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Obesity and Price Sensitivity at the Supermarket

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Abstract

In this paper, we employ a rich data set at the individual level in order to examine which factors are most highly correlated with obesity. Our main result is that, even after controlling for income levels and other factors, high "price-sensitivity" for food products is associated with high obesity rates. We find that a woman of average height who stated that prices were "not important at all" when purchasing food products had a weight circumference 4.5 centimeters (roughly 1.8 inches) smaller than those who stated that price was "very important." We also show that this price effect is not limited to those with low income levels.

KEYWORDS: obesity, price sensitivity

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1. Introduction

Obesity is a serious health condition since excessive body mass is an important risk factor for cardiovascular disease, stroke, hypertension, Type 2 diabetes and some cancers. Over the last three decades, the number of people suffering from obesity has tripled. According to the World Health Organization (WHO) there are over one billion overweight adults, 300 million of whom are obese. Additionally, childhood obesity is a very serious problem and has reached 'epidemic' levels in some countries.[1] The cost of treating obese individuals has put huge strains on government healthcare budgets.

Two competing theoretical approaches try to explain the 'economics of obesity.' According to the first theory, obese individuals are irrational in their decisions due to a lack of health and nutrition information. Proponents of this theory argue that the best way to reduce the problem of obesity is to increase the awareness of the public about the risks associated with obesity. The second approach argues that obesity is a 'rational' outcome of changes in technology, relative prices, and income. Lakdawalla and Philipson (LP 2002) and Lakdawalla et. al. (2005) argue that technological innovations have led to weight increases over time in the population by making production (both at home and at work) less demanding physically. They also argue that engaging in physical activity has become more expensive, both in terms of the direct cost, as well as the opportunity cost of time. In the case of income, these studies argue that the relationship between obesity and income may be an inverted "U" shape. This is because both food and being healthy (skinny) are normal goods; they postulate that food effect likely dominates for low income individuals, while the being healthy (skinny) effect dominates for wealthier individuals.

Advancements in science and technology (and in some cases subsidies) have made “junk” food less expensive and fruits and vegetables more expensive. Data collected from a Seattle supermarket by Drewnowski (2004) suggest that, *per calorie*, carrots cost virtually five times more than cookies or potato chips and orange juice costs virtually five times as much as soft drinks. The difference (in price per calorie) has been increasing in the U.S. in recent years. Pollan (2007) notes that between 1985 and 2000, fruit and vegetable prices in the US increased by about 40% while the price of soft drinks dropped by 23%. According to Pollan (2007), the change in relative prices is primarily due to the U.S, farm bill, which provides generous subsidies for corn and soy, which are prime ingredients in high-density “processed food.” Corn syrup, for example, is the primary ingredient in most soft drinks. The farm bill provides virtually no help to farmers growing fresh produce. Although the differences vary from country to country, the

[1] See the WHO website: http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/

phenomenon that high-energy density foods are less expensive per calorie than fresh fruits and vegetables is fairly universal.[2]

Many authors believe that the high price of fruits and vegetable prevents low-income individuals and families from consuming these foods and that the relatively low price of high density foods has led to an increase in the consumption of the high density foods. According to Drewnowski and Barratt-Fornell (2004), dry snack (or junk) foods like chocolate, French fries, cookies, and candy all contain very little water, and consequently may cause more weight gain than fruits and vegetables. These high-density processed foods are typically much less expensive per calorie than corresponding healthy ones.

There is empirical evidence that increased obesity is due, in part, to increased caloric consumption. In a longitudinal study, Cutler et. al (2003) document that Americans have become increasingly obese over time and argue that the increase is primarily due to increases in food consumption. Using country-level data over time from several developed countries, Bleich et. al (2007) find additional evidence that increased obesity is due to increased caloric consumption. There is also evidence that obesity is a problem for those with lower socioeconomic status. Using longitudinal data from National Longitudinal Survey of Youth, Baum and Ruhm (2007) find that while body weight changes with the age, for a given age, weight is negatively correlated with socioeconomic status and that the differences between the different socioeconomic groups increase with age. Murcott et. al (1993) find survey evidence that the working class mothers preferred "filling" food that was high in fat and sugar content and low in price.

In this paper, we employ a rich data set at the individual level in order to examine which factors are most highly correlated with obesity. We are certainly not the first to write on the issue of obesity (as our discussion in this introduction indicates.) The individual level cross-section data set we employ, however, has several unique features that enable us to examine issues that were not addressed by previous work. Our data set, which comes from the very thorough 1999-2001 (MABAT) Israeli Health and Nutritional Survey,[3] has the following measures that typically are not available in other data sets: Researchers who built the database we employ *measured* the waist circumference (WC), as well as the weight and height of the individuals in the study. The latter two measures enable calculation

[2] The phenomenon is not limited to the developed world. Abay (2006) concludes that Egypt's food subsidy program, which reduces price of the dense caloric food, may be in part responsible for increased obesity for women with children.

[3] As noted, the survey was carried out from 1999-2001. In our robustness analysis, we control for the date each individual was surveyed in order to control for changes in 'general economics conditions' over the time period the survey was administered. As we report in section 5, our results are robust to including the date each individual was surveyed.

of the Body Mass Index (BMI), which is weight in kilograms divided by height squared (where height is in meters). BMI is the most widely used index for body size and is equal to the weight of the individual in kilograms divided by height squared (in meters). A BMI greater than or equal to 30 is a commonly used proxy for obesity. In most other studies, researchers must rely on self-reported levels of weight and height – and there is evidence from Cawley and Burkhauser (CB 2006) that overweight individuals are more likely to under-report their weight (and hence BMI).[4,5]

Perhaps more importantly, we have data on (measured) waist circumference; data on waist circumference are typically not available. Women with waist circumferences greater than 88 cm in women, and men with waist circumferences greater than 102 cm are considered obese. Waist circumference is probably a more attractive proxy for obesity than BMI. Bray, Bouchard, and James (1998) and CB (2006) emphasize that it is not just the amount of fat that matters for health, but rather the location – and abdominal obesity (a large amount of fat near the internal organs and the waist) is correlated with morbidity. Hence, in this paper, we will primarily employ WC; we divide WC by height (WC/H) to create a measure that, like BMI, is adjusted for height. (WC/H has a nice interpretation: it is weight circumference as a percentage of height.) Our results are qualitatively unchanged whether we use WC/H, WC, or BMI as our proxy for obesity.[6]

Finally, we have data on *price sensitivity* for food products. Regarding this last point, consumers were asked the following question: When you buy food, how important is price. The range is from 0 to 3, where "0" means that price is "not important at all," "1" means "not too important, "2" means "important," and "3" means "very important." Since *price sensitivity* is the prime variable of interest and since it is still the case that women make most of the family food purchases in Israel, we conducted the analysis for women.

In section 2 below, we show that those for whom price is very important consume fewer vegetables (and other expensive food products) and more inexpensive food products like junk-food (i.e., candy and sugars) than those for

[4] We have self-reported data as well and the same effects exist in our data set.

[5] Using other measures of obesity (that are not available for most studies), CB (2006) found that using BMI to classify obesity resulted in a false-positive rate of 10% for men, i.e., 10% of the men classified as obese by BMI were not obese according to other measures of obesity. In the case of women, however, the false positive rate was less than 2%. This result is due, in large part, to the fact that, for a given volume, muscle weighs more than fat and, on average, men are much more muscular than women. This suggests that BMI is not a particularly good measure of obesity for men, but is indeed a relatively good measure of obesity for women.

[6] When we use WC/H as our proxy for obesity in our main regression in Table 4, we have a higher adjusted R squared value (0.28) than when we use WC alone (0.22) or BMI (0.17). See the regressions in Table 4 below and in the appendix.

whom price is not important at all when making food purchases. Hence *price sensitivity* is associated with real behavior associated with food consumption and is meaningful.

Our main result is that, even after controlling for income levels and other factors, greater food "price-sensitivity" is associated with a higher obesity rate. When we use WC/H as our proxy for obesity, we find that women (of average height) who stated that price was not important at all when purchasing food products had a waist circumference 4.5 centimeters (roughly 1.8 inches) smaller than those who stated that price was "very important." When we use BMI as a proxy for obesity, we find that women who stated that price was not important at all when purchasing food products had a Body Mass Index (BMI) 1.3 units below those who stated that price was "very important." This suggests that our results are robust to using different proxies for obesity. Further, we found that similar results obtained for individuals with income above the median level as well as below the median level. This suggests that the "price sensitivity" effect is not confined just to those with lower socioeconomic status. We also find some empirical support for the inverted "U" shaped relationship between income and obesity postulated by LP (2002) and Lakdawalla et. al. (2005).

Our study is related to the literature that examines the relationship between obesity and food prices. Gustavsen and Rickertsen (2009) find that obesity is more likely among those who consume large amounts of sugar-sweetened carbonated soft drinks (SSCSD) than it is among those who do not consume much SSCSD. They also find that an increase in price reduces the absolute consumption of 'heavy' consumers of SSCSD by more than it reduces the absolute consumption of SSCSD among 'light' consumers of SSCSD. Using experimental methods, Epstein et al. (2007) find that non-obese mothers were more likely than obese mothers to substitute healthy, low-energy density food when the price of high-energy-density (junk) food increased. Our paper uses 'researcher' measured data on both waist circumference divided by height (WC/H) and BMI. It also examines a different aspect of the association between food price sensitivity and obesity than these studies. Further, our paper finds some empirical support for the inverted "U" shaped relationship between income and obesity. Hence, our results are complementary to these studies and add to the literature that examines the relationship between food price sensitivity (and income), and obesity.

2. Data

2.1 Background

Despite the wide availability of fresh fruit and vegetables, Israelis are eating more processed food, and obesity is a serious and growing problem in the country. Like most of the developed world, BMI levels in Israel are much higher now that they were in the past. In 1986, results from a less thorough survey in Israel indicate that the average BMI of men aged 25-64 was 25.8 (vs. 26.8 in the recent MABAT survey,) while the average BMI of women aged 25-64 was 24.9 (vs. 27.1 in the recent MABAT survey.)[7] The average BMI of women rose by 9% from 1986 to 2001, while the average BMI of men rose by 4% over the same period.

Data from the MABAT survey show that 22.6% of all adults are obese (i.e., they have a BMI above 30). Thus, the percent of obese individuals in Israel is fairly similar to that of the United States. Child obesity is a growing problem in Israel as well. Gross et. al (2009) studied more than 1 million (17 year old) male draftees into the Israeli army from 1967 to 2003 and found that obesity levels in this group tripled over that period.

2.2 Price Sensitivity, Prices, and Consumption Patterns

In order to show that *price sensitivity* is a meaningful measure, in this section, we examine food prices in Israel, and consumption patterns for individuals in our data set as a function of their relative price sensitivity.

Like most countries, food prices (per calorie) in Israel are high for fresh produce such as fruit and vegetables relative to the prices of processed foods. Prices per 100 Kcal (for 2001) -- shown in Figure 1 below -- are such that vegetables (and chicken breasts) cost roughly three times that of candy (per calorie), while fruits cost more than three times as much as white bread.[8]

Here, we briefly compare the consumption patterns of (i) women who reported that price is not important at all (price=0) and (ii) women who reported that price is very important (price=3) when purchasing expensive, moderate, and inexpensive food products. In the case of less healthy (and relatively inexpensive)

[7] The 1986 data are from a study that is summarized at the World Health Organization's web site. See http://apps.who.int/infobase/reportviewer.aspx?rptcode=ALL&uncode=376&dm=5&surveycode=101220ae1, last accessed June 2, 2009.

[8] The vegetable price index in Figure 1 includes frequently consumed vegetables (tomatoes, cucumbers, carrots, squash), while the fruit index includes frequently consumed fruits and the price used is the "in season" price.

alternatives, Table 1 below shows that individuals for whom price is a very important factor, eat on average 48% more sugars and 8% more candy and drink 2% more soft drinks than those for whom price is not important at all. In the case of more healthy (and more expensive) alternatives, Table 1 below shows that individuals for whom price is a very important factor, eat on average 9% fewer vegetables and 11% less chicken. In the case of moderately priced products, individuals for whom price is very important drink 7% fewer fruit juices, and eat on average 23% more fruit than those for whom price is not important at all. This final result is likely due in part to the fact that vegetables are 56% more expensive per calorie than fruits in Israel. Although these differences are not statistically significant, these results suggest that women who consider price very important when making food purchases eat a less healthy diet. This suggests that price sensitivity is a meaningful measure for our analysis.

		Price is not important at all (N=162)	Price is very important (N=198)
Food category	Cost of item	Mean Quantity (grams)	Mean Quantity (grams)
Vegetables	Expensive	214.0	195.0
Poultry	Expensive	43.6	38.7
Fruit	Moderate	159.8	196.4
Fruit Juices	Moderate	29.7	27.5
Sugars, Sweeteners	Inexpensive	22.5	33.2
Candy, Chocolate	Inexpensive	3.7	4.0
Soft Drinks	Inexpensive	201.2	205.2

Table 1: Consumption of different types of food, in grams per day

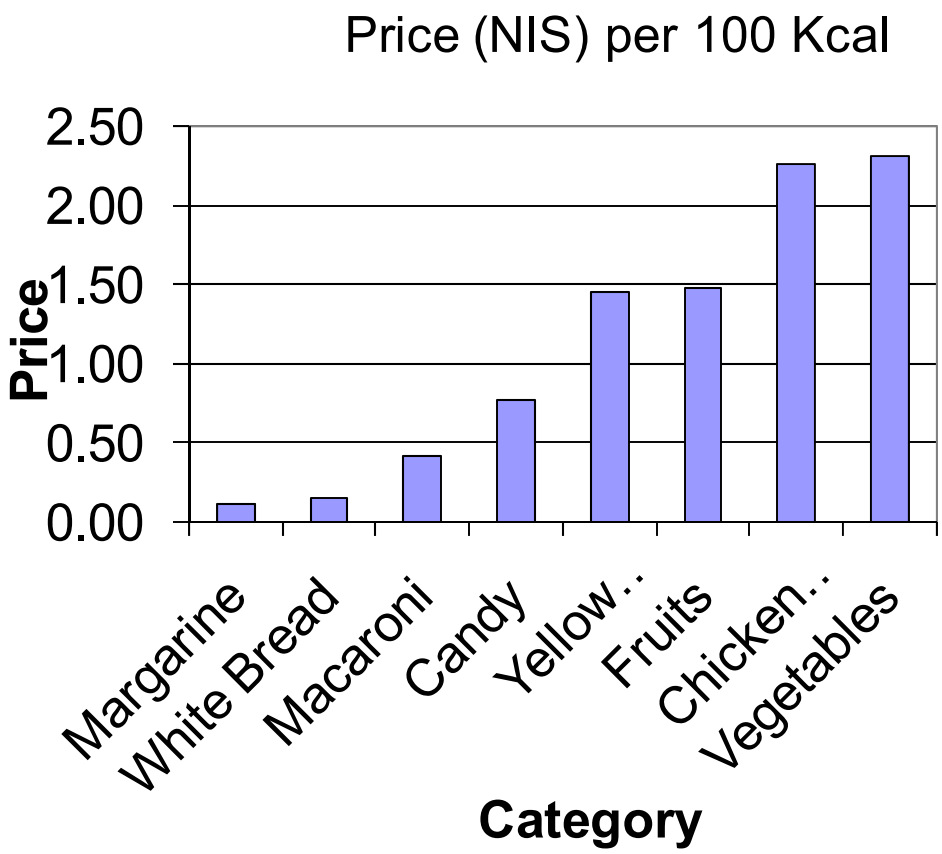

Figure 1: Price per Kcal, Israel 2001[9]

2.3 Variables Employed for the Study

The following variables are available for the study:

Age – Age in years

BMI – "Researcher Measured" Body Mass Index (BMI)

WC – "Researcher Measured" Waist Circumference in centimeters

[9] Sources: Israeli Ministry of Health for the conversion between weight of food in grams and calories and the Israeli Central Bureau of Statistics for prices per gram. The prices are in New Israeli Shekels (NIS). The average exchange rate during the survey period was approximately $1=4 NIS.

WC/H – "Researcher Measured" Waist Circumference (centimeters) / Height (meters)

Majority – a dummy that takes on the value one if the individual is Jewish

Education – the number of years of schooling

Income – the monthly household income in the following ranges

1. Less than 1440 NIS
2. 1440 – 3000
3. 3001-4500
4. 4501-6000
5. 6001-9000
6. 9001-12000
7. 12000-15000
8. 15000-18000
9. 18001-24000
10. Greater than 24,000

Price – The answer to the following question: When you buy food, how important is price. The range is from 0 to 3, where "0" means that price is "not important at all," "1" means "not too important, "2" means "important," and "3" means "very important." From this variable, we define four dummy variables:

Price_0 = equals one if Price=0 and 0 otherwise.
Price_1 = equals one if Price=1 and 0 otherwise.
Price_2 = equals one if Price=2 and 0 otherwise.
Price_3 = equals one if Price=3 and 0 otherwise.

Active – a dummy variable that takes on the value one if the individual is active.[10]

Quantity – total quantity of food consumed per day (in grams)

Summary Statistics are shown in Table 2:

[10] The survey defined active as "having regularly engaged in physical activity during leisure hours, lasting 20 minutes or more (at least three times a week,) that led to rapid breathing and perspiration."

Variable	Mean	Std. Deviation	Minimum	Maximum
WC	85.89	13.03	61	140
WC/H	53.7	8.46	36.4	86.4
BMI	27.11	5.49	16.8	47.9
Age	42.85	10.79	25	64
Majority	0.79	0.41	0	1
Education[11]	12.54	3.97	0	22
Price	1.67	0.93	0	3
Price_0	0.14	0.35	0	1
Price_1	0.22	0.41	0	1
Price_2	0.46	0.50	0	1
Price_3	0.18	0.38	0	1
Income	4.60	1.80	1	10
Active	0.33	0.47	0	1

Table 2: Descriptive Statistics[12]

In the case of price sensitivity, Table 2 shows that 14 percent said that price was not important at all while buying food products, while 22 percent responded that price was not too important; 46 percent indicated that price was important, while 18 percent indicated that it was very important. Correlations among these and the other variables are shown in Table 3.

[11] A small number of women listed education levels less than nine years of schooling. Israel has compulsory education through this level, but it is possible that some people leave school early. In any case, removing these few observations has no effect on our results.

[12] N=1,127 for all variables except for WC and WC/H. We are missing data on waist circumference for sixty-six women. Hence waist circumference (WC) and WC/H have 1061 observations. When we use BMI as the dependent variable, we have 1127 observations.

	BMI	WC/H	Age	Majority	Edu	Price	Income	Active
BMI	1.00							
WC/H	0.88	1.00						
Age	0.34	0.43	1.00					
Majority	-0.11	-0.13	0.19	1.00				
Education	-0.26	-0.36	-.28	0.23	1.00			
Price	0.11	0.12	0.11	0.22	-0.03	1.00		
Income	-0.19	-0.26	-.11	0.27	0.50	-0.12	1.00	
Active	-0.03	-0.08	0.08	0.18	0.17	0.02	0.21	1.00

Table 3: Correlations among Variables: (N=1061)[13]

Table 3 shows that the highest correlation (0.50) among the independent variables is between education and income levels. The table shows that the correlation between price sensitivity (price) and income is relatively small: (-0.12). The correlation between BMI and WC/H is 0.88.

3. Analysis

In Table 4, we report the results of two regressions: (I) with measured WC/H as the dependent variable and (II) with measured BMI as the dependent variable. The independent variables are Age, Majority, Education, Price_1, Price_2, and Price_3, Income, and Active.

[13] We include 'price' rather than the (0,1) dummy variables in Table 3 for ease of presentation.

Dept Variable:	(I) Measured WC/H		(II) Measured BMI	
Independent Variables	Coefficient	T-statistic	Coefficient	T-statistic
Age	0.31	14.06	0.17	11.16
Majority	-3.42	-5.55	-2.09	-5.05
Education	-0.35	-5.03	-0.14	-3.14
Price_1	0.88	1.15	0.37	0.71
Price_2	1.48	2.15	0.70	1.50
Price_3	2.77	3.42	1.43	2.59
Income	-0.31	-2.07	-0.15	-1.49
Active	-0.86	-1.75	-0.12	-0.35
Constant	47.61	32.77	23.44	24.04
Observations	1061		1127	
Adjusted R^2	0.28		0.17	

Table 4: Dependent variables: (I) measured WC/H, (II) measured BMI

When discussing results from regressions with WC/H as the dependent variable, we use the average height for women in Israel: 1.63 meters. Table 4 shows that when we use WC/H as a proxy for obesity, a 45 year old woman of average height has a waist circumference 5.05 (0.31*10*1.63=5.05) centimeters larger than a 35 year old woman. Majority (Jewish) women have smaller waist circumferences than those of minorities (Christians, Moslem, Druze, etc.). Women with higher education have smaller waist circumferences and the effect is statistically significant. The estimated coefficient is such that four additional years of schooling is associated with a waist circumference that is 2.28 centimeters (0.90 inches) smaller.

The estimated coefficient on Income is negative and statistically significant (t=-2.07) and is such that an increase in a woman's family income from 7,500 NIS to 16,500 NIS a month is associated with a decrease in her waist circumference by 1.52 centimeters (0.6 inches). Table 4 also shows that those women who are active have a waist circumference 1.4 centimeters (0.55 inches) smaller than those women who are not active, and this effect is statistically significant (t=-1.75) at the 92% level.

In the case of price, women who stated that price was very important when buying food products had a waist circumference approximately 4.5 centimeters (roughly 1.8 inches) larger than those who stated that price was not important at all (and this effect is statistically significant (t=3.42).

The second regression in Table 4 also shows that older women have higher BMIs. Other things being equal, a 45 year old woman has a BMI level 1.7 units higher than a 35 year old woman. Majority (Jewish) women have lower BMIs than those of minorities (Christians, Moslem, Druze, etc.). Other things being equal, majority women have a BMI value approximately 2.1 units lower than minority women. Women with higher education have lower BMIs and the effect is statistically significant (-0.14, t=-3.14.) The estimated coefficient is such that four additional years of schooling is associated with a BMI level 0.56 units lower.

The coefficient on income (-0.14, t=-1.49) is negative although not statistically significant. The estimated coefficient on Income is such that an increase in a woman's family income from 7,500 NIS to 16,500 NIS a month is associated with a decrease in her BMI by 0.42 units. The second regression in Table 4 also shows that those women who are active have a BMI 0.12 units lower than those women who are not active, but this effect is statistically significant. In the case of price, women who stated that price was very important when buy food products had a BMI approximately 1.43 units above those who stated that price was not important at all and this effect is statistically significant (t=2.59.)

Hence, the results are similar regardless of which proxy for obesity we use. Since the adjusted R squared is much higher (0.28 vs. 0.17) in the first regression in Table 4, we will continue the analysis with this specification (WC/H as the dependent variable). As we discuss below, all of our results are robust to using either WC or BMI as our proxy for obesity.

4. Different Income Levels

It is often thought that obesity is primarily a problem for lower income households. In the case of women in households below (above) the median income, 32% (41%) replied that price was not important at all or not too important, while 68% (59%) replied that price was important or very important when buying food. Hence, while there are some differences between the two groups regarding price sensitivity to food products, it is important to note that many women in households with income above the median are quite sensitive to food prices.

In Table 5, using WC/H as the dependent variable, we separately run regressions for those with family income levels below the median family income and for those with income levels above the median family income.[14] The regressions in Table 5 show that our results regarding price sensitivity are robust to both high and low incomes. In particular, when we use WC/H as the

[14] The number of observations is not exactly equal, because we have income categories.

dependent variable, the estimated coefficient on Price_3 is virtually unchanged from Table 4 (2.89, t=2.41) for those with household incomes less than the median income. Similarly, for those with household incomes greater than the median income, the estimated coefficient on Price_3 (2.32, t=2.09) is again statistically significant as well. This suggests that sensitivity to food prices cuts across all income classes and is not just an issue for lower income households.

Dependent Variable: Measured WC/H				
Independent Variables	Women (< median income)		Women (> median income)	
	Coefficient	T-statistic	Coefficient	T-statistic
Age	0.30	8.97	0.34	10.78
Majority	-3.54	-4.28	-2.88	-2.94
Education	-0.49	-5.33	-0.11	-1.01
Price_1	1.05	0.87	0.70	0.72
Price_2	1.44	1.36	1.27	1.41
Price_3	2.89	2.41	2.32	2.09
Income	0.44	1.13	-0.43	-1.55
Active	0.50	0.66	-2.00	-3.14
Constant	47.51	20.40	44.20	18.43
Observations	516		545	
Adjusted R^2	0.28		0.19	

Table 5: household income (i) below and (ii) above median level

Table 5 also has an interesting result regarding income. LP (2002) and Lakdawalla et. al. (2005) note that, theoretically, there are two opposing effects when income increases. On one hand, since food is a normal good, individuals consume more when incomes increase. On the other hand, being attractive (and skinny) is a normal good as well. This would have an opposing effect on weight and waist circumference as income increases. They postulate that the former effect would dominate for individuals with relatively low incomes; the latter effect would dominate for individuals with relatively high incomes. Table 5 shows that the estimated coefficient on income is positive (0.44, t=1.13) for women with relatively low household incomes, while the estimated coefficient on income is negative (-0.43, t=-1.55) for women with relatively high household incomes. Although the results are not statistically significant, the signs of the coefficients in Table 5 are consistent with this theory.

There are other differences as well between the high and low income groups. The estimated coefficient on education is negative and significant (-0.49, t=-5.33) for the low income group, while the estimated coefficient on education is

statistically insignificant for the high income group. The estimated coefficient on physical activity is negative and significant (-2.00, t=-3.14) for the high income group; for the low income group there is no virtually association between physical activity and obesity.

5. Robustness

Our results are unchanged if we exclude minority women from the study. Additionally, nothing changes in our results if we include total quantities/calories consumed as a right-hand side variable in the regression analysis. This holds both for the case when we use WC/H as the dependent variable, as well as the case when we use BMI as the dependent variable.

When we employ the "log-log" functional form, where all variables (except 'dummy' variables) are in logarithms, we obtain qualitatively similar results, both in the case when WC/H is the dependent variable and in the case when BMI is the dependent variable. This suggests that our results are robust to alternative functional forms.

Further, nothing changes qualitatively if we use waist circumference (WC), rather than WC/H as our proxy for obesity. Tale A1 in the Appendix shows the results of a regression with the same independent variables as in Table 4 and WC as the dependent variable.

Finally, our results are qualitatively unchanged if we add a variable for the date in which the survey was taken. The survey was carried out from 1999-2001. When we control for date each individual was surveyed, in order to control for changes in 'general economic conditions,' we find that the estimated coefficient on Price_3 is virtually unchanged (2.84, t=3.49) from the first regression in Table 4 (2.77, t=3.42). This is also the case when we employ either BMI or WC as our proxy for obesity. Hence, our results seem quite robust.

Summary Remark

In this paper, we employed a rich data set at the individual level in order to examine which factors are most highly correlated with obesity. The individual level cross-section data set we employed had several unique features, the most important being (i) researcher measured data on proxies for obesity and (ii) data on *price sensitivity* to food products. Our main result is that, even after controlling for income levels and other factors, we find that high "price-sensitivity" for food products is associated with high obesity. Our results suggest that the price effect is not trivial and obesity is a problem that is not limited to those with low income levels.

Appendix: Regression with waist circumference as dependent variable

Dependent Variable: Measured waist circumference (WC)		
Independent Variables	Coefficient	T-statistic
Age	0.43	11.88
Majority	-6.98	-7.08
Education	-0.42	-3.79
Price_1	1.04	0.85
Price_2	1.95	1.77
Price_3	3.60	2.77
Income	-0.33	-1.37
Active	-1.31	-1.68
Constant	78.60	33.80
Observations	1061	
Adjusted R^2	0.22	

Table A1: Dependent variable: Measured waist circumference

Table A1 shows that our results are robust to using waist circumference as a proxy for obesity. Table A1 shows that other things being equal, a 45 year old woman has a waist circumference 4.3 centimeters larger (1.7 inches larger) than a 35 year old woman. Majority (Jewish) women have smaller waist circumferences than those of minorities (Christians, Moslem, Druze, etc.). Women with higher education have smaller waist circumferences and the effect is statistically significant. The estimated coefficient on income (-0.33, t=-1.37) is negative

although not statistically significant. Table A1 also shows that those women who are active have a waist circumference 1.31 centimeters smaller than those women who are not active, and this effect is statistically significant (t=-1.68) at the 90% level. In the case of price, women who stated that price was very important when buy food products had a waist circumference approximately 3.6 centimeters (1.4 inches) larger than those who stated that price was not important at all and this effect is statistically significant (t=2.77.)

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