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**What Causes Obesity?
And Why Has It Grown So Much?
An Alternative View**

by

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Introduction

In recent years, economists have attempted to explain the rising levels of obesity not only in the U.S. during the last three decades but in many developed countries. For the most part, these economists' models have utilized neoclassical economic tools and relied on the conventional wisdom of health science practitioners. The results of this theorizing have been disappointing at best. The purpose of this paper is to develop an alternative socio-economic model of obesity based more on behavioral economics concepts and on the best thinking that health science has to offer. Instead of rational economic decision makers, this paper assumes decision makers are boundedly rational. Instead of weight gain and obesity being strictly determined by the amount of calories consumed minus the calories expended, weight gain is determined much more by what people eat. Also, the weight-obesity outcome is determined by how different people respond to the growing infrastructure of obesity (notably the suppliers of fast food and processed foods). In general, obesity in the present model is the result of individual decisions to choose poor diets and poor life behavior patterns (including exercise). Unlike in the rational obesity model, these are not decisions of rational economic men or women. The rising obesity levels are the result of poor decisions by many boundedly rational individuals who have encountered very significant changes in food supplying industries and society overall.

The plan of the paper is as follows. Section one provides some indications of the magnitude of the obesity problem. Section two provides an explanation of the rational obesity model. Section three draws on the work of two distinguished health science

writers and explains why conventional health science conceptions of obesity are flawed. It also explains about the key dietary and life behavioral patterns that cause obesity. Section four provides an overview of the alternative socio-economic model of obesity. Section five analyzes the four external factors contributing to obesity, and section six explains about the four internal factors contributing to obesity. Section seven summarizes the model, particularly as it relates to individual decision making. Section eight considers whether the eating habits involved with obesity amount to an addiction. Section nine considers the distribution of obesity among different socio-economic groups. Section ten provides a few important policy implications, and section eleven concludes.

The Magnitude of the Obesity Problem

Obesity rates in the U.S. are high and have been rapidly rising over the last thirty years. Using body mass index (BMI) greater than thirty as the criterion, the percent of the adult population who are obese was 13.95 in 1976-1980. By 1999-2000, this figure had risen to 29.57 percent, and by all reports was continuing to rise (Rosin 2007, p. 619). The U.S. obesity rate is substantially higher than even the European countries (UK, Germany) with the highest rates (p. 620). Further, the percent of overweight and obese children has also been rapidly rising over the last thirty years (pp. 620-622). The problem is not just in the U.S. Rates of obesity are rising in almost all developed and developing countries, even in Japan that has one of the lowest rates in the world (Delpeuch et al 2009, pp. 7-9; Bleich et al 2008, pp. 280-281).

Obesity is a major health problem in that it “is a major risk factor for many chronic conditions [the diseases of civilization, also known as the Western diseases],

including type 2 diabetes, cardiovascular disease, hypertension, hypercholesterolemia, certain types of cancer ... , stroke, ..." and six other conditions (diabetes is the one most closely linked to obesity) (Rosin 2007, pp. 621-622). The annual total costs of obesity are estimated to be nearly seven percent of annual medical expenditures. Obesity is implicated in 300,000 premature deaths per year in the U.S., which is somewhat less than the number associated with tobacco use but substantially more than the numbers associated with alcohol and illicit drug use (Chou et al 2004, p. 566). In addition to physical ailments, obesity has been found to be "related to lower satisfaction with work, family relations, partner relationships, and social activities" and depression (Stutzer 2007, p. 10).

The Rational Obesity Model

In the rational obesity model, individuals, based on their preferences, attempt to maximize their expected utility over a long time period by choosing their type and amount of food consumption (diet) and the amount and strenuousness of their exercise activity. The former choice determines the calories they consume and the latter determines the calories they expend. The difference between these two is net calories consumed or expended. A positive net calorie balance is associated with weight gain; a negative balance is associated with weight loss. Over time the accumulated weight changes tend to produce an equilibrium or desired weight (W_U) reflecting the individual's preferences for tasty, filling food on the one hand and health and appearance concerns on the other. Typically the rational actor's choice of diet and exercise causes his/her W_U to exceed W^* , the optimal weight based on health considerations. When W_U (or more precisely, desired BMI) substantially exceeds the individual's W^* , the optimal healthy

weight or BMI, say by 20 percent, this would be considered to be rational obesity. Figure 1A below depicts the essence of the model.

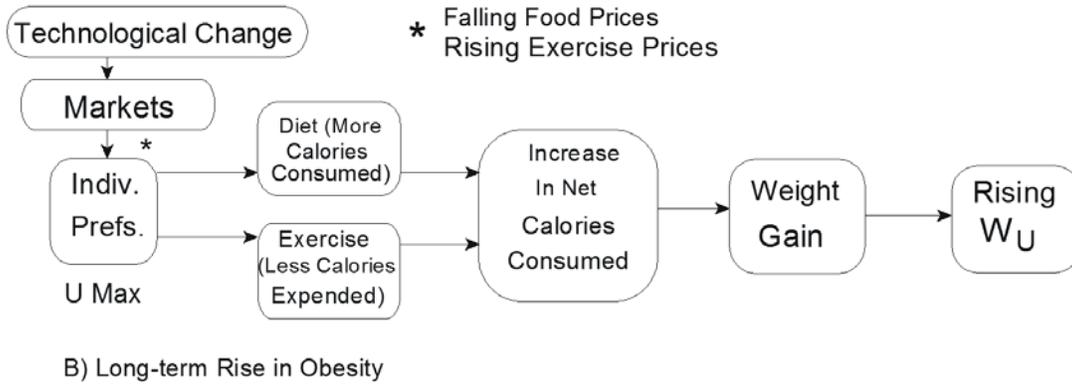
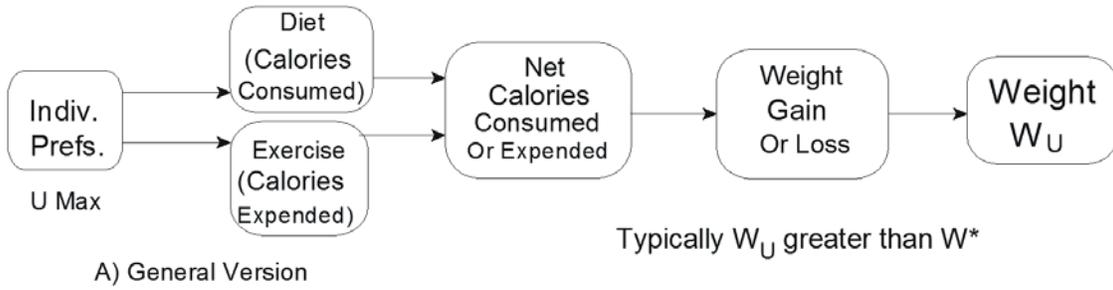
This model emphasizes that obesity is an outcome of an individual's choices and is, thus, an avoidable condition. The obese person has evaluated the long-term expected benefits and costs associated with his diet and exercise pattern and has chosen a combination involving obesity. If these benefits and costs were to change, it would be expected that the individual would change his diet and exercise pattern accordingly. These expected benefits and cost might change due to changes in external conditions or because of changes in the individual's preferences. According to Philipson and Posner (1999, p. 2), this model can explain the growth of obesity during the last several decades. The key factor in their view is "technological change [which] has both lowered the cost of intake of calories and raised the cost of expending calories....The price of calories has fallen because food prices have declined" with innovation in food industries. Moreover, as a consequence of this and other innovation, most work now requires much less strenuous exercise than it once did (see also Lakdawalla and Philipson (2002)). Workers who desire more exercise than their work affords must in many cases pay for the opportunity (for somewhat different models of rational obesity, see Cawley (2004) and Goldfarb et al (2006)). Figure 1B below depicts the factors causing a long-term rise in obesity according to the rational obesity model.

An Alternative Health Science

A number of writers have challenged the conventional scientific wisdom or dogma regarding calories and weight gain. This article draws especially on two such writers: Gary Taubes, a distinguished science journalist who has been a correspondent

for *Science* magazine, and Mark Hyman, a medical doctor who has pioneered in the relationship between diet and health. In particular, this article draws upon Taubes' *Good Calories, Bad Calories: Challenging the Conventional Wisdom on Diet, Weight Control and Disease* (2007) and Hyman's *UltraMetabolism: The Simple Plan for Automatic Weight Loss* (2006).

Figure 1
The Rational Obesity Model



Taubes and Hyman are largely in agreement on the main problems with the conventional scientific wisdom. Among the important elements of their critique are the following: 1) It is wrong or at least very misleading to view weight gain or loss as strictly determined by net calories consumed. 2) Hormones, especially insulin, and hormonal balance are crucial in determining what causes the body's fat deposits to grow. 3) Simply eating too much fat is not a cause of obesity (Hyman emphasizes the importance of eating "good fats" and avoiding "bad fats"). 4) Diets rich in starchy, sugary, refined, easily digestible, and processed carbohydrates which raise insulin levels are the most important factor contributing to obesity. 5) Our bodies, especially our digestive and metabolic systems, have a natural tendency to homeostasis, automatically regulating and maintaining our health, including our weight (this automatic regulation, however, can be thrown off by poor health habits and patterns).

From the point of view of Taubes and Hyman, the rational obesity model incorporates faulty health science insofar as 1) it views weight gain or loss as determined by net calories, 2) it ignores the role that hormones play in obesity, 3) it ignores the role of simple carbohydrates in obesity, and 4) it ignores the homeostatic aspect of our bodies. Therefore, what is needed is an alternative model of obesity, in particular a socio-economic model of obesity that incorporates the best health science. In my judgment, Hyman's work is the best and most complete in this regard.

The essence of Hyman's view is that there are nine factors, four dietary and five life behavioral patterns, that are the key causes of obesity. The dietary factors are: 1) diet high in refined, processed carbohydrates, 2) diet high in bad fats, 3) diet low in fiber, and 4) diet low in antioxidants and high in oxidants. The problematic life behavioral

patterns are: 1) overly rapid eating, 2) eating in the presence of stress, especially chronic stress, 3) sleep deprivation, 4) lack of exercise, and 5) high exposure to toxins that cause an overloaded detoxification system.

With regard to diet, Hyman (2006, pp. 42-43) explains that our health and weight regulation require phytonutrients, healing plant chemicals, which one can acquire by eating real, whole, unprocessed plant food. The *phytonutrient index* (PI) indicates how rich the carbohydrates you eat are in phytonutrients. The problematic carbohydrates, the ones with too much sugar too quickly absorbed, cause the insulin levels in an individual's blood to become elevated. Over time this could lead to insulin resistance where it takes more and more insulin to help the sugar get into one's cells. This condition has been called the metabolic syndrome. The *glycemic load* (GL) is a measure of the response of your blood sugar (and insulin level) to a meal. Eating food with a high GL and low PI is likely to cause poor health outcomes including obesity (Hyman 2006, pp. 44-47).

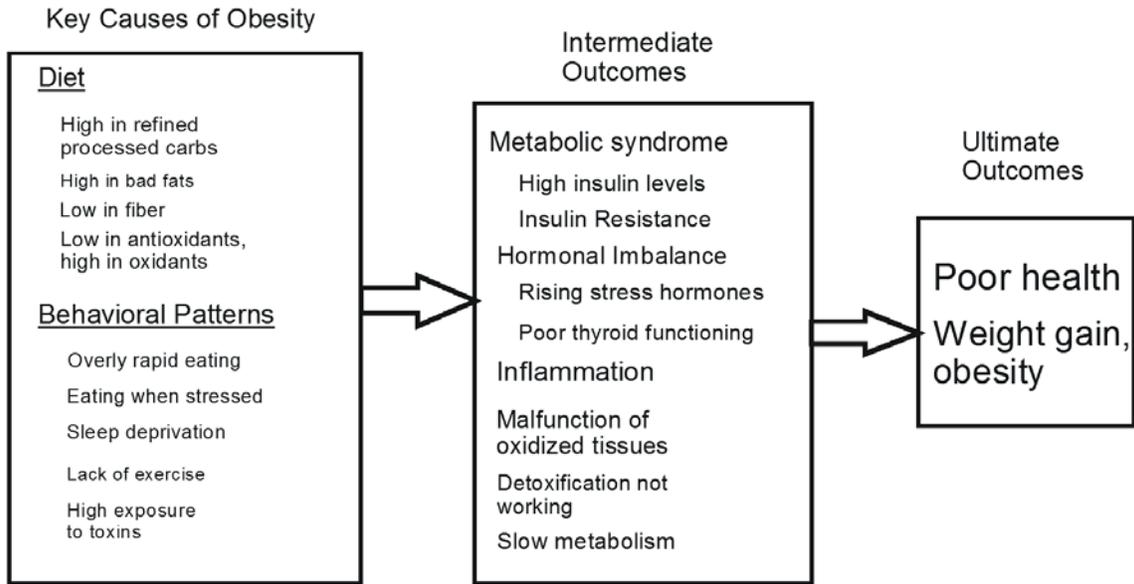
The good fats that Hyman (2006, pp. 33-39) recommends are: omega-3, monounsaturated, some polyunsaturated, and some saturated fats. On his list of bad fats are most saturated fats and all trans fats. In general, "bad fats ... turn off your fat-burning genes, making it much harder for you to lose weight" (p. 33). On the other hand, good fats increase your metabolism and help you burn fat. As Hyman (2006, pp. 149-156) also explains, oxidation occurs when the body is damaged by free-radical oxygen which "steals" an electron from a molecule in the body. If enough antioxidants are present and not too many oxidants, this oxidation will be reduced. Besides eating foods that reduce oxidation and avoiding foods that cause it, Hyman (pp. 151-155) recommends various

steps people can take to keep oxidation from being problematic and contributing to obesity.

With regard to behavior patterns, Hyman (2006, pp. 110-118) explains that eating fast (pp. 61-63) and sleep deprivation (p. 118) in the presence of chronic moderate to high stress cause one's body to release into the bloodstream a hormone called cortisol that sets off a number of physiological responses including becoming less sensitive to the hormone that tells your brain you are full. This is one important pathway from stress to weight gain. The same thing happens to animals such as lab rats. Lab rats exposed to stress "ate less, exercised more and gained weight ... from stress alone!" (p. 111). Consistent with this, a study of twenty pairs of human twins who differed by more than 37 pounds in weight found that the overweight twins had higher levels of stress hormones and poorer health outcomes (p. 117).

Another important life pattern is exercise or lack thereof. Hyman (2006, pp. 158-161) finds that exercise 1) dramatically improves the efficiency at which your cell's mitochondria transform food and oxygen into energy, and 2) increases the number of mitochondria one has, thereby increasing one's metabolic rate. A higher metabolic rate makes it possible for one's body to burn more calories. Conversely, a sedentary pattern contributes to weight gain, and possibly obesity, by lowering the metabolic rate. Further Hyman (2006, pp. 190-205) finds that the environmental toxins that all of us are exposed to "play a major role in the current obesity epidemic ... and people's ability to lose weight in general" (p. 193). The problem is that "the total load of all toxins – pesticides, industrial chemicals, mercury and more – has exceeded our bodies ability to get rid of them ... contributing to metabolic problems that promote weight gain and prevent weight

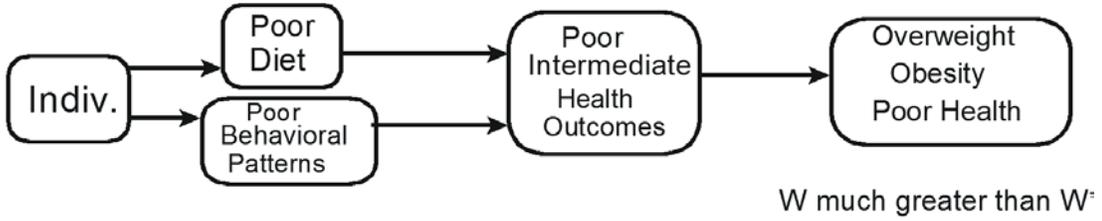
Figure 2
Health Science on Causes of Obesity and Poor Health



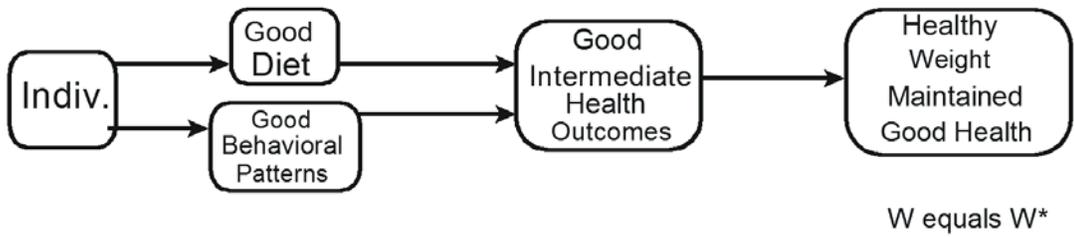
Source: Hyman, *UltraMetabolism*, 2006

Figure 3
Health Choices of the Bounded Rational Actor

A) Worst Health Case



B) Best Health Case



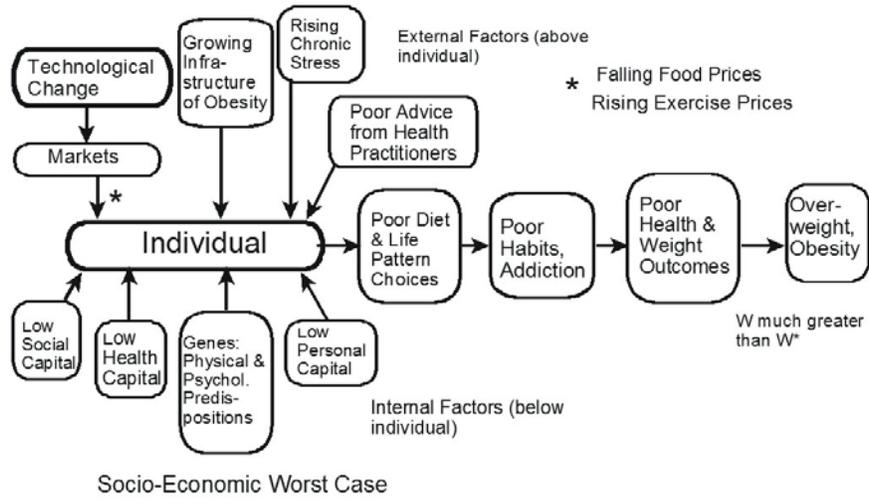
loss” (193). These toxins are typically stored in fat tissue (pp. 194-195). Such “toxins inhibit the function of your thyroid and your mitochondria as well as throwing your hormones out of balance, all of which wreak havoc on your metabolism” (p. 205).

The above health science related to the causes of obesity and poor health is summarized in Figure 2 above. Figure 3, also above, includes an individual who is faced with choices about diet and life patterns. Unlike in the rational obesity model, the individual’s decision making exhibits bounded rationality because the individual’s knowledge and ability to process information is quite limited, and the health reality is complex. Figure 3 leaves out all the health science specifics of Figure 2. However, it indicates the range of health and obesity outcomes from worst (Figure 3A) to best (Figure 3B) which are a consequence of the choices. Not surprisingly, as Hyman explains, individuals who choose or who find themselves with poor diets and poor behavior patterns are likely to have poor health outcomes including being overweight or obese. On the other hand, individuals who choose really good diets and behavior patterns will not only have good health but are highly likely to maintain an optimally healthy weight (W^*).

The Principal Elements of an Alternative Socio-Economic Model of Obesity

To understand the growth of obesity during the last thirty years or so, it is necessary to consider much more than health science. It is necessary to consider the many external and internal factors that influence an individual’s choice of diet and life patterns. There are many reasons why these external and internal factors influence or reinforce individuals’ choices of diet and behavioral patterns. Further, there is much evidence that at least some of the important external factors have become increasingly negative,

Figure 4
Factors Causing Increase in Overweight and Obese Individuals



thereby leading individuals increasingly to make poor diet and life pattern choices. Figure 4 depicts the worst case where the external and internal factors impinging on the individual make poor diet and behavioral pattern choices likely and obesity probable as a consequence of these choices. In the sections that follow, these internal and external factors are explained. The internal factors are the individual's endowment of 1) personal capital, 2) social capital, 3) health capital, and 4) genes that determine an individual's physical and psychological predispositions to obesity. The external factors are: 1) technological change impacting on markets causing changes in the prices of food and exercise, 2) the infrastructure of obesity, especially the behaviors of various suppliers of processed food, 3) socio-economic factors contributing to chronic stress in individuals, and 4) the advice about eating and behavior from health professionals. The essence of the argument is that obesity tends to occur when vulnerable individuals who have low personal capital, low social capital, low health capital, and genes predisposing them to obesity encounter stressful situations, lower prices of food and higher prices of exercise, poor advice from health practitioners, and the large and growing infrastructure of obesity.

The External Factors Contributing to Obesity

Four external factors contributing to obesity are analyzed in this section.

The Infrastructure of Obesity

The infrastructure of obesity, the first external factor, refers to the features of the socio-economy that influence eating negatively, and thus, tend to contribute to food consumers' poor health and obesity. One important part of this infrastructure is the changing behaviors of important actors in the food industry, behaviors that lead to poor diet choices on the part of consumers. Another part is changes in important socio-

economic patterns that contribute to consumer's poor decision making with regard to food.

First, consider the influences deriving from food suppliers, in particular the agricultural, food processing, food distribution, and food preparation industries, especially the food processors and food preparers. There is a great deal of evidence that they are increasingly selling unhealthy foods. What do we mean by unhealthy foods? Following Hyman (2006, chapters 3 and 4), unhealthy foods are foods high in 1) bad fats and 2) carbohydrates with a low phytonutrient index and high glycemic load, especially refined grains, sugar and sugary items, processed food, and junk food. Many of these unhealthy foods are ones quickly turned to sugar by the body, and people experience them as stressful, therefore resulting in increases in adrenaline and cortisol in their bloodstream. David Kessler (2009) emphasizes that unhealthy foods are ones high in sugar, fat, and salt, often added by food processors. Healthy foods in contrast are whole, unprocessed foods, full of fiber, antioxidants, vitamins, minerals, phytonutrients, and healthy fats (Hyman 2006, p. 52).

The following are typical characteristics of the unhealthy foods of today: 1) cheap, 2) convenient, 3) fast (delivered quickly), 4) attractively packaged, 5) tasty, 6) marketed extensively and attractively, 7) mass produced with high productivity, 8) prepared quickly, 9) available throughout the country, 10) available in big portions, 11) easy to eat, not much chewing required, 12) palatable, has the capacity to stimulate the appetite and prompt more eating (Kessler 2009, p. 36), 13) light, refined, 14) uniform quality, 15) habit forming, 16) tending to override the body's satiety signals, 17) provide

a multisensory experience, 18) calorie dense, and 19) contain added chemical flavors (Schlosser 2001, chapter 5; Kessler 2009, pp. 115-119).

The food suppliers are not just supplying these unhealthy foods because they are being demanded by consumers. As Kessler (2009) explains, food suppliers are actively designing these foods to enhance their appeal. More specifically, they are creating foods with added sugar, fat, and salt 1) to make them hyperpalatable, 2) to make them override the body's satiety signals, which indicate when one is full, and 3) to make them more habit forming. In other words, these firms are optimizing every element in the hedonic equation (p. 127). The goal according to an industry expert "is to get you hooked" by creating foods with "craveability" (p. 125). As Kessler sees it, the food suppliers are creating customers who are "conditioned hypereaters" (pp. 137-141). In a variety of ways, they have attempted to create a hyperstimulating environment conducive to triggering hypereating. As Kessler (pp. 16-17) notes, under these conditions people's natural homeostatic tendency to maintain a desirable weight goes awry. To support all these food design efforts, food processing companies have been making huge investments (Acs et al 2007b, p. 141).¹

In addition to food suppliers' product design efforts, these companies have aggressively used advertising and other marketing strategies to persuade consumers to buy more of their products. Indicative of the magnitude of their efforts is the fact that "the food industry is the second largest advertiser in the United States (after the automotive industry)" (Philipson and Posner 2008, p. 980). Only two percent of this advertising goes for foods low in sugar, fat, and salt; one-third of this is targeted at children; eleven percent of this food advertising is for fast food advertising, and much of

the rest is for sugary snacks and cereals, soft drinks, and candy (Brownell and Horgen 2004, p. 102; see also Brody 2010; and for a statistical analysis, see Chou et al 2008). The junk food advertisers have not just used television and radio; they have used product placement in movies and have found numerous ways to get their products advertised and sold in schools (Brownell and Horgen 2005, chapters 5 and 6). Regrettably, as the country's main pediatrics association, a broad coalition of organizations concerned with child welfare, an organization concerned with media and children, a leading nutrition watchdog group, and a top medical journal conclude, these advertising practices are all too effective as well as being "deceptive, exploitative, and harmful to the health and well-being of our children" (p. 116). The result, according to Brownell and Horgen (p. 21) is that "eating in American culture is like swimming in a tsunami. The best of intentions get pulled under by massive forces."²

In the background are a number of important socio-economic patterns that add to the potency of the food suppliers' efforts. First, people are spending more time away from home and eating less at home. To some extent, this is because more women are working away from home. This has led to more eating at restaurants, especially fast food establishments (Brownell 2004, pp. 36-37; Finkelstein et al 2005, pp. 245-246). Because people have less time at home, many are shifting to foods requiring less preparation time at home. Another pattern is that more food is being consumed as snacks, which are often unhealthy processed foods (Acs et al 2007b, p. 139; Kessler 2009, pp. 174-175). The introduction and wide scale adoption of microwave ovens during the last three decades is important because this has made it easier and cheaper to buy and consume prepackaged foods in the home (Finkelstein and Zuckerman 2008, p. 24). Further, many schools are

serving more unhealthy food, having accommodated to students' desire for fast food type fare. Lastly, the U.S. unfortunately does not benefit from a French cultural pattern (involves slower eating, smaller portions, no snacks) that serves to dampen or inhibit conditioned hypereating (pp. 175-176).

The basic idea related to the obesity infrastructure is that “The root of the [obesity] problem ... lies in the powerful social and cultural forces that promote an energy-rich diet and a sedentary lifestyle” (Brownell and Horgen 2004, p. 27). This environment has gotten a lot more potent over the last thirty years. It's not that these influences will cause everyone to change their diet and become obese. Some people's genes will not allow this. Some people are not easily influenced; some people already are very knowledgeable about nutrition or otherwise not susceptible to this influence. But unfortunately, many are very susceptible or vulnerable to this toxic food environment.

Technological Change, Markets and Prices

The second external factor is the impact of technological change on the markets for food and exercise. As indicated earlier in the section on the rational obesity model, technological change has led to lower food (or calorie consumption) prices and higher exercise (or calorie expenditure) prices. This factor has relevance for the present model but requires some further explanation. First, the relative price changes for different types of food have been quite different. Although the price of food relative to other goods has declined by sixteen percent since 1960, the prices of fresh fruits and vegetables, fish, and dairy products have increased relatively since 1983 (Finkelstein and Zuckerman 2008, pp. 20-21). On the other hand, the prices of unhealthy foods including fats and oils, sugars and sweets, and carbonated beverages have become relatively less expensive. In the case

of carbonated beverages, it is clear that the lower relative price has resulted in increased consumption (p. 22). The same is true for fats and oils. Thus, the evidence supports the view that it is the relative decline in price of unhealthy foods, not food in general, that has contributed to obesity. Note that the price of high fructose corn syrup (originally developed in the 1970s), a sweetener considered to be unhealthy, is twenty percent cheaper than table sugar, a fact which goes far to explain why it has been added to many products in place of sugar (p. 25). As a result of the relative price changes mentioned above, “whole foods ... have come to represent a smaller proportion of calories consumed, while products that are more highly processed ... have increased in terms of calorie intake” (Acs et al 2007b, 138).³

What accounts for the decreasing relative prices of these unhealthy food products?

“The answer lies largely in advances in food processing, preservation, and cooking technologies that have allowed more foods to be produced in a central location and then consumed quickly and cheaply. Innovations such as vacuum packing, improved preservatives, deep freezing, stretch-wrap films, irradiation, hydrogen peroxide sterilization, and microwaves, to name a few, have significantly lowered the monetary and nonmonetary cost of food, including the time cost of acquiring, preparing, cooking and cleaning up after food, as well as the financial cost of purchasing food. Foods more dependent on technology are often those with the greater amounts of added sugars and fats and therefore the highest in calories. It is exactly these foods that have seen the greatest drop in prices and preparation time, and as a result, the greatest increases in

consumption.” (Finkelstein and Zuckerman 2008, pp. 22-23; see also Cutler et al 2003, 105-107)

The processing of potatoes into French fries is a prime example (Schlosser 2001, chapter 5).

Poor Advice from Health Practitioners

The third external factor is poor health advice. If Hyman and Taubes are correct about the health science of obesity, and therefore, the health science mainstream has gotten significant elements of the causes of obesity wrong, it follows that their advice regarding healthful eating has been deficient in some very important respects. Recall Hyman and Taubes critique of the conventional scientific wisdom above. Based on this, Hyman and Taubes have identified the two most important elements of the poor health advice which has been widely disseminated over recent decades:

1) To keep weight from rising, avoid eating more calories than your body uses (Taubes 2007, p. 292). Moreover, “the treatment for obesity is to create a caloric deficit by eating less and/or expending more” (p. 357).

The fact that semi-starvation methods have failed as a treatment for obesity (p. 258), and increased exercise has not been found to be an effective method for treating obesity (pp. 259-260) is strong evidence that the above advice is poor or inadequate.

2) Eat a low-fat diet either to avoid accumulating excess body fat or to reduce body fat and lose weight (Hyman 2006, p. 29).

For several decades, “the U.S. government (Department of Health and Human Services, 1988), the American Heart Association (1996), and the American

Diabetes Association (1997) have all recommended a low-fat diet to prevent and treat obesity. It seems perfectly logical: if you don't eat fat, you won't gain fat. There's one problem—science does not support this recommendation.” (Hyman 2006. p. 29; see also Taubes 2002, pp. 6-8)

Further, this mainstream health advice is not helpful because in focusing people's efforts on calories and fat, people fail to do what is important in order to be healthy and to avoid obesity, namely they fail to eat healthy carbohydrates and healthy fats, thereby failing to maintain appropriate hormonal balance.⁴

Rising Chronic Stress

The fourth external factor is rising levels of chronic stress. Earlier, following Hyman (2006, pp. 110-118), the role of stress with respect to obesity was explained. Essentially, chronic moderate to high stress in people can set off hormonal and other physiological changes which can lead to weight gain and obesity. Arguably, the last thirty years when obesity levels have risen substantially are ones during which U.S. people have experienced rising levels of chronic stress. Divorce rates have been high, economic instability appears to have increased, and other socio-economic factors may well have increased stress levels. However, without careful research on different types of stress and their levels over time, the importance of this factor would be hard to determine. Any statement at this point on this factors' importance would only be speculation.

The Internal Factors Contributing to Obesity

Genetic Predispositions

The first internal factor analyzed here is a person's genetic predispositions. Clearly, people's genetic physiological and psychological predispositions can not explain

the rapid rise of obesity over the last thirty years. People's genetics can only change slowly over long periods of time as their genes mutate, adapting to changing environmental conditions (Rosin 2008, p. 624; Finkelstein and Zuckerman 2008, p. 54). Differences in individual and group genetic predispositions are, however, very important in explaining corresponding individual and group differences in weight and the prevalence of obesity. According to Hyman (2006, pp. 24, 197-198, 205), a person's genes determine his or her metabolism, ability to detoxify their bodies, and production of hormones, among other things, all of which affect their weight gain and likelihood of becoming obese. The studies of adopted adults and twins reared apart provide much support for the relative importance of genetics in determining a person's weight (Brownell and Horgen 2004, p. 23). Although the growing infrastructure of obesity may be a very important factor contributing to weight gain and obesity during recent decades, an individual will not become obese unless he or she has a "willing" biology or genetic predisposition (p. 24). Exactly how much of the variability in body weight from person to person is accounted for by genes is subject to some disagreement. According to Brownell and Horgen, 25 to 40 percent of this variability is explained by genes; other authors, however, have cited higher figures (Finkelstein and Zuckerman 2008, p. 52).

Personal Capital

The second internal factor is the individual's endowment of personal capital. Personal capital is a kind of human capital embodied in individuals. However, it is different from standard human capital which is generally associated with investment in education and training (Tomer 2008, chapter 6). Investment in personal capital (PC) is intended to improve the quality of an individual's psychological, physical, and spiritual

functioning (p. 82). Unlike standard human capital, the PC capacities are for the most part noncognitive and nonacademic in nature. Many PC qualities are essential to successful job performance; however, this paper focuses largely on the qualities linked to consumption activity and related aspects of one's personal life.

“A person's stock of personal capital is partly a product of one's genetic inheritance, partly a result of the life-shaping events that one has encountered, and partly an outcome of one's efforts to mature and to grow in nonintellectual ways.”
(Tomer 2008, p. 82)

PC is relevant here because an individual's accumulated PC will determine much about how she responds to the influences deriving from the infrastructure of obesity as well as to the economic incentives from the markets for food and exercise. Recall that the prices of unhealthy foods, typically processed carbohydrates and some fats and oils, have decreased substantially relative to healthy, whole foods. Not only have the prices come down but the availability, aggressive marketing, and various aspects of the appeal of fast, processed foods have increased making them more difficult to resist. Therefore, it is not hard to understand why persons with small endowments of PC will to a great degree succumb to the many influences from the infrastructure of obesity.

Others who have acquired greater endowments of PC in the form of emotional competencies, ingrained habits of thought, feeling and behavior, will be in a much stronger position to resist these influences. Among the important PC qualities relevant here are the ability to be self-regulating or self-controlling which involves, for example, the ability to control impulse, the ability to delay gratification, and the ability to keep distress from swamping the ability to think (see Tomer 2008, pp. 84-85 and Goleman

1998, pp. 26-27). In general, people who have acquired a sufficient set of these basic competencies will have achieved a desired “balance” involving integration of emotions and thinking, more specifically an integration of the functioning of the amygdala and the prefrontal lobes of the brain.

“The amygdala is the seat of emotion; its messages trigger emotional responses. These unrestrained emotional messages can be very strong and in an emergency very rapid. In contrast, the role of the prefrontal lobes is to comprehend the situation confronting a person and to coordinate, moderate, and regulate the individual’s emotional response in order that the response is appropriate to the situation. Complementary functioning of the amygdala and the prefrontal lobes is prerequisite for emotionally intelligent behavior. As people learn better ways to manage their emotions, new brain pathways and circuitry are created enabling the desired complementary functioning as well as desired biochemical balance.”
(Tomer 2008, pp. 163-164 based on Goleman 1994, pp. 13-29)

People with a low endowment of the relevant PC are vulnerable to the infrastructure of obesity, and accordingly, easily develop the attitudes, behaviors, and habits encouraged by the food suppliers (Kessler 2009, p. 155). Another way of looking at it is that low PC people are easily induced into making investments in consumption capital in which they acquire the ability to use and appreciate the various fast, processed foods. These consumption capital investments are complementary to their stock of PC, and these investments play an important role in keeping these people coming back as customers of the fast food and processed food suppliers. Following Kessler (pp. 6, 145-162), the low PC people typically become conditioned hypereaters. These hypereaters

have become powerless in the face of certain foods; they have become emotional or compulsive eaters who are driven to respond excessively to the sensory stimuli of palatable foods, especially ones high in sugar, fat, and salt (pp. 27-28). When experiencing the stimulus of a palatable food reward, conditioned hypereaters are out of control because they have an inability to feel satisfied; they continue to eat in a way that overrides the wisdom of the body (pp. 9, 145). Such vulnerable people are typically individuals with significant imbalances who often experience emotional distress with strong feelings of anxiety, anger, or depression. A strong conditioned hypereating pattern may be formed when eating particular foods helps the person restore at least temporarily a sense of balance and control otherwise missing. Thus, eating this food is a kind of self-medication; it has a “hedonic calming effect” (Kessler 2009, p. 150). Further, as Hyman (2006, pp. 61-62, 111, 118) emphasizes, these vulnerable, low PC people typically experience chronic stress, eat rapidly, lack exercise, and are sleep deprived, patterns frequently leading to obesity. On the other hand, high PC people who have invested in complementary consumption capital have acquired an appreciation of the virtues and healthfulness of whole foods as well as an appreciation of the seductive, unhealthy aspects of fast, processed foods. They, therefore, have the ability to choose healthy food wisely and to resist the attractions and incentives of unhealthy food.

Health Capital

The third internal factor is the individual’s endowment of health capital. Health capital (HC) is a stock consisting of the accumulated individual learning that contributes to his or her physical health and some aspects of mental health. These learned behaviors relate to our eating patterns, exercise activity, use of nutritional supplements, use of

medicines, use of potentially toxic substances (alcohol, illicit drugs, and so on), recreational activity, and other lifestyle patterns. Certain kinds of HC would be particularly important from the standpoint of avoiding obesity. Following Hyman, it would be important to learn 1) to eat slowly, 2) get sufficient sleep, 3) understand the nutritional value of different foods, and 4) get sufficient exercise. In general, a person who has adopted a healthful, wholesome lifestyle and established many good habits would be high in HC and unlikely to become obese. Note that the category, HC, overlaps with some aspects of consumption capital and PC.

Social Capital

The fourth internal factor is the individual's endowment of social capital (SC). SC refers to the capacity that is embodied in an individual's social relationships or the bonds and connections between an individual and others. SC is embodied in families, institutions, civic communities, and the larger society. The strength and quality of an individual's SC endowment arguably has a relationship to the person's likelihood of becoming obese. "In the presence of strong positive social relationships, people's imbalances are likely to be more muted and less problematic. Conversely, when social capital is weak and negative, people's imbalances are likely to be more pronounced and problematic" (Tomer 2008, p. 165). This implies that people with weak and/or negative SC are more likely to be vulnerable to the influences from the infrastructure of obesity and the economic incentives from the markets for food and exercise.

Individual Decision Making

As indicated earlier and summarized in Figure 4, the socio-economic model of obesity developed here includes four external factors that influence individual decision

making: technological change and market prices, the infrastructure of obesity, chronic stress levels, and advice from health practitioners. However, the individual decisions regarding diet, exercise, and lifestyle depend very much on how different individuals respond to the external factors. The responses are determined to a great extent by individual endowments of personal capital, social capital, and health capital as well as their genes. Given strong, positive endowments of the three types of intangible capital, an individual is likely to choose a good diet and good behavioral patterns even if the negative influences from the infrastructure of obesity are strong. However, when the intangible capital of an individual is weak, the external factors, for example, a strong, negative infrastructure of obesity, are likely to produce an unfavorable outcome involving poor diet and poor behavioral patterns, the kind likely to cause obesity. Note that an individual may not have the possibility of becoming obese unless they have at least some genetic predisposition to obesity.

In this model, unlike in the rational obesity model, the individual is not maximizing utility or targeting a particular weight or net calorie consumption. The individual may have some outcome aspirations, but these aspirations are likely to be for a complex combination of health, good looks, and weight. Further, the decision-making outcome will be determined to a great extent by the relative strength of the internal and external factors. If the negative external factors are getting stronger over time, as they apparently were during the last three decades, without any significant changes in the internal factors, this would indicate a rising level of obesity as has been observed.

Is It an Addiction?

A number of authors have explored whether the poor eating patterns leading to obesity involve addictions. Brownell (2004, pp. 33-34) does not take a definitive stand on this issue, but he cites evidence of addictive-like withdrawal symptoms in rats whose sugar intake was stopped and testimony of many people who have emphatically claimed to be addicted to sugar and sweets. According to the Rudd Center for Food Policy and Obesity at Yale University, “neurobiological research has identified similarities in the way the brain responds to drugs and highly palatable foods” (www.yaleruddcenter.org; see also Avena et al 2007 and Cawley 2007, pp. 33-34). Recall that Kessler’s (2009) view is that many succumb to a pattern involving conditioned hypereating of palatable foods. To be sure, these are strong, compelling habits, but they are not quite addictions.

What is an addiction? An addiction is 1) a habit, 2) harmful, 3) a pattern where the user is dependent on the commodity, 4) a pattern involving compulsive consumption and craving, and 5) a pattern in which deprivation of the good causes significant withdrawal symptoms (Tomer 2008, pp. 155-156). The typical pattern of food consumption leading to obesity is certainly habitual and harmful. However, the negative eating patterns typically involve a lower degree of dependence, craving, and withdrawal symptoms than what are recognized to be full-fledged addictions. In other words, while conditioned hypereating is a strong, harmful pattern, it does not involve the total dependence and severe craving that addiction does.

The Distribution of Obesity Among Different Socio-Economic Groups

The model developed here clearly indicates that socio-economic groups with low personal capital, low health capital, and low social capital will be expected to have higher

obesity rates than socio-economic groups with higher endowments of intangible capital. While getting good measures of these three types of intangible capital for different groups would no doubt be very difficult, there are data on the rates of obesity for certain racial, ethnic, and income groups, data that lends support to the model's distributional implications. According to Drewnowski and Darmon (2005, p. 270S),

“The rates of obesity and type 2 diabetes in the United States and other industrialized countries follow a socioeconomic gradient, with highest rates observed among minorities and the poor. At the individual level, [high] obesity rates are linked to low incomes, low education, minority status, and a higher incidence of poverty....[Further] low-income consumers are more likely to be frequent users of fast-food as opposed to full-service restaurants and are more likely to live in areas with less physical access to healthier foods. It is well established that higher diet quality, as measured by the Healthy Eating Index, is associated with higher incomes, more education, and with lower rates of obesity and overweight.”

(See also Acs et al 2007a, pp. 224-225 and Henderson 2007, pp. 59-66)

Thus, the implications of the present model are at least consistent with the main facts regarding the distribution of obesity among socio-economic groups.

A Few Policy Implications

It is beyond the scope of this paper to provide an in-depth discussion of the policy implications of the present model. However, a few important and interesting policy implications should be mentioned. The model clearly indicates that low or poor endowments of personal capital, health capital, and social capital are associated with high

rates of obesity. It follows that obesity rates could be lowered if people who are relatively poor in the relevant intangible capital were to make significant efforts (i.e., investments) to raise certain of their intangible capacities. Although Kessler (2009, pp. 181-225) does not explicitly use the language of intangible capital, his discussion of how to deal with the obesity problem recognizes that people would need to make significant efforts to bring about lasting qualitative changes in their behaviors. In particular, Kessler has explained specifically and carefully what conditioned hypereaters would need to do to overcome their compulsive, bad habits. “The cornerstone of treatment for conditioned hypereaters is developing the capacity to refuse the [food] cue’s invitation to the brain in the first place. That refusal must come early, and it must be definitive” (p. 182).

According to Kessler (2009, pp. 184-189), the ability to change entrenched habits involves five major components: 1) developing awareness of the food choice situations and the associated risks (pp. 185-186), 2) learning and developing alternative responses to these situations (pp. 186-187), 3) “formulating thoughts that compete with and serve to quiet the old [dysfunctional] ones” (p. 187), 4) developing relationships with people who can provide crucial support, thereby helping the habit plagued individual recognize and avoid [tempting food] cues and acknowledging his or her success in doing this (pp. 188-189), and 5) developing new emotional responses to food such as “changing one’s emotional appraisal of salient food” (p. 197). Further, it is necessary for the afflicted individuals to develop a set of rules which provide needed structure in order to keep them from becoming aroused by unhealthy food (p. 190). The latter “requires attention, practice, and advance planning, motivated by the expectation that... [the individual] will ultimately derive emotional satisfaction in new ways” (p. 195). Essentially, the

intangible investment necessary to overcome habitual hypereating of unhealthy foods involves making a “perceptual shift and learning new behavior that eventually becomes as rewarding as the old” (p. 201).

Besides dealing with the internal factors relating to obesity as above, policy measures must deal with the external factors, especially the infrastructure of obesity. This is a big topic, too big to tackle here, as there are many aspects of the obesity infrastructure, and for each there are a variety of possible policies that might help to reduce or eliminate its negative influence. Therefore, this remains an important topic for further research and debate. In any case, an important general implication of the present model is that success in lowering the obesity rate cannot focus solely on the external factors; it will require measures dealing simultaneously with the internal and external contributors to the problem.

Finally, it is important to note that societal efforts to deal with obesity should be part of a larger effort to help people lead more healthful and satisfying lives, which, of course, includes helping people 1) make healthful, nutritious food choices and 2) engage in a sufficient amount of appropriate exercise.

Conclusion

The model developed here along with the accompanying explanations indicates that the obesity problem is very much embedded in the socio-economic patterns of countries like the U.S. and is unfortunately likely to continue growing in the absence of concerted efforts to arrest the key factors contributing to its growth. As this paper indicates, while obesity is explainable and understandable, it is not correct to think that obesity is a consequence of economically rational choice. With regard to explaining the

rapid rise of obesity rates, the socio-economic model of obesity developed here is a clear alternative to the rational economic model of obesity. Arguably, this alternative model is based on better health science, better assumptions about individual decision making, and better understanding of the external and internal factors influencing individual choices regarding diet and other behavior patterns relevant to obesity. This model makes sense insofar as it explains the main “stylized facts” about obesity in developed and developing countries. Hopefully, skilled empirical researchers will be able to gather sufficient data in order to rigorously test the model’s propositions. There is also a need for policy research that builds on the key insights deriving from this model.

References

- Acs, Zoltan J.; Henderson, Lenneal J.; Levy, David T.; Lyles, Alan; and Stanton, Kenneth R. 2007a. "A Policy Framework for Confronting Obesity," in Acs, Z. J. and Lyles, A. Eds. *Obesity, Business and Public Policy*. Cheltenham, UK: Edward Elgar, 221-252.
- Acs, Zoltan J.; Cotten, Ann; and Stanton, Kenneth R. 2007b. "The Infrastructure of Obesity," in Acs, Z. J. and Lyles, A. Eds. *Obesity, Business and Public Policy*. Cheltenham, UK: Edward Elgar, 135-155.
- Avena, Nicole M.; Rada, Pedro; Hoebel, Bartley G. 2008. "Evidence for Sugar Addiction: Behavioral and Neurochemical Effects of Intermittent, Excessive Sugar Intake," *Neuroscience and Biobehavioral Reviews*, 32(1), 20-39.
- Bleich, Sara N.; Cutler, David; Murray, Christopher; and Adams, Alyce. 2008. "Why Is the Developed World Obese," *Annual Review of Public Health*, 29, 273-295.
- Brody, Jane E. 2010. "Risks for Youths Who Eat What They Watch," *New York Times*, April 20.
- Brownell, Kelly D. and Horgen, Katherine B. 2004. *Food Fight: The Inside Story of the Food Industry, America's Obesity Crisis, and What We Can Do About It*. New York: Contemporary Books.
- Cawley, John. 2004. "An Economic Framework for Understanding Physical Activity and Eating Behavior," *American Journal of Preventive Medicine*, 27(3S), 117-125.

- Cawley, John. "The Economics of Childhood Obesity Policy," in Acs, Z. J. and Lyles, A. Eds. *Obesity, Business and Public Policy*. Cheltenham, UK: Edward Elgar, 27-56.
- Chou, Shin-Yi; Grossman, Michael; and Saffer, Henry. 2004. "An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System," *Journal of Health Economics*, 23, 565-587.
- Chou, Shin-Yi; Rashad, Inas; and Grossman, Michael. 2008. "Fast-Food Advertising on Television and Its Influence on Childhood Obesity," *Journal of Law and Economics*, 51(4), 599-618.
- Currie, Janet; Della Vigna, Stefano; Moretti, Enrico; and Pathania, Vikram. 2010. "The Effect of Fast Food Restaurants on Obesity and Weight Gain," *American Economic Journal: Economic Policy*, 2, August, 32-63.
- Cutler, David M.; Glaeser, Edward L.; and Shapiro, Jesse M. 2003. "Why Have Americans Become More Obese?," *Journal of Economic Perspectives*, 17(3), Summer, 93-118.
- Delpeuch, Francis; Maire, Bernard; Monnier, Emmanuel; and Holdsworth, Michelle. 2009. *Globesity: A Planet Out of Control*. London: Earthscan.
- Drewnowski, Adam and Darmon, Nicole. 2005. "The Economics of Obesity: Dietary Energy Density and Energy Cost," *American Journal of Clinical Nutrition*, 82(suppl.), July, 265S-273S.
- Finkelstein, Eric A.; Ruhm, Christopher J.; and Kosa, Katherine M. 2005. "Economic Causes and Consequences of Obesity," *Annual Review of Public Health*, 26, 239-257.

- Finkelstein, Eric A. and Zuckerman, Laurie. 2008. *The Fattening of America: How the Economy Makes Us Fat, If It Matters, and What to Do About It*. New York: John Wiley.
- Gandal, Neil and Shabelansky, Anastasia. 2010. "Obesity and Price Sensitivity at the Supermarket," *Forum for Health Economics and Policy*, 13(2), 1-17.
- Goleman, Daniel. 1994. *Emotional Intelligence*. New York: Bantam Books.
- Goleman, Daniel. 1998. *Working with Emotional Intelligence*. New York: Bantam Books.
- Goldfarb, Robert S.; Leonard, Thomas C.; and Suranovic, Steven. 2006. "Modeling Alternative Motives for Dieting," *Eastern Economic Journal*, 32(1), Winter, 115-131.
- Henderson, Lenneal J. 2007. "Obesity, Poverty and Diversity: Theoretical and Strategic Challenges," in Acs, Z. J. and Lyles, A. Eds. *Obesity, Business and Public Policy*. Cheltenham, UK: Edward Elgar, 57-75.
- Hyman, Mark. 2006. *UltraMetabolism: The Simple Plan for Automatic Weight Loss*. New York: Atria Books.
- Kessler, David A. 2009. *The End of Overeating: Taking Control of the Insatiable American Appetite*. New York: Rodale.
- Lakdawalla, Darius and Philipson, Tomas. 2002. "The Growth of Obesity and Technological Change: A Theoretical and Empirical Examination," NBER Working Paper No. 8946, May, 1-25.

- Philipson, Tomas J. and Posner, Richard A. 1999. "The Long-Run Growth in Obesity as a Function of Technological Change," University of Chicago Law School Working Paper No. 78, 1-26.
- Rosin, Odelia. 2008. "The Economic Causes of Obesity: A Survey," *Journal of Economic Surveys*, 22(4), 617-647.
- Schlosser, Eric. 2001. *Fast Food Nation: The Dark Side of the All-American Meal*. Boston: Houghton Mifflin.
- Stutzer, Alois. 2007. "Limited Self-Control Obesity and the Loss of Happiness," IZA Discussion Paper No. 2925, July.
- Taubes, Gary. 2002. "What if It's All Been a Big Fat Lie?," *New York Times*, July 7.
- Taubes, Gary. 2007. *Good Calories, Bad Calories: Challenging the Conventional Wisdom on Diet, Weight Control, and Disease*. New York: Alfred A. Knopf.
- Tomer, John F. 2008. *Intangible Capital: Its Contribution to Economic Growth, Well-Being and Rationality*. Cheltenham, UK: Edward Elgar.

¹ Currie et al (2010) find that proximity to a fast food restaurant has a significant effect on the risk of obesity. More specifically, their empirical analysis found that 1) when a fast food restaurant is very close to a school, it raises the obesity rate for young teens and 2) when a fast food restaurant is relatively close to the residence of a pregnant woman, it raises the probability that she will gain a significant amount of weight during her pregnancy.

² After listening to my presentation concerning the factors contributing to obesity, especially the infrastructure of obesity, one of my students, Flavia, whose home is in

Bolivia, remarked on the contrast between Bolivia and the U.S. In Bolivia, she said, there are very few fast food restaurants and little processed food is sold. Bolivian people rarely buy these foods partly because their prices are higher than the fresh, whole foods which are the regular fare in their markets. She also noted that she does not recall seeing any obese people in Bolivia. I found this to be an interesting bit of anecdotal evidence supporting the alternative health science on which this paper is based.

³ There is also evidence that women with greater food “price-sensitivity”, a measure of how important price is when buying food, have higher obesity rates than women with lower price-sensitivity, controlling for income and other relevant factors (Gandal and Shabelansky 2010).

⁴ When people, especially women, who are hyper sensitive about being slim and too little concerned about being healthy, acting in accord with mainstream cultural values, follow calorie restricted diets recommended by health practitioners, the results are frequently counter productive in the long-term. While the dieter may lose weight in the short-term, the lost weight is likely to be both muscle and fat. The problem almost inevitably occurs when the individual goes off the restricted diet and gains the weight back. Typically, more weight is gained back and the weight gain is mostly fat. Thus, the individual winds up being more overweight (or obese) than before the dieting began (Hyman 2006, pp. 13-17).