households. This means that low-educated households will bear a larger share of a tax on either food since high-educated households are more responsive to price changes. Taxing unhealthy foods discourages consumption of unhealthy foods by all households, however high-educated households will decrease their consumption more.

The behavior of high-educated and low-educated households is comparable for soda and fruit juice consumption. The own-price estimate is –1.2240 for high-educated households and –1.4581 for low-educated households. Therefore a 1% increase in the price of sodas and fruit juices will decrease consumption by 1.2240% for high-educated households and 1.4581% for low-educated households. Note though there is a tension between the tax's ability to discourage consumption versus its ability to raise revenue. The more elastic demand is, then the greater the ability of the tax to discourage consumption. However this means the tax will be less effective in raising revenue since there are fewer consumers.

The cross-price elasticity estimates also indicate that the behavior differs between the two samples. The cross-price elasticity of unhealthy foods with respect to the price of meat is 0.2977 and with respect to the price of fruits and vegetables is –0.2857 for high-educated households. The same two estimates are –0.0646 and 0.9280 for low-educated households. Therefore high-educated households find unhealthy foods and meats to be substitutes but unhealthy foods and fruits and vegetables are complements, while the low-educated households find the reverse. It is less clear how the cross-price elasticity information should be used to guide tax policy. This is why the tax reform calculations are needed.

Table 5: Elasticity Estimates High Education Sample

	Bread Price	Meat Price	Fruit Price	Dairy Price	Unhealthy	Soda Price	Misc Price
Income Elasticities:							
	0.8836	1.1345	0.9974	0.8694	1.0422	0.8089	1.0639
Uncompensated Elasticities:							
Bread & Cereal	–1.3272	–0.6304	–0.9898	0.5889	1.0262	1.1847	–0.7360
Meat	–0.3797	–1.6457	–0.0964	0.2552	–0.0455	–0.6073	1.3849
Fruit & Vegetables	–0.7099	–0.0957	–1.2594	–0.0744	0.6456	–0.1131	0.6096
Dairy Products	0.5149	0.4394	–0.0750	–1.2583	–0.6126	0.3026	–0.1804
Unhealthy Foods	1.0339	–0.0648	0.9280	–0.7311	–2.7811	–0.6110	1.1838
Soda & Fruit Juice	1.5879	–1.3745	–0.1878	0.4719	–0.7776	–1.2240	0.6953
Miscellaneous Foods	–0.3742	1.1837	0.4010	–0.1305	0.5517	0.2194	–2.9151
Compensated Elasticities:							
Bread & Cereal	–1.2305	–0.4610	–0.8528	0.6989	1.1209	1.2571	–0.5326
Meat	–0.2555	–1.4281	0.0795	0.3963	0.0760	–0.5144	1.6461
Fruit & Vegetables	–0.6008	0.0956	–1.1048	0.0496	0.7524	–0.0314	0.8393
Dairy Products	0.6100	0.6061	0.0598	–1.1501	–0.5194	0.3738	0.0198
Unhealthy Foods	1.1480	0.1351	1.0896	–0.6014	–2.6694	–0.5256	1.4238
Soda & Fruit Juice	1.6764	–1.2193	–0.0624	0.5725	–0.6910	–1.1578	0.8815
Miscellaneous Foods	–0.2578	1.3878	0.5660	0.0018	0.6657	0.3066	–2.6701

Table 6: Elasticity Estimates Low Education Sample

	Bread Price	Meat Price	Fruit Price	Dairy Price	Unhealthy	Soda Price	Misc Price
Income Elasticities:							
	0.8669	1.1009	1.0323	0.8380	1.0560	0.8060	1.0867
Uncompensated Elasticities:							
Bread & Cereal	–0.8830	–0.5963	–0.5806	0.5974	0.3802	0.6175	–0.4020
Meat	–0.2915	–1.7632	0.0584	0.0023	0.1320	–0.4455	1.2067
Fruits & Vegetables	–0.4781	0.1161	–1.0208	–0.3021	–0.2335	0.0931	0.7930
Dairy Products	0.5371	0.0427	–0.3164	–0.7481	–0.3982	0.3495	–0.3045
Unhealthy Foods	0.3490	0.2977	–0.2857	–0.4609	–1.5633	–0.3091	0.9164
Soda & Fruit Juices	0.6960	–1.0373	0.1582	0.4340	–0.3271	–1.4581	0.7282
Miscellaneous Foods	–0.2367	1.3699	0.5058	–0.2137	0.4816	0.2901	–3.2836
Compensated Elasticities:							
Bread & Cereal	–0.7909	–0.3961	–0.4653	0.7007	0.4748	0.6990	–0.2221
Meat	–0.1747	–1.5089	0.2047	0.1335	0.2522	–0.3419	1.4351
Fruits & Vegetables	–0.3685	0.3546	–0.8836	–0.1791	–0.1208	0.1903	1.0072
Dairy Products	0.6260	0.2362	–0.2050	–0.6482	–0.3068	0.4284	–0.1307
Unhealthy Foods	0.4611	0.5416	–0.1453	–0.3351	–1.4481	–0.2097	1.1355
Soda & Fruit Juices	0.7816	–0.8511	0.2654	0.5301	–0.2391	–1.3822	0.8954
Miscellaneous Foods	–0.1213	1.6209	0.6502	–0.0842	0.6002	0.3923	–3.0582

7 Tax Reform

The efficiency cost of taxation is created by the distortion in household behavior. Households make an optimal consumption choice based on the prices they face. Imposing taxes causes households to deviate from their optimal choice in a world without taxes and it is this deviation that is the efficiency cost. Therefore the objective of optimal tax design is to raise the necessary revenues in a manner that minimizes this efficiency cost.

If households have well-informed preferences over diet and health then their consumption choice is optimal even if it is not considered the most healthy. However if households are not well-informed about diet and health, then their consumption choice is not optimal. Moreover if the tax regime is designed to encourage the healthy eating that the consumer desires, but is unable to achieve due to lack of proper nutrition education, then taxing unhealthy foods can lead to a more optimal solution.

The following tax reform examines how incorporating health considerations changes the design of the optimal tax regime. The tax regime is calculated twice. First, the government calculates the tax regime while respecting the preferences of all households. The government is only focused on optimal tax considerations in this scenario; the goal is to minimize the efficiency costs of taxes. The tax regime is calculated a second time, however now the government only respects the preferences of the high-educated households who are assumed to be well-informed about diet and health. This incorporates health considerations into the design of the tax regime because the government only considers the behavior of those who are assumed to have correct preferences.

Let $v^e = v(p, m^e)$ denote the indirect utility of high-educated households and π^e their proportion. Similarly, let $v^u = v(p, m^u)$ denote the indirect utility of low-educated households and π^u their proportion. Naturally, $\pi^e + \pi^u = 1$. The iso-elastic social welfare function introducted by Atkinson (1973) is:

$$\begin{aligned} W &= \frac{1}{1-\eta}\left[\pi^e\left(v^e\right)^{1-\eta} + \pi^u\left(v^u\right)^{1-\eta}\right], \qquad && \eta \neq 1 \text{ and } 0 \leq \eta < \infty, \qquad (11) \\ &= \left[\pi^e \ln v^e + \pi^u \ln v^u\right], && \eta = 1. \end{aligned}$$

where $\eta \geq 0$ denotes the inequality aversion index. If $\eta = 0$, the social welfare function reduces to the utilitarian function and if $\eta \to \infty$, the social welfare function reduces to the Rawlsian function.

Consider increasing the tax rate for any good $j = 1, 2, \ldots, n$ from its existing price by a "small amount." The change in social welfare is:

$$\frac{\partial W}{\partial t_j} = \pi^e \left(v^e\right)^{-\eta} \frac{\partial v\left(p, m^e\right)}{\partial t_j} + \pi^u \left(v^u\right)^{-\eta} \frac{\partial v\left(p, m^u\right)}{\partial t_j}. \tag{12}$$

This is the marginal value of the last "dollar" of tax revenue. Since it is measured in utility terms, it is necessary to translate it to dollar terms via the social welfare value of a dollar:

$$\delta \equiv \frac{\partial W}{\partial m} = \pi^e \left(v^e\right)^{-\eta} \frac{\partial v\left(p, m^e\right)}{\partial m^e} + \pi^u \left(v^u\right)^{-\eta} \frac{\partial v\left(p, m^u\right)}{\partial m^u}. \tag{13}$$

The government tax revenue function is

$$T = \sum_{i=1}^{n} t_i \left[\pi^e x_i\left(p, m^e\right) + \pi^u x_i\left(p, m^u\right)\right]. \tag{14}$$

Increasing the tax rate on good j by a "small amount" will change tax revenue by:

$$\begin{aligned} \frac{\partial T}{\partial t_j} &= \sum_{i=1}^{n} t_i \left[\pi^e \frac{\partial x_i\left(p, m^e\right)}{\partial p_i} + \pi^u \frac{\partial x_i\left(p, m^u\right)}{\partial p_i}\right] + \\ & \quad \left[\pi^e x_j\left(p, m^e\right) + \pi^u x_j\left(p, m^u\right)\right]. \end{aligned} \tag{15}$$

This allows one to calculate the marginal social cost of the last "dollar" raised by taxing good j to be

$$\mu_j \equiv \frac{\left(\partial W / \partial t_j\right) / \delta}{\partial T / \partial t_j}. \tag{16}$$

The government respects the preferences of both high-educated and low-educated households in this situation. The optimal tax regime is determined by optimal tax considerations only.

Now consider the case where the government believes the preferences of low-educated households are incorrect. The government, now motivated by health considerations in addition to optimal tax considerations, designs the tax regime with respect to the preferences of high-educated households. Define $v^{eu} = v^e\left(p, m^u\right)$ to be the indirect utility function for low-educated households when they are assumed to have the preferences of high-educated households. The marginal social cost of the last "dollar" raised by taxing good j is still represented by equation (16).

Now though the social welfare function is

$$\begin{aligned} W &= \frac{1}{1-\eta}\left[\pi^e (v^e)^{1-\eta} + \pi^u (v^{eu})^{1-\eta}\right], & \eta \neq 1 \text{ and } 0 \leq \eta < \infty, \\ &= \left[\pi^e \ln v^e + \pi^u \ln v^{eu}\right], & \eta = 1. \end{aligned} \tag{17}$$

The marginal value of the last "dollar" of tax revenue now becomes

$$\frac{\partial W}{\partial t_j} = \pi^e (v^e)^{-\eta} \frac{\partial v(p, m^e)}{\partial t_j} + \pi^u (v^{eu})^{-\eta} \frac{\partial v^e(p, m^u)}{\partial t_j}. \tag{18}$$

The social welfare value of a dollar also needs to be adjusted:

$$\delta \equiv \frac{\partial W}{\partial m} = \pi^e (v^e)^{-\eta} \frac{\partial v(p, m^e)}{\partial m^e} + \pi^u (v^{eu})^{-\eta} \frac{\partial v^e(p, m^u)}{\partial m^u}. \tag{19}$$

Note low-educated households still use their preferences to determine their consumption. Therefore the tax revenue function is unchanged. It is only in the social welfare function where the government assumes all households have the preferences of high-educated households. Comparing the marginal social cost between the two scenarios shows how incorporating health benefits changes the design of the optimal tax regime.

8 Appendix A: Composition of Food Demand Categories

The food categories for the demand model are created using both the aggregate food and individual food expenditures reported by the Diary Survey. The majority of the Diary Survey aggregate categories are used as defined by the BLS, however there are three aggregate categories which are disaggregated because they contain both healthy and unhealthy food items.

The bakery products category is separated into healthy bread items, which fall into the cereals and breads category, and unhealthy dessert items, which fall into the unhealthy foods category. Similarly processed fruits is separated into the healthy fruits, which fall into the fruits and vegetables category, and the unhealthy fruit juices, which fall into the sodas and juices category. Lastly, nonalcoholic beverages are separated into sodas, which fall into the sodas and fruit juices category, and other beverages, which fall into the miscellaneous foods category.

- cereals and breads: cereal and cereal products and bakery products (white bread; bread other than white; fresh biscuits, rolls, muffins; crackers; bread and cracker products);
- meats: beef, pork, poultry, fish and seafood, other meats, eggs;
- fruits and vegetables: fresh fruits, fresh vegetables, processed fruits (frozen fruits, canned fruits, dried fruits), processed vegetables;
- dairy products: fresh milk and cream, other dairy products;
- unhealthy foods: bakery products (cakes and cupcakes; cookies; doughnuts, sweet rolls, coffee cakes; frozen refrigerated and canned bakery products; pies, tarts, turnovers), sugar and other sweets, fats and oils;
- sodas and fruit juices: nonalcoholic beverages (cola drinks, other carbonated drinks, noncarbonated fruit flavored drinks), processed fruits (frozen orange juice, frozen fruit juices, fresh fruit juices, canned/bottled fruit juices);
- miscellaneous foods: miscellaneous foods, nonalcoholic beverages (coffee, tea, other noncarbonated beverages).

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