Optimal Weight

Are government goals for reducing obesity sensible?

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The rising prevalence of obesity in the United States is often referred to as an epidemic (although it has apparently leveled off since 1999). Obesity is defined as a body mass index (BMI) of 30 or higher, and it has been associated with many health problems, including diabetes, hypertension, high cholesterol, heart disease, stroke, sleep apnea, some cancers, gallstones, gout, asthma, and osteoarthritis. Based on 2005 Medical Expenditure Panel Survey data, medical spending on obesity in the U.S. non-institutional adult population has been estimated to be $168.4 billion (in 2005 dollars), which was 16.5 percent of all medical spending that year.

Concern over rising health care costs has predictably encouraged a growing number of government interventions aimed at reducing the prevalence of obesity. Examples of such interventions include restrictions on soda sales at public schools, special taxes imposed on sodas, disallowing soda sales for food stamp recipients, regulations requiring restaurants to post caloric content of menu items, bans on toys offered in children's meals with high levels of calories and salt, and restrictions on locations of new restaurants.

Researchers typically assume that reduction of obesity prevalence is desirable without addressing the more fundamental issues of its optimal level, whether its optimal level has grown over time, and whether optimal levels are identical for all individuals. In this article we develop a simple demand/supply framework to model the optimum level of obesity. We examine these fundamental issues before evaluating desirability of government interventions. Our conclusions run counter to conventional wisdom that government has the necessary information to systematically reduce the prevalence of obesity in line with optimal levels that differ between individuals.

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The Model

Weight gain is caused by an imbalance between calories entering the body and calories leaving the body. Obesity arises when the intake of calories sufficiently exceeds the outflow of calories in a manner that results in a BMI of 30 or higher.

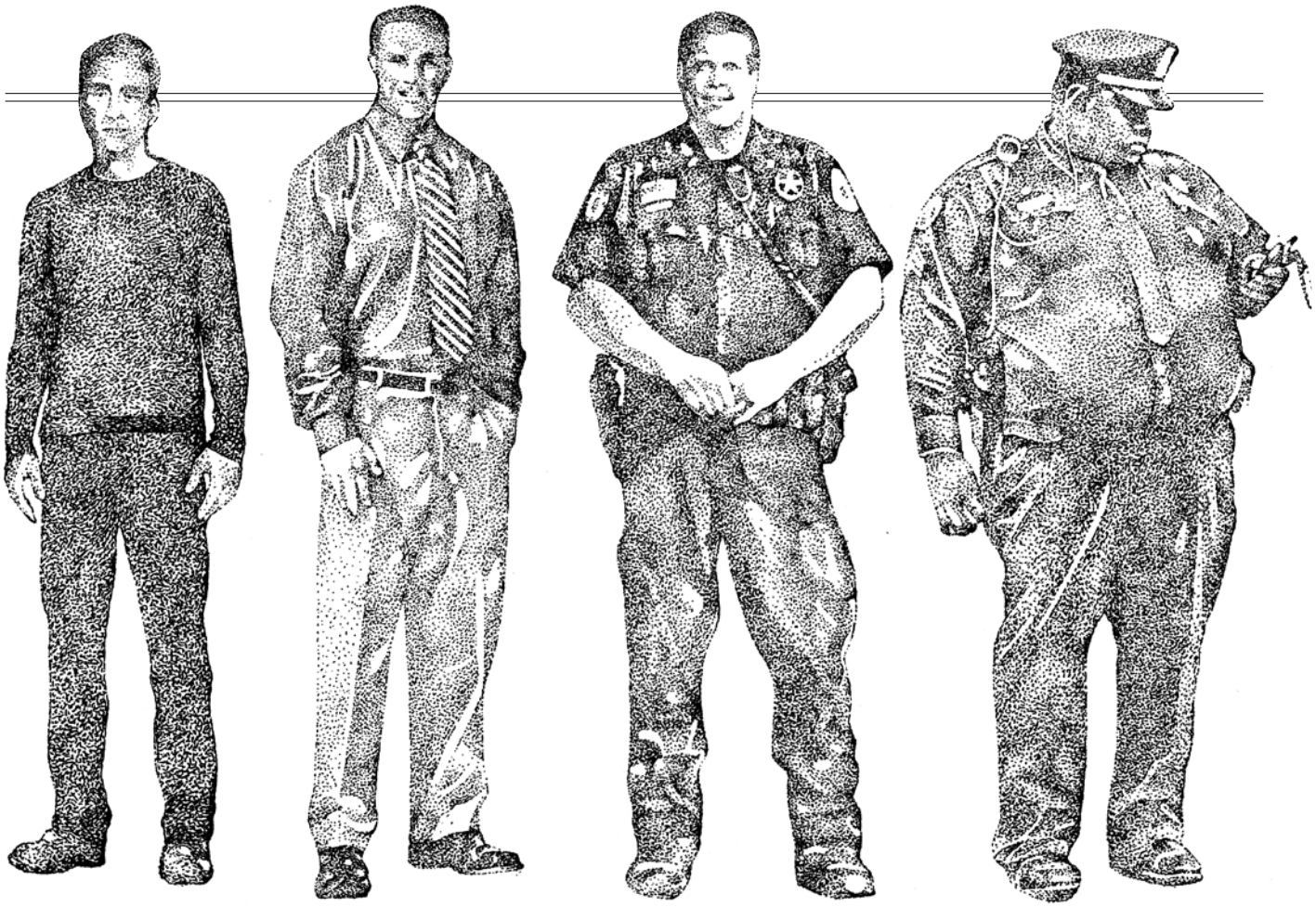
We use the model that Thorkild Sorensen proposed in a 2009 paper to show the relationships between energy input, energy output, and weight. If *EI* is energy input and *EO* is energy output, then a positive energy imbalance, $EI - EO > 0$, results in some energy stored, *ES*. *EC* is the energy used to convert surplus energy into tissue mass. The change in energy stored is then:

$$(1)\ \Delta ES \div \Delta t = EI - (EO + EC)$$

Changes in energy stored result in changes in body weight. *EO* is composed of the basal metabolic rate, *BMR*, and the energy spent on physical activity. If *PAF* is the physical activity factor, then *EO* can be expressed as $EO = BMR \times PAF$. The change in energy stored, and hence weight, can then be expressed as:

$$(2)\ \Delta ES \div \Delta t = EI - (BMR \times PAF + EC).$$

Equation (2) identifies factors that affect body weight. Energy input and physical activity are determined by choices that indi-



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viduals make. *BMR* and *EC* depend on genetics as well as other factors including body weight, the amounts of lean and fat tissue, gender, and age.

Energy (i.e., calorie) input and physical activity choices made by consumers and producers in the economy can be expressed by demand and supply schedules of weight. Choices determine whether weight gain is positive, negative, or zero. Weight gain arises from engaging in a mix of activities that results in intake of calories exceeding outflow of calories. Eating, drinking, and undertaking sedentary leisure activities are ways of demanding excess calories and, hence, weight gain. Demand also represents the marginal benefit schedule of weight as derived from satisfaction received from consuming another calorie or enjoying an additional restful moment.

Supply of weight comes from sellers of calories and providers of less physically active lifestyles. Supply represents the marginal opportunity cost of weight gain. Costs include those associated with acquiring and consuming calories, wages that may be lost due to reduced productivity caused by rising weight, health and medical costs associated with weight gain, and costs of engaging in more sedentary lifestyles.

Figure 1 displays equilibrium price and quantity of weight as determined by the intersection of demand and supply. The equilibrium quantity represents the optimum level of weight. There is also some rate of obesity prevalence for society associated with this optimum. This quite simple model suggests several important issues associated with obesity.

First, the optimum level of weight changes as demand and supply vary over time. Factors that cause demand or supply to shift rightward result in higher optimum levels of weight. Many causes of increased demand for weight gain have been suggested. These include: increased consumption of sugar-sweetened beverages, reduction in real prices of food, urban sprawl, reduced cigarette smoking, less time spent preparing healthy meals at home, eating more food from restaurants, rising numbers of food stamp recipients, and food engineering that stimulates the brain in manners that increase eating.

Factors that have been suggested as increasing supply include technological change leading to a more sedentary lifestyle, increased availability of restaurants, a growing lack of grocery stores selling healthy foods, and agricultural policies that encourage production of "excess calories."

From the standpoint of economic efficiency, rising obesity reflects shifts of demand and supply of weight over time. This is surely a contentious conclusion given that the literature on obesity focuses on prevention of obesity rather than examining whether its rise is somehow linked to changes in its efficient level. Nonetheless, marginal benefits still equal marginal costs, although optimum levels have apparently increased over time.

Second, optimal weight, and hence optimal prevalence of obesity, is likely to be different for different individuals. Simple observation indicates a wide diversity among individuals. Genetics is known to affect weight. As expressed in Equation 2, genetics can affect weight through its effects on the basal metabolic rate and energy consumption. Subgroups of the population that are genetically more predisposed to obesity experience more weight

gain and higher levels of obesity prevalence than other subgroups for identical levels of energy input and physical activity factor. Genetic predispositions to obesity are believed to partially explain why obesity prevalence has risen at different rates among groups.

This effect is illustrated in Figure 2, where group *B* individuals are more genetically predisposed to weight gain and thus more readily turn excess calories into additional weight than do individuals in group *A*. Marginal costs are also lower for group *B* because their bodies are genetically more predisposed to turning excess calories into weight gain. Population subgroup *B* will have a higher optimal weight and obesity prevalence level than group *A*, even if the demand for weight is the same for both subgroups. Of course, demand may vary between groups as well, thus indicating that a "one size fits all" prediction for optimal weight makes little sense.

Figure 2 illustrates that setting a goal to achieve the same obesity prevalence levels for all groups in a society is misguided. If group *B* is at weight q_A, then the marginal benefits of weight exceed the marginal costs of weight for group *B*. Group *B*'s optimum resides at q_B. Group *B* would not be at its optimum level if it were somehow coerced through government intervention into becoming slimmer in order to achieve a uniform policy goal of q_A. Adopting a "one size fits all" policy goal for weight thus exerts an "excess burden" on those subgroups that exhibit optimal weight in excess of government goals.

Healthy People 2010, a federal program to promote healthy living that was started in 2000, set a goal of achieving a 15 percent obesity prevalence rate for all categories of adults and a 5 percent obesity rate for children by 2010. The goals were not achieved by any state of the United States, yet the same obesity goals are contained in Healthy People 2020, the successor program. Table 1 exhibits obesity prevalence by state using data collected by the Behavioral Risk Factor Surveillance System. Prevalence for 1995 and 2009, and the percentage change over this period, are displayed. These data are frequently cited in news reports and by obesity researchers as evidence of an obesity epidemic that requires immediate and dramatic government intervention.

There is little reason to believe that uniform prevalence goals are derived from any economic model within a demand and supply framework as developed in our paper. The fact that one state exhibits higher obesity prevalence or a larger increase over time does not necessarily or directly correlate with the degree to which it diverges from optimal weight. Differences in obesity prevalence and their rates of change clearly differ substantially by state, but these differences surely reflect variations in demand and supply across states and over time.

Data from the National Health and Nutrition Examination Survey are also frequently cited as proof of an obesity epidemic. Data indicate that about one-third of adults in the United States are obese, with woman having a slightly higher obesity rate than men. Non-Hispanic blacks have an obesity prevalence rate that is about 36 percent greater than Non-Hispanic whites. Hispanics have a prevalence rate about 19 percent greater than non-Hispanic whites. About 17 percent of children and adolescents aged 2 through 19 years are classified as obese. Again, these data reflect that different groups of individuals have experienced different variations in demand and supply over time that do not directly indicate the degree to which various groups exhibit variations from optimal weight.

FIGURE 1

Supply and Demand for Calories

Equilibrium quantity of weight

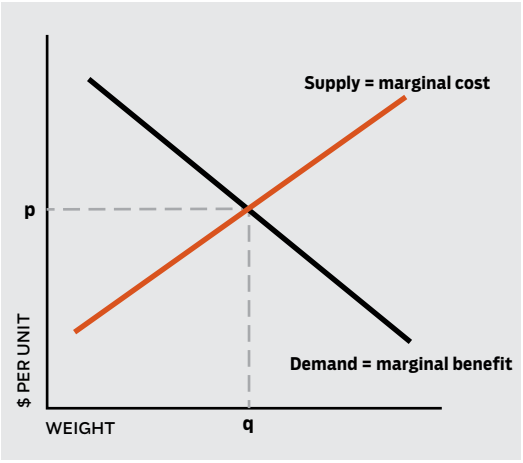
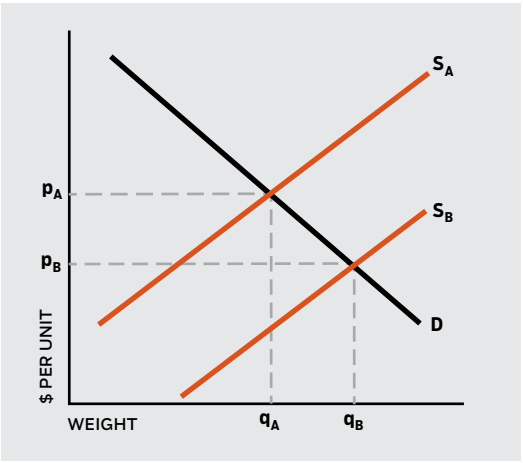


FIGURE 2

Different Groups, Different Weights

Comparing optimal weight for subgroups A and B



Government Intervention

Presence of externalities is often used to justify government intervention to reduce obesity. It is often claimed that the obese do not pay their full health care costs because their above-average medical costs raise insurance costs for all other insured individuals and because some portion of their medical costs are publicly funded. However, obese individuals are known to have shorter life expectancies than the non-obese and thus their lifetime medical costs are lower than their slimmer counterparts. Jayanta Bhattacharya and Kate Bundorf, in a 2009 *Journal of Health Economics* paper, also find that obese workers with employer-sponsored health insurance pay for their greater medical costs by receiving lower cash wages than are paid to non-obese workers. In addition, Bhattacharya and Mikko Packalen, in a 2008 paper, argue there is a positive innovation externality associated with the obese that roughly matches any negative Medicare-induced health insurance externality of obesity. They conclude there

is no rationale for "fat taxes" because of the Medicare-induced subsidy of obesity.

The negative externality argument is thus less than persuasive. In any case, a more efficient method to account for additional medical costs of obesity would be to directly charge insurance premiums that reflect the risk of incurring greater medical costs.

Ignorant and lazy? | Proponents of government intervention also argue that consumers lack self-control and adequate information on products such as sugar-sweetened beverages. A 2009 *New England Journal of Medicine* article by Kelly Brownell et al. argues:

> [M]any persons do not fully appreciate the links between consumption of these beverages and health consequences; they make consumption decisions with imperfect information. These decisions are likely to be further distorted by the extensive marketing campaigns that advertise the benefits of consumption. A second failure results from time-inconsistent preferences (i.e., decisions that provide short-term gratification but long-term harm). This problem is exacerbated in the case of children and adolescents, who place a higher value on present satisfaction while more heavily discounting future consequences.

TABLE 1

Changing Obesity Rates

By state, for years 1995 and 2009

	1995	2009	% Change		1995	2009	% Change
Alabama	19	32	69	Montana	13	24	77
Alaska	20	25	28	Nebraska	16	28	72
Arizona	13	26	95	Nevada	13	26	98
Arkansas	18	32	80	New Hampshire	15	26	74
California	15	26	69	New Jersey	15	24	65
Colorado	10	19	88	New Mexico	13	26	97
Connecticut	13	21	68	New York	14	25	77
Delaware	17	28	61	North Carolina	17	30	78
Florida	17	27	54	North Dakota	16	28	73
Georgia	13	28	108	Ohio	18	30	70
Hawaii	11	23	112	Oklahoma	14	32	137
Idaho	14	25	77	Oregon	15	24	55
Illinois	17	27	64	Pennsylvania	16	28	71
Indiana	20	30	49	Rhode Island	13	25	89
Iowa	18	29	63	South Carolina	17	30	80
Kansas	16	29	81	South Dakota	14	30	118
Kentucky	17	32	92	Tennessee	18	33	79
Louisiana	18	34	92	Texas	16	30	86
Maine	14	26	87	Utah	15	24	58
Maryland	16	27	64	Vermont	15	23	60
Massachusetts	12	22	86	Virginia	16	26	62
Michigan	18	30	66	Washington	14	27	94
Minnesota	15	25	66	West Virginia	18	32	73
Mississippi	20	35	82	Wisconsin	16	29	83
Missouri	19	31	62	Wyoming	14	25	78

Source: BFRSS data Note: Utah's data begin in 1998.

Such notions are widespread, as evidenced by the constant, uncritical repetition of that notion by purported experts, policymakers, social commentators, and the media. But the scientific basis for this notion is unclear. And even if "excessive" soda consumption is a product of short-term gratification syndrome, it remains doubtful that policymakers can somehow overturn this human failing without exerting unintended adverse effects on others.

Government intervention aimed at lowering tobacco use offers several examples of unintended effects. A 2004 *Health Economics* paper by M. C. Farrelly et al. and a 2006 *American Economic Review* paper by J. Adda and F. Cornaglia both indicate that tax hikes on cigarettes have led smokers to switch to higher-tar and -nicotine brands so that they can maintain chemical intake levels as they smoke less, to the detriment of their health. A 2004 *Journal of Health Economics* paper by Shin-Yi Chou et al. found that higher cigarette prices (stemming from tax hikes), which reduce smoking, are associated with higher rates of obesity.

Interventions are also likely to impose costs on the non-obese as well as the obese. For example, taxes imposed on alcohol mostly lower consumption of light users with little to no effect on heavy drinkers. Such interventions are also often regressive in nature, with burdens on the poor higher than the non-poor.

Policymakers also suffer from an information problem themselves when attempting to levy Pigovian taxes on supposed externalities. The "correct" tax requires knowledge that certainly does not exist. A 2010 *Obesity Reviews* analysis by B. Rokholm et al. of the obesity epidemic notes that clear evidence on specific causes of the obesity epidemic is lacking. The above-discussed *New England Journal of Medicine* article provides scant hope that "correct" soda taxes are known; the authors conclude: "As with any public health intervention, the precise effect of a tax cannot be known until it is implemented and studied, but research to date suggests that a tax on sugar-sweetened beverages would have strong positive effects on reducing consumption." This is wishful thinking given recent evidence that a one percentage point increase in the tax rate on soda was associated with a decrease of just 0.003 points in body mass. In other words, large tax increases are unlikely to exert much effect on population weight. Evidence indicates that a 58 percent tax on soda, equivalent to the average federal and state tax on cigarettes,

would drop the average body mass by only 0.16 points — a trivial effect given obesity is defined as a BMI of at least 30.

Finally, there is little evidence that previous government intervention has lowered obesity among the poor. A 2004 U.S. Department of Agriculture review by P. Linz et al. concludes that, despite many low-income individuals being both obese and recipients of one or more food assistance programs, the research literature does not show that programs have lowered obesity. (The review does cite two studies that find a positive correlation between food stamps and obesity in women, although neither study tested for a causal connection.) More recently, a paper by Jay Zagorskya and Patricia Smith reports that the typical female food stamp participant's BMI is significantly more than someone with the same socioeconomic characteristics who is not in the program. For the average American woman, this means an increase in weight of 5.8 pounds. Good intentions aside, we should be skeptical of the notion that the expansion of government programs would somehow lower obesity when research has yet to prove that past programs have not inadvertently encouraged obesity.

Can "Nudges" Promote Efficient Weight?

Behavioral economists Richard Thaler and Cass Sunstein argue that policymakers should "nudge" individuals toward efficient decisions. Because they "nudge" rather than strong-arm or explicitly prohibit behaviors such as obesity, nudges are labeled "libertarian paternalism." Thaler and Sunstein believe these labels allow them to escape negative connotations attached to paternalism — policies aimed at protecting individuals who are believed unable to protect themselves. For example, they write, "People often make poor choices — and look back at them with bafflement!" Behavioral economists thus attempt to correct self-inflicted behaviors that cause us to exercise too little, eat too much, take on too much debt, smoke tobacco, drink too much alcohol, and save too little for retirement.

Rearranging food placements in cafeterias so that healthy foods are more prevalent and sweets are less so is one nudge favored by behavioral economists who believe diners have difficulty controlling impulses to eat unhealthy food. Grocery managers could nudge shoppers by replacing candy with healthier snacks near checkout stands, since this location is known to spark impulse buying.

But it is important to recognize differences between "nudging" by businesses versus governments. Profits motivate businesses and thus their nudges foster efficiencies, since otherwise there would be no purpose. For example, rewards for staying in good health are nudges that are in line with raising profits. The private marketplace has responded to the increase in obesity by providing various means of reducing weight gain. Diet sodas and diet foods are readily available in stores. Sales of Diet Coke overtook those of Pepsi-Cola for the first time in 2010, making it the number two carbonated soft drink in the United States. Exercise equipment can be easily obtained and there appears to be an ample supply of health spas and gyms. Some businesses now pay their employees to lose weight. Private industry undertakes much research seeking medicines that will reduce the costs of achieving weight loss. Unlike government interventions aimed at weight reduction, the costs of these private activities are not imposed on the non-obese.

The private sector is thus actively involved within its goal of maximizing profits. Government and behavioral economists operate under no such profit constraint and thus efficiency may have little to do with their motivation. Just as government cannot match supply with demand better than markets, behavioral economists are unlikely to know how to successfully nudge us toward greater efficiency even when they believe they have uncovered irrational behavior associated with weight gain.

There are other downsides to such nudging. Consider food labeling laws that require restaurants to list their fat and calorie contents. Sounds good at first, but it might also lead some diners to exercise less caution and personal judgment simply because "nudgers" have taken on the responsibility for watching what we eat. Nudges make it less important to think on our own. Intervention may also make it appear that the "eat less, exercise more" adage no longer is a surefire recipe for controlling weight. Substituting government for personal responsibility rarely works out as planned.

There is also evidence that such nudges do not work so well. A 2009 study by B. Elbel et al. of New York City's 2008 law on posting calories in restaurant chains examined how menu calorie labels influenced fast food choices. Information on patrons of fast food restaurants in New York communities was compared with that on patrons in Newark, N.J., a city without labeling laws. While 28 percent of patrons in New York said the information influenced their choices, researchers could not detect a change in calories purchased after the law. A similar conclusion was reached in a 2011 study by Eric Finkelstein et al. of a mandatory menu-labeling regulation requiring all restaurant chains with 15 or more locations to disclose calorie information in King County, Wash. No impact on purchasing behavior was found, as measured by trends in transactions and calories per transaction.

Finally, it is perhaps obvious, but "libertarian paternalists" place themselves in the role of fathers guiding the actions of children. This role is appropriate when exercised by parents over children, but it remains questionable to award behavioral economists this same role over adults.

Conclusion

There is no question that the prevalence of obesity has risen dramatically in recent years. Researchers typically assume its reduction is desirable without addressing the more fundamental issue of its optimal level. Our paper suggests optimal levels of obesity have increased over time and that optimal levels are not identical for all individuals or groups. Meanwhile, the

federal government has set a goal of 15 percent for adult prevalence and 5 percent for child prevalence. Adopting a "one size fits all" policy goal for weight thus exerts an "excess burden" on those subgroups that exhibit optimal weight gain in excess of government goals.

There is little evidence that obesity stems from some sort of market failure. And even if a negative externality exists, government does not command the required expertise to systematically reduce its prevalence toward optimal levels. Placing identical goals for obesity rate reduction across all individuals also exerts excess burdens on those individuals who differ from government's mandated "ideal" weight. There is also no reason to believe that "ideal" weight bears any correspondence to optimal weight. R

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