Tahereh Alavi Hojjat

Rata Hojjat

The Economics of Obesity

Poverty, Income Inequality and Health

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The Economics of Obesity

Poverty, Income Inequality and Health

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To my parents

Tahereh Alavi Hojjat

To the mother

Rata Hojjat

Foreword

In 1958, the celebrated economist John Kenneth Galbraith noted that "more die in the United States of too much food than of too little." Unfortunately, this is truer today than it was 60 years ago. We are finally beginning to understand how prescient these words were. Over the last decade, there has been an increasing awareness of the obesity epidemic. President Obama issued a proclamation in August 2015, designating September as National Childhood Obesity Awareness Month. This year also marked the 5-year anniversary of the "Let's Move!" campaign by First Lady, Michelle Obama. Yet this recognition is not entirely new. As early as 1968, Senator McGovern began efforts to create the US Senate Select Committee on Nutrition and Human Needs. Initially created to study the issue of hunger and malnutrition, it quickly began focusing on national nutritional policy to tackle obesity-related diseases. Almost half a century has passed since that time and we still continue to struggle with this issue. In fact, the prevalence of obesity has more than doubled from 15 % in 1980 to about 34 % in 2006. In order to have solutions, we must first understand the problem. Why is there an obesity epidemic? Who is affected by obesity? More importantly, what do income inequality and poverty have to do with it?

In *The Economics of Obesity: Poverty, Income Inequality, and Health*, Drs. Tahereh and Rata Hojjat address these issues head on. They outline the shift in obesity rates that has occurred among the poor and the affluent. Much of this is related to the widespread availability of energy-dense foods – foods rich in fat content and lower in water content. We tend to consume the same amount of food by weight per day and not necessarily the same calories. As a result, we eat more energy-dense foods by weight than we would of the less processed, less energy-dense foods. These energy-dense foods have become the driving force for not just the obesity epidemic but also the changing distribution of obesity by income and wealth. In this powerful book, the authors make the compelling case of why obesity in the developed world disproportionately affects the poor and how socioeconomic factors and income inequality continue to drive this trend.

As a physician, I am intimately familiar with the consequences of obesity. It increases rates of many serious chronic illnesses like diabetes, high blood pressure,

high cholesterol, heart disease, and stroke. It is also linked to increased rates of osteoarthritis and a poorer quality of life. Obesity is also associated with the increased risk of dying from all causes. The insidious detrimental impact of obesity for individuals cannot be overstated.

As an oncologist, I also recognize the impact that obesity has on increasing cancer risk in our society. Obesity is a well-recognized risk factor for the development of multiple cancers including uterine, colorectal, breast, pancreatic, and others. The National Cancer Institute's SEER (Surveillance, Epidemiology, and End Results) database estimates that approximately 4 % of new cancer cases in men and 7 % in women are due to obesity. In fact, depending on the cancer type, the rates may be much higher.

Much has been written about the economic causes of obesity and some has been written about its cures. None perhaps offers as comprehensive a treatment of these issues as the authors provide in this book. They describe the serious nature of the threat we face, not only to our health but also to our society. They meticulously outline why the obesity epidemic, at its core, is an economic issue – one that is heavily shaped by poverty and income inequality. It is significantly cheaper and easier to consume energy-dense junk food than to prepare a home-cooked meal. Yet as we see, this is not simply a result of poor individual choices. In the context of poverty, it may be fait accompli.

As we see throughout the book, the obesity epidemic is a result of our increased demand for energy-dense foods coupled with public policies that encourage this behavior. We see how the principles of supply and demand hold true in promoting the obesity epidemic, especially for those living in poverty. As chair and professor of economics at DeSales University, Dr. Tahereh Hojjat is uniquely qualified to explain how we can, and must, decrease the demand for energy-rich foods. Decreasing the demand requires changes in the microlevel decisions involving multiple stakeholders – individuals, parents, healthcare providers, and nongovernmental organizations among others. Yet we have to put these stakeholders in a position to succeed. In Chap. 7, we learn some specific ways government policies can decrease the supply side of the equation – such as decreasing subsidies for energy-dense foods and shifting the focus to healthier options.

There continues to be increasing attention paid to the obesity epidemic by the government and more specifically by the CMS (the Centers for Medicare and Medicaid Services). In 2009, as part of the American Recovery and Reinvestment Act (ARRA), the Congress passed the HITECH (Health Information Technology for Economic and Clinical Health) Act – supporting the concept of implementing electronic health records (EHRs). Notably, part of the information in the first phase of implementation was documenting body mass index as a discrete field. As the old adage goes, you cannot manage what you cannot measure. But once having measured it, the next steps are much less clear. Nutritional counseling may check off a quality metric, but without affordable access to healthy food options, the low-cost, energy-dense foods will continue to be a fallback.

On a personal note, as an oncologist, this is an epidemic that we must address urgently. The oncologic burden of obesity continues to rise. If we can tackle the

obesity epidemic, we can decrease not just the widely recognized health complications but perhaps also reduce the cancer burden on our society. In a worldwide study published in *The Lancet Oncology*, Dr. Arnold and colleagues estimated that 481,000 new cancer cases in adults in 2012 were attributable to obesity. As Benjamin Franklin famously wrote, "an ounce of prevention is worth a pound of cure." In the case of obesity, an ounce of prevention is surely worth much more. We also need to do a better job in training in our next generations of physicians and providers on how to provide treatment for obesity. Pediatricians have to retrain themselves to combat adult diseases previously not seen in pediatric populations on an unprecedented scale. The training should be started in medical school and continued through residency.

Drs. Hojjat lays out the challenge before us – the burden of the obesity epidemic on the poor is both an economic challenge and an ethical imperative. The current rates of obesity are not sustainable if we are to remain a productive healthy society and control our healthcare costs. We must do better. From a public policy perspective, this is the Holy Grail: better health, lower cost. The authors lay out specific concrete steps our political and civic leaders must take to address the policy issues that contribute to this cycle of poverty, income inequality, and obesity. We can only hope our leaders have the strength to listen and the wisdom to act.

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Preface

When my father visited the USA from our homeland of Iran for the first time, he was struck by many stark differences between the two regions. One observation that surprised him was the vast presence of obesity in a country that is deemed to be a leader in progress around the world. How could a country so educated be so uninformed about decisions related to their health? He also could not help but notice the correlation between obesity, poverty, and race. My father was not unique in making these observations – other relatives' first visits yielded similar remarks.

As an economist, my father's observations sparked curiosity in me as to how this health crisis affects our economy. Furthermore, when I began developing a new course on global economic issues at my university, I delved into a range of books, articles, podcasts, and social media to increase my understanding of poverty and income inequality in the USA. The Wilkinson and Pickett work, *The Spirit Level: Why Greater Equality Makes Societies Stronger* (2009), helped me to connect the dots between these issues. Using "evidence-based politics," they examined the causes of the differences in life expectancy and health inequalities in peoples at different levels of the social hierarchy in modern societies. The focal problem was to understand why health gets worse at every step down the social ladder, so that the poor are less healthy than those in the middle, who in turn are also less healthy than those further up on the social ladder. Looking at the data, Wilkinson and Pickett concluded that there is a point at which countries reached a threshold of material living standards, after which the benefits of further economic growth are less substantial. When that happens, the "diseases of affluence" become the "diseases of the poor" in affluent societies. Diseases like obesity, stroke, and heart problems, which had been more common among the better-off members in each society, reversed their social distribution to become more common among the poor.

There are many ways to view the obesity issue. From a dietary perspective, the global increase in weight gain is attributable to a number of factors including a shift in diet toward increased intake of energy-dense foods that are high in fat and sugars but low in vitamins, minerals, and other micronutrients. In addition, trends toward less physical activities are occurring due to increased access to transportation, increased urbanization, and improved technologies. These factors are changing

forms of living and work into those that support a more sedentary lifestyle. Given these universal trends, obesity ultimately becomes a problem for all peoples and ethnic groups, affecting people at every income level.

The focus of this book is to uncover and better understand the economic factors of obesity, concentrating on the group of people most predisposed to this health issue. For we can also say that poverty and the environment, along with unequal distribution of income, are unquestionably part of the equation. More data and research on income distribution and on health and social problems, with an updated snapshot of the relation between poverty, income inequality, and obesity, and how one relates to another will be tested. Evidence will reveal troubling long-term social consequences for our society, to a greater degree than many other global concerns currently in the spotlight. Yet, in countries like Japan and the Scandinavian countries, substantial improvements in the quality of life for the vast majority of the population have been seen. Signs of a hopeful, healthier future are, therefore, possible.

We need to change the way people see their own societies in which they live. We need to voice the way that they may support the necessary policies and political changes. We are not the first to advocate a more healthy society while living with increased healthcare costs that grow at unsustainable rates. We certainly will not be the last to encourage policy makers to provide a supportive environment for parents and their children to make wise choices in their living and eating behaviors. Obesity can be and must be confronted for the betterment of the entire population.

Center Valley, PA, USA   Tahereh Alavi Hojjat

Acknowledgments

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List of Abbreviations

ARRA	American Recovery and Reinvestment Act
BMI	Body mass index
CDC	Centers for Disease Control and Prevention
CPI	Consumer price index
DOLS	Dynamic ordinary least square
EU	European Union
FDA	Food and Drug Administration
FMOLS	Fully modified ordinary least squares
FTC	Federal Trade Commission
GDP	Gross domestic product
HEI	Healthy Eating Index
HITECH	Health Information Technology for Economic and Clinical Health
NHAES	National Health and Nutrition Examination Survey
OECD	Organisation for Economic Co-operation and Development
SEER	Surveillance, Epidemiology, and End Results
SNAP	Supplemental Nutrition Assistance Program
USDA	US Department of Agriculture
WHO	World Health Organization
WIC	The Special Supplemental Nutrition Program for "Women, Infants, and Children"
WIP	Women, Infants, and Children Program

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Introduction

Prologue

Abstract *Obesity in the USA, where more than two-thirds of adults are overweight and one-third of the overweight population is obese, is widely acknowledged to be a severe and growing problem. There is growing evidence that obesity is largely an economic issue. In addition, it is particularly worrisome because racial ethnic minorities and populations at the lower end of the national income scale with the least education and highest poverty rates bear the largest burden of obesity. Understanding the complex relationship between social inequality, poverty, and obesity requires drawing from evidence and theories from multiple fields of the social sciences including, but not limited to, sociology, demography, psychology, epidemiology, and other fields of public health and medicine* (Huang et al. 2009). *Each of these areas will be examined in this work.*

Economists hardly suggest that poor health and social problems are the real determinants of income inequality. Instead, they emphasize taxes and benefits, international competition, change in technology, and the mix of skills needed by industry. We will provide evidence that poverty and income inequality have been growing at the same time. We will touch on the factors responsible for major changes in inequality and its consequences on health – on obesity in particular.

In this book, ideas from multiple fields will be presented with more emphasis on behavioral economics that analyzes consumer behavior related to eating habits. It should be noted that the rapid rise in obesity has occurred in the USA in the last 40 years as the result of multiple and simultaneous social, biological, technological, and economic processes (Anderson and Butcher 2006; Apovian 2010; Philipson and Posner 2008). It is beyond the scope of this book to detail the many complex causes of the rise in obesity for the entire population of the USA, as well as in other countries. Instead, this work focuses on the explanation of how inequality, measured at multiple levels of social disadvantage, and poverty lead to higher levels of obesity in the USA and other parts of the world. The first part of this book provides a brief introduction to the issue. Chapter 1 describes different perspectives on causes of obesity; Chap. 2 is an investigation of the causes of obesity; Chap. 3 analyzes

behavioral pattern and diet choices; Chap. 4 is an economic analysis of the socio-economic factors, such as poverty and obesity; and Chap. 5 studies the impact of inequality on obesity. Chapter 6 is devoted to the data and methodology, Chap. 7 is an overview of food policy recommendations and interventions in the fight against obesity, and finally, Chap. 8 has our concluding remarks.

We conclude that stemming the obesity epidemic cannot be separated from stemming the tide of poverty and the income inequality gap. Our study indicates that there is a long-run relationship existing between obesity, income inequality, and poverty. Thus, improving health depends upon transforming economic conditions. These issues need to be addressed through a concerted program of environmental and public policy interventions.

There are numerous factors contributing to a good life. Two critical factors are material living standards and health. Looking at health and income helps us to avoid the fact that is all too common today, when knowledge becomes so specialized, and each specialty focuses on a specific factor contributing to human well-being. For instance, economists focus on income, public health scholars focus on mortality and morbidity, and demographers focus on births, deaths, and population growth. All of these factors contribute to the well-being of humans. If a few people get a lot more money and more people get little or nothing, but it seems that all is well, economists usually argue that the world is a better place, as long as no one gets hurt, known as the "Pareto criterion." Yet, this idea undermines the well-being as we only include material wealth being taken into account. We may as well ask those who get rich and hence gain more political power toward public health and education system if those who did not lose in terms of material well-being were indeed better off in other terms. Thus, as Deatone (2013) argues, one cannot assess society, or justice, using material living standards alone. That explains why we are also considering income, health, and inequality, which together allow us to look at a number of other macroeconomic factors.

Over the past several decades, obesity has grown to major global epidemic portions. In the USA, we find that the rapid rise in obesity rates began in the 1980s. Between 1960 and 1980, obesity prevalency rates in the USA increased from 2 percentage points to 15% (Allison et al. 1999). In the past 25 years, obesity rates have more than doubled. During the late 1980s and early 1990s, obesity climbed to 23%, reaching 31% by 2000 (Finkelstein et al. 2005). Also, the prevalence of obesity increased from 7% in 1980 to nearly 18% in 2012 among children ages 6–11 years in the USA (Ogden et al. 2014). According to the Centers for Disease Control and Prevention (CDC), obesity in the USA now affects approximately 34% of American adults and 17% of children (2015a).

Furthermore, the National Health and Nutrition Examination Survey of 2009–2010 reported that more than 6.3% of adults have extreme obesity (see the glossary of terms) − 74% of men are considered to be overweight or obese. In 2010, in the USA, no state had a prevalence of obesity of less than 20%. Thirty-six states had a 25% or more prevalence of obesity. Twelve of these states (Alabama, Arkansas, Kentucky, Louisiana, Michigan, Mississippi, Missouri, Oklahoma, South Carolina, Tennessee, Texas, and West Virginia) had a prevalence of 30% or more.

The childhood obesity problem has caught the attention of policy makers and other levels of government and has become a front-burner issue for concerned communities, public health, and business leaders, such as Mayors De Blasio and Kenney of New York and Philadelphia cities, respectively. The latter official recently proposed a "soda tax" for the city of Philadelphia in order to increase city revenues as well as cut into the over-usage of sugar-intense sodas by the city's children and adults. The USA spends over $190 billion on the treatment of obesity-related conditions per year (Cawley and Meyerhoefer 2012). Furthermore, direct medical spending on diagnosis and treatment of obesity-related conditions is likely to increase with rising levels of obesity. Even though direct medical cost does not directly reduce economic growth, it represents a diversion of private and public funds to healthcare from other economic issues such as investment in industries and business that could boost the economy (Cawley and Meyerhoefer 2012).

Obesity is not limited to the USA. Most of the world has grown fatter since the 1970s. In poorer societies, both obesity and heart disease are more common among the rich than among their poorer communities. But, as societies get richer, they tend to reverse their social distribution, and obesity becomes more common among the poor and less so among the rich. Studies found that among poorer countries, it is the poor, or more unequal ones, who have become more underweight, while the opposite pattern occurs in rich and industrialized countries (Wilkinson and Pickett 2009).

According to the most recent figures from the National Child Measurement Programme, which assesses the height and weight of primary school children in England, just over 33% of 11-year-olds are now overweight or obese. Among 4- and 5-year-olds, it is 22%. The figures are similar in Wales, Scotland, and Northern Ireland (Winterman 2012). The unfortunate aspect of this is that, as the average person becomes fatter, it becomes socially acceptable to be fat (Jenkins 2013). Compared to 39 other OECD and non-OECD countries, the USA was determined to be the fattest country of them all according to a recent report by the Organisation for Economic Co-operation and Development (OECD) in 2010.

The Centers for Disease Control and Prevention (CDC) in 2015 defines *overweight* as a body mass index (BMI) greater than or equal to 25 kg/m^2 but less than 30 kg/m^2. *Obesity* is defined as a BMI greater than or equal to 30 kg/m^2 and is additionally divided into Grade I (BMI = 30–34 kg/m^2), Grade II (BMI = 35–39 kg/m^2), and Grade III (BMI $\geq$40 kg/m^2) – see the World Health Organization (WHO) in 2000. The terms "overweight" and "obesity" are used to express weight ranges that are greater than what is considered healthy for a given height. In the case of adults, weight and height are used to calculate "body mass index" (BMI) to define what qualifies as overweight and obese, with obesity in adults generally defined as a BMI of 30 or greater, with a BMI of 25–29 categorized as being overweight (Dalrymple 2010) (for more details, see Table 1 on weight range). During 2011–2012, more than two-thirds (68.5%) of adults in the USA were either overweight or obese, 34.9% were obese (Grades 1–3), and 6.4% were extremely obese (Grade 3 obesity) (Ogden et al. 2014). A 2012 policy brief titled "Weight Bias: A Social Justice Issue," by R. R. Friedman and Puhl of the Rudd Center for Food Policy and Obesity, quoted Joseph Nadglowski Jr., president and CEO of the Obesity Action Coalition, as stating, "Obesity carries

Table 1 Weight range – Centers for Disease Control and Prevention BMI categories

Height	Weight range	BMI	Considered
5′ 9″	124 lbs. or less	Below 18.5	Underweight
	125–168 lbs.	18.5–24.9	Healthy weight
	169–202 lbs.	25.0–29.9	Overweight
	203 lbs. or more	30 or higher	Obese

Source: National Center for Health Statistics, 2011. Definitions apply to all adults and women. Definitions for children vary by sex and age. The World Health Organization uses the same definitions. http://www.cdc.gov/healthyweight/assessing/bmi/

with it one of the last forms of socially acceptable discrimination. We, as a society, need to make every possible effort to eradicate it from our culture" (Ibid., p. 2).

According to the National Health and Nutrition Examination Survey (NHANES), obesity prevalence in 2007–2008 was 32.2% and 35.5% among adult males and females, representing a more than 100% increase from 1976 to 1980 and a 50% increase from 1988 to 1994 (Flegal et al. 2010).

Grade III obesity (BMI ≥40.0 kg/m) grew even more rapidly, rising from 1.3% in the late 1970s to 4.7% in 2000 (Flegal et al. 2002). The estimated annual medical cost of obesity in the USA was $147 billion in 2008 US dollar currency evaluation. The medical costs for people who were obese were $1,429 higher than those with normal weight (Finkelstein et al. 2009).

The Magnitude of the Obesity Problem

Obesity rates in the USA are high and have been rapidly rising over the past 30 years, albeit with some leveling off recently. Obesity is not only on the rise among young adults but also throughout the older population as well. In 2009, nearly one in eight Americans (12.6%) was aged 65 or older. This ratio is expected to jump to one in five (19.7%) by 2030, due in part to longer life expectancies and the aging of the baby boom generation. Because the highest rates of obesity are found among baby boomers, aged 44–62 in 2008, it is likely that the prevalence of obesity among older adults will continue to climb in the coming decades as this population ages. The study anticipated that by 2010, 37.4% of adults aged 65 and older will be obese, and that proved to be true. If this trajectory continues unabated, it is projected that nearly half of the elderly population will be obese in 2030 (Sommers 2009).

According to the World Health Organization (WHO) in 2013, 42 million children under the age of 5 were overweight or obese. Once considered a high-income country problem, overweight and obesity are now on the rise in low- and middle-income countries, particularly in urban settings. In developing countries with emerging economies (classified by the World Bank as lower- and middle-income countries), the rate of increase of childhood overweight and obesity has been more than 30% higher than that of developed countries.

Authorities view obesity as one of the most serious public health problems of the twenty-first century (Barness et al. 2007). A frightening warning comes from the USA, where obesity is considered a real pandemic with adults. It already involves about nine million young people (Sturm 2007). Obesity-related healthcare spending is estimated to cost up to $190 billion per year or more than 20% of total US healthcare cost. If nothing is done to stop the epidemic now, it will rise by additional $50 billion or more on top of that by 2030 (Carroll 2013). As of 2007, the nation is spending $75 billion a year on weight-related diseases, such as type 2 diabetes, heart disease, hypertension, high cholesterol, gallbladder disease, and osteoarthritis as merely on the top of the list. Almost 80% of obese adults have one of these conditions, and nearly 40% have two or more. At present, obesity is not only a problem from the clinical point of view; it is also a social issue of considerable importance.

We are going to review different phases of obesity since the 1970s: phase 1 of obesity began in the early 1970s and is ongoing; average weight is progressively increasing among children from all socioeconomic levels, racial and ethnic groups, and regions of the country. Today, about one in three children and adolescents is *overweight* (with a BMI in the 85th–95th percentile for age and sex) or obese (BMI above the 95th percentile), and the proportion approaches one in two in certain minority groups. Though it has attracted much attention from the medical profession and the public, childhood obesity during this phase has actually had little effect on public health, because an obese child may remain relatively healthy for years. Phase 2 of obesity is characterized by the emergence of serious weight-related problems (Ludwig 2007). The incidence of type 2 diabetes among adolescents, though still not high, has increased by a factor of more than 10 in the past two decades and may now exceed that of type 1 diabetes among black and Hispanic adolescents. A fatty liver associated with excessive weight, unrecognized in the pediatric literature before 1980, today occurs in about one in three obese children. Other obesity-related complications affecting virtually every organ – ranging from crippling orthopedic problems to sleep apnea – are being diagnosed with increasing frequency in children. There is also a heavy psychosocial toll; that is, obese children tend to be socially isolated and have high rates of disordered eating, anxiety, and depression. When they reach adulthood, they are less likely than their thinner counterparts to complete college and are more likely to live in poverty.

It may take many years to reach phase 3 of the epidemic, in which the medical complications of obesity lead to life-threatening disease. Poverty and social isolation would complicate the timely identification and management of such problems. Shockingly, the risk of dying by middle age is already two to three times as high among obese adolescent girls as it is among those of normal weight, even after other lifestyle factors are taken into account (Ludwig 2007). Obesity is implicated in 300,000 premature deaths per year in the USA, 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). In addition to physical ailments, obesity has been found to be related to lower satisfaction with work, family relations, partner relationships, social activities, and depression (Stutzer 2007).

The point of concern is that, even for those countries that are aware of the wide-spread problem of obesity and overweight issues, very few of them have adequate monitoring systems in place, a fact which is remarkable in view of the importance of this issue. Consequently, the frequency and standard of monitoring urgency need to improve so that the progress of the global epidemic can be tracked and lessons from the experiences of different countries and population groups can be learned (Swinburn et al. 2011). If obesity is detected in phase 1, when it is easier to detect and improve the situation, it costs less to the society than when it reaches to phase 3, which has more medical complications.

Chapter 1
Different Perspectives on Causes of Obesity

Abstract Many people believe that obesity is genetically determined. Genes do undoubtedly play a role in how susceptible different individuals are to becoming overweight, but the sudden rapid rise in obesity in many societies cannot be explained by genetic factors alone. Obesity is caused by numerous changes that have taken place in societies and the way we live, including changes in costs of food, ease of preparation, availability of energy-dense foods, spread of fast-food restaurants, development of the microwave, decline in cooking skills, decline in physical activities, and changes in socioeconomic conditions.

Over time, obesity has changed its social distribution. In the past, the rich were fat and the poor were thin. But in developed countries, these patterns are now reversed (Brunner et al. 1998). There has been an increase in the prevalence of obesity among both genders of all ages and ethnic and racial backgrounds. According to the National Association of School Nurses, obesity has more than tripled among adolescents in the past 20 years. Thirty-three percent of students today are obese or overweight, with related mental and physical health issues, including depression and the growing number of type 2 diabetes cases (Table 1.1).

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed on one hand and calories expanded on the other hand. The body needs a certain amount of energy (calories) with food to keep up basic life functions. Body weight tends to remain the same when the number of calories eaten equals the number of calories the body uses or "burns off." Over time, when people eat and drink and consume more calories than they burn off, the energy balance tips toward weight gain, overweight, and obesity. Children need to balance their energy as well. Energy balance in children happens when the amount of energy taken in from food or drink exceeds the energy being used by the body. Causes and consequences of this imbalance are beyond the scope of this book, as it can be very complex regarding heterogeneous populations at the individual level. Many factors can lead to energy imbalance and weight gain. They include genes, eating habits, how and where people live, attitudes and emotions, life habits, and income. Most health

Table 1.1 Health issues among all school-aged children in the United States

Obese, overweight, 32%	Asthma, 10%
Vision deficiencies, 24%	Food allergies, 5%
Prescribed medication for more than 90 days, 13%	Seizure disorder, 5%
Mental, emotional, or behavioral problems, 10%	Hearing deficiencies, 5%
Illness or injury resulting in more than 11 missed school days, 6%	Attention deficit hyperactivity disorder, 5%

Source: *National Association of School Nurses and Wall Street Journal*, September 25, 2012, D3

experts agree that there is no single cause of obesity, rather a combination of factors is to blame for the problem. Some people likely carry a genetic makeup. Other factors include an increasingly sedentary lifestyle, a work environment that requires hours of sitting at a desk, having less time to prepare meals and relying on eating out, lack of money for good ingredients, and the high price of exercise. All of these causes and others likely contribute to the problem of obesity. We will analyze the issue from an economic point of view, considering the major factors contributing to consumer behavior and hence consumption in such a way that leads to obesity in general.

Energy-dense foods and energy-dense diets have been blamed for the global obesity epidemic (French et al. 1997). The energy density of food is defined as the energy per unit weight or volume (kcal/100 g or mega joules per kilogram). The frequency of consuming restaurant food was positively associated with increased body fatness in adults. The increasing proportion of household food income spent on food prepared away from home in the United States may also help explain the rising national prevalence of obesity (McCrory et al. 1999) – for example, snacks, sweets and desserts (Zizza et al. 2001), sweetened soft drinks (Bray et al. 2004), and large portion sizes (Rolls et al. 2002) have all been linked to greater obesity risk.

Three studies published in *The New England Journal of Medicine* represent the most rigorous effort yet to examine the possible link between sugar-sweetened beverages and expanding US waistlines (Brody 2012). The most effective single target for an intervention aimed at reducing obesity is sugary beverages (Ludwig 2007). In addition, food choices are made on the basis of taste, cost, convenience, and, to a lesser extent, health and variety (Glanz et al. 1998). Variety refers to the innate drive to secure a varied diet, whereas health refers to concerns with nutrition, chronic disease, and body weight. The authors used a national sample of 2,967 adults in order to measure important factors in food choices. Response rates were 71% to the first survey and 77% to the second survey sent to people who completed the first survey. Univariate analyses were used to describe importance ratings. Respondents reported that taste is the most important influence on their food choices, followed by cost. Their results suggest that nutritional concerns are less relevant to most people than taste and cost. One implication is that nutrition education programs should be designed to promote nutritious diets as being tasty and inexpensive.

Researchers at the US Department of Agriculture (USDA) have pointed out that the American diet is inconsistent with the Food Guide Pyramid (Frazao and Allshouse 2003). The consumption of fat and sweets at the pyramid's tip far exceeds

recommendations compared with the low intake of fruits and green leafy vegetables. The reason that fats and sweets have come to dominate the food supply is they are inexpensive, good tasting, energy dense, and convenient to use. Studies support that limited financial resources may be one reason why people are not eating more healthy food (Darmon et al. 2002). Their studies add considerable support to the idea that economic constraints are a major factor in determining the nutritional value of foods purchased. The greater the economic constraints on individuals, the poorer the nutritional quality of foods selected.

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). This environment has intensified over the past 30 years by opening more fast-food restaurants and more advertising. It is clear that the profit motive of the food industry is not consistent with the current nutritional needs of the nation. Health economists have demonstrated that the prevalence of obesity is directly proportional to food prices and access to restaurants (Chou et al. 2004). They estimated the effects of fast-food restaurants advertising on children and adolescent being overweight. Their results indicate that a ban on theses advertisements would reduce the number of overweight children ages of 3 to 11 in a fixed population by 18% and would reduce the number of overweight adolescents between the ages of 12 and 18 by 14% (Chou et al. 2008). Causes are not limited to advertising only; they range from a lack of education about food, limited cooking skills, and limited money to buy healthier food to longer working hours and marketing campaigns for junk food aimed at kids (Winterman 2012).

Food-related marketing is poorly regulated in the United States. In 1980, the Congress stopped the Federal Trade Commission (FTC) from regulating food advertising. Food advertising targets children who are "not old enough to understand the healthy implications" of what they are consuming (Paarlberg 2010). The Center for Science and the Public Interest concluded that the food industry spends $2 billion a year advertising to children, who see an average of 13 food ads per day (Paarlberg 2010, p. 89). Between 1994 and 2006, 600 new children's food products were introduced into the market (Paarlberg 2010). Children in America spend $30 billion of their own money on junk food each year (Paarlberg 2010, p. 89). Many European countries have banned junk food advertisements during children's television programs. The former head of the Food and Drug Administration (FDA), David Kessler, blamed the food industry for causing Americans to overeat because "they design foods for irresistibility, delivering tastes" that are "intentionally addictive" and therefore difficult to resist (Paarlberg 2010).

Although the dramatic rise in obesity may be explained by environmental factors, there has been little emphasis on the obese persons' economic environment. In particular, there has been little research on diet quality and economics of food choice. The broader problem may lie with growing disparities in incomes and wealth, declining value of real minimum wage, food imports, tariffs, and trade. Evidence is emerging that obesity in America is largely an economic issue (Drewnowski and Darmon 2005). Jobs have become less strenuous and people must

pay a high price for exercise arenas, or equipment. Calories have become relatively cheaper and exercise has become relatively more expensive. This subject will be explored in more detail throughout this book.

Choices of certain products and eating habits are closely related to preferences, lifestyle, culture, ethnicity, and income level. Since World War II, food traditions and culture of the industrialized countries have suffered a sudden and profound change. Of course, economic development has led to greater availability and variety of food, but this availability has resulted in greater obesity and diseases associated with it (Neel 1962). The economic transition toward increasing economic output measured by gross domestic product (GDP) brings with it several transitions including traditional foods and cuisines to more processed energy-dense food. The pace of these transitions has increased substantially in recent decades. Economic growth is important for low-income countries to move from poverty to economic prosperity. However, for high-income countries, higher levels of GDP bring greater consumption of all products. The technological changes that are creating cheaper and more available food calories and the strong economic forces driving consumption will inevitably lead to overconsumption and obesity (Philipson and Posner 2003).

In developing countries the food culture is changing as well. Because of social media and awareness of food consumption in industrial countries, developing countries tend to adopt eating habits similar to those of the western world, and they are particularly influenced by the industrialized American diet and availability of information and access to packaged food. In (1989), Sobel and Stunkard studied the relation between socioeconomic status (SES) and obesity. They covered the 1960s through the mid-1980s and found 144 published studies on the SES-obesity relation in men, women, and children in the developed and developing world. They found a consistently inverse association for women in developed societies with a higher likelihood of obesity among women in lower socioeconomic status. In developing societies, a strong direct relation was observed for women, men, and children, with a higher likelihood of obesity among persons in higher socioeconomic strata, as they could afford to eat more.

Considering the Unites States and its food environment, with high obesity in the Mid-South region (in particular in Arkansas, Mississippi, and Louisiana), the study reveals that it is also a region where dollar stores (DS) are becoming prominent features of the retail environment. Arkansas, Mississippi, and Louisiana each have more than 140 dollar stores per million residents (Drichoutis et al. 2015). This compares to only 14 stores per million residents in California and 37 stores per million residents in New York State. Even in Texas, the dollar store density is considerably smaller at 86 stores per million residents. Given the significant increase in the number of dollar stores, the authors' objective in their study was to examine how access to these types of stores influences weight outcomes of children (Drichoutis et al. 2015). In this study, they examine the effect of access to dollar stores on children's BMI. To determine whether children and their guardians have easy access to dollar stores, they created binary measures of whether a dollar store is in close proximity to the child's residence. They focused specifically on children in early elementary grades because their diets are more likely to be dictated by the adults in their lives,

and so any DS effects would most likely be felt in these young children. Their sample includes three different age sets: 2004–2008, 2005–2009, and 2006–2010. Although they found no evidence that the presence of dollar stores within a reasonably close proximity to the child's residence increased the body mass index, they warn community leaders and public health professionals interested in childhood obesity to be wise to recognize that dollar stores are now prominent features of the food environment facing residents in many rural and lower-income urban communities. Many people now consider dollar stores as their neighborhood supermarkets. Dollar stores are especially dense in regions of the country where childhood obesity rates are the highest. The question of how dollar stores could contribute to dietary health should be considered in efforts to combat childhood obesity (Drichoutis et al. 2015).

Finally, the foods available are heavily processed with added salt and added fat as consumer behavior, price of food, and demand drive the production of food (Physicians Committee for Responsible Medicine 2010; Atwell 2007). Health-conscious consumers, shopping in a traditional grocery store, encounter fruits and vegetables sprayed with pesticides along with meat and poultry which are laden with hormones and antibiotics (Atwell 2007). Further, much of the available fish is grown unnaturally on farms (Atwell 2007). Consumers eating these toxic food sources find that their body's ability to utilize the macronutrients in food is degraded, thereby leading to the consumption of calories that are not used for energy and stored as fat (Atwell 2007).

Chapter 2
Consequences of Obesity

Abstract Obesity is now the most prevalent nutritional disease of children and adolescents in the United States. Obesity is the second leading preventable cause of death in the United States. Although obesity-associated morbidities occur more frequently in adults, significant instances of obesity as well as the antecedents of adult disease occur in obese children and adolescents. Obese children and adolescents are targets of early and systematic social stigmatization. This can cause low self-esteem which, in turn, can hinder academic and social functioning and persist into adulthood, influencing their future job opportunities and income.

Each year approximately 300,000 lives are lost due to the direct or indirect consequences of obesity. The rising trend of obesity is worrisome because it has significant consequences for individuals, business, and society. Obesity is associated with multiple chronic conditions, such as high blood pressure, high cholesterol, heart disease and stroke, type 2 diabetes, and uterine, breast, colon, and gallbladder cancers. Sleep apnea, arthritis, and depression can also be linked to obesity. There is 50–100% increased risk of all-cause mortality among obese individuals. Around 80% of obese individuals have diabetes, high cholesterol, high blood pressure, or heart disease. Direct medical costs related to obesity are secondary to preventive, diagnostic, and treatment services. Must et al. (1999) study that excess weight is associated with an increased incidence of cardiovascular disease, type 2 diabetes mellitus (DM), hypertension, stroke, dyslipidemia, osteoarthritis, and some cancers. They argue that overweight and obesity are common health conditions and their prevalence is increasing globally. Their estimates suggest that 1 in 2 adults in the United States is overweight or obese, defined by a body mass index (BMI) of higher than 25, an increase of more than 25% over the past three decades. These dramatic increases have occurred among the three major racial and ethnic groups and include both sexes. Field et al. (2001) are also supporting Must et al. (1999) as they studied 10 years of follow-up and concluded that the incidence of diabetes, gallstones, hypertension, heart disease, colon cancer, and stroke (men only) increased with degree of overweight in both men and women. Adults who were overweight but not

obese (i.e., $25.0 \leq BMI \leq 29.9$) were at significantly increased risk of developing numerous health conditions. Moreover, the dose-response relationship between BMI and the risk of developing chronic diseases was evident even among adults in the upper half of the healthy weight range (i.e., BMI of 22.0–24.9), suggesting that adults should try to maintain a BMI between 18.5 and 21.9 to minimize their risk of disease.

Around 700,000 new cancers caused by being overweight or obese are predicted by 2035. And the estimated number of people living with diabetes worldwide has topped 4 million for the first time, an increase of 119,965 compared with the previous year, and a rise of 65% during the past decade (The Lancet 2016). Hammond and Levine (2010) measured direct medical costs associated with obesity. They argue that relative medical spending for the obese may be as much as much as 100% higher than for healthy weight adults, and nationwide "excess" medical spending may amount to as much as $147.0 billion annually for adults and $14.3 billion annually for children. Obesity is a serious health concern for children; obese children and adolescents are more likely to become obese as adults.

Indirect costs focus on premature mortality, higher disability insurance premiums, and labor market productivity (morbidity). Mortality costs include future income lost as a result of premature death. Morbidity costs also factor income lost from decreased productivity, restricted activity, and the absence from work. As per the indirect costs related to obesity, obese people tend to be less productive than the average healthy person, and they are more subject to the phenomenon of presentism, that is, the tendency to go to work even if you are not in optimal physical condition (Finkelstein et al. 2010). There is growing evidence that obese employees have greater rates of absenteeism and presentism. In his analysis, Finkelstein et al. (2010) combined multiple data sets to quantify medical expenditures and the value of lost productivity resulting from absenteeism and presentism for overweight and obese full-time employees. The cost of obesity among full-time US employees has been estimated to be $73.1 billion per year (Finkelstein et al. 2010), causing, for example, 18% due to sick days, 41% due to lack of productivity because of health issues, and 41% due to general medical expenses. Hence, the hidden or so-called indirect costs related to obesity are a relevant percentage of the total. The economic loss of productivity caused by excess mortality is estimated at $49 billion per year in the United States and Canada (Behan and Cox 2010). The economic loss of productivity caused by overweight or obesity for totally disabled workers is at $72 billion (ibid).

Due to the health consequences resulting from excess weight, the increase in obesity also has profound economic consequences on employers and government; the loss of productivity caused by obese conditions of employees is as high as the medical expenses attributable to such conditions. Furthermore, many people in the United States have not secured employment because they experience discrimination for being obese. The outcome is that this impacts negatively on the country's economy because of reduction in national output and tax revenue. There is also an increase in the national government expenditure on both incapacity and unemployment benefits.

There are different estimates of such costs as a result of a confluence of factors, such as the date of measurement, representativeness of the sample, and the scope of measurement. For example, Thompson et al. (1998) took a look at the total cost of obesity to American businesses, differentiating between health insurance expenditures, paid sick leave, life insurance, and disability insurance. The authors estimated that the total nonmedical cost of obesity among the country's businesses was $5 billion in 1994. Of that, $2.4 billion was spent on paid sick leave, $1.8 billion on life insurance, and $0.8 billion on disability insurance. Thompson et al. (2001) also found that obese adults have 48% more inpatient days per year and 1.8 times more pharmacy dispenses. In 2010, it was concluded that 27% of young adults are "too fat to serve in the military" (Paarlberg 2010, p. 84). Between 1995 and 2008, there was a 70% increase in the number of recruits who failed their physicals due to being overweight (ibid, p. 84).

Puhl and Heuer (2009) described the high degree of prejudice and discrimination that obese individuals suffer in employment, education, and health care. The studies they reviewed showed that obese patients were less likely to get screenings for breast, cervical, and colorectal cancer, among other examples. The stigma of obesity evidently compounds its effect on health status and mortality. Mitchell et al. (2008) found that, based on data from the Canadian Community Health Survey 2003, overweight and obesity were associated with a markedly lower use of cervical cancer screening.

Obesity has a variety of significant effects on the body. For example, excess weight puts additional pressure on tissue in joints, such as the knees, causing increased risk of arthritis and damage to tendons and ligaments. It also inhibits healing of joints damaged by accidents or surgery. Higher weight increases the effort of movement, causing stress on the heart and muscles. An increased volume of tissue in the torso and abdomen can inhibit the normal function of organs. For example, excess abdominal tissue can cause esophageal reflux and other digestive problems, which excess consumption of food may exacerbate.

Alternatively, obesity may result from reduced physical activity, and certain excess morbidity associated with obesity, such as cardiovascular problems, may be caused by the lack of exercise. Fatty tissue affects the chemical balance of the body, interacting with hormones such as estrogen and insulin and thus altering their effect on the body (Rosin 2007).

Many people also either do not view obesity as a public issue or they believe that it is a personal problem alone. Forty percent of parents with obese children believe their children are the right weight (Paarlberg 2010, p. 93). Obesity's social acceptance is being advocated for by the National Association to Advance Fat Acceptance. Society is accepting obesity as the norm, when it is killing us and creating a generation of future diabetics.

Chapter 3
Economic Analysis: Behavioral Pattern and Diet Choice

Abstract In recent years, economists have attempted to explain the factors responsible for rising levels of obesity during the past decades, not only in the United States but also in many developing countries. This chapter considers an economic perspective on obesity. We explore economic perspectives to understand better why there are more overweight and obese people since the mid-1980s and why the lower social and income classes are more obese on the average. The purpose of this chapter is to develop an alternative socioeconomic model of obesity based more on behavioral economics concepts and on an alternative to the conventional health-science wisdom.

In the past three decades, economists' models have utilized neoclassical economic tools and relied on the conventional wisdom of health-science practitioners to explain the rising levels of obesity. Economists can contribute to the understanding of the cause of obesity by relying on models that include nontraditional decision-making. This analysis is consistent with behavioral economics, the branch of economics that combines insight from economics, psychology, and neuroscience to better understand consumers' situations in which actual choice behavior deviates from the predications made by earlier theories, which incorrectly concluded that people were *always* rational, deliberate, and uninfluenced by emotions and environment. It is very likely that economic decision-makers, rather than being fully rational, are only rational to a limited degree. Their decisions, rather than being strictly determined by the amount of calories consumed minus the calories expended, are determined much more by the kinds of foods they eat – the kinds of calories consumed.

Obesity is the result of individual decisions to choose poor diets and poor life-behavioral patterns (including exercise). Unlike in the rational obesity model, these are not decisions of rational economic men or women. Of course, sensible people care about the taste of food, not simply about health, and eating is a source of pleasure in and of itself. We do not claim that everyone who is overweight is necessarily failing to act rationally, but we do reject the claim that all or almost all Americans are choosing their diet optimally (Thaler and Sunstein 2008). What is true for diet is

true for other risk-related behavior, including smoking and drinking. Many smokers, drinkers, and overeaters are willing to pay third parties to help them make better decisions.

Thinking like economists, we can consider demand and supply side issues here. As individuals, we demand certain products that can be either raw agricultural products like whole potatoes or in a processed form, such as French fries. Economics tells us that if the price of food falls, individuals buy larger quantities of the goods at lower price, ceteris paribus or all things being equal. Other factors such as change in tastes or income also will affect the demand for a given product.

On the supply side, firms are in business to supply us the goods and beverages that they think we are willing and able to pay in order to purchase. How much they will supply will be affected by costs of production and by technology that might influence the way in which food is produced. Any improvement in technology or change in resource price will cause the supply of food to be affected. In today's industrialized world, because of modern technology and farming methods, the quantity of production is increasing, and the price of food is falling. However, while the quantity of foods has increased and the price has fallen, the quality of food has also changed. The relative price of foods, nutritious versus nonnutritious, has emerged as a major factor impacting obesity and health, with nutritious food costing much more than nonnutritious food.

Given the utility maximizing rule, the consumer allocates his or her income so that the last dollar spent on each product yields the same amount of extra utility (U Max). The rational consumer must compare the extra utility from each product with its added cost, that is, its price.

The obese person evaluating the long-term expected benefits and costs associated with his or her diet and exercise pattern chooses a combination that leads to obesity. If these benefits and costs were to change, it would be expected that the individual would change his or her diet and exercise pattern accordingly. These expected benefits and costs might change because of changes in external conditions or changes in the individual's references that will be discussed in the following section and summarized in Fig. 3.1.

Technological advancement has led to lower food or caloric consumption prices and higher exercise, or caloric expenditure prices. 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 16% since 1960, the prices of fresh fruits and vegetables, fish, and dairy products have increased relatively since 1983 (Finkelstein and Zuckerman 2008). Analyses of price increases during the period of 1985–2000 for food in different categories show that cost of sweets, fats, and caloric beverages fell substantially in relation to fresh vegetables and fruits (Economic Research Service of the USDA 2002). Retail prices of fresh fruit and vegetables have increased 120%, while prices of fats and oils increased by 38% from 1985 to 2000 (ibid). In February of 2013, the consumer price index (CPI) for all fresh vegetable rose 6.3% over the previous year. If anything, these trends accentuate income-based disparities in the access to healthy diets. The indices were constructed so they would each equal 100 during the 1982–1984 base period. Over the course of 27 years, the fresh
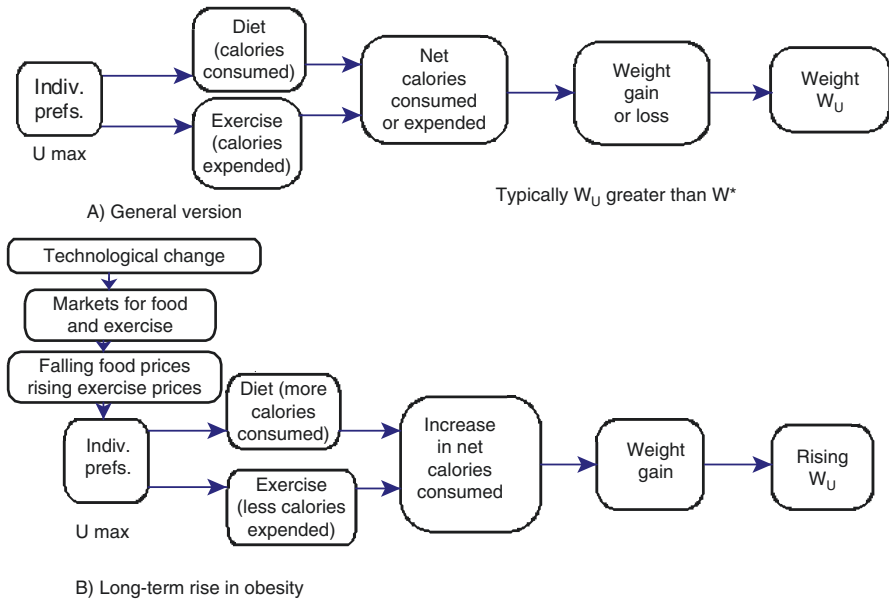
Fig. 3.1 The rational obesity model

fruits and vegetables index rose 49%. By contrast, the price index for cakes, cupcakes, and cookies increased until the early 1990s, and then decreased, leaving it 6% higher in 2006 than in 1980. In 2006, the fresh fruits and vegetables index stood 40% higher than the index for cakes, cupcakes, and cookies.

Another external factor is the role of government which has poured billions of dollars into dietary campaigns. Agricultural subsidies undercut those efforts by skewing the market in favor of unhealthful calories. Much of the food we have to choose from and how much it costs are determined by the Conservation and Energy Act of 2008, known as the "Farm Bill." Federal support for agriculture began during the Great Depression, as a temporary support or subsidy to farmers, paying them extra when crop prices were low. Nearly eight decades later, the benefits flow primarily to large commodity producers of corn and soy, which are as profitable as ever. The current bill gives some $4.9 billion a year in automatic payments to growers of such commodity crops, thus driving down prices of corn, corn-based products, and corn-fed meats. Cows that are raised on corn, rather than grass, result in meat that is higher in calories and contain more omega-6 fatty acids and fewer omega-3 fatty acids – a dangerous ratio that has been linked to heart diseases (Foley 2013).

The government has failed to combat the growing national obesity levels. What farmers grow has been steered by the government's policies for the last 100 years. Farmers have been pushed to increase production of commodities, including corn, wheat, cotton, rice, milk, and soybeans, which "lend themselves to large-scale production, easy storage, and long-distance shipping" (Wallinga 2010, p. 408).

After World War II, increased production of fats and sugars was thought to be the solution to domestic and global malnutrition. The government pushed US farmers to "feed the world" by producing more and more, which would then be exported. Beginning in 1947, the US Department of Agriculture (USDA) created a "cheap food policy that encouraged commodity farmers to produce as much as possible" (Wallinga 2010, p. 408). There was a belief that this overproduction would help the United States capture the global growing markets after World War II with these efficient method of production to produce cheap commodity grains. The output of US farmers rose 2.6 times between 1948 and 2002, and yields per acre were 600% higher in 2009 than in 1920 (Wallinga 2010, p. 408).

Cheap corn has also become a staple in highly processed foods, from sweetened breakfast cereals to soft drinks. Between 1985 and 2010, the price of beverages sweetened with high-fructose corn syrup dropped 24%, and by 2006 American children consumed an extra 130 calories a day from those beverages (ibid). Over the same period, the price of fresh fruits and vegetables rose 39%. For families on a budget, the price difference can be decisive in their food choices. 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 (Tomer 2011).

Figure 3.1 depicts the essence of the model, the factors causing a long-term rise in obesity according to the rational obesity model. This model was initially developed by Tomer (2011).

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%, this would be considered to be rational obesity.

Food prices have declined with innovation in food industries and government subsidies as explained. Moreover, as a consequence of this and other innovation, and changes in the working environment, most work now requires much less strenuous exercise than it once did (see also Lakdawalla and Philipson (2002). Advancements in workplace technology may have been responsible for a portion of the increase in obesity in the 1980s, but the majority of the shift away from manual employment predated this time period. According to Finkelstein et al. (2005), the fraction of wage and salary workers employed in goods-producing industries versus services fell from 27% in 1980 to 19% in 2000 (Council of Economic Advisors). However, this decline represents the continuation of a longer-term trend: 35% of jobs were in goods-producing industries in 1960. This gradual decline in manual labor began well before the rapid rise in obesity rates and suggests that other factors are more likely to be responsible for the rise in obesity. This evidence is not intended

to be comprehensive, since goods-producing jobs have also become more sedentary over time.

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). This model emphasizes that obesity is an outcome of an individual's choices and is, thus, an avoidable or a voluntary condition. Meanwhile, other factors may influence an individual's choices and hence their consumption. As mentioned, developments in agriculture and food technology have made added sugars and vegetable oils accessible globally at remarkably low costs. As a result of added fats, the cost of the daily diet has been maintained at a lower level. Americans have the lowest-cost food supply in the world. The typical American diet derives almost 40% of daily energy from added sugars and added fats which are relatively inexpensive (Frazoa and Allshouse 2003). Given low price and tasty low-quality food, the marginal utility per dollar of low-quality food can be high and that can lead to higher consumption. Diet quality is also influenced by one's socioeconomic position and may well be limited by financial access to nutrient-dense foods.

Until recently, no one has seriously questioned whether a low-cost food supply has brought anything but benefits to the US consumers. However, studies are beginning to link the low cost of foods with the obesity epidemic. One study found that technological advances led to a decline in the price of food, which in turn led to higher energy intakes (Lakdawalla and Philipson 2009). The drop in food price was said to account for up to 40% of the increase in body mass index since 1980 (ibid). The sad part of this result is that the population subgroups with the least resources are more vulnerable to the obesity epidemic, and thus, any policy changes in terms of higher taxes on unhealthy food will amount to punitive measures.

An Alternative Model

A number of writers have challenged the conventional scientific wisdom or dogma regarding calories and weight gain. Among them are Taubes (2002) and Hyman (2006), who have pioneered a rethinking of the relationship between diet and health. They are largely in agreement on the main problems with the conventional scientific wisdom, but at the same time, they criticize the important elements of conventional thinking. Among their critiques are that it is wrong, or at least very misleading, to view weight gain or loss as strictly determined by net calories consumed; that hormones, especially insulin, and hormonal balance are crucial in determining what causes the body's fat deposits to grow; that simply eating too much fat is not a cause of obesity (Hyman emphasizes the importance of eating "good fats" and avoiding "bad fats"); that diets rich in starchy, sugary, refined, easily digestible, and processed carbohydrates that raise insulin levels are the most important factor contributing to obesity; and that our bodies, especially our digestive and metabolic systems, have a natural tendency to homeostasis, that is, the automatic regulation and

maintenance of our health, including our weight. This automatic regulation, however, can be thrown off by poor health habits and patterns, it is argued.

Taubes (2002) and Hyman's (2006) viewpoints incorporate the role of hormones, the role of carbohydrates, and homeostasis of our bodies to explain the causes of obesity. The essence of Hyman's view is that nine factors – four dietary and five life-behavioral patterns – are the key causes of obesity. The dietary factors are (1) a diet high in refined, processed carbohydrates, (2) a diet high in bad fats, (3) a diet low in fiber, and (4) a diet low in antioxidants and high in oxidants. The problematic life-behavioral patterns are, therefore, overly rapid eating; eating in the presence of stress, especially chronic stress; sleep deprivation; lack of exercise; and 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, that one can acquire by eating real, whole, unprocessed plant food. The *phytonutrient index* (PI) indicates how rich the carbohydrates an individual eats are in phytonutrients. The problematic carbohydrates are the ones with too much sugar that is too quickly absorbed into the digestive system, thus causing the insulin levels in an individual's blood to become elevated. Over time, this could lead to insulin resistance in which 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 the 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). They categorize good fats and bad fats (omega-3, monounsaturated, some polyunsaturated, and some saturated fats) (2006, pp. 33–39). On the list of bad fats are most saturated fats and all trans fats. In general, "bad fats turn off most of your fat-burning genes, making it much harder for you to lose weight" (p. 33). By contrast, 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. 110118) 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.

Another important life pattern is exercise or lack thereof. Hyman (2006, pp. 158–161) finds that exercise dramatically improves the efficiency at which your cell's mitochondria transform food and oxygen into energy and also 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
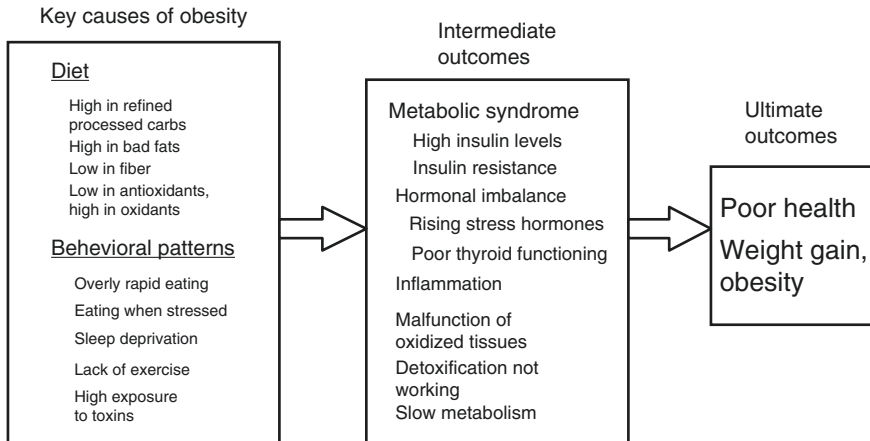
Fig. 3.2 Health science on causes of obesity and poor health (Source: Hyman, UltraMetabolism 2006)

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 loss" (ibid). 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 Fig. 3.2.

Other ideas affecting decision-making are narrow framing where people's tendency to exclude key factors when making decisions and some consumers rejection of long-term care could be based on narrow framing (Gottlieb and Mitchell 2015). Psychologists have noted that people have tendency to make decisions in isolation, and many people fail to account for other risks they face, particularly when making complex decisions (Loewenstein and Rabin 1999).

In the past two decades, the US government has been providing education to individuals about nutrition. The food pyramid, developed in 1992, surfaced as a picture representation of how much of each macronutrient an individual should eat, and the pictogram organized each food into groups (Dietary Guidelines for Americans n.d.). It is interesting to note that the grain group (the commodity crop) represents the largest category taking its place at the bottom of the pyramid. Grains are easily processed into foods with little nutritional value, but high in calories. This food pyramid was rearranged in 2005, when it was noted that the American population was not becoming any leaner (Dietary Guidelines for Americans n.d.). The USDA released a new educational program in 2015, called the "My Plate" campaign (Choose MyPlate.gov n.d.).

Even in this campaign, grains labeled whole this time are still appearing as a significant portion of food on a plate. Again, this approach is placing responsibility for consumption of food on the individual; while in the meantime, food producers are subsidized and encouraged to produce commodity crops. In addition, farmers are penalized for producing fruits and vegetables, which are considered specialty crops (Physicians Committee for Responsible Medicine 2010). If Americans increased their consumption of fruits and vegetables to levels recommended by federal dietary guidelines, there would be a gap in production of these crops, and the United States would need to rely more heavily on imported fruits and vegetables at increased costs. Interestingly, it would require an additional 13 million acres of land to grow sufficient fruits and vegetables for the American population, if the USDA guidelines were followed (Physicians Committee for Responsible Medicine 2010). This estimate does not change even with the new *My Plate* guidelines.

Additionally, the food environment in America does not provide enough healthy options for all Americans to consume the right types of healthy foods. To increase the supply of fresh fruits and vegetables, there are two simplistic solutions, that is, increasing imports and increasing domestic production. It would be untenable for American health to rely more on imports that could potentially cease at any moment, especially as other industrialized nations grapple with obesity, albeit at lower rates. For production to increase domestically, the US policy would have to shift away from cheap calorie commodities toward fruits and vegetables. The farms most suited to increase production of produce are midsize farms, not large corporate farms, which produce commodities on an immense scale. Midsize farms have the ability to more easily diversify their crop base than large corporate farms do (Wallinga 2010, p. 410).

Finally, the government has several ways to start taking more proactive steps against the growing obesity epidemic. Nutritional education is essential, in particular at this time when consumers are often tricked by advertising and the complicated labeling process, which make it difficult to make a truly informed choice. The government's *My Plate* program pushes exercise and activity education much more than nutrition. The two cannot be separated if we are to raise children to be informed eaters.

Policy interventions for obesity can only be realistically directed at the environment (making healthy choices easier) rather than the individual (compelling them to make healthy choices). The major strategies available to directly affect behaviors aim to increase the motivation to make healthy choices and include social marketing, health education, and health promotion. This area will be discussed in detail later.

Chapter 4
Socioeconomic Factors: Poverty and Obesity

Abstract The relationship between obesity and poverty has become more obvious and complex: being poor in one of the poorest countries may be associated with poor nutrition, while being poor in a developed country could mean a higher risk of obesity. Obesity is a problem for all races and ethnic groups in the United States and, generally speaking, affects people of all income levels. But a higher proportion of the poor, minorities, and the less educated tend to be obese. The mission of medicine is to develop scientific and practical bases for disease prevention and to devise effective ways to educate the public about health risks. None of this is to deny that social conditions, especially poverty, affect physical well-being and length of life.

In this chapter, we will explain different types of poverty and will identify how socioeconomic groups with low personal capital, low health capital, and low social capital have higher obesity rates than socioeconomic groups with higher endowments of intangible capital. We will support the idea that although government programs help the poor, poverty remains high because the inequality of economic outcomes has increased sharply.

Poverty status, or the percentage of the poverty level, is based on family income, family size, and the number of children in the family. For families with two or fewer adults, poverty depends on the age of the adults in the family. The poverty level is based on a set of income thresholds that vary by family size and composition. Families or individuals with income below their appropriate thresholds are classified as below the poverty level. These thresholds are updated annually by the US Census Bureau to reflect changes in the consumer price index (CPI) for all urban consumers. The Census Bureau report of 2013 indicated that the poverty rate in America held stable between 2011 and 2012 at about 15%. According to the official measure, poverty today is higher than it was in 1973, when it reached a historical low level of 11.1% (Danziger 2013). In 2012, 14.7 million people in the United States had family incomes between 100% and 125% of their poverty threshold. The near-poverty rate for individuals decreased from 6.3% in 1966 to 4.7% in 2012 (Heggenes and Hokayem 2013).

According to the US Census Bureau, the total poverty rate rose in the early 1980s in the United States. In 1993 that rate was 15.1%, making it the highest since 1983. Between 1993 and 2000, the rate turned downward, falling to 11.3% in 2000. Then, in 2001, poverty rose. Due to slow employment growth and slow wage growth, the rate rose from 11.7% to 12.7% by 2014. The Census Bureau report of 2013 indicated that the poverty rate in America was stable between 2011 and 2012 at about 15%.

The official poverty definition uses money income before taxes and tax credits and excludes capital gains and noncash benefits, such as the Supplemental Nutrition Assistance Program, or SNAP, benefits and housing assistance. The thresholds do not vary geographically. All things being equal, such programs, whether we count them or not, should have reduced the official poverty rate across generations. But all things have not been equal. Although these programs help the poor, poverty remains high because the inequality of economic outcomes has increased sharply.

Before income inequality took off in the 1980s, the poverty rate fell more rapidly with the gross national product (GDP) growth in the United States. But while the economy grew by 2.8% in 2012 and corporate profits went up as a share of national income, the earnings of full-time workers, median household income, and the poverty rate barely changed. That is not to say that growth is no longer necessary for reducing poverty. In our age of inequality, growth alone is insufficient. It is policies that lower the unemployment rate and increase wages that reap more benefits to the poor. Growth alone does not guarantee less poverty, since income distribution also matters. One estimate found that two-thirds of the fall in poverty was the result of growth; one-third came from greater equality (The Economist 2013). More equal countries cut poverty further and faster than unequal ones. Research supports that just 1% increase in income reduced poverty by 0.6% in most unequal countries, while it reduced poverty by 4.3% in the most equal ones (The Economist 2013). Poverty used to be a reflection of scarcity. But now it is also the problem of identification, targeting, and distribution.

The World Health Organization (WHO) set up a study in 26 countries in the 1980s to monitor trends in cardiovascular diseases and the risk factors for these diseases, including obesity. It found that, as rates of obesity increased, their social gradient steepened (WHO MONICA project 2000).

As *The Economist* magazine notes in its own survey of obesity, "the rich and well-educated have mostly managed to stay slim." Also, it said that obesity is prevalent among the Medicaid population, and thus it burdens those tax payers (Jenkins 2013). Obesity is truly a form of serious malnutrition. The Scientific Report of the 2015 *Dietary Guidelines Advisory Committee* notes that the US population has a shortfall of vital nutrients, such as vitamins A, D, E, and C, folate, calcium, magnesium, fiber, potassium, and iron. If two-thirds of a population had serious undernutrition or anorexia nervosa, there would be a recognized national emergency.

The point is confirmed by Sobal and Stunkard (1989) where they found that in developed countries, there is an inverse relationship between obesity and socioeconomic status, that is, the higher social classes are able to compensate for a sedentary lifestyle with more information and sport opportunities, plus they can afford better quality food, organic and less processed. In less developed countries, with a $2500

GDP per capita, a direct relationship prevails, and excess weight is observed more frequently among the higher social classes (Monteiro et al. 2004).

Poverty can affect social life and sociability as well. Friendship and involvement in social life are highly protective of good health, while low social status or bigger status differences and more inequality are harmful (Wilkinson and Pickett 2009). Sociability is measured by the strength of community life and how much people trust each other. Larger differences in income and wealth create a social gulf between people. Social status stratification, like ranking systems or pecking orders among animals, is fundamental, with orderings based on power and coercion and on privileged access to resources, regardless of others' needs. In its most naked, animal form, the situation becomes "might is right and the weakest eat last" in a Darwinian type of life.

Friendship is about reciprocity, mutuality, sharing, social obligations, cooperation, and recognition of each other's needs. Food sharing and eating together carry a symbolic message, and it is particularly powerful as food is the most fundamental of all material necessities. As we have the same need, competition for scarce necessities leads to a continuous conflict of man against man (Hobbes 1998). This reality in turn indicates that human beings have an unrivaled potential to benefit from cooperation and sharing of resources.

There are other types of poverty. There is "consumption poverty," where Meyer and Sullivan (2003) argue that food consumption offers a more robust measurement of poverty than income. Meyer and Sullivan (2006, 2008, 2012) also provide evidence that consumption is a better predictor of well-being than income. Sociologists also developed another alternative to measure poverty known as "asset poverty." Asset poverty measures the extent to which American households have a stock of assets which is sufficient to sustain a basic need level of consumption during temporary hard times (Haveman and Wolff 2004). Although these measures complement standard measures of "income poverty," due to the lack of historical data on asset poverty, we focus only on income poverty as the basis for assessing the status of the nation's least well-off citizens. In addition, income poverty rates are a key determinant of the allocation of federal funds to states and localities for use in education and other social programs for the disadvantaged. While it is likely that consumption and asset-based measures could potentially be related to obesity as well, those measures are beyond the focus of this book.

Existing studies suggest that the high cost of healthier diets may contribute to the obesity epidemic, especially among the lower-income and low-educated groups (Tables 4.1 and 4.2). At the individual level, obesity rates are linked to low incomes, to low levels of education, to one's minority status, and to a higher incidence of poverty. In his research, Tomer (2011) indicates that socioeconomic groups with low personal capital, low health capital, and low social capital have higher obesity rates than socioeconomic groups with higher endowments of intangible capital. This has been supported by other studies that indicate that higher diet quality, as measured by the Healthy Eating Index (HEI), is associated with higher incomes, more education, and thus with lower rates of obesity and overweight (Henderson 2007).

Table 4.1 Percentage of obese adults by household income, 2007–2009

Percentage of obese adults by household income, 2007–2009	
Less than $15,000	35.3%
$15,000–$24,999	31.4%
$25,000–$34,999	29.6%
$35,000–$49,999	29.1%
$50,000+	24.5%

Source*:* "F As in Fat: How Obesity Threatens America's Future," *Trust for America's Health,* June 2010

Table 4.2 Percentage of obese adults by educational level, 2007–2009

Percentage of obese adults by educational level, 2007–2009	
Did not graduate high school	33.6%
Graduated high school	30.3%
Attended college or technical school	29.6%
Graduated college or technical school	22.0%

Source: "F As in Fat: How Obesity Threatens America's Future," *Trust for America's Health,* June 2010

A USDA study showed that low-income households spent approximately $1.43 less per person per week on healthy food such as fruits and vegetables compared with higher-income households (Blisard et al. 2004). While higher-income households did increase fruit and vegetable consumption after an increase in income, lower-income households did not. One explanation can be that fruits and vegetables were not a priority among low-income families and that they chose to spend their limited resources on items that were perceived as more essential to their diets, such as meat, clothing, or rent. In general, healthier diets cost more.

According to the following information presented in Tables 4.1 and 4.2, during 2007–2009, the percentage of obese individuals has been the highest for low-income families (35.3%) and the lowest for higher-income families (24.5%). Also, a higher level of education is a contributing factor to a better diet and healthy weight. It is suggested by the data that those with less than a high school education have higher percentages of obesity (33.6%) and those with higher educational experiences have lower percentages of obesity (22%). This viewpoint is also consistent with the Lakdawall and Philipson (Darmon et al. 2002) findings that the obesity problem and poor health status are very much a problem of low-income status.

Rising obesity rates reflect an increasingly unequal distribution of income and wealth. It is by now widely accepted that income poverty is a risk factor for premature mortality and increased morbidity (Subramanian and Kawachi 2004). Obesity affects poor children disproportionately to richer ones. Twenty percent of low-income children are obese, compared with about 12% of children from more affluent families (Centers for Disease Control and Prevention 2012). Among girls, race

is also an important factor. About 25% of black girls are obese, compared with 15% of white girls (ibid). Thus, there is in fact intriguing evidence that a person's socioeconomic position can affect health. Braveman and Gottlieb insist that illness is caused by the power imbalance in capitalist societies. Evidence points to socioeconomic factors such as income, wealth, and education as fundamental causes of a wide range of health outcomes (Braveman and Gottlieb 2014).

Thus, if we wish to improve conditions for low-income children, we must infuse the free market system with social programs. According to Fineberg, former dean of the Harvard School of Public Health, "a school of public health is like a school of justice." Income inequality affects health by undermining civil society. Lack of social cohesion leads to lower participation in political activities such as voting, serving in local government, and volunteering in political campaigns. And lower participation, in turn, reduces government spending on public goods such as education and social safety nets (Satel and Marmor 2001). It is not just income dispersion itself that matters for health, but the proportion of the population that suffers true poverty-related problems, such as undernourishment, lack of access to timely medical care, and so on. In the United Sates, for example, the poverty level is higher than in the parts of Europe where the social safety net is more readily available and has a much finer mesh.

Furthermore, the stunted longevity of poorer people pulls down the average life expectancy for the United States. When poverty concentrations are high, poor people are not only coping with their own poverty but also the consequences of the poverty of their neighbors. Jargowsky's (1996) analysis of data from the 1970, 1980, and 1990 US Census shows that the residential concentration of poverty is a measure that tells us what proportion of poor people in a city live in high-poverty areas. He estimated that in 1970, about one in four poor blacks lived in high-poverty neighborhoods, but in 1990 that proportion had risen to one in three. This also is true among whites, for whom the poverty concentration doubled in two decades, while income inequality also widened. The concentration of poor people in poor areas increased a wide variety of stress, such as exposure to gang violence, drugs, pollution, poor level of services, worse schools, and so on. Educational achievements and aspirations are the key factor in social mobility. Wilkinson and Pickett (2009), who gathered information on social mobility in eight countries, discovered that public expenditures on education are strongly linked to the degree of income inequality. In the United States, the least equal of the study group, only two-thirds (68.2%) of the spending on school education, was public money, while in Norway, the more equal of the eight countries, almost all (97.8%) of the spending on school education, was in the public expenditure budgets.

In the 21 countries studied by the Organisation for Economic Co-operation and Development (OECD) in 2013, a full 40-h workweek still would not lift families out of relative poverty. This study includes France, home to the 35-h workweek that almost met the threshold. Minimum wage workers who are supporting a spouse and two children need to work 40.2 h to get their families out of poverty. The poverty line is defined as 50% of the median wage in any nation. To gauge the generosity of each country's floor on hourly pay, one can also look at another measure: the minimum

wage as a percentage of the local median wage may also be used as a measure of relative poverty. Those ratios vary widely across the world. In the United States, the minimum wage was less than 40% of the median wage in 2013, which meant the United States had one of the lowest percentages compared to the other economies the OECD examined. The median wage ratios are much higher across the Atlantic, but Europe's sovereign debt crisis has taken its toll on those countries as well. In Ireland, Greece, and Spain – three of the hardest-hit countries in the euro currency zone – minimum wage levels as a ratio to the median wage were higher in 2007 than in 2013 (Chandran 2015).

Other factors, including addictive personality, stress, depression, and seeking comfort in familiar foods, are leading to a higher consumption of sweets and desserts found more prevalent among low-income families. In addition, physical access to supermarkets and grocery stores, marketing and distribution of healthy foods, urban sprawl, and the time spent commuting to work have also contributed to failure to adhere to healthy diets (Morland et al. 2002). The data implies that people with weak and/or negative social capital are more likely to be vulnerable to the influences of the social and geographical infrastructure toward obesity and the economic incentives regarding food and exercise.

Tomer (2008) argues that in the presence of strong positive social relationships, people's imbalances are likely to be more muted and less problematic. Conversely, when social capital (SC) is weak and negative, people's imbalances are likely to be more pronounced and problematic. Social capital refers to the capacity that is embodied in an individual's social relationships or the bonds and connections between an individual and others. Social capital 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 (Tomer 2011).

Poverty and obesity vary among states in the United States, as indicated in Tables 4.3 and 4.4, where Mississippi has the highest obesity rate of 35.4% in 2013 and Montana has the lowest rate of 19.6%.

Table 4.3 States with highest obesity rates, 2013 [January–December 2013, Gallup-Healthways Well-Being Index]

Ten states with highest obesity rates	% of obese
Mississippi	35.4
West Virginia	34.4
Delaware	34.3
Louisiana	32.7
Arkansas	32.3
South Carolina	31.4
Tennessee	31.3
Ohio	30.9
Kentucky	30.6
Oklahoma	30.5

Source: http://www.gallup.com/poll/161717/boulder-remains-least-obese-metro-area.aspx

Table 4.4 States with lowest obesity rates, 2013 [January–December 2013, Gallup-Healthways Well-Being Index]

Ten states with lowest obesity rates	% of obese
Montana	19.6
Colorado	20.4
Nevada	21.1
Minnesota	22.0
Massachusetts	22.2
Connecticut	23.2
New Mexico	23.5
California	23.6
Hawaii	23.7
New York	24.0

Source: http://www.gallup.com/poll/161717/boulder-remains-least-obese-metro-area.aspx

Chapter 5
Income Inequality and Obesity

Abstract Many developing countries have experienced a sharp rise in income inequality during the past three decades. In the last 15 years, countries like Great Britain and the United States have experienced a major increase in income inequality. Across the United States, the degree of income inequality is associated with a wide range of factors that may influence health, with greater income inequality associated with higher unemployment, higher proportions of people without health insurance, lower per capita medical spending, and lower rates of high school graduation. Wilkinson's analysis showed that higher-income inequality within the United States and within the selected countries was a powerful determinant of health. Early socialists and others believed that material inequality was an obstacle to a wider human harmony, to a universal human brotherhood, sisterhood, or comradeship. The quality of social relations deteriorates in less equal societies, and thus inequality becomes a powerful social divider. In this chapter, we focus on the question: Does the unequal distribution of income in a society pose an additional hazard to the health of the individual, in terms of obesity, and standard of living in that society?

We are going to examine how the scale of income differences may be related to health problems. Human beings have lived in a range of societies, from the most egalitarian prehistoric hunting and gathering societies to the most plutocratic dictatorships. Although modern societies do not fall into either of those extremes, it is reasonable to assume that there are differences in how hierarchical they are.

The evidence from a range of studies suggests that there is indeed a correlation between income inequality and health and social problems. There is less agreement about whether or not there is a causal relationship, but some rigorous studies provide evidence of such a relationship. Individuals are affected by the social structure. It is individuals – not the societies themselves – who have poor health, are violent, or become teenage mothers. Review of the research leads one to conclude that people in many developed countries have experienced substantial rises in anxiety and depression and that their connection to income inequality becomes clear. The trend has been aggravated particularly between the 1970s and 1990s (Wilkinson and Pickett 2009). Greater inequality seems to heighten people's social evaluation

anxieties by increasing the importance of social status. Instead of accepting each other as equals on the basis of our common humanity, getting the measure of each other becomes more important as status differences widen. Then social position becomes a more important feature of a person's identity. Greater inequality is likely to be accompanied by increased status competition and status anxieties (ibid, p. 44). In such societies, people pay more attention to social status and how they are assessed by others.

Wilkinson and Pickett (2009) believe that where income differences are bigger, social distances are bigger and social stratification is more important. From their viewpoint, the most plausible explanation for income inequality's apparent effect on health and social problems is "status anxiety." This suggests that income inequality is harmful because it places people in a hierarchy that increases status competition and causes stress, which leads to poor health and other negative outcomes.

Goldthorpe (2009) was more critical of the "status anxiety" hypothesis. He pointed out that in some countries, people may accept a particular status order, and so it would not necessarily lead to psychosocial stress. This may explain why Japan, which seems to have a strong status hierarchy, nevertheless performs well in terms of social problems. If people accept the hierarchy in Japan as fair, then it may not lead to social problems. Goldthorpe argued, further, that redistribution may, in fact, heighten stress if people think it is unfair. As mentioned above, Japan is an interesting case study for the status anxiety hypothesis.

Thus income inequality and health outcomes may be related across the United States because, in this context, income inequality reflects many current and past social and environmental factors that have important health effects. Across countries, the association between current income inequality and these social and environmental factors may or may not exist, depending on the choice of countries and their historical, cultural, political, and economic contexts. Jurisdictions that allow income inequality to increase may often be those that also systematically underinvest in education, welfare, health care, and a range of social institutions that serve as safety nets for people in unfavorable circumstances. In these circumstances income inequality, both currently and in the past, will be related to health outcomes (Pearce and Smith 2003).

These health inequalities are not just limited to life expectancy, but also to infant mortality, mental health, physical health, and so on. Lynch et al. (2001) carried out an extensive review of research in the field and found links between income inequality and child health outcomes (infant mortality, low birth weight, and so on), but less support for a link with broader health outcomes such as life expectancy. However, this review also found strong evidence for links between income inequality and homicide and violent crime. The most recent of these, the *Marmot Review,* found that in England, people living in the poorest neighborhoods will, on average, die 7 years earlier than people living in the richest neighborhoods (Marmot 2010). Karen Rowlingson (2011) studied the income inequality and health in the United Kingdom. The main aim of this report was to review the evidence concerning the impact of income inequality on health and social problems and recommend policy implications. The key findings from Rowlingson's independent review are that the

evidence does indeed suggest that there is a correlation between income inequality and a range of health and social problems in the United Kingdom.

Another study suggested that the loss of life from income inequality in the United States in 1990 was the equivalent of the combined loss of life due to lung cancer, diabetes, motor vehicle accidents, HIV-related causes, suicide, and homicide (Lynch et al. 1998).

Early socialists and others believed that material inequality was an obstacle to a wider human harmony, to a universal human brotherhood, sisterhood, or comradeship. The quality of social relations deteriorates in less equal societies, and thus inequality becomes a powerful social divider (Wilkinson and Pickett 2009). Thus, Wilkinson's analysis commented that higher-income inequality within the United States and within the selected countries was a powerful determinant of health. Furthermore, low social status, poor social affiliations, and stress in early life are powerful risk factors for chronic stress and insecurity in rich societies (ibid). Thus "social capital" takes its place alongside "economic capital" and "human capital" as something fundamental to the smooth functioning of society and economic growth.

The data on trusting others within the United States taken from the federal government's *General Social Survey* that monitored social changes in the country for more than a quarter of a century shows that trust fell from a high of 60% in 1960 to a low of less than 40% by 2004. In the same time period, the Gini index of inequality increased from 0.35 to 0.45. The index is being used as a measure of income inequality and will be explained in the following section.

International data from the European and World Values Survey supports these findings. People trust each other most in the Scandinavian countries and the Netherlands. Sweden has the highest levels of trust overall with 66% of people feeling that they can trust others. According to the international data, low levels of trust in the United States are related to high inequality (ibid, p. 54). The key point is that trust affects the well-being of individuals as well as the well-being of civic society. High levels of trust mean that people feel secure that they have less stress and worries, and hence they see others as cooperative community members rather than competitive ones. A number of convincing studies in the United States have linked trust to healthy people who have high levels of trust and live longer (Barefoot et al. 1998).

It is often said that greater equality is impossible because people are essentially not equal. But that is a confusion of terms since equality does not mean being the same as others. People did not become the same when the principle of equality before the law was established. Nor does reducing material inequality mean lowering everyone's standards or leveling everyone in society to a common level of public mediocrity. Wealth, inherited or not, is a poor predictor of genuine merit (Wilkinson and Pickett 2009). George Bernard Shaw, the British playwright, said "Only where there is a pecuniary equality can the distinction of merit stand out" (Shaw 2007).

Data shows that the average US family income stagnated as inflation adjusted when the bottom 90% of American family income fell to 10.7% in 2012 according to the Commerce Department. Meanwhile, the top 0.1% family income increased by 20.5% during the same period of 2002–2012 (Table 5.1).

Table 5.1 Average family income excluding capital gain, adjusted for inflation, USA

Families	2002	2012	Percentage change
Bottom 90%	$34,067	$30,439	−10.7%
Top 10–5%	127,692	130,990	2.6
Top 5–1%	204,446	216,947	6.1
Top 1–0.5%	396,524	441,423	11.3
Top 0.5–0.1%	708,440	837,377	18.2
Top 0.1–0.01%	2,147,943	2,782,303	20.5
Top. 01%	12,240,438	21,569,156	76.2

Source: Thomas Picketty and Emmanuel Saez (2013)

Wilkinson and Pickett (2009) gathered data on obesity from the International Obesity Task Force that shows that the proportion of the adult population, both men and women, who are obese with a body mass index or BMI of more than 30, is lower in countries where income differences are smaller (ibid, p. 91). They argue that the relationship with inequality is strong enough for them to be confident that the disparity is not by chance. Furthermore, they found that the differences between countries are large. For the United States, over 30% of adults are obese – a level of more than 12 times higher than Japan's, where only 2.4% of Japanese adults are obese. Within the United States, there are no states with a level of adult obesity lower than 20%. States with lower gross domestic product, or GDP per capita, have a higher obesity rate. We will discuss this data in the following chapters.

A 12-year study of working-age men in the United States found that if they were unemployed, they gained weight (Smith et al. 2008). When their annual income drops, they gain, on the average, of 5.5 pounds. There is also other supportive evidence for a causal relationship between societal income inequality and obesity. For example, following the reunification of West Germany with East Germany, the latter society experienced a rapid increase in inequality. That is to say that in 1990, after the fall of the Berlin Wall, inequality increased in the former East Germany (Martin 2000). There is evidence from studies following people over time that this disruption led to an increase in body mass index of the children, young adults, and mothers. From 1991 to 2000, the prevalence of overweight increased from 10 to 17.5% in East Germany and from 14.8% to 22.2% in West Germany (Hesse et al. 2003).

Various measures based on different countries are available to quantify the extent of income inequality within a given community or society. There are absolute or relative differences in income, occupation, wealth, education, and other resources. The *materialist theory* argues that health is influenced by material conditions in life. Availability of resources, working and living conditions, and access to proper nutrition and medical services help shape health and influence health behavior (Bartley 2004). *Neo-materialist theory* expands upon these materialist explanations by describing the origins of poverty and income inequality that lead to poor health (Lynch et al. 2000). The latter theory examines the social policies and processes that led to underinvestment in social, public, and physical infrastructure, such as qualities of housing and schools, lack of health insurance, and the availability of social

services and job opportunities resulting in negative health outcomes for vulnerable populations (Lynch and Kaplan 1997). These historical, cultural, political, and economic processes determine the distribution of economics and social resources in a given region to create material conditions that influence health (Lynch et al. 2000). For example, poor and minority individuals may live in a segregated neighborhood with little or no access to grocery stores providing affordable nutritious food. These conditions in turn affect the food consumption choices of disadvantaged individuals with limited budgets. The third explanation is the *psychosocial theory* that links the inequality conditions and the perception of inequality that leads to poor health (Lynch et al. 2000). Among individuals, income inequality influences perceptions of social rank and relative positions according to income, which produce negative emotions such as bad feelings of social anxiety, shame, envy, frustration, and distrust. These negative emotions are internalized and can result in more stress leading to overeating and smoking, both of which can lead to poor health (Wilkinson 1996).

Measures of Inequality

There are different methods to measure income inequality. Of these, the Gini coefficient is the one more frequently used. The Gini coefficient varies from 0 to 1.0, and it is defined as half of the arithmetic average of the absolute differences between all pairs of incomes in a population when the total is being normalized on mean income. If incomes in a population are distributed completely equally, the Gini value is 0, and if one person has all the income in the condition of maximum inequality, the Gini is 1.0. The Gini coefficient can also be illustrated through the use of a *Lorenz curve* as indicated in Fig. 5.1. On the horizontal axis is the percentage of the families in a society, and on the vertical axis is the percentage of the aggregate income within the society. Under conditions of perfect equality in the distribution of income (Gini = 0) – line (a) – each decile group accounts for exactly 20% of the aggregate income, such that the Lorenz curve follows the 45-degree line of equality. The Gini coefficient is the ratio of the area between the Lorenz curve and the 45-degree line of equality [line (a)].

The distribution of income cannot be boiled down to one mechanism, such as supply and demand in the labor market, nor can it be measured by a single measure of inequality like the Gini coefficient. It is the result of many different processes working together. History matters just as the market, politics, and demography do (Deaton 2013). Until the early 1970s, the United States was the very model of a modern major economy. Since then, the situation has changed toward less growth and more inequality.

> The top fifth have been prospering while the majority lags behind. But the separation is not just economic. Gaps are growing on a whole range of dimensions, including family structure, education, lifestyle, and geography. Indeed, these dimensions of advantage appear to be clustering more tightly together, each thereby amplifying the effect of the other. Reeves (2015)

Fig. 5.1 Lorenz diagram
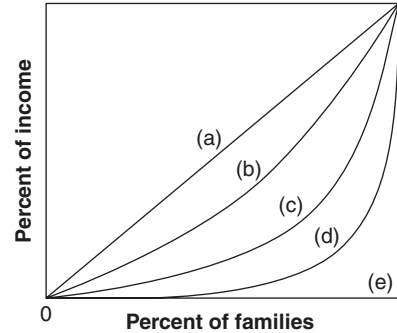
It is not just the top fifth (top 20%) of households by income that have more money than the 80% below them. There are multiple advantages for the top 20% as well. Reeves argues that people in the top-quintile households are more likely to have a graduate or professional degree, to have two earners in the family, and perhaps to be married. For example, in 1979 a 40-something-year-old in the top income quintile was about 6 percentage points more likely to be married than the one in the bottom 80%. Today, the gap is 17 percentage points. Along with the increased association between top-quintile income and marriage, each of the differentials for graduate education and two-earner status have also increased by around 10 percentage points between the years of 1979 and 2014 (Reeves 2015). The marriage gap between the upper middle class and the rest of the population also has social implications. It is an important factor in the transmission of class status to the next generation of the top quintile since married couples are more likely to stay together, combine their annual income, and maintain stable families, all of which predict better outcomes for their children.

The Congressional Business Office's latest net income tabulations show that inequality was almost 5% lower in 2013 than it was in 2007. The Great Recession hurt the incomes of Americans up and down the income distribution, but the biggest proportional income losses were at the very top. To be sure, income gains in the recovery after 2009 have been concentrated among top income recipients. Even so, their income losses over the recession and recovery have been proportionately bigger than the losses suffered by middle- and low-income families (Burtless 2016).

Today, it is not just money that separates the rich from the rest of the population but family life, education, and neighborhood, among other things. Reeves' (2015) empirical analysis confirms that different advantages are increasingly overlapping with each other. He further argues that the United States is becoming a more class-stratified society, contrary to the nation's self-image as a socially dynamic democracy. In particular, the barriers are hardening between the upper class and the majority below them.

There are positive aspects for the top quintile in perpetuating inequality. Rewards for better education, more innovation, and greater creativity are higher in more unequal societies. But there are limits to social and economic inequalities that become threats to the general social well-being arising from plutocracies. Deaton carefully studied human well-being over the past 250 years. He defines the term well-being to all of the things that are good for a person that make for a good life.

Well-being includes material well-being, such as income and wealth; physical and psychological well-being, represented by health and happiness; and education and the ability to participate in civil society through democracy and the rule of law. His focus is on health and wealth. Income inequality, however, is becoming a global issue. Deaton (2013) assesses human progress over the past 250 years and argues that the world is a better place than it used to be, but he also sounds notes of concern over the vast inequalities between and within the world's nations. He also sheds light on the issue of the relationship between income and caloric intake.

Jan Tinbergen saw the evolving distribution of income, not as it has been viewed in the past, as a battle between labor and capital, but as a race between technological development and increased improvements in schooling (Tinbergen 1974). Katz and Goldin (2010) used this analogy to describe recent developments in the US labor market. The technology used at work requires skill and training, or perhaps just the adoptability that comes from a good general education. If the education of workers falls behind what the market is looking for, the price of education will rise, the earnings of more educated workers will pull ahead, and inequality will increase. Changes in the technology of production have consistently favored those with more skills. This trend is described as *skill-based technical progress* (Deaton 2013). Economists attribute the acceleration in skill-based technical progress over the past 30 years to be the main engine driving increased inequality in earnings. This trend may not go on indefinitely, if the education system becomes flexible enough to produce the new skills as quickly as the need for them grows. Companies such as the automotive industries have introduced ongoing educational programs during the regular workday to keep their labor force at and ahead of the industrial learning curve. Perhaps the increase in inequality will eventually come to an end.

Deaton (2013) provides an upbeat assessment of human progress over the past 250 years in his book*, The Great Escape: Health, Wealth, and the Origins of Inequality*. He documented why the world is a better place today than it used to be with substantial increases in general wealth, health care, and human longevity. But he also sounds notes of concern over vast inequalities that have occurred between and within nations. He said that he was heartened by the brighter political spotlight that had been thrust on income inequality in recent times.

Over the past quarter of a century, the share of jobs in the US economy in manufacturing has declined, while the share of jobs in services has risen. A common view is that because manufacturing jobs are relatively higher-paying jobs compared to the salary-earning service workers, this shift had negative impact on wage-earning workers. However, jobs also differ in other ways, so looking only at pay suggests an incomplete picture (Sorkin 2016). Sorkin argues that between January 1990 and March 2016, wages fell by 2.9 percentage points solely because manufacturing jobs shifted to sectors with lower pay. However, these lower-paying sectors have more non-desirable nonpay characteristics, such as more dangerous, or unpleasant working conditions, or inadequate benefits offsetting roughly half of the pay losses due to sectoral shifts. Therefore, accounting for the changes in pay and nonpay compensation, workers have lost about 1.4 percentage points of the value of jobs over the past quarter of a century due to the shifting sectoral composition of

manufacturing jobs (Sorkin 2016). More recently, while the move toward lower-paying sectors continues, it has not been offset by a move toward sectors offering higher nonpay compensation. Since January 2010, the composition of jobs shifted toward sectors that pay 0.5% less. Moreover, in contrast to earlier years, faster-growing sectors do not have more-desirable nonpay characteristics. So accounting for both changes in pay and nonpay characteristics, sectoral shifts have reduced the value of workers' employment by 0.5% since January 2010 (ibid). While US inequality can be a positive extension of rising wealth, Sorkin concludes that "he had grown concerned that things were moving too far in the wrong direction. It is a great danger if inequality becomes so extreme that it can threaten democracy."

It is widely acknowledged that *individual* income is a powerful determinant to *individual* health (Subramanian and Karachi, Subramanian and Kawachi 2004). Bezruchka (2001b) made the startling claim that income inequality is the major cause of our nation's health problems. He dismisses the role individuals can play in safeguarding their own well-being, claiming that "research during the last decade has shown that the health of a group is not affected substantially by individual behaviors such as smoking, diet and exercise." Better prescriptions for a healthy society, he argues, would include a "consumption tax." Bezruchka is not alone in believing that improving health depends upon transforming economic conditions. Kawachi in his 2000 publication, *Is Inequality Bad for Our Health?*, declares that income inequality is an "important public health problem." Indeed, for the past decade, public health experts have become increasingly eager to expand their professional agenda beyond health into broader areas of controversy. To be sure, attempts to understand the ultimate nonmedical sources of bad health care, for example, poor education, lower class status, and healthy food deprivation, have occupied scholars for decades. But there is an enormous difference between explicating these factors and claiming scientific authority for political remedies. Indeed, fixating on social transformation as the proper role of public health professionals' risk-taking, physicians and epidemiologists believe that public health officials are taking away their traditional medical mission, or, at least, trivializing it. That medical mission is to develop the scientific and practical bases for disease prevention and to devise effective ways in educating the public about health risks. None of this is to deny that social conditions, especially poverty, affect physical well-being and length of life. Public health practitioners do have the responsibility of designing policies that effectively prevent disease, reduce contagion, and minimize injury. But they are sorely mistaken in thinking if they think that they have special expertise in changing the income distribution, in defining social justice, or in producing the instruments that can attain it.

A central premise of the new public health scholarship is the "income inequality" hypothesis. This hypothesis has spawned a minor academic industry that has produced some important and carefully drawn epidemiological studies. It has also produced a surprising volume of ideologically driven speculation that fails to withstand critical scrutiny. The hypothesis reached a wide audience in the early 1990s through the publications of Wilkinson (1996), who claims the causal link between income inequality and individual health represents the most important limitation on the quality of life in modern societies. From this, he concludes that there is "a
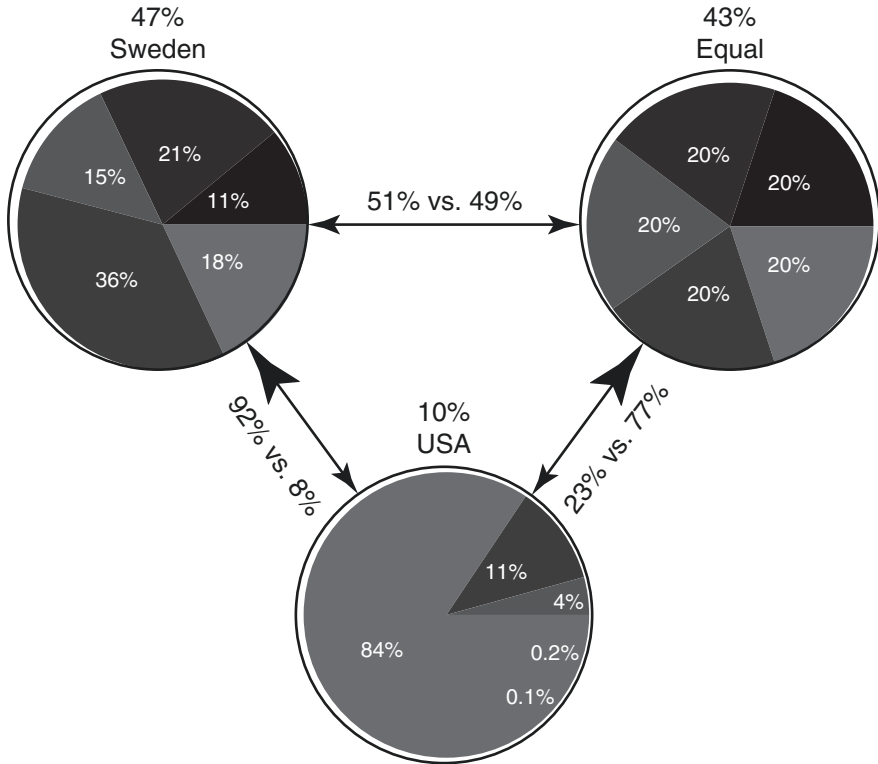
Fig. 5.2 Relative preference among all respondents for three distributions: Sweden (upper left), an equal distribution (upper right), and the United States (bottom). Pie charts depict the percentage of wealth possessed by each quintile, for instance, in the United States, the top wealth quintile owns 84% of the total wealth, the second highest 11%, and so on (Source: http://www.people.hbs.edu/mnorton/norton%20ariely.pdf)

persuasive case for the redistribution of income." Wilkinson and others point to data purporting to show that health and longevity are, in large part, determined by relative wealth. For example, wealthy countries with more equal income distributions, such as Sweden and Japan, have longer life expectancies than the United States. Kawachi et al. (1996–2000) expand on Wilkinson's thesis. "The health of a population depends not just on the size of the economic pie, but how the pie is shared." The authors speculate on how social inequality produces differences in health at each step on the socioeconomic ladder. "Income inequality," they observe, "appears to affect health by undermining civil society. Lack of social cohesion leads to lower participation in political activity (such as voting, serving in local government, volunteering for political campaigns)." Lower participation, in turn, reduces public demands for increased government spending on public goods, such as education and social safety nets. Then "social capital" takes its place alongside "economic capital" and "human capital" as something fundamental to the smooth functioning of society and economic growth (Fig. 5.2).

Other public health scholars point to the disease-producing anxiety of not being able to keep up with the Joneses. Lynch and Kaplan (1997) argue that health may be affected through individual appraisals of relative position in social order. Even those with good incomes might feel relatively deprived compared to the super rich. There is in fact intriguing evidence that a person's socioeconomic position can affect health. Consider Brunner and Marmot (1998) and his colleagues who examined workers in the five grades of the British civil service, all of whom had access to health care and at least a decent income. It was no surprise to the researchers that civil servants at the lowest grades suffered heart disease at about three times the rate of men at the top tier. But they were puzzled to discover that even highly paid professionals in the fourth category had twice as much heart disease as the workers right above them. What appeared to explain this finding was the fact that these workers had little "control of destiny" – their jobs were heavy with responsibility, but with relatively little authority.

There are other factors that need to be considered as evidence suggesting that the prime driver of wage inequality is also related to the growing gap between the most and least profitable companies, not the gap between the highest- and lowest-paid workers within each company. That suggests policies that have focused on individuals, from minimum wages to education, may not be enough to close the pay gap. Promoting competition between companies, such as through antitrust oversight, may also be important. A company at the 90th percentile, that is, more profitable than 90% of all other companies, saw its return on invested capital jump from 22% in 1982 to 99% in 2014. For the median company, the return climbed from 9% to just 16%, and for the company at the 25th percentile, it stayed the same, at 6%.

Separate research suggests that pay has closely followed these companies' fortunes. Jae Song of the Social Security Administration and four coauthors looked at pay records of more than 100 million workers between 1980 and 2013 and compared their pay to that of other workers at the same firm. Workers at the 90th and 99th percentile did see their pay rise much more than median- and lower-paid workers over the time period. But no such disparity appeared among coworkers at the same firm – the ratio of their pay to their firm's average remained flat. In other words, everyone at the top companies, from the lowest to highest paid, pulled away from the pack, and everyone at the bottom companies languished. Some companies may so dominate their market that they can extract profits over and above what a purely competitive landscape would allow. Economists call these excess profits "rents." Employees at those companies then share in those rents. In the 1970s, both workers and shareholders of industries such as airlines and telecommunications shared in the rents made possible by the high regulatory barriers to entry, but then, deregulation sharply squeezed those rents.

Data supports that the biggest gains in profits have been among technology and health-care companies such as pharmaceuticals or drug manufacturers. Such companies' profits do not come from tangible assets, such as factories and land, but from intangible assets, such as technology standards, patents, and networks of customers or suppliers. This makes their products more useful and profitable while presenting formidable barriers to would-be competitors. These trends underline the importance

of competition policy, whether policing mergers and anticompetitive behavior more closely or ensuring that incumbents do not use regulations to keep out upstarts – such as granting pharmaceutical companies excessive patent protection. More competition is not just good for customers; it is good for the workers as well.

"Illness is caused by the power imbalance in a capitalist society," insists Braveman (2006). She argues that we must counteract the free market with social programs. For those like Braveman who condemn capitalism, it is a small step to say that income inequality is the issue.

Yet, there are fundamental problems with the evidence upon which their arguments for the redistribution of income are based. Pollack (in Satel and Marmor 2001) questioning the very measures of inequality typically cited the indices of income dispersion. He argued that in practice, it is very difficult to distinguish the potential health effects of income inequality from the strong effects that arise from absolute need. To those at the bottom of the economic ladder, it may be the ability to meet daily needs that matters most, not relative status. In this reading of the evidence, money is meaningful to the poor because of what it can buy, not because they have less of it than others. Thus, it is not so much income dispersion itself that matters for a person's health, but the proportion of the population that suffers true poverty-related problems, such as undernourishment, lack of access to timely medical care, and so on. Pollack points out that the health impact of inequality itself is really unknown, once one focuses on closely connected characteristics like race. What we are left with is an energetic advocacy of deeply uncertain claims about the connection between health and the degree of income inequality (Satel and Marmor 2001). It is hardly surprising that an increasingly individualistic free market-oriented society, in which job security is diminished, benefits have been cut, and the social security safety net is increasingly fragile, produces both reduced levels of trust and community participation *and* increased inequalities in income and health (Pearce and Smith 2003).

There are also dangers in concluding from the relationship between health and wealth that being less well-off produces disease. Indeed, the so-called healthy worker effect suggests an opposite reading, that is, that health may determine income. After all, people who are healthier are more likely to hold jobs, to work competitively, and engage in activities that help them advance both their social and economic positions and, in turn, protect their health. We have to be cautious in making generalizations about the longevity-threatening effect of a socially stratified society, as there are some striking exceptions to the income inequality schema. For instance, in Denmark, the gap between the top and bottom of the income scale is smaller than in the United States, yet its citizens have a lower average life expectancy than ours. The Japanese have the longest life expectancies, but their social hierarchy is very rigid.

The relationship between obesity and socioeconomic status differs by sex, race, and ethnicity group. Among women and specifically non-Hispanic white women, obesity prevalence increases as income decreases, while among non-Hispanic black and Mexican-American men, obesity prevalence decreases as income decreases. Although the prevalence of obesity among women with income below 130% of the

poverty level is higher than among those with higher incomes, most obese women do not have incomes below 130% of the poverty level. Among men and women with college degrees, the prevalence of obesity is lower than among those with some college education. Moreover, college-educated women are less likely to be obese compared with those with less than a high school diploma. Between 1988–1994 and 2005–2008, the prevalence of obesity increased in adults at all levels of income and education (Ogden et al. 2010).

Chapter 6
Data and Methodology: Empirical Investigation of the Relationship Among Obesity, Income Inequality, and Poverty

Abstract Several studies conclude that major health and social problems are more common in more unequal countries and states. Internationally, Scandinavian countries and Japan were rated the highest on the healthy end of the distribution. In this chapter, we will proceed to present our theoretical model, and then the model will be used for econometric specification to test our hypothesis. We will extend our previous analysis to an empirical formulation to examine whether there is a long-run relationship among the variables obesity, poverty, and income inequality. The panel co-integration tests point to the existence of a long-run relationship between obesity and income inequality and poverty.

Based on literature reviews and theoretical explanations as discussed in the previous chapters, we will examine the empirical relationship between obesity, income inequality, and poverty in this chapter. Then, we will extend our analysis to an empirical formulation to examine whether there is a long-run relationship among the variables mentioned above.[1]

According to 2011 OECD report, income inequality (measured by the Gini coefficient) in the United States has been increasing steadily since the mid-1980s (OECD 2011), to the point at which it is compared with Madagascar, Mexico, Nepal, and Rwanda, and more critically than most of North and West Africa, Europe, and Asia. The United States now ranks third in income inequality among all the advanced economies, with the top 1% of Americans controlling nearly a quarter of all the country's income. Not since 1928 has the top 1% controlled this level of national income (Elmes and Derry 2013). In a 2011 study, the 20% wealthiest Americans controlled 84% of the country's wealth (Norton and Ariely 2011). At the same time, according to the US Census Bureau, the nation's poverty rate in 2011 rose to 15.1% – its highest level since 1993 – up from 13.2% in 2008. In 2012, the US government defined poverty as a family of four living at or below $23,050 of total yearly income.

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[1] The description of the variables is given in the appendix.

Before returning to our analysis, we need to look at the present scenario of poverty, obesity, and income inequality within the United States. Poverty and obesity vary among states, as indicated in Tables 4.2 and 4.3, where, in 2013, Mississippi had the highest obesity rate of 35.4%, while Montana had the lowest rate of 19.6%. Figure 6.1 shows the linear relationship between obesity and poverty and between obesity and income inequality, respectively. Wilkinson and Pickett (2009) studied all 50 of the United States to measure health and social problems using the Index of Health and Social Problems. Across the country, among those that tended to perform well were the states of New Hampshire, Minnesota, North Dakota, and Vermont. Among those which did least well were Mississippi, Louisiana, and Alabama (ibid. p. 174). They concluded that the major health and social problems are more common in more unequal countries and states. Internationally, Scandinavian countries and Japan were rated the highest on the healthy end of the distribution.

The linear-fitted Fig. 6.1 shows that both of the variables, poverty and income inequality, positively affect obesity. The partial correlation among the variables also shows that the relation is positive.[2]

In the next step, we will proceed to the theoretical model. This model will be used for econometric specification to test our hypothesis (Tables 6.1 and 6.2).

Model and Methodology

Specification of the Model

We follow Subramanian and Kawachi (2004) and their model of the intrinsically multilevel nature of the income inequality hypothesis by contrasting the individual-level and aggregate-level models. Using typical regression notations, we can specify the individual-level relation between income and obesity as follows:

$$y_i = \beta * (x_i) + e_i,$$

where y_i is the obesity or health status of the individual i, x_i is the income of the individual i, $\beta*$ represents the nonlinear (or concave) nature of the relation between y_i and x_i, and e_i is the residual differences in individual health (obesity), after accounting for individual income.

Meanwhile, the aggregate (societal)-level relation between income inequality and obesity can be expressed in the following way:

$$y_j = \alpha (W_j) + u_j$$

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[2] See the appendix.
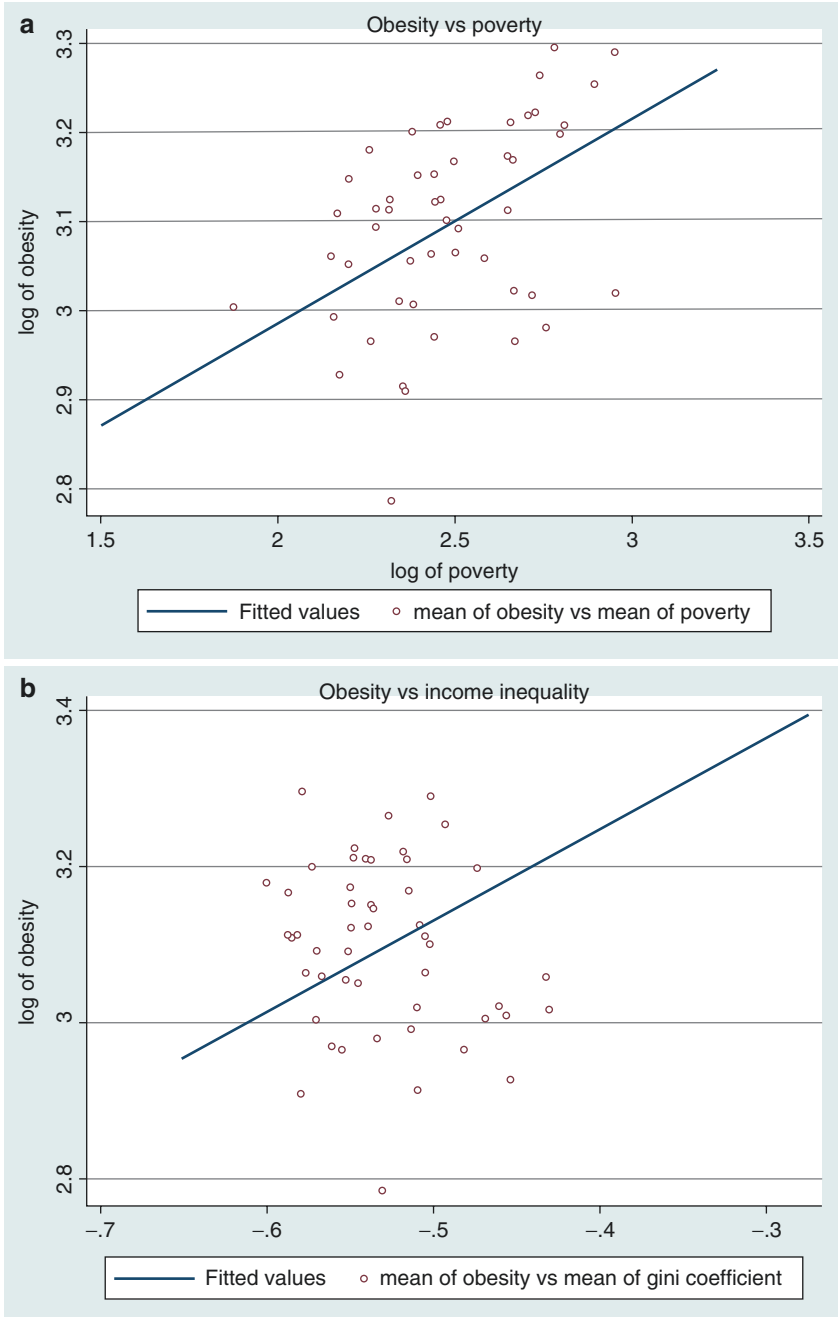
Fig. 6.1 Linear fit. Panel (**a**): obesity vs. poverty. Panel (**b**): obesity vs. income inequality

Table 6.1 US states with highest obesity rates, 2013 January–December 2013, Gallup-Healthways Well-Being Index

Ten states with highest obesity rates	Percent of obese
Mississippi	35.4
West Virginia	34.4
Delaware	34.3
Louisiana	32.7
Arkansas	32.3
South Carolina	31.4
Tennessee	31.3
Ohio	30.9
Kentucky	30.6
Oklahoma	30.5

Source: http://www.gallup.com/poll/161717/boulder-remains-least-obese-metro-area.aspx

Table 6.2 US states with lowest obesity rates, 2013 January–December 2013, Gallup-Healthways Well-Being Index

Ten states with lowest obesity rates	Percent of obese
Montana	19.6
Colorado	20.4
Nevada	21.1
Minnesota	22.0
Massachusetts	22.2
Connecticut	23.2
New Mexico	23.5
California	23.6
Hawaii	23.7
New York	24.0

Source: http://www.gallup.com/poll/161717/boulder-remains-least-obese-metro-area.aspx

where y_j is the average obesity of a society j, W_j is the income inequality in society j (measured by the Gini coefficient), α estimates the relation between y_j and W_j, and u_j is the residual differences in societal health (obesity), after accounting for societal-level income inequality. Following the above independent and identical distribution assumptions, one can summarize these societal differences in a variance parameter.

Following Subramanian and Kawachi (2004) again, we can summarize the following equation by incorporating the "income inequality hypothesis":

$$y_{jt} = \beta^*\left(x_{jt}\right) + \alpha\left(W_{jt}\right) + u_j + e_{jt}$$

where y_{jt} is the obesity (health) status of society j at time t, x_{jt} is the income of society j at time t (with β^* estimating the nonlinear (or concave) nature of the relation between y_{jt} and x_{jt} within a society), and W_{jt} is the level of income inequality in society j with α estimating the effect of societal income inequality on individual

health – obesity having taken account of the individual income-health relation. An important aspect of the specification in the third equation is that variation in health status is seen to be coming from two sources, that is, one from the individual (e_{jt}) and society (u_j) and two from the variation attributable to the level of individuals and to the level of societies.

Although Subramanian and Kawachi (2004) used a multilevel model, in this study we try to capture the differences in obesity that arise from income and from income inequality. We intend to establish whether there is a co-integration between obesity, income inequality, and poverty. The basic idea is to check the monotonicity of the relationship that is crucial for policy purposes. Our hypothesis states that both poverty and income inequality positively affect the rise in obesity. If the relationship is monotonic, then reducing income inequality or poverty will reduce obesity.

In this study, we define y_{jt} as obesity which is used as a proxy for health status for each state j at time t and x_{jt} as poverty which is used as a proxy for poverty status of each state j at time t with W_{jt} as the level of income inequality in each state j at time t. The sources and definition of variables are given in the appendix.

Based on the above information, we have the following econometric specification for panel data as

$$\text{obesity}_{jt} = \alpha_i + \beta_{1j}\text{gini}_{jt} + \beta_{2j}\text{poverty}_{jt} + \varepsilon_{jt}$$

or, in trans-log form, we have the following:

$$l\_\text{obese}_{jt} = \alpha_i + \beta_{1j}l\_\text{gini}_{jt} + \beta_{2j}l\_\text{poverty}_{jt} + \varepsilon_{jt}$$

where each variable is expressed in natural logarithmic form and j (refer to state) = 1, 2,…, n; t (refer to year) = 1, 2,…,T.

Methodology

There are a number of co-integration tests, such as in Engle and Granger (1987), Johansen (1991), and in Phillips and Ouliaris (1990), which are documented in the time series literature. However, these tests fail to take advantage of information across countries, which lead to a loss of efficiency in estimation. Several authors, such as Pedroni (1999) and Kao and McCoskey (1998), devoted their efforts to develop co-integration tests with panel data. In their research, we use the co-integration tests proposed by Pedroni (1999) and by Kao and McCoskey (1998) to test whether the co-integration relationship exists in the estimated equations.

Before estimating the co-integrating equation, we performed unit root test of the variables according to Levine et al. (2002), Pesaran (2004), and Breitung (1999). After the unit root test, we estimated the co-integrating fourth equation to determine whether l_obese, l_gini, and l_poverty are co-integrated. Pedroni (1999) and Kao and McCoskey (1998) provide different statistics for this purpose.

Table 6.3 Panel unit root test (level)

	LLC		Breitung		IPS	
Variable	None	Intercept	Trend	Trend	Intercept	Trend
l_obese	11.28	−8.06***	−12.19***	−3.30***	−1.59	−3.13***
l_gini	−8.398***	1.9	5.92	0.384	−1.06	−1.5
l_poverty	0.645	−6.11***	−9.26***	−3.87***	−2.77***	−2.83***

N. B: *LLC* Levin, Lin, Chu (2002), *IPS* Im, Pesaran, Shin (2003). The other statistics are described in detail in Breitung (2000). The statistics are asymptotically distributed as standard normal with a left-hand side rejection area. A *** indicates the rejection of the null hypothesis of nonstationary (LLC, Breitung, IPS) at 1% level of significance

Table 6.4 Panel unit root test (first difference)

	LLC		Breitung		IPS	
Variable	None	Intercept	Trend	Trend	Intercept	Trend
l_obese	−29.85***	−36.73***	−40.07***	−19.14***	−5.97***	−6.38***
l_gini	−22.52***	−12.99***	−10.96***	−3.60***	−3.38***	−3.38***
l_poverty	−35.98***	−30.81***	−28.47***	−13.80***	−5.13***	−5.26***

N. B: *LLC* Levin, Lin, Chu (2002), *IPS* Im, Pesaran, Shin (2003). The other statistics are described in detail in Breitung (1999). The statistics are asymptotically distributed as standard normal with a left-hand side rejection area. A *** indicates the rejection of the null hypothesis of nonstationary (LLC, Breitung, IPS) at 1% level of significance

Result Discussion

The fourth obesity equation is an estimate for a sample of 50 states of the United States using the annual series taken from US Census Bureau and the US Centers for Disease Control and Prevention from 1998 to 2012. All the variables are in logarithmic form. The first step is to check for the integration properties of the variables involved. Table 6.3 shows the results of the panel unit root tests. The level method has been specified with fixed results and shows the individual time trends in the data generating process.

More or less, a unit root is detected for the level variables, while the first differences appear to be stationary. Due to this result, each variable includes a random walk component. Table 6.4 shows the results of unit root tests for the variables in their first-differenced form. The panel co-integration tests point to the existence of a long-run relationship between obesity and income inequality and poverty as presented in Table 6.5.

For example, the null hypothesis of no co-integration is rejected by most of the Pedroni (1999) tests at the 1% level. Specifically, when we consider the intercept and trend cases, both the panel statistics and group statistics reject the null of no co-integration in all tests. We also performed the co-integration test proposed by Kao and McCoskey (1998) where null hypothesis is no co-integration. We also see that the test confirms the long-run relationship among the variables as the test rejects the null of no co-integration. Table 6.6 shows the Kao and McCoskey (1998) test of co-integration.

Table 6.5 Panel co-integration test (Pedroni 1999)

	Panel statistics			Group statistics		
	None	Intercept	Intercept and trend	None	Intercept	Intercept and trend
Variance ratio	−3.078160	−3.342651	8.697003***			
Rho statistics	−0.953278	2.661710	−2.383546***	1.627019	5.019088	0.770848
PP statistics	−5.206063***	0.272696	−13.84519***	−6.641029***	−0.358981	−16.98591***
ADF statistics	−4.013324***	−0.629284	−5.809005***	−6.372481***	−0.727203	−5.802846***

N. B: Statistics are asymptotically distributed as standard normal. The Pedroni statistics are described in detail in Pedroni (1999). The variance ratio test is right sided, while the other Pedroni tests are left sided

Table 6.6 Panel co-integration test (Kao and McCoskey 1998)

Null hypothesis: no co-integration		
Trend assumption: no deterministic trend		
User-specified lag length: 1		
Newey-West automatic bandwidth selection and Bartlett kernel		
	t-Statistic	Prob.
ADF	−6.006750***	0.0000
Residual variance	0.008742	
HAC variance	0.008354	

N. B: The LM test from Kao and McCoskey (1998) is right sided and carried out using either FMOLS or DOLS residuals. A *** indicates the rejection of the null hypothesis of no co-integration (Pedroni) or no co-integration (Kao and McCoskey) at least on the 0.05 level of significance

Table 6.7 Co-integrating regression (FMOLS)

Dependent variable: l_obese				
Method: panel fully modified least squares (FMOLS)				
Panel method: pooled estimation				
Co-integrating equation deterministics: C				
Coefficient covariance computed using default method				
Long-run covariance estimates (Bartlett kernel, Newey-West fixed bandwidth)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
l_gini	3.009226	0.210942	14.26563	0.0000
l_poverty	0.172195	0.059664	2.886078	0.0040
R-squared	0.479683	Mean dependent var	3.119495	
Adjusted R-squared	0.445767	S.D. dependent var	0.219577	
S.E. of regression	0.163468	Sum squared resid	18.03725	
Durbin-Watson stat	0.519357	Long-run variance	0.046557	

N. B: Panel method is pooled estimation. The co-integration equation is deterministic. We use Bartlett kernel lag and Newey-West fixed standard error of residuals

After the confirmation of the long-run relationship, the next step is to estimate the long-run relationship using FMOLS or DOLS.[3] Both the FMOLS and DOLS results are below. The regressor enters with the correct sign and they are highly significant.

Table 6.7 shows the co-integrating regression using the FMOLS method. Both of the regressors are highly significant. It is to be noted that both of the coefficients represent the elasticity of obesity with respect to each variable. Our results suggest that income inequality is more responsible for the obesity than poverty as the elasticity of obesity with respect to income inequality is greater than that of with respect to poverty.

Table 6.8 shows the same result when the DOLS method is used. This result also resembles the FMOLS result. Although the coefficient of l_poverty is insignificant,

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[3] See Pedroni (1996, 2000, 2001)

Table 6.8 Co-integrating regression (DOLS)

Dependent variable: l_obese				
Method: panel dynamic least squares (DOLS)				
Panel method: pooled estimation				
Co-integrating equation deterministics: C				
Fixed lead and lag specification (lead = 1, lag = 1)				
Coefficient covariance computed using default method				
Long-run variance (Bartlett kernel, Newey-West fixed bandwidth) used for coefficient covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
l_gini	3.061257	0.226335	13.52531	0.0000
l_poverty	0.124680	0.075706	1.646896	0.1003
R-squared	0.873811	Mean dependent var	3.098143	
Adjusted R-squared	0.771900	S.D. dependent var	0.233995	
S.E. of regression	0.111755	Sum squared resid	5.257980	
Long-run variance	0.013013			

N.B: Panel method is pooled estimation. The co-integration equation is deterministic. We use Bartlett kernel lag and Newey-West fixed standard error of residuals

the signs of the coefficients resemble the FMOLS result. Both of the long-run co-integration estimations confirm that there is a long-run relationship between obesity, income inequality, and poverty and that the relationship is positive.

This positive relationship calls for some explanation regarding obesity. As poverty leads the consumer to purchase low quality of food and lowers the affordability of spending on exercise, the probability of having obesity increases, while the reduction of poverty levels can mitigate the problem of obesity. On the other hand, income equality often leads the consumer to purchase a higher quality of food as explained in previous chapters. Thus, reducing income inequality and poverty has a broad impact in reducing obesity both in the micro- and macro-levels.

Causality Test

Although regression results show a basic type of correlation, they do not express the causality that may exists. To identify the causality among the variables, we first conducted the cross-sectional dependence test suggested by Pesaran (2015). The null of these tests is that there is no cross-sectional dependence. Both of the tests reject the null hypothesis.[4] Then, we conducted the panel of Granger causality tests suggested by Dumitrescu and Hurlin (2012). Table 6.9 shows the causality test result. It is clear that there is a bidirectional causal relationship between l_poverty and l_obesity. It is assumed that poverty is an important reason for becoming obese, and, at the same time, obesity reduces the potential for access to resources including

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[4] Pesaran statistics is 96.016 (0.000) and Frees statistics is 7.808(0.000). Figures in parenthesis are *p*-values.

Table 6.9 Panel causality test

Null hypothesis:	W-Stat.	Zbar-Stat.	Prob.
l_poverty does not homogeneously cause l_obesity	3.18748	1.68234	0.0925
l_obesity does not homogeneously cause l_poverty	4.61781	4.95207	7. E-07
l_gini does not homogeneously cause l_obesity	1.86908	−1.33155	0.1830
l_obesity does not homogeneously cause l_gini	4.39338	4.43902	9. E-06
l_gini does not homogeneously cause l_poverty	3.32673	2.03596	0.0418
l_poverty does not homogeneously cause l_gini	4.15008	3.93590	8. E-05

N. B: This test is performed through Dumitrescu and Hurlin (2012)

employment due to health-related problems that in turn affect their income. In addition, we find that l_obesity causes l_gini unidirectionally.

Data from the 1980s and 1990s in the United States shows that about 36% of children whose parents were in the bottom fifth of the wealth distribution end up in the same bottom fifth themselves as adults. It also shows that among children whose parents are in the top fifth for wealth, 36% of them can be found in the same top fifth (Mishel et al. 2007). While those at the top can maintain their wealth and status, those at the bottom find it difficult to climb up the income and social ladder.

Inequality affects educational achievement and aspirations (Wilkinson and Pickett 2009). In the United States, the least equal of the previous eight industrial countries, only two-thirds or 68.2% of the budget on school education is public money. This is likely to have a substantial impact on social differences in access to higher education and hence on social mobility. Again, this bidirectional causal relationship shows that there are other economic and noneconomic factors directly or indirectly causing poverty and obesity.

In addition, we find that l_obesity causes l_gini unidirectionally. Obesity is the result of imbalances between food and beverage consumptions (energy intake) and physical activity (energy expenditure). Gaining weight occurs when caloric consumptions exceed calories expended. Social disadvantages, as explained in previous chapters, influence energy expenditure and energy intake and lead to obesity. Poor people tend to live in social and physical environments that are not conducive to physical activity because of lack of access to indoor and outdoor places to exercise or walk.

Also, obese adults are malnourished, affecting their work and income productivity, in contrast to those who are not malnourished. This condition eventually reduces their income. Again, there is a bidirectional causal relationship between l_gini and l_poverty. This result is confirmed since both poverty and inequality are intertwined.

In summary, there are multiple ways that inequality and poverty influence obesity outcomes, through food consumption and physical activity. Disadvantaged individuals not only lack personal resources and knowledge that influences energy intake and expenditure, but they also are more likely living in under-resourced and unsafe environments that limit their ability to engage in healthy food and social behavior.

Chapter 7
Food Policy Interventions

Abstract Obesity is mainly associated with unhealthy eating and low levels of physical activity but also, increasingly, with social and economic development and policies in the areas of agriculture, transportation, urban planning, the environment, food processing, distribution, marketing, and education. Obesity-related health-care spending is estimated to cost up to $190 billion per year or more than 20% of the total US health-care cost. If nothing is done to stop the epidemic now, it will rise by an additional $50 billion or more by 2030 (Carroll 2013).

Obesity's rising costs are not what the United States' economy needs as the government attempts to put a lid on exploding health-care expenditures. Any national strategy should have clear guidance on prevention and treatment of established overweight and obesity problems.

The ecological framework by Story et al. (2008) examines the individual factors (personal), social environment (networks), physical environments (settings), and macro-level environments (sectors). On a personal level, the authors site cognitions, behaviors, lifestyle, biology, and demographics as influences on peoples' dietary choices. On this personal level in the United States today, the concern is the demographic factor that encompasses income, race, and ethnicity. Along with the wealth disparity in the United States, there is an equally large disparity in access to quality nutrient-rich foods.

Bentham and Ezzati (2016) combined results from 1,472 studies in 200 countries looking at the measured – rather than self-reported or estimated – heights of about 18.6 million people born from 1896 to 1996. Their study gives us a picture of the health of nations over the past century and reveals how the average height of some nations may even be shrinking, while others continue to grow taller. They argue that height is strongly influenced by the mother's nourishment during pregnancy and the child's during infancy. Height is also linked to overall health and well-being in a society. They speculated that countries like Japan, Singapore, and France had larger-than-median gains in height but little change in BMI, in contrast to places like the

United States and Kiribati (India), where height has increased less than the world-wide median, while BMI has increased a great deal. The decline could be because of worsening nutrition standards for poor Americans.

In low-income neighborhoods over the past decade, there has been an exodus of small neighborhood ("mom 'n pop") grocery stores, only to be replaced by fast-food chains offering a large volume of food at extremely low prices (Story et al. 2008). Limited access to supermarkets contributes indirectly to the risk of obesity. In comparison with smaller grocery and convenience stores, supermarkets tend to offer a greater variety of healthier foods. Overall, the number of food stores in poor neighborhoods is nearly one-third less than in wealthier areas, and the quality of these stores – their size and physical condition and the range and nutritional content of their merchandise – tends toward poorer quality (Mantovani et al. 1997).

Parents have a role in preventing obesity in their children. Significant numbers of parents do not recognize obesity among themselves let alone among their children (Sylvetsky-Meni et al. 2015). Identification by a parent that a child is obese does not necessarily mean that there is action taken. Furthermore, parents who identified their children as obese often indicate that they have little or no control over their children's obesity as it is seen as a hereditary condition (Sylvetsky-Meni et al. 2015). There is a significant amount of research completed on predicting changes of a parent's behaviors and its influence on a child's obesity. Some research has shown promise but most has shown that while parents can influence their children's obesity, it is not a complete answer to the problem. In fact, as Park et al. (2014) demonstrate, a parent's intention to change behavior does not always mean a parent will follow through with those changes.

Our family and friends shape our choices through role modeling, social support, and social norms (Story et al. 2008). If children are raised in an environment where unhealthy eating habits are displayed, they learn this behavior through role modeling and accept it as the norm. Obesity is a serious health concern for children; obese children and adolescents are more likely to become obese as adults. One study found that approximately 80% of children who were overweight at age 10–15 years were obese adults at age 25 years. Data from the National Health and Nutrition Examination Survey (NHANES) (1976–1980 and 2003–2006) show that the prevalence of obesity has increased; for children aged 2–5 years, prevalence increased from 5% to 12.4%, for those aged 6–11 years, prevalence increased from 6.5% to 17%, and for those aged 12–19 years, prevalence increased from 5% to 17.6% (Center for Disease Control and Prevention 2009).

On the physical level, eating habits are examined at home, work, school, neighborhoods, restaurants, and supermarkets. All of these physical places pose issues of access, availability, barriers, and opportunities (Story et al. 2008). If parents rely on a subsidized school lunch program, is it not our duty as a society to see that children are fed quality and nutritionally balanced food instead of cheap processed foods with little nutritional value? At the macro-level, food choices are affected by marketing, agricultural policy, assistance programs, health care, and economic systems (Story et al. 2008). While decisions are made at the microlevel, obesity at the macro-level

is a policy challenge for the public, corporate, industrial, small business, and non-profit sectors of the society.

Achieving energy balance and healthy weight require limiting energy intake from total fats and shifting fat consumption away from saturated fats (which come mostly from animal products) to unsaturated fats (which come mostly from plant foods). Also, it requires an increase in physical activity – at least 30 min of regular, moderately intense activity on most days. The implementation of these recommendations requires sustained political commitment and the collaboration of many stakeholders, public and private. Government, international partners, civil society and nongovernmental organizations, and the private sector have vital roles to play in shaping healthy environments and making healthier diet options affordable and easily accessible to all people, in particular to low-income families.

The fact is that a single coordinated public policy that addresses the obesity infrastructure is highly unlikely due to the various interest groups and lobbyists at the federal, state, and local levels. Various and competing industries, consumer, health care, insurance, medical, agricultural, educational, and other groups work against each other and will not necessarily produce a single, coherent, feasible, and effective policy or market strategy that advances both a significant obesity treatment program and prevention imperatives (Acs et al. 2007). How well these sectors work together as institutions ostensibly interested in the health, education, and welfare of the society to tackle the obesity issue is questionable.

In 2016, *The Lancet* noted that:

> We know that taxing works to reduce purchases of unhealthy products from many other examples and some concrete country evidence for sugar sweetened beverages. We know we have an unabated epidemic of adult and childhood obesity in many high-income countries and an emerging one in low-income and middle-income countries based on present trajectories. We know our current approaches don't work. We know obesity is the result of an obesogenic environment maintained by large global food and drink companies with a vested interest to provide ultra-processed, energy-dense, nutrient-poor food as cheaply as possible, and of an increasingly sedentary lifestyle. And we know that obesity prevention and treatment needs urgent, serious, and multifaceted action, beyond just a sugar tax. And yet, even that small and insufficient step is hotly debated and governments are dragging their feet. One reason, undoubtedly, is the undue influence of the food and drink industry and other lobby groups on governments and policy makers. The new 2016 *Global Access to Nutrition Index*, released on Jan 14, 2016 which ranks the twenty-two largest companies on contributions in tackling obesity and undernutrition, showed that the industry as a whole is moving far too slowly. (p. 199)

The 2015–2020 Dietary Guidelines are designed to help Americans eat a healthier diet. Intended for policymakers and health professionals, this edition of the Dietary Guidelines outlines how people can improve their overall eating patterns – the complete combination of foods and drinks in their diet. This edition offers five overarching guidelines and a number of key recommendations with specific nutritional targets and dietary limits (http://health.gov/dietaryguidelines/2015). The new dietary guidelines by the US Department of Agriculture and Health and Human Services, released on January 7, 2016, were quickly criticized by nutrition experts

for not going far enough as they still mainly focused on sugar reduction, just covering much of the same old ground perhaps influenced by lobbying groups. The private sector with vested interests generally reacts only if strong and impartial science-based guidelines and clear policies leave them no other choice (The Lancet 2016, p. 199). This statement alone is clear evidence that the obesity epidemic will not be reversed without strong government leadership, regulation, investment in programs, monitoring, and research.

Many in society argue that the fault for the obesity epidemic lies with the businesses that supply us with most of our food. That includes not only the fast-food industry, which has been singled out for criticism, but also the soft drink industry, the snack food industry, and restaurants. The US government is also implicated for the role it has played in subsidizing corn and the introduction of inexpensive high-fructose corn syrup in the 1980s. In addition, the government has failed to play an active role in regulating the whole eating process, from individuals to producers. With the increasing role of food advertising, and so many consumers relying heavily on information from food producers, consumers are not always able to make informed choices about what and how much to eat. The government needs to play a much more active role in regulating the food industry and hence fighting obesity.

Supportive environments and alternative communities are fundamental in shaping people's choices and making healthier choice of foods along with regular physical activity available to them in preventing obesity. Individuals need to be responsible for their own physical well-being, but it can only have its full effect where and when people have access to a healthy lifestyle. Obesity is mainly associated with unhealthy eating and low levels of physical activity, but the problem is also linked to people's behavior and, increasingly, to social and economic development and policies in the areas of agriculture, transportation, urban planning, the environment, food processing, distribution, marketing, and education.

Certain groups are affected more than others. Unlike most adults, children and adolescents cannot choose the environment in which they live or the food they eat. They also have limited ability to understand the long-term consequences of their behavior. They therefore require special attention when fighting the obesity epidemic. Without effective intervention, the costs of obesity might well become catastrophic, arising not only from escalating medical expenses but also from diminished worker productivity due to physical and psychological disabilities. Future economic losses could mean the difference between solvency or bankruptcy for Medicare users, between expanding and shrinking health-care coverage, and between investment in and neglect of social infrastructure, with profound implications for our international competitiveness. The human costs of obesity is incalculable (Ludwig 2007).

Indeed, the childhood obesity problem has caught the attention of policy makers at all levels of government and is a front-burner issue for concerned public health officials and community and business leaders. Proposals to address childhood obesity are often aimed at augmenting features of the environment by improving access to healthy foods in or around the home and school, reducing accessibility or exposure to unhealthy food and/or providing more opportunities for exercise and vigorous play. Although a broad consensus exists regarding the dietary and lifestyle

habits needed to prevent and treat childhood obesity, we lack anything resembling a comprehensive strategy for encouraging children to eat a healthful diet and engage in physical activity. Such a strategy would need to include legislation that regulates junk food advertising, the provision of adequate funding for decent lunches, and regular physical activities at school. In addition, the strategy would need to include the restructuring of the farm subsidy programs toward favoring nutrient-dense rather than calorie-dense produce and mandated insurance coverage to prevent and treat pediatric obesity (Ludwig 2007).

According to the School Nutrition Association, many schools are trying to offer healthy food choices on their menus. Several states now ban vending machines in elementary schools or limit what can be sold in the machines and when students can access them. But clearly it is going to take sweeping national reform to repair this problem (Bornstein 2008). Another barrier is No Child Left Behind, which put tremendous pressure on schools to ensure that students perform well on standardized tests in math and science. As a result, physical education and health classes have been minimized and more priority is given to tests rather than nutrition education, as tests are not given on those subject areas.

Food policy interventions at the national and international level may be the most promising approach to making healthy food affordable and accessible to world citizens. The World Health Organization (WHO) stated that the key to maintaining a healthy weight is an affordable supply of fresh nutrient-rich foods. Such access could possibly be facilitated through a combination of agricultural subsides, pricing policies, regulatory action, and consumer education. This approach will require some degree of cooperation between government, academia, and the food industry.

There are two main policy approaches to address national obesity. One approach is to reduce the demand for products and to change the lifestyle that contributes to obesity. This approach can be achieved by information, education, taxing products, and food labeling. The second approach is to reduce the supply side by cutting subsidies of agricultural products that keep costs low. There have been several suggestions not only to remove the offending foods from consumers' reach but also to discourage consumption of those offending foods, thereby promoting vigorously alternative and healthier diets. The latter can be achieved through imposing taxes on fats and sweets, while nutrition can be improved at schools by limiting access to vending machines containing beverages and snacks and regulating the sales of competitive foods.

Because the food industry to a certain degree has failed to self-regulate, government regulation of food advertising is necessary to reverse the childhood obesity epidemic. Companies are not adhering to any uniform standard; rather, each company sets its own standard, which means the monitoring compliance is going to be quite difficult. Even more problematic is this: at no point has the entire food industry agreed to restrict marketing to children. Food marketing to children is a profitable endeavor, and it has been a powerful lobby that is difficult to regulate without significant grassroots pressure from advocacy groups.

Agricultural policy options include the provision of economic incentives for the production of healthier foods and removal of existing subsides. Recent research

has uncovered the baneful influence that corn-based sweeteners have had on America's obesity epidemic. It is estimated that Americans consume 73% of corn-derived sweeteners per person per year (*Sugarcane Profile*, Agricultural Marketing Resource Center 2010). Pollen (2006) points out that the growth of corn-based sweeteners is a direct result of the government's farm policy, which subsidizes corn production. A basic consequence of economic law is that when something is subsidized, more of it will be produced at lower price. In addition, calories from high-fructose corn syrup are less healthy than from natural sweeteners, such as sugar.

Children spend a significant portion of time in schools, making it natural that the eating habits acquired during school years become part of their lifelong behaviors. In the United States, 17% of children under 20 years old are obese or about 12.5 million people, according to the Centers for Disease Control and Prevention. Since 1980, the rate has tripled, leveling off in recent years, but remains at a historical high. Public health experts warn that it could bring long-term health risks (Tavernise 2012). It is mostly the result of access to widely promoted foods that have limited nutritional values. According to a Center for Disease Control 2006 study, 33% of elementary schools had canteens, snack shops, or vending machines. Most of the foods sold were of poor nutritional quality. Children in the Unites States, the study concluded, consume on average almost three times as many calories from sugar-sweetened beverages, compared with Dutch children (ibid).

David Ludwig (2007) suggests that there is a need for public policy changes in speaking to the importance of both education and regulation. "It suggests that if we want long-term changes in body weight, we will need to make long-term permanent changes in the environment for children" (Ludwig 2007). Education matters, but it is not enough, as it needs to be accompanied by restrictions that curb unhealthy habits and environmental changes that foster healthier habits.

So, although national obesity strategies are welcomed and much needed, there needs to be a comprehensive involvement by all relevant government departments concerning both prevention and treatment. In addition to the health sector, the education sector is a vital factor and model, empowering children and adolescents with relevant knowledge about food and nutrition in addition to the opportunity to do physical activity beyond competitive sports.

Transport and urban planning departments need to ensure that cities and environments support easy and preferred access to healthy food and physical activity. Economic, business, and enterprise departments need to be held accountable for the health effects of their policies.

Addressing obesity in both children and adults is difficult. The treatment strategies need to be multifaceted and begin with the need to recognize the conditions of being overweight and obese along with their consequences and the range of nutritional information and advice all the way to bariatric surgery. Interventions for childhood obesity work only if the whole family is engaged. Any national strategy should have clear guidance for the treatment of overweightness and obesity (The Lancet 2016, p. 199).

Menu Labeling

Americans consume one-third of their daily caloric intake from fast foods and restaurants because they are inexpensive and convenient for them. Consumers are mostly ignorant of daily food caloric consumption and the content of sodium, sugar, or fat in the food they consume. People who eat away from their homes are more likely to consume supersized portions of food. It has been estimated that adults who eat away from their homes consume 250 more calories per day than they need. Portions served in fast foods and restaurant chains have been increasing since the 1970s. National public opinion polls show that around 83% of Americans are in favor of menu labeling. Adults often read food labels and make purchasing decisions based on them. Menu labeling provides nutritional information regarding calories, carbohydrates, and the presence of fats and sodium in the food content. Currently, restaurants that have this information make it available in their posters or in their websites but do not always make it readily accessible to consumers when they are making food decisions.

Nutrition labels are the primary source of information on food products and have been the subject of policy intervention around the world (Mazzocchi et al. 2009). In most countries nutrition labeling of processed food is voluntary. The United States is an exception and the European Union (EU) is planning to make nutritional labeling compulsory. Some studies measured the long-term costs and benefits of labeling. Some research argued for high benefits (Silverglade 1996) and others claimed that costs were much greater than benefits (Petrucelli 1996). The latter study (Golan et al. 2001) supports the view that the social benefits of labeling outweigh the costs. The research concludes that consumers read labels and alter their purchase decisions and that producers respond to the incentives provided by labels through the introduction of new, healthier formulas to improve the nutritional profile of their labels. An interesting evaluation is provided by Variyam and Cawley (2006), who looked at the impact of mandatory labeling on obesity using a difference-in-difference method to account for existing trends. The study finds a significant impact on labeling on weight but only for non-Hispanic white females. The total monetary benefits in terms of reduced cost of illness were estimated to be about $166 billion (in 1991 dollars) over a 20-year period. Recent evaluation (Garretson and Burton 2000) has found clear benefits of labeling to the subgroup of people motivated to improve their diet but with limited knowledge.

Taxation, Subsidization, and Reducing Income Inequality

On a federal level, the government has experimented with a variety of subsidies in the agricultural market for over a century. Having dealt with everything from price floors to paid-land diversion, the US government now prefers direct payments, as

well as subsidized crop insurance guaranteeing certain payouts to farmers (Urry 2015). While in theory this practice is a good thing for consumers as it keeps food prices down, the government's focus on subsidizing corn, wheat, and soybeans is in some ways quite questionable. Instead of subsidizing "healthy" crops that Americans need to buy to maintain a healthy diet of fresh and frozen fruits and vegetables, the government's practices often harmed many smaller farms, actually subsidizing and lining the pockets of large factory farms, resulting in the production of crops that are used for highly processed groceries, such as high-fructose corn syrup, and heavily processed grain cereals or ethanol, which is again heavily subsidized as an energy source. The end result for consumers is that they walk into grocery stores and discount markets where sugary snacks and drinks are much cheaper and there are fewer healthy alternatives.

Besides price controls, the US government is heavily involved in food choices based on both their educational programs and their food assistance programs. Many Americans rely on the USDA's nutritional recommendations in determining how to feed their families. These recommendations are constantly changing and often questioned by nutrition experts. For example, new guidelines introduced in January 2016 finally specifically stated that consumers should limit their intake of sugars and saturated fats, but instead of using strong language of what to avoid, they used language about reductions and limits that are more difficult for the public to translate into an informed shopping decision. (CBS News 2016). Nutritionists are concerned that the USDA is more interested in maintaining good relationships with food and beverage manufacturers than in making strong recommendations for the American public's health.

The government's Supplemental Nutrition Assistance Program (SNAP) and Nutrition Program for Women, Infants, and Children (WIC) are heavily relied on by many of impoverished Americans. Nearly 46 million Americans used SNAP in 2015 (Bello 2015) and nearly one out of four Americans participated in one of the USDA's food or nutrition programs (Oliveira 2015). Many have pointed out that so few of the SNAP cards for alcohol and tobacco list restrictions, while others prefer the WIC-type programs that only allow the purchase of specific foods, including whole grains, produce, dairy products, and 100% juice needed for pregnant and nursing women and for their small children (Saslow 2013). Saslow mentions that when Texas State Representative Terry Canales tried to make minor changes by banning energy drinks in their SNAP program, he encountered a barrage of questions from industry experts concerning that decision.

A tax placed on a product may actually lead to an increase in its ultimate price. Price increases lead to a reduction in the quantity consumed. This occurs as consumers either cut down or stop purchasing the product. Taxes on items such as alcohol and tobacco have been shown to reduce the consumption. The same can be utilized for foods; one way to reduce the demand for unhealthy food is to impose a tax on foods that are most closely associated with obesity. Would increasing the cost of unhealthy foods through taxation result in a decline in the prevalence of obesity

in this country? As stated in the previous sections, one can purchase a larger quantity of unhealthy foods at a lower cost than healthy foods, which potentially results in poor eating choices due to one's economic situation. Powell and Chaloupka (2009) looked at this very question. They examined "whether altering the cost of unhealthy, energy-dense foods, compared with healthy, less dense foods through the use of fiscal pricing tax or subsidy policy would, in fact, change food consumption patterns and overall diet enough to significantly reduce individuals weigh outcomes." Over the past few years, we have seen a rise in taxes placed on candy, beverages, and snack food at the local, state, and federal levels. They found that small taxes or subsidies were not likely to produce significant changes in body mass index (BMI) or obesity prevalence but that nontrivial pricing interventions may have a measurable effect on Americans' weight outcomes, particularly those of children and adolescents in the low socioeconomic levels of society and those classified as at risk of obesity.

Taxation alone is unlikely to address the problem. However, it does have several benefits. The revenue gained from taxation can be directed toward consumer education, providing public exercise facilities and therefore lowering the public costs of health care. Another option is to impose taxes on restaurant franchises that may ultimately reduce the supply of restaurants. Similar taxes can be imposed on snack vending machine and restaurants. Poor dietary practices by certain communities may be targeted by taxing products in particular locations.

There are other suggestions, such as companies saving money and then writing off some of the costs by implementing a workplace weight loss program through subsidies provided through the Affordable Care Act. "Empirically, you don't see a lot of cost savings from weight loss because most people gradually gain weight over time. As a result, most of the potential savings are from avoided weight gain, rather than weight loss, per se," Meyerhoefer (2016) claims. According to the 2009–2010 data from the Rudd Center for Food Policy and Obesity at Yale University, 17 states wrote laws to extend taxes on soda – two of these states were Colorado and Washington. There have been studies that investigated the potential for soft drink taxes to combat rising levels of child and adolescent obesity through a reduction in consumption of sugary drinks. Fletcher et al. (2010) stated that based on state soft drink sales and excise tax information between 1989 and 2006 and the National Health Examination and Nutrition Survey that soft drink taxation, as currently practiced in the United States, has led to a moderate reduction in soft drink consumption by children and adolescents. However, they showed that this reduction in soda consumption is completely offset by increases in consumption of other high-caloric drinks.

In general, tax legislation distorts market functions and reduces economic efficiency. Proponents of soda taxation argue that it falls into the realm of a "Pigovian tax," where Pigovian tax is a tax levied on any market activity that generates negative externalities (costs not internalized in the market price). The tax is intended to correct an inefficient market outcome and does so by being set equal to the social cost of the negative externalities.

McGranahan and Schanenbach (2011) argue that such tax may actually increase total economic efficiency in the presence of externalities from consumption. Therefore, taxes on such goods not only increase revenue for the government but may also improve the overall welfare through a reduction in "overconsumption" of those goods. In the case of the soda tax, reducing consumption may reduce average body weight and obesity rates. This, in turn, might reduce health problems related to obesity, such as diabetes and heart disease, and may reduce health-care expenditures. It usually does not matter whether a tax is imposed on the producers or consumers of a good, because the producers may pass some of the tax on to the consumers – much of that tax passes on to the consumers depending on elasticity of demand and supply for that particular product.

Whether an increase in soda taxes has any potential impact on public health, we can determine through a review of a few findings. A recent study by Fletcher et al. (2010) found that the soda taxes did not reduce obesity rates. Recent proposals, however, suggest raising the tax rates to levels much higher than those that are currently seen and may lead to a different outcome if the tax is high enough to affect consumption. Recent research suggests that soda consumption is modestly responsive to price changes. According to Andreyeva et al. (2010), an increase in the soda price by 10% decreased consumption by between 2.7 and 8.1% or an elasticity of 0.27–0.81. Second, lowering soda consumption would necessitate a reduction in overall caloric consumption in order to be effective. An alternative to increased consumption of healthy food is subsidization of healthy foods – lowering their price eventually leads to an increase in their supply and price.

The University of Illinois research by Powell and Chaloupka (2009) found that existing state taxes on sugary drinks did not significantly reduce soda consumption nor obesity. But, they added that those taxes were relatively small. A heftier tax would probably have had some impact, they claimed. Still, they believed that people have many other sugar sources apart from sodas which makes a soda tax different from, say, a tobacco or alcohol tax. They noted that some municipalities taxed sugary drinks in the form of a license fee. The Richmond and El Monte levies were structured as business license fees imposed on merchants – not as taxes on each drink purchase. This meant that it was up to the sellers to decide how to pass along the added costs. Thus, the effectiveness of imposing a sugar tax depended on how it affected the price of the products and hence consumptions.

Finally, leveling the playing field by extending subsidies and insurance programs more widely to fruits and vegetable producers may be positive steps toward fighting obesity. As in other segments of this work, income inequality appears to affect health by undermining civil society. With the lack of social cohesion and lower participation in political activity, less government spending on public goods, education, and social safety nets will take place. Therefore, any policy to reduce the income inequality gap in turn can be linked to health and socioeconomic success. Even if the link between inequality and health is clearly established, the public health profession has little or no expertise in designing policies to reduce inequality and thus to solve problems of social justice.

Reducing Poverty and Access to Healthy Food in Low-Income Areas

The juncture of race, environment, and poverty cultivates a growing culture of overweight and obesity (Powell et al. 2004). These authors note that obesity reduction programs and prevention strategies require a healthier lifestyle, though they concede the following points:

- Moving from a high poverty area (10% poverty rate) to a low poverty area (1% rate) is associated with a 50% increase in the overall availability of physical activity opportunities.
- Fifty-seven percent of communities with a 1% poverty rate are likely to have bike paths, while fewer than 9% of communities with a 10% poverty rate are likely to have such facilities.

In addition, there is no equal access to nutritional food for all Americans. Minorities and low-income people usually consume an insufficient portion of healthy foods. There are several reasons for this pattern, such as the increased cost of fresh foods in low-income neighborhoods, the lack of public transportation to supermarkets, and the scarcity of supermarkets and grocery foods in low-income areas stocking healthy foods. The environment within the community influences access to physical opportunities, for example, lack of sidewalks, safe bike paths, parks in neighborhoods, and unsafe environments with high crime rates.

To increase access to healthy foods, the following steps may be taken, including tax incentives to attract supermarkets to low-income areas, increased access to public transportation, and incentives for the creation of more local farmers markets. One community-based intervention showed that WIC recipients who received $10 weekly vouchers for healthy foods did increase their consumption of fruits and vegetables.

Roles of Advertising and Technology

The food industry may play a significant role in promoting healthy diets. Highly processed foods are the major focus in advertisements. Analysis of data for more than 13,000 children found that there is a significant association between the amount of time children spend watching television and the prevalence of obesity. Diets and Gortmaker (1985) concluded that, among 12–17-year-olds, the prevalence of obesity increased by 2% for each hour of TV viewed, even after controlling for other variables such as prior obesity, race, and socioeconomic status. Also, those hours spent watching television contributed to a sedentary lifestyle and eventually an increased risk for obesity.

According to the American Psychological Association, children under the age of two are more likely to accept the advertiser's messages as truthful, accurate, and

unbiased. One might argue that education can help close that gap, but Mizerski's study (1995) shows that children in elementary school simply do not have the cognitive abilities to understand the difference between advertising and education. It is difficult to help them to shift from craving their favorite advertised snacks to consider eating fruit such as a banana that is almost never marketed. It becomes a never-ending cycle, as those adults, now obese and unhealthy, try to help their children to live a better life by eating healthy foods – a life that they themselves did not live.

It is nearly impossible to untangle the connections of advertising, parental control, and education, as it relates to consumer behavior. Nestle (2006) shows a consistent correlation between the increase in childhood obesity and child-centered marketing from the 1960s to the present. She relies on studies by nonprofit organizations, including the Institute of Medicine, that show that marketing of unhealthy choices to children will cause them to make bad choices. Even if parents turn off televisions and computers and just walk or drive down the street, children will be bombarded with marketing images of various types. In the age of technology, modern statistical techniques of telemarketers and advertisers know where and how to phish, just as modern techniques in geology know how to tell the oil and gas companies where and how to drill (Akerlof and Shiller 2015). They see the cornucopia that a free market delivers. Just as every coin has two sides, so do free markets. The same human ingenuity that produces the cornucopia of wonderful foods also creates the art of persuasion of the salesman. The market that produces foods that are good for everyone also produces foods that are not so good for everyone. They produce both, so long as there is a profit to be made. The marketplace may be our most powerful tool. But, like all powerful tools, it is also a two-edged sword (ibid, p. 150).

Food products mostly marketed to children include cereals, candies, sweets, sodas, and snack foods. Australia, Canada, Sweden, and England have adopted regulations that prohibit certain food advertisements in programs watched by young children. Many other countries regulate marketing to children. Sweden and Norway ban marketing to children younger than 12. The Canadian Province of Quebec bans marketing to children younger than 13. Finland bans advertisement that are delivered by children or by family cartoon characters. French Parliament banned all vending machines in middle and secondary schools (Linn and Novosat 2008). Corporate tax deductions for advertising and marketing junk food to children could be eliminated.

Children may be spending less time engaged in physical activity during school. Daily participation in physical activity among adolescents dropped from 14% over the last 13 years (from 42% in 1991 to 28% in 2003). Children spend a considerable amount of time with social media. One study found that time spent watching TV, videos, and movies averaged over 3 h per day among children 8–18 years old (Center for Disease Control and Prevention 2009).

Print and electronic media programs also may influence children's behavior in a positive manner. Options include the reduction or regulation of food advertisements that target children, promoting children's educational programs advertising healthy eating and exercise habits, and an intervention to reduce the time that children spend with the media and in texting.

Chapter 8
Concluding Comments

Abstract Obesity prevalence among low-income preschool-aged children has increased. One out of seven low-income, preschool-aged children is obese, and obesity in low-income 2–4-year-olds increased from 12.4% in 1998 to 14.5% in 2003. Some attribute obesity to genetic factors, and they can play a role in specific cases of obesity. However, the rapid rise in the rates of overweight and obesity in the general population in recent years cannot be attributed solely to genetic factors. The genetic characteristics of the human population have not changed in the last three decades, but the prevalence of obesity has tripled among school-aged children during that time (Centers for Disease Control and Prevention (2009) Childhood overweight and obesity). Markets matter for health policy; markets work and markets fail. If markets fail, government intervention is beneficial; otherwise health-improving measures may be ineffective, or they may end up worsening social welfare. To move from theory to practice, this book has provided further analysis and policy recommendations and guidance.

Economic growth is the engine for reducing poverty and material deprivation. Yet growth is faltering in the industrial-rich portions of the world. Growth in recent decades has been lower than in previous ones, although there has been some improvement in the quality of life and services. Almost everywhere, slower economic growth has come with increases in inequality. In the case of the United States, current extremes of inequality in wealth and income have occurred, such as have not been seen for more than a hundred years (Deaton 2013). This in turn causes other distributional conflicts between poor and rich, between old and young, between Wall Street and Main Street, between medical providers and their patients, and between political parties and those representatives.

Infelicitously, the global pandemic of obesity continues unabated. 2.7 billion adults worldwide are projected to be overweight or suffer from obesity by the year 2025 (World Obesity Federation 2015). Obesity is driving up the global presence of type 2 diabetes, cardiovascular diseases, and several types of cancer. Yet, the implementations of recommended policies to reduce overweightness and obesity have been slow and patchy (Roberto et al. 2015).

Meyerhoefer (2016) and a team of researchers found that obesity rates have more than doubled in the United States in the past 30 years. As a significant risk factor for diabetes, cardiovascular diseases, and other clinically significant health problems, obesity accounts for almost 21% of US health-care costs. The greatest savings in medical costs occurred when morbidly obese individuals with diabetes lost between 5% and 10% of their body mass index. The researchers found a nonlinear relationship between weight gain and medical costs. "We thought we'd see an elevation in cost as people became overweight. You don't see that. Costs don't go up until you get into extreme obesity," Meyerhoefer reports. His study found that a relatively small percent of the population, those with the highest BMI and classified as having Class III obesity, generates most of the medical costs of obesity.

Meyerhoefer and his team also found that the medical costs of obesity in the United States are much higher – nearly $316 billion a year – than previous studies have shown. To put it in perspective, that is about the annual cost of Parts A and B of the Medicaid program combined. In addition, the study found the average cost to treat obese individuals has risen 14% since 2005. Such studies as Meyerhoefer and his team conducted should be used by public policy makers, health insurers, employers, and government agencies to evaluate the cost-effectiveness of medical interventions to prevent and treat obesity.

Politics was once seen as a way of improving people's social and emotional well-being by changing their economic environment. But over the last few decades, these policies have not materialized, while politicians, who have a wonderful opportunity to do good, have engaged in little more than a form of political window dressing. Political will is dependent on the development of a vision of a better society that is both achievable and inspiring. The task is to develop policies based on recognition of the kind of society we need to create and be committed to while realizing and making the appropriate institutional and technological opportunities happen.

Some suggest that Americans grossly underestimate the level of wealth and income inequality in the United States (Norton and Ariely 2011), just as they underestimate the level of hunger and food insecurity in the United States and its cost to businesses, organizations, and society (Sheppard et al. 2011). This underestimation contributes to the broad misunderstanding of how hunger and food insecurity occur, where they exist, how entrenched they are in our social structure, and how deeply they are connected to the very production processes that put food in our grocery stores and in our homes.

Obesity is a very complex issue, affecting not only the individual but also the society as a whole in terms of spillover costs. Obesity is a problem for all races and ethnic groups in the United States and, generally speaking, affects people of all income levels. But a higher proportion of the poor, minorities, and the less educated tend to be obese. In a poor neighborhood, stores are stocked with cheaper, less healthy food, people have less access to fitness facilities, neighborhoods may not have sidewalks, and the local park may be the place where gangs hang out or drugs are sold, rather than a safe place for evening jogs.

By any measure, blacks and Hispanics are in worse shape than whites. Fifty-eight percent of African-American women older than 20 are obese by CDC standards.

For Hispanics, the proportion is 42%, and for whites it is 32%. In combination with a generally poor diet, and less access to medical care, the level of physical inactivity helps explain why minorities suffer proportionately more hypertension, type 2 diabetes, and heart disease (Barbour 2011).

The economic consequences of obesity to society are tremendous, driving up high costs in health care, depressing productivity, and lowering wages. Therefore, in order to analyze this issue, we have examined and reviewed different factors: individual behavior and various socioeconomic factors. We have also proposed policy changes to tackle the issue. Obesity needs much more serious attention than countries and global health organizations are currently prepared to give. The goal of sugar reduction by introducing a sugar tax is a small step in the right direction. Nevertheless, it should not distract us from the need for far deeper and broader measures.

Unlike in the rational obesity model, the individual is not about maximizing utility, or targeting a particular weight, or net caloric consumption. The individual may have some aspirations, but these aspirations are likely to be for a complex combination of health, good looks, and weight. Further, the decision-making outcomes will be determined to a great extent by the relative strength of the internal and external factors. It seems that negative external factors, such as the environment or neighborhood, got stronger over time, without any significant changes in the internal factors. These conditions indicate a rising level of obesity as has been observed. Governments have largely abdicated the responsibility of confronting and solving obesity to individuals, to the private sector, and to nongovernmental organizations. Yet the obesity epidemic cannot or will not be reversed without strong government leadership, the introduction of market regulations, and a vigorous investment in programs, monitoring, and research (Swinburn et al. 2011).

While decisions are made at a microlevel, obesity is a macro-level policy challenge for the public health, corporate, industrial, small business, and nonprofit sectors of the society. The fact is, a single coordinated public policy that addresses the obesity infrastructure is unlikely due to conflicting interest groups and lobbying at the federal, state, and local levels by various and disparate industries, consumers, health-care practices, insurance companies, and medical, agricultural, educational, and other groups. That single coordinated public policy will rarely if ever result in a single, coherent, feasible, and effective policy or market strategy that will advance both obesity treatment and prevention imperatives (Acs and Lyles 2007).

Food policy intervention through either public interest groups or through the US government is the key to fighting obesity. There is no single strategy that can be effective alone. Rather, a combination of different approaches is needed for success. Since social environment plays an important role in dietary decisions, it is absolutely important for policy analysts and policy makers to at least be clear about their primary concerns, such as seeing if the goal is to reduce poverty or to create greater wealth and income equality. The aim should be made explicit and positive in nature rather than confusing it with reducing inequality. Of course, both objectives may be pursued at the same time. But, in the long run, we need to be clear that they are distinct (Reeves 2016).

Dr. Thomas Farley, the former (2009–2014) health commissioner in New York City and the newly hired health commissioner of Philadelphia, reported a 5.5% decline in the number of obese schoolchildren from 2007 to 2011. Although this number is small, some argue that it is an indication that the obesity epidemic, one of the nation's most intractable health problems, may actually be reversing its present course (Tavernise 2012). Some experts note that the current declines, concentrated among higher income, mostly white populations, are still not benefiting many minorities' children. For example, in New York City, they measured children in kindergarten through eighth grade from 2007 to 2011 and reported that the number of white children who were obese dropped by 12.5%, while the number of obese black children dropped by 1.9% (Tavernise 2012). Though obesity is now part of the national conversation with aggressive advertising campaign in major cities in the United States, many scientists doubt that anti-obesity programs actually work. Researchers say that it will take a broad set of policies applied systematically to effectively reverse the trend (McGuire 2012).

Doctors cannot solve all the world's problems. But they might reasonably have something useful to say about the health of their societies in which they live and work. Health is an important human value. Governments should take its social implications much more seriously. Gaining an understanding of the obesogenic factors within the community aids the counselor in providing improved weight management support to the individual. In individual or group sessions, the counselor can educate clients about social and environmental issues that contribute to obesity and about available community resources promoting wellness. These resources can include the Overeaters Anonymous meetings. Other actions may include low-cost or free nutrition programs for the general public; libraries with books, CDs, and DVDs on nutrition and weight loss; low-cost or free local gymnasiums, trails, and parks; and lists of mental health practitioners who specialize in weight management and eating disorders and who offer sliding fee scales. Many counselors are also equipped to lead neighborhood wellness programs (e.g., at local YMCAs or community centers) focusing on the mental health and public health aspects of weight management (Sheesley 2016).

None of this can be accomplished without a policy intervention from the government with support from public interest groups. Furthermore, stemming the obesity epidemic cannot be separated from stemming the rising tide of poverty and wealth and the widening of the income inequality gap. It is clear that greater equality and improved well-being of the whole population are also keys to national standards of achievement and how countries perform in different fields. If you want to know why one country does better or worse than another, the first thing to look at is the extent of inequality (Wilkinson and Pickett 2009).

If a country wants to have a lower obesity rate, it must first address the underlying inequalities which create a steeper social gradient in unhealthy lifestyles. Unintended consequences of wealth and income inequality are great. It is known that in more unequal societies, people are six times more likely to be clinically obese, their life expectancy to be shorter, and the murder rate to be higher. The reason for such differences is quite simple. The effect of inequality is not confined

just to the least well-off. Instead they affect the vast majority of the population (Wilkinson and Pickett 2009). Thus, benefits of greater equality seem to spread across all income groups. If governments understood the consequences of the widening of wealth and income differences, they would be keener to prevent them.

In addition, community leaders and public health professionals interested in childhood obesity ought to be wise to recognize that dollar stores are now prominent features of the food environment facing residents in many rural and lower-income urban communities. Many people now consider dollar stores as their neighborhood "supermarkets." Dollar stores are especially dense in regions of the country where childhood obesity rates are now the highest. The question of how dollar stores contribute to dietary health ought to be considered in efforts to combat childhood obesity. For instance, educational interventions targeting children and their parents should emphasize ways of shopping wisely at the local dollar stores for sources of nutritious food items. Community initiatives also ought to be developed that would further entice dollar stores to carry healthy foods. This would likely require cooperation between the store owners and the entire community (Drichoutis et al. 2015).

There is growing evidence that obesity in the United States is largely an economic issue. Even if the link between inequality, poverty, and health was clearly established and tested, public health professionals have no particular expertise in reducing inequality, or in solving broader problems of social injustice. Indeed, it is the responsibility of politicians as policy makers to design better policies to combat the wealth and income inequality gap and growing poverty of local communities.

Adult obesity creates long-term economic and social costs to the general population, insurance companies, and the government, with a decrease in life expectancy. The cost of health care increases annually because of the comorbidities associated with the problem. Prevention, intervention, education, medical treatment, and nutrition changes are needed to treat the obese population, but prevention is the key (Blackburn 2012). In short, in order to address this issue, we need to develop an understanding of the underlying systems that are driving obesity and also devise innovative approaches to reorient those systems as a sustainable way to encourage healthy weight. In addition, nations need to establish mechanisms for regular reporting on progress toward national and global obesity targets and propose specific analyses of obesity drivers and solutions.

Thus, obesity is likely to share common determinants and solutions with other major emergent problems that the world is facing, such as growing poverty, greater wealth and income inequality, and climate change. Health and social policies for obesity treatment and prevention tend to focus on the individuals. This approach has limitations in its ability to understand *why* people continue to live a sedentary lifestyle and have an unhealthy diet and *how* depression and stress play a role on their eating behavior. Because behavioral changes are easier for people who feel in control and in a good emotional state, lessening the burdens of inequality could make an important contribution toward reducing the epidemic of obesity.

Karen Rowlingson (2011) studied income inequality and health in the United Kingdom. The main aim of her report was to review the evidence concerning the

impact of income inequality on health and social problems. However, the report concludes by considering a range of policy implications. Given that the main conclusion is that both individual income (material circumstances) and income inequality (relative income) make a difference to health and social problems, it seems clear that both need to be tackled. A range of policy levers can be used to do this, from redistribution through the tax/benefit system to original income and wealth policies, to stronger public services, and to a greater focus on equal opportunities.

Appendix

Table 1 Description of the variables

Variable	Unit	Description	Source
Obesity	In body mass index (BMI). The natural logarithm of BMI index, which is more than 30, is used as the variable "obesity." In econometric specification, we denote it as *l_obesity*	The body mass index (BMI), or Quetelet index, is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height and is universally expressed in units of kg/m^2, resulting from weight in kilograms and height in meters. If pounds and inches are used, a conversion factor of 703 $(kg/m^2)/(lb./in^2)$ must be applied. When the term BMI is used informally, the units are usually omitted. Commonly accepted BMI ranges are underweight, under 18.5; normal weight, 18.5–25; overweight, 25–30; and obese, over 30. The data structure is in panel, and the data is collected from 1995 to 2012 for all states in the United States	Centers for Disease Control and Prevention, USA. www.cdc.gov/nchs

Variable	Unit	Description	Source
Poverty	In percentage. The variable is measured as the natural logarithm of the percentage. In econometric specification, we denote it as *l_poverty*	Poverty is measured as the number of person below in poverty line and is expressed as percentage Poverty statistics presented in ACS reports and tables adhere to the standards specified by the Office of Management and Budget in Statistical Policy Directive 14. The Census Bureau uses a set of dollar value thresholds that vary by family size and composition to determine who is in poverty. Further, poverty thresholds for people living alone or with nonrelatives (unrelated individuals) and two-person families vary by age (under 65 years or 65 years and older). If a family's total income is less than the dollar value of the appropriate threshold, then that family and every individual in it are considered to be in poverty. Similarly, if an unrelated individual's total income is less than the appropriate threshold, then that individual is considered to be in poverty. The poverty thresholds do not vary geographically. They are updated annually to allow for changes in the cost of living (inflation factor) using the consumer price index (CPI). Poverty status was determined for all people except institutionalized people, people in military group quarters, people in college dormitories, and unrelated individuals under 15 years old. These groups were excluded from the numerator and denominator when calculating poverty rates. Since the ACS is a continuous survey, people respond throughout the year. Because the income items specify a period covering the last 12 months, the appropriate poverty thresholds are determined by multiplying the base-year poverty thresholds (1982) by the monthly inflation factor based on the 12 monthly CPIs and the base-year CPI. For more explanation, see http://www.census.gov/acs/www/UseData/Def.htm. The data structure is in panel, and the data is collected from 1995 to 2012 for all states in the United States	US Bureau of the Census, Current Population Survey, Annual Social and Economic Supplements. http://www.census.gov/hhes/poverty

Variable	Unit	Description	Source
Gini	In ratios. The variable is measured as the natural logarithm of the percentage. Gini coefficient is used to measure the extent of inequality. In econometric specification, we denote it as *l_gini*	The Gini coefficient is a measure of inequality of variance. It is often applied to measure inequality of incomes in a particular area. A score of "0" on the Gini coefficient represents complete equality, i.e., every person has the same income. A score of 1 would represent complete inequality, i.e., where one person has all the income and others have none. The information was tabulated from the American Community Survey conducted by the US Census Bureau. We refer gini coefficient as income gini coefficient and the ratio measures the extent of income inequality. The data structure is in panel, and the data is collected from 1995 to 2012 for all states in the United States	US Bureau of the Census, Current Population Survey, Annual Social and Economic Supplements

Table 2 Correlation of the variables

Variable	*l_obesity*	*l_poverty*	*l_gini*
l_obesity	1.000		
l_poverty	0.2716	1.000	
l_gini	0.2990	0.2885	1.000

Table 3 Poverty rate and income distribution coefficients for people, based on alternative definitions of income

Year	Money income before taxes and cash transfer, plus realized capital gain (losses) and health insurance supplements Official threshold	Poverty rate (percent) CPI-U-RS threshold	Gini coefficient
1980	20.1	19.0	0.462
1981	21.1	19.8	0.466
1982	22.0	20.6	0.475
1983	21.8	20.6	0.478
1984	20.8	19.5	0.477
1985	20.4	19.1	0.486
1986	19.9	18.7	0.505
1987	19.7	18.7	0.488
1988	19.7	18.5	0.489
1989	19.4	18.1	0.492
1990	19.9	18.7	0.487
1991	21.1	19.7	0.490
1992	22.1	20.6	0.497
1993	22.6	21.1	0.514
1994	22.0	20.3	0.515
1995	21.1	19.5	0.509
1996	20.8	19.1	0.511
1997	20.3	18.7	0.513
1998	19.3	17.4	0.509
1999	18.7	16.9	0.508
2000	18.0	16.5	0.506
2001	18.5	16.9	0.510
2002	19.0	17.4	–
2003	19.5	17.8	–
2004	20.0	18.3	0.503
2005	19.7	18.1	0.501
2006	18.9	17.3	0.495
2007	19.3	18.0	0.492
2008	20.8	19.6	0.497
2009	23.0	21.6	0.505

Glossary of Terms

Body mass index (BMI) is a system of measurement in which a person's height and weight are entered into a formula in order to arrive at a single numerical value. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). According to the US National Institutes of Health, a BMI of 19–24.9 is normal, 25–29.9 is overweight, 30–39.9 is obese, and 40 and above is extremely obese.BMI = a+b weight, weight is measured in kilograms. While genetic difference exits in how many calories are needed to perform a task, average value is 879 for men and 829 for women, and b is 11.6 for men and 8.7 for women (Mazzocchi et al. 2009).

Budget constraint In consumer theory, the budget constraint defines the bundle of goods and services that a consumer can buy given his/her limited income and market prices.

Childhood obesity The definition of childhood obesity differs from that of adult obesity because BMI in childhood changes substantially with age. Hence, age- and sex-specific cutoff points to define childhood obesity (overweight) from 2 to 18 years are often used instead of BMI.

Co-integration test A test of multiple time series, with different variables regressing two independent random walks against each other.

Consumer theory A theory of microeconomics to model consumer demand based on a set of rationality assumptions on the structure of consumer preferences. With rational preferences and subject to a budget constraint, consumers make their choice in order to maximize their overall satisfaction (utility). Theory-based demand models are used to explain consumption choices on the basis of changes in relative prices and real income.

Cost-benefit analysis An economic procedure to evaluate a policy intervention on the basis of the costs and benefits of the intervention, relative to the status quo. Costs and benefits include direct monetary effects and nonmonetary and opportunity costs (the cost of resources in their best alternative use).

Economic growth The change in a country's real output, usually measured as percentage change in real gross domestic product.

Economies of scale These are the reduction in the cost per unit of output associated with an expansion of output.

Expected utility When an economic decision has uncertain outcomes, expected utility measures the average utility, measured as the weighted average of the utility of all possible outcomes, using the probability of each outcome as the weights.

Gini coefficient A measure of statistical dispersion intended to represent the income distribution of a nation's residents and the most commonly used measure of inequality. It varies from 0 to 1.

Glycemic load (GL) of food A number that estimates how much the food will raise a person's blood glucose level after eating it. One unit of glycemic load approximates the effect of consuming 1 g of glucose.

Granger causality test A statistical hypothesis test for determining whether one time series is useful in forecasting another.

Healthy Eating Index (HEI) A measure of diet quality that assesses conformance to federal dietary guidance.

Income elasticity Responsiveness of consumption to changes in price, expressed as the percentage change in consumption generated by a 1% change in price.

Lorenz curve A measure of the distribution of wealth (or income or other factors) in a society. It is a graph on which the cumulative percentage of total national income (or some other variable) is plotted against the cumulative percentage of the corresponding population (ranked in increasing size of share). The extent to which the curve sags below a straight diagonal line indicates the degree of inequality of distribution.

Market failure A market outcome where the allocation of goods is not economically efficient because of externalities, imperfect information, or market power.

Market power A departure from perfect competition, where some economic agents have the power to alter or control price.

Phytonutrient index The amount of colorful plant pigments and compounds in a food that help prevent disease and promote health.

Prevalence (of a disease) The proportion of existing cases of a given disease in the total population at a given time.

Price elasticity Responsiveness of consumption to changes in price, expressed as the percentage change in consumption generated by a 1% change in price.

Social capital (SC) The bonds, connection, and network of relationship among people who live and work in a particular society, enabling that society to function effectively.

Social costs The sum of all private costs plus external costs (externalities imposed to the society). In functioning markets, external costs are zero and social costs equal to private costs.

Utility function The function relating utility to consumption levels and the outcomes of consumption (including health).

Utility maximizing rule The consumer allocates his or her income so that the last dollar spent on each product yields the same amount of extra utility (U Max).

WIC (Women, Infants, and Children) The Special Supplemental Nutrition Program for Women, Infants, and Children provides federal grants to states for supplemental foods.Source: Mazzocchi et al. (2009), ebook: http://site.ebrary.com/lib/desales/reader.action?docID=10317694&ppg=180&tm=1467309665060

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