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THE OBESITY EPIDEMIC: CAUSES AND CURRENT POLICY PERSPECTIVES

INTRODUCTION

During the past three decades, the United States and most of the rest of the developed world have experienced a rapid and sustained rise in the obesity rate. This trend has stimulated a considerable amount of research by economists and other social scientists dealing with its causes and with policies to combat it. The increase in obesity has extremely serious public health consequences because the condition is an important risk factor for premature death and for health problems including diabetes, coronary heart disease, hypertension, and asthma. Consequently, the persistent increase in obesity puts stress on the health care system and raises medical expenditures. The prevalence of obesity also has implications for productivity losses.

Obesity is measured by the body mass index (BMI), defined as weight in kilograms divided by height in meters squared (kg/m^2). According to the World Health Organization (1997) and the National Heart, Lung, and Blood Institute (1998), a BMI value between 20 and 22 is "ideal" for adults 18 years of age and older, regardless of gender, in the sense that mortality and morbidity risks are minimized in this range. Adults with a BMI greater than or equal to 25 are classified as overweight, and those with a BMI greater than or equal to 30 are classified as obese. An overweight child is defined as having a BMI above the 85th percentile based on age- and gender-specific growth charts, and an obese child is defined as having a BMI above the 95th percentile based on age- and gender-specific growth charts for children and adolescents.

The data displayed in Table 1 show that obesity rates in the United States remained steady from approximately 1960 until about 1980. Since then, they have increased dramatically. Between 1980 and 2000, the percentage of obese adults grew from 15 percent to 31 percent, and the percentage of obese children ages 6 through 19 rose from approximately 6 percent to 16 percent.[1] Hence, the number of obese adults doubled and the number of obese children almost tripled in a period of two decades. The most recent data in the table suggest a leveling of these trends for most age groups at unacceptably high values from a public health perspective. Currently, about one out of six children and one out of three adults is obese in the United States.

Some estimates indicate that the increasing prevalence of obesity accounts for approximately 300,000 deaths every year, next only to the preventable mortality associated with cigarette smoking (McGinnis and Foege 1993; Allison et al. 1999). In a more recent study, Flegal et al. (2005) report a smaller but still substantial figure of approximately 112,000 excess deaths related to obesity in the year 2000. This still exceeds the third and fourth leading causes—alcohol abuse and illegal drug use. Aggregate medical spending for the United States that is attributed to obesity accounted for approximately 10 percent of total annual medical expenditures in recent years (Rashad and Grossman 2004). Obesity costs more in annual medical care expenditures than cigarette smoking—around $147 billion in 2008 (Finkelstein et al. 2009)—because of the long and costly treatments for its complications. A large percentage of these costs are borne by Medicare, Medicaid, private health insurance companies, and ultimately by the population at large, rather than by the obese. To make matters worse, Americans spend $33 billion annually on weight reduction products (Rashad and Grossman 2004). There are often serious health risks associated with some of these products, which can further increase the costs of obesity.

These factors underscore why one of the targets of the Healthy People 2010 initiative of the U.S. Department of Health and Human Services (2000) was to reduce the adult obesity rate to 15 percent and the childhood obesity rate to 5 percent by 2010. The data in Table 1 clearly indicate that these goals will not be met. If society is to grapple effectively with today's obesity problem, it is essential to understand how and why obesity became a problem in the first place.

Possible Causes

Obesity is a complex public health problem that is related both to individual characteristics that are genetic or acquired and to the individual's economic environment. Medical research has identified a number of potential determinants of obesity, including genetic disposition. However, the stability of obesity until about 1980, and the continuous and dramatic increase since that year, suggest that genetics may not play a very prominent role in the upswing, as genetic change typically does not take place quickly.

Any model of obesity must explain at least some of the determinants of calories consumed and calories expended—the proximate causes of that outcome. This can be accomplished either by examining their direct impacts on obesity or their impacts on caloric intakes via food consumption and on caloric outtakes via physical activity. Since obesity is related to personal behavior and choices with regard to diet and exercise, it is natural to focus on factors and incentives that can influence the body weight of adults and children. Economists have much to contribute to this investigation, although the factors at work are multifaceted, and the policy prescriptions are by no means straightforward. Not surprisingly, most of their research has emphasized the roles of prices (defined broadly to include the time required to prepare and consume meals), the time required to exercise, and the value of that time.

For example, Lakdawalla and Philipson (2002) find that declines in the real prices of grocery food items can account for as much as 40 percent of the increase in the body mass index of adults between 1980 and 1994. Technological advances in agriculture caused grocery prices to fall, the authors show, and these declines caused consumers to demand more groceries. Government policy heightened the effect by encouraging production. Pollan (2003) points to a shift in the early 1970s toward direct farming subsidies as another source of the rise in caloric intake. The old system, an agricultural-support arrangement designed to discourage production of corn and other storable commodities, had much smaller effects on producers' decisions. But the new system, one that emphasized subsidies, encouraged farmers to harvest larger amounts.

Cutler, Glaeser, and Shapiro (2003) and Bleich et al. (2008) present evidence that important technological changes in the home kitchen have contributed to an increase in caloric consumption. Microwaveable meals and other foods that are easy to cook are desirable because they are quicker to prepare; they are also fattier and higher in caloric content. In turn, increases in labor force participation rates of women have created incentives to introduce these innovations by raising the cost of time allocated to meal preparation. However, based on time-series data for the United States and other developed countries, these authors conclude that reductions in calories expended due to less time allocated to physical exercise and other forms of active leisure cannot account for the rise in adult obesity.

More recent research has employed richer data and has focused on the price effects just discussed, while calling attention to some conceptual issues. In the latter area, the real price of food stopped falling in the mid-1990s, while obesity continued to rise. Moreover, Cawley (2010) notes that U.S. farm policy raises the prices of sugar and milk by limiting imports and through regional dairy agreements, respectively. He also notes that the cost of farm products represents a small fraction of the cost of food at the retail level. Lakdawalla and Philipson (2002) estimate the impact of food prices on body mass index by analyzing a panel of residents in U.S. cities who face differing food costs. They do not account for time-invariant and area-specific unobserved factors that may be correlated with price and weight by estimating regressions with individual or city fixed effects.

Using the appropriate fixed-effects specification, Goldman, Lakdawalla, and Zheng (forthcoming) investigate the effect of the price of a calorie (a general measure of the price of food) on BMI in the Health and Retirement Study. Individuals in this longitudinal data set were over the age of 50 when they were first interviewed in 1992. The authors use a sample of more than 3,000 individuals who were observed in four waves between 1992 and 2004 and allow current body weight to be related to past body weight. They find very modest short-term effects of the price of calories on body weight. The long-term effect, which allows for the reduction in BMI in a given year due to a price hike to reduce body mass index in future years, is much bigger but accrues slowly over time. Within 10 years, a 10 percent permanent increase in the price of a calorie is associated with a BMI reduction of between 2 and 3 percent. Within 40 to 50 years, the reduction amounts to approximately 5 percent. This reduction is modest from a clinical perspective but is nontrivial when applied to the population at large in light of the total growth in mean BMI over the last several decades.

Several studies have focused on the effects of high-calorie (unhealthy) and low-calorie (healthy) food prices on weight outcomes. The former has been measured by a fast-food restaurant price index and has been falling over time. The latter has been measured by a fruit and vegetables price index and has been rising over time. Chou, Grossman, and Saffer employ the Behavioral Risk Factor Surveillance System (BRFSS), which consists of

annual telephone surveys of persons of age 18 years and older conducted by state health departments in collaboration with the Centers for Disease Control and Prevention. Using data for persons 18 years of age and older in the BRFSS for the period 1984–1999, the authors report that the elasticity of BMI with respect to the real price of fast food is –0.04. That is, a 10 percent reduction in price increases BMI by 0.4 percent. Powell (2009) obtains an elasticity of –0.08 (that is, a 10 percent reduction in price increases BMI by 8 percent) for all youths ages 12 through 17 at baseline in the 1997–2000 waves of the National Longitudinal Survey of Youth. The survey is a representative national sample of youths who were between the ages of 12 and 16 as of December 1996. When Powell limits her estimates to youths whose mothers have at most a high school education, the elasticity rises to –0.13. Powell and Chaloupka (forthcoming), however, find no impact of the price of fast food on BMI among children below the age of 12 in the 1997 and 2002/2003 rounds of the Panel Study of Income Dynamics Child Development Supplement (PSID–CDS; see http://psidonline.isr.umich.edu/CDS/ for a description of this dataset). In the same panel, the elasticity of BMI with respect to the real price of fruits and vegetables is 0.25 for all children and 0.60 for children from low-income families. That is, these authors find that a 10 percent increase in inflation-adjusted prices of fruits and vegetables increases children's BMI by 2.5 percent, and the BMI of low-income children by 6 percent. These are important findings because children whose parents have low income or low education are more likely to be obese.

Meltzer and Chen (forthcoming) note that minimum wage labor constitutes a major production cost at fast-food restaurants, and more generally, in food consumed away from home. Hence, the 50 percent decline in the real minimum wage since 1968 has contributed to reductions in the real price of food consumed away from home and is expected to lead to increases in obesity. Using data from the BRFSS, they find that a $1 decrease in the real minimum wage is associated with a 0.06 increase in BMI. This relationship is significant across gender and income groups, and is largest among the highest percentiles of the BMI distribution. Real minimum wage decreases can explain 10 percent of the increase in BMI since 1970. They conclude that the declining real minimum wage rate has contributed to the increasing rate of obesity in the United States.

Chou, Grossman, and Saffer (2004) report that as much as two-thirds of the increase in adult obesity from 1980 through 2000 can be explained by the rapid growth in the per capita number of fast-food restaurants and full-service restaurants, especially the former. They also report that the very modest growth in the per capita number of fast-food and full-service restaurants accounts in large part for the stability of adult weight in the period from 1960 to 1980, before the first major obesity upswing. During that period, the per capita number of full-service restaurants actually fell. Hence, their study points to restaurant growth as the primary cause of increased obesity after 1980.

What caused this explosive restaurant growth? The principal driver seems to have been the increases in rates of labor force participation by women. As nonwork time for women became increasingly scarce and valuable over the last few decades, time devoted to at-home meal preparation decreased. Families began eating out more often. Indeed, Anderson, Butcher, and Levine (2003) find that the rise in average hours worked by mothers can account for as much as one-third of the growth in obesity among children in certain families. In part, the rise in obesity may have been an unintended consequence of encouraging women to become more active in the workforce.

Anderson and Matsa (2011) argue that the findings in the Chou–Grossman–Saffer study may reflect, in part, reverse causality because fast-food restaurants may choose to locate in areas with a high prevalence of obesity and a large demand for high-calorie food. To deal with this issue, they employ the exogenous placement of interstate highways in rural areas as an instrument for the per capita number of restaurants in a two-stage least squares estimation strategy. That is, the location of interstate highways are determined by considerations that are not related to factors that potentially influence obesity. On the other hand, once the highways are built, restaurants will choose to locate very near to these highways in order to serve the large number of highway travelers. This research design assumes that with the per capita number of restaurants held constant, highway proximity should have no impact on body weight. Using data for residents of rural counties in 11 states in the BRFSS during the years 1990–2005, Anderson and Matsa find that location near an interstate predicts restaurant availability. There is, however, no effect of predicted restaurant availability on BMI or on the probability of being obese. They present evidence from the Continuing Survey of Food Intake by Individuals (see http://www.ars.usda.gov/Services/docs.htm?docid=14392) that residents of rural areas consume fewer calories at home on days when they eat a meal at a restaurant. One problem with their study is that it pertains only to rural residents, almost all of whom are white, and may not generalize to the population at large.

Currie et al. (2010) present evidence that supports positive effects of fast-food restaurant availability on weight outcomes. Among ninth graders in California, a

fast-food restaurant within a tenth of a mile of a school results in a 5 percent increase in obesity rates. Among pregnant women in Michigan, New Jersey, and Texas, a fast-food restaurant within half a mile of residence results in an approximate 2 percent increase in the probability of gaining over 20 kilograms. They indicate that their results differ from those in the Anderson-Matsa study because most of the children and mothers they examine reside in urban areas and are minorities. Indeed, the weight gain effects for pregnant women are larger for blacks and Hispanics than for whites and are larger for women with, at most, a high school education than for those with some college or more.

Previously, we indicated that Anderson, Butcher, and Levine (2003) attribute part of the increase in childhood obesity to the growth in the attachment of women with children to the labor market. Based on data in the PSID-CDS, Fertig, Glomm, and Tchernis (2009) report that an increase in the fraction of time spent watching television raises BMI, while an increase in the fraction of time spent reading or listening to music lowers it. In turn, children of mothers who work more hours allocate a larger amount of time to watching television and a smaller amount of time to reading or listening to music. Hence, maternal supervision—the way in which children's time is allocated between activities—appears to play a role in the relationship between maternal hours of work and childhood obesity, although the magnitudes of the effects are modest.

The extent to which the findings just summarized contribute to an explanation of trends in childhood obesity is not clear-cut. The average amount of time children spent watching television actually fell from the late 1970s to 2005 (Chou, Rashad, and Grossman 2008). Of course, the trend may have differed for children whose mothers worked, compared to children whose mothers did not work. But no information is available on this issue. Moreover, the time that children allocate to playing electronic video games and using computers has risen over this period. Thus, it may be the case that the stability of trends in active leisure for adults summarized by Bleich et al. (2008) also holds for children. Put differently, the increase in the time allocated to video games and computers may have just offset the reduction in time spent watching television. The net result may have been no change in the time allocated to sports and other types of active leisure.

A problem with inferring changes in energy expenditure from time budget studies is that these studies are done sporadically and do not employ panels of the same individuals. Hence, it is worth noting that Zhao and Kaestner (2010) report that reductions in population density due to urban sprawl (a low density development pattern, which changes the built environment in which individuals reside) are associated with increases in obesity. More densely populated urban areas offer more transportation choices, are more compact, and have a variety of stores and activity centers within reach. All these factors should lower the cost of physical exercise and other forms of active leisure, and they could lead to lower rates of obesity. Government spending on roadwork and infrastructure may thus have an influence on the obesity rate by subsidizing sprawl.

Indeed, Zhao and Kaestner (2010) address the possible endogeneity of population density by exploiting the plausibly exogenous variation in population density caused by the expansion of the U.S. interstate highway system, which largely followed the original 1947 plan for the system. Estimates indicate that if the average metropolitan area had not experienced the decline in the proportion of population living in dense areas over the last 30 years, the rate of obesity would have been reduced by approximately 13 percent. The mechanism here may well be the negative consequences of sprawl as the proximate determinants of exercise. For example, the availability of parks and gyms and the cost of transportation have been shown to have important impacts on physical activity in studies by Sen, Mennemeyer, and Gary (forthcoming) and by McInnes and Shinogle (forthcoming). Sprawl increases the amount of time required to travel to these facilities and the cost of this travel.

Chou, Grossman, and Saffer (2004) appear to have unmasked a final and very surprising culprit in the alarming rise in obesity: the crackdown on smoking via tax increases. Higher cigarette taxes and higher cigarette prices have caused more smokers to quit, but these smokers seem to have begun eating more as a result. Clearly, those who curtail their habit or quit smoking altogether typically gain weight as the appetite-suppressing and metabolism-increasing effects of smoking come to an end. According to their research, each 10 percent increase in the real price of cigarettes produces a 2 percent increase in the number of obese people, other things being equal.

The price effect just reported has the potential to contribute a significant amount to an explanation of the upward trend in obesity since the inflation-adjusted price of cigarettes has risen by approximately 164 percent since 1980. This large growth resulted in part from four federal excise tax hikes, a number of state tax hikes, and the settlement of the state lawsuits filed against cigarette manufacturers to recover Medicaid funds spent treating diseases related to smoking. While Gruber and Frakes (2006) and Courtemanche (2009) show that the finding is sensitive to alternative specifications, Fletcher (2009) reports that individuals who quit smoking due

to the introduction of workplace smoking bans gained a substantial amount of weight. By making it more difficult to smoke, these bans raise the cost of this behavior.

These findings underscore the idea that social action can have unintended consequences. Oftentimes, there is a trade-off involved in achieving goals that society favors, such as increased food production, more workforce participation by women, and fewer smokers. Lower real food prices have significantly increased living standards. Expanded labor market opportunities for women have increased families' command of real resources and increased equality of opportunity. Cigarette smoking is still the largest cause of premature death among Americans; pushing smokers to quit will have obvious health benefits. Federal subsidies for highway construction have greatly improved transportation, which in turn has facilitated economic development. But the results that we have summarized also suggest that these efforts contributed to the rising prevalence of obesity. Whether public policies should be pursued that offset the unrecognized or ignored consequences of previous public policy that discouraged smoking, increased market opportunities, increased the availability of cheaper and high-calorie food, and improved transportation depends on the costs and benefits of these policies.

Rationale for Government Intervention

If obesity were purely a cosmetic problem, the pressing need for solutions to reverse it would not seem necessary. Yet obesity has been linked to various medical conditions and poor health outcomes. Clearly, obesity carries a high personal cost. But does it carry a high enough social cost to make it a concern of public policy? The case for government intervention is weakened if consumers are fully informed, and if the obese bear all the consequences of their actions. The case is strengthened if consumers do not have full information or something that reasonably approximates it, or if third parties like Medicare, Medicaid, private health insurance companies, and ultimately the nonobese end up bearing significant amounts of the costs.

In the case of children, one justification for government intervention is that society as a whole may reap substantial current and future production and consumption benefits from improvements in children's health. The case is strengthened because overweight children are extremely likely to become obese adults and because children are less likely to have information about the consequences of their actions or to heavily discount these consequences. The case is weakened because parents may more easily and immediately affect the choices made by their children than can the government.

Of course, the assumption that adult consumers have rational expectations about the frequency of their future consumption behavior has been shown to be violated in some settings. DellaVigna and Malmendier (2006), for example, analyze data from health club memberships and demonstrate that consumers' behavior regarding membership and attendance at health clubs is not consistent with standard models of preferences, but can better be explained by overconfidence about future self-control. For example, members who choose to join a club by paying a flat monthly fee pay more per visit than they would pay if they purchased a 10-visit pass. Along these lines, O'Donoghue and Rabin (1999, 2001) underline time-inconsistent and present-biased preferences and demonstrate the emergence of procrastination when choices involve immediate costs and delayed rewards. Consideration of such preferences is important in the case of obesity because attempts to lose weight typically involve immediate reduction in utility (a reduction of food consumption and an increase in physical effort to exercise), but a delayed benefit (weight loss and health benefits that are achieved after periods of effort). Thus, additional external incentives may be helpful in motivating overweight individuals to alter their behavior.

If certain goods harm consumers and if consumers have time-inconsistent and present-biased preferences, Gruber and Köszegi (2001) show that very stiff excise tax hikes or other policies to increase the cost of consuming the goods in question are required. But Becker (2009) interprets the upward trend in obesity as the response of rational and forward-looking consumers to past, current, and anticipated future medical innovations that have reduced and are expected to reduce the health consequences of being overweight. Bhattacharya and Packalen (2008) go one step further and point out that there is a positive externality from the upward trend in obesity because it induces medical research on, for example, heart attacks and diabetes that will benefit the nonobese as well as the obese.

Considering that Medicare and Medicaid finance about 40 percent of the medical care costs associated with obesity (Finkelstein et al. 2009), and that private group health insurance premiums are not adjusted for weight status, one might be tempted to say that obesity has, by definition, become a public concern. One important justification of public policy formulated around various interventions is that being obese generates negative externalities. Put differently, some of the costs generated by obese individuals are shouldered by others. For example, if an increase in the obesity rate in the population raises health insurance premiums for everybody because premiums are not adjusted for the risk of obesity-related illness, then nonobese individuals face

higher health insurance premiums imposed upon them by obese individuals. Furthermore, and more important from a social welfare point of view, obesity may generate moral hazard in insurance coverage. That is, pooled heath insurance may cause people to gain weight because weight gain is not associated with higher insurance premiums.

There is a wage penalty associated with being obese (for example, Cawley 2004; Tekin and Wada 2010; Mocan and Tekin forthcoming), which should act as a disincentive to being obese. On the other hand, Rashad, Kelly, and Markowitz (2009/2010) and Bhattacharya et al. (forthcoming) report that being insured leads to a greater BMI and a higher probability of being obese. On net, Bhattacharya et al. (forthcoming) conclude that health insurance does, to quote them, "make you fat" because health insurance allows individuals to engage in unhealthy behavior if it is believed that the consequences of such behavior may be rectified using medical interventions through health insurance.

Current Policy Options

With the caveats outlined in the previous section in mind, we discuss the potential impacts of some current policy options to address the obesity epidemic. A tax on sugar-sweetened beverages (sodas) is one policy lever that has attracted a good deal of recent attention (Brownell and Frieden 2009; Brownell et al. 2009).[2] For example, Brownell et al. (2009) propose an excise tax of 1 cent per ounce of soda, and argue that the associated 15–20 percent increase in soda price would curb soda consumption from 12 to 20 percent. They claim that even a conservative calculation based on this proposal reveals a decline in calorie consumption by 20 calories per person per day, which then translates into a weight loss of about 2 lbs. each year for the average person.

Recommendations of soft drink taxation are based on the assumption that the demand for soda is reasonably price sensitive. More specifically, it has been assumed that the price elasticity of the demand for soda is in the range of –0.80 to –1.0. This suggests that a 10 percent increase in the price of soda, say due to a tax, would generate a decrease in soda consumption by 8–10 percent. When using this estimate of the price elasticity, researchers and public health officials refer to Andreyeva, Long, and Brownell (2010), which is a review of earlier studies on price elasticities of various food categories. The authors of the paper just cited surveyed 14 articles that estimated price elasticities for various categorizations of soft drinks, fruit drinks, and nonalcoholic beverages. However, they were able to identify only one published study that estimated the price elasticity of carbonated soft drinks, one study that estimated the price elasticity of the combined category of soda and fruit drinks, and one study that provided an estimate for regular soft drinks. There are concerns with all of these studies that jeopardize the reliability and relevance of the estimated parameters. For example, two of these studies employ old data sets from households that were surveyed more than 30 years ago (Heien and Wessells 1988, 1990). One study estimates models using data on 42 metropolitan areas, rather than data on individuals or households (Bergtold, Akobundu, and Peterson 2004). Furthermore, even these papers, which categorize foods more narrowly than other studies, do not define food categories with sufficient precision to be useful for predicting the impacts of a tax on soda.[3] As a result, the widely cited price elasticity of demand for sugar-sweetened, carbonated soft drinks is based on information contained in a handful of studies that have significant empirical challenges.

In contrast to the estimates emphasized by Andreyeva, Long, and Brownell (2010), Duffey et al. (2010) employ very recent data to estimate the effects of soda prices on total energy intakes from soda, whole milk, hamburgers, and pizza. They use the Coronary Artery Risk Development in Young Adults (CARDIA) study, which consists of 5,115 participants observed at baseline (1985–86), seven years after baseline (1992–1993), and 20 years after baseline (2005–2006). They report that an 18 percent soda tax would generate a decline in daily calorie intake by 56 kcal, which would translate into a 5 lb. weight loss per person per year. This simulated impact, which takes into account observed increases in burger and pizza consumption and reductions in milk consumption when the price of soda rises, is more than twice the implied estimate provided by Brownell et al. (2009).[4] The predicted impact is remarkably large, especially because calories from sugar-sweetened beverages constitute only about 6 percent of total calories consumed. Although the data set used by Duffey et al. (2010) covers recent years and although it has up to three observations per respondent, the models estimated using these data do not include fixed effects. Thus, the potential for bias in the estimated price effects cannot be ruled out.

If taxes are indeed effective mechanisms to reduce soda consumption, and if variations in calories from soda influence the risk for obesity, then one would observe a direct impact of taxes on body weight. Powell, Chriqui, and Chaloupka (2009) examine this issue in the the Monitoring the Future surveys. These are nationally representative annual samples of eighth-, 10th-, and 12th-graders. The authors relate BMI levels of these students to a number of state-level, food-related tax variables, including the tax rates for soda purchased through grocery stores as well as through vending

machines. They find no association between soda tax rates and adolescent weight.

Fletcher, Frisvold, and Tefft (2010) employ data from the 1990 to 2006 waves of the Behavioral Risk Factor Surveillance System (BRFSS). Using more than 2.7 million observations, they estimate models which include state, year, and quarter-of-year fixed effects to control for unobservable factors that might be correlated with obesity and taxes. The results show that taxes are very weakly related to adult BMI. Specifically, a 1 percentage point increase in soft drink taxes (which is about a 30 percent increase) lowers adult BMI by 0.003, which is essentially zero, as the mean BMI is about 26 in the sample.

Fletcher, Frisvold, and Tefft (forthcoming) employ data from the National Health and Nutrition Examination Survey (NHANES) spanning the years 1989–2006 to analyze the impact of soft drink taxes on adolescent consumption of soda and other drinks as well as on body weight. Individuals in this nationally representative sample receive detailed physical examinations including actual measurement of height and weight. The authors find that a 1 percentage point increase in soft drink taxes reduces the calories from soda by six (which is about a percent decrease in calorie intake from soda), but that this modest decline in soda-based calories is completely offset by increases in consumption of other high-calorie drinks, such as juice and milk. Consistent with these results, the authors find that soft drink taxes have no impact on the BMI of adolescents.

The type of substitution just reported dovetails with theoretical predictions by Schroeter, Lusk, and Tyner (2008) and by Yaniv, Rosin, and Tobol (2009). In the model in the former paper, a tax on high-calorie food can increase body weight if exercise falls and/or the consumption of low-calorie food rises by a sufficient amount. In the model in the latter paper, fast-food or junk-food taxes increase obesity for health-conscious consumers who increase the time they allocate to the preparation of healthy meals at the expense of exercise.

Taken together, the papers summarized above cast doubt on the potential effectiveness of a soda tax as a vehicle to curb obesity. A different policy proposal pertains to enhancing the amount of information available to consumers when they make their decision on food consumption. If consumers are educated about the harmful medical and productivity-related effects of obesity, and if they are knowledgeable about the amount of calories they should consume for their optimal weight, then providing information to them about the calorie content of the food items may reduce their calorie intake.

One way to operationalize this idea is to have restaurants display the amount of calories contained in each food item. In fact, the Patient Protection and Affordable Care Act, the official name of the federal health care reform legislation enacted in March 2010, mandates that calorie labels be posted on food items at chains with 20 or more restaurants within the next two years. New York City implemented its own calorie posting law on April 1, 2008. Bollinger, Leslie, and Sorensen (forthcoming) analyze data from Starbucks stores in New York City before and after the implementation of the law, as well as data from a control group of Starbucks stores in Boston and Philadelphia, where calorie posting was not mandated. They find that after the enactment of the law, average calories per transaction fell by 6 percent. This effect was almost entirely due to the change in consumers' food choices (rather than a change in decisions on beverage consumption). This finding underscores the potential importance of increasing consumer access to relevant calorie information.

A related policy lever, which some think may be especially effective in the case of children, is to limit their exposure to advertisements of high-caloric foods. Chou, Rashad, and Grossman (2008) evaluate the impacts of such a policy in the specific case of exposure to fast-food restaurant advertising on television. They find that a ban on these advertisements would reduce the number of obese children ages 3–11 in a fixed population by 18 percent and would reduce the number of obese adolescents ages 12–18 by 14 percent. Currently, companies can deduct this type of advertising from their income in computing their corporate income tax. Chou, Rashad, and Grossman also report that the elimination of this provision would produce smaller declines of between 5 and 7 percent in the weight outcomes just mentioned but would impose lower costs on children and adults who consume fast food in moderation because positive information about restaurants that supply this type of food would not be completely banned from television.[5]

Given the substantial health care costs associated with obesity, and given the objective of the 2010 health care reform act to increase the insured population, efforts to encourage prevention may become increasingly attractive to insurers and employers. The act itself mandates coverage of preventive care, but does not include subsidies for exercise. Nevertheless, these may be on the horizon. In principle, appropriate incentive mechanisms may induce people to engage in physical exercise for weight loss. One particular incentive is a financial reward that is attached to successful weight loss. Recent research investigated the impact of various financial reward mechanisms. Volpp et al. (2008) designed a randomized trial where 57 participants from Philadelphia were randomly assigned to three weight loss plans: a weight-monitoring program involving monthly weigh-ins, or the same program with

two different financial incentives. The first incentive program involved a lottery, where participants were eligible for daily lottery prizes with large or small payoffs (with differential expected payoffs) conditional on having reported a weight at or below their weight loss goal. The second plan involved a deposit contract where the participants were given the opportunity to contribute up to $3 each day and where their contribution was matched one-to-one and a daily $3 fixed payment was added. Under this plan each participant could earn up to $252 per month depending on how much they invested and how much weight they lost. After 16 weeks, the incentive groups lost 9–10 lbs. more than the control group. The weight loss at the end of the 16-week period was not fully sustained seven months later, but incentive participants weighed significantly less at seven months than at the start of the study, while those in the control group did not.

Cawley and Price (forthcoming) employed data from a firm that coordinates a program of financial incentives for weight loss in various worksites. Using data on 2,407 employees in 17 worksites who participated in a year-long program, they studied attrition and weight loss in three types of programs: one that offers no financial rewards for weight loss (the control group), one that offers quarterly payments based on the percentage of loss from baseline weight, and a third that takes bonds that are refunded only if the employee achieves a specified weight loss goal, while a quarterly lottery drawing gives away prizes to those who have lost some weight. The authors documented higher attrition rates than found by previous studies. Financial rewards were associated with modest weight reductions. After one year, participants in the program that required posting a bond lost 1.9 lbs. more than those in the control group that faced no financial incentives. The weight loss of those who were on the quarterly payment program was no different than those in the control group.

The difference in the outcomes between Volpp et al. (2008) and Cawley and Price (forthcoming) underscores the importance of the design of incentive schemes.[6] As detailed in Volpp et al. (2008), because of such issues as loss aversion and the desire to avoid regret in decision making under risk, attention has to be paid how the incentive scheme is designed to alter behavior and to achieve weight loss.

These studies suggest that financial incentives may motivate individuals to lose weight. However, the current evidence on the effectiveness of such programs is obtained from relatively small and location-specific samples. Additional studies with larger samples need to be conducted to infer about their external validity. In addition, the cost-effectiveness of these incentive programs needs to be analyzed.

Conclusion

Perhaps the main message that we wish to convey is that there is no free lunch, and that with benefits come costs. Positive changes such as increases in technology that lowered the real price of food, reduced smoking, and increased female participation in the labor force have also carried unforeseen negative consequences. Was the anti-smoking campaign a mistake if it also encouraged obesity?

We do not, of course, believe people should start smoking in order to become thin, substituting one type of unhealthy behavior for another. This may have been one of the unintended consequences of social change and government action. Nor do we suggest that women abandon the labor force to provide their families with home-cooked meals. Whether public policies should be pursued that offset the ignored or unanticipated consequences of previous policies that contributed to the rise in obesity will depend, in the end, on evaluations of the external costs and benefits of these policies. We hope that our paper will stimulate discussions and future research along these lines.

Endnotes

1. These figures are simple averages of the percentages for children ages 6–11 and ages 12–19.

2. In a similar vein, New York City put forth a demonstration project in October 2010. If approved by the U.S. Department of Agriculture, New York would prevent the participants of its Food Stamp Program from buying beverages that contain more than 10 calories per eight-oz. serving (other than milk or milk substitutes) using food stamp dollars.

3. For example, in Heien and Wessells (1988), soda stands for colas, fruit juice, diet, and carbonated water.

4. Brownell et al. (2009) report that in 2005–2006, adults in the United States consumed 175 kcal daily from sugar-sweetened beverages (p. 1,599). They calculate a 1-cent excise tax (which constitutes a 15–20 percent price increase for a 20-oz. soft drink) would produce a 20 kcal reduction in calorie consumption per person per day.

5. Chou, Rashad, and Grossman (2008) point out that there is conflicting evidence on trends in television and commercial viewing by children since 1980. Hence, it would be premature to point to their findings as a partial explanation of the upward trend in childhood and adolescent obesity.

6. A different incentive structure involves payments by lost weight. Finkelstein et al. (2009) designed a study that assigned 207 overweight or obese adults from North Carolina to three groups: a control group, an incentive group where participants would earn $14 for each percentage point of weight lost from the baseline, and another incentive group where potential earnings were $7 for each percentage point of weight loss. At three months, control group participants lost an average of 2.0 lbs., while the $7-incentive group members lost 3.0 lbs. and the participants of the $14-incentive group lost 4.7 lbs.

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Table 1: Trends in the Prevalence of Obesity, by Age and Period (Percentage of Population[a])

	1960–1962	1963–1965	1966–1970	1971–1974	1976–1980	1988–1994	1999–2002	2003–2006	2007–2008
Ages 2–5	n/a[b]	n/a	n/a	n/a	5	7.2	10.3	12.4	10.4
Ages 6–11	n/a	4.2	n/a	4	6.5	11.3	15.8	17	19.6
Ages 12–19[c]	n/a	n/a	4.6	6.1	5	10.5	16	17.6	18.1
Ages 20–74[d]	13.3	n/a	n/a	14.6	15.1	23.3	31.1	34.1	33.8

Sources: National Center for Health Statistics (2009), *Health United States 2008*, Tables 75 and 76; http://www.cdc.gov/obesity/childhood/prevalence.html; Flegal et al. (2010); and Ogden et al. (2010).

a For children, obesity is defined as body mass index (BMI) at or above the sex- and age-specific 95th percentile BMI cutoff points based on Centers for Disease Control and Prevention growth charts. See http://www.cdc.gov/growthcharts. For adults, obesity is defined by BMI greater than or equal to 30.

b Not available.

c Ages 12–17 in 1966–1970.

d Age-adjusted. Age 20 and over in 2007–2008.

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