The Economics of Obesity

A Report on the Workshop Held at USDA's Economic Research Service

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Abstract

Since the mid-1970s, the prevalence of obesity and overweight has increased dramatically in the United States. The prevalence of overweight has tripled among children and adolescents, and nearly two out of three adult Americans are either overweight or obese. Although high health, social, and economic costs are known to be associated with obesity, the underlying causes of weight gain are less understood. At a basic level, weight gain and obesity are the result of individual choices. Consequently, economics, as a discipline that studies how individuals use limited resources to attain alternative ends, can provide unique insight into the actions and forces that cause individuals to gain excessive weight. In April 2003, USDA's Economic Research Service and the University of Chicago's Irving B. Harris Graduate School of Public Policy Studies and the George J. Stigler Center for the Study of the Economy and the State jointly hosted a workshop on the Economics of Obesity. The purpose was to provide an overview of leading health economics research on the causes and consequences of rising obesity in the United States. Topics included the role of technological change in explaining both the long- and short-term trends in obesity, the role of maternal employment in child obesity, the impact of obesity on wages and health insurance, behavioral economics as applied to obesity, and the challenges in measuring energy intakes and physical activity. The workshop also discussed policy implications and future directions for obesity research. This report presents a summary of the papers and the discussions presented at the workshop.

Keywords: Behavioral economics, energy expenditure, energy intake, fast-food consumption, food consumption, food prices, health insurance, maternal employment, physical activity, technological change, self-control, wages

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Summary

In recent decades, obesity and overweight has dramatically increased among all demographic groups within the U.S. population. Nearly two out of three adult Americans are either overweight or obese. Among children and adolescents, overweight prevalence has tripled from 5 percent in the 1970s to 15 percent in 1999-2000. Although high health, social, and economic costs are known to be associated with obesity, the mechanisms underlying this weight gain are less clear. Recently, economists have begun applying the tools of economics to shed new light on the rise in obesity. The economics approach looks at people's choices within the constraints of the time and resources at their disposal. Since overweight and obesity are the outcome of such constrained choices, economic analysis can provide a unique insight into the actions and forces that cause individuals to gain excessive weight over time. In April 2003, USDA's Economic Research Service and The University of Chicago's Irving B. Harris Graduate School of Public Policy Studies and George J. Stigler Center for the Study of the Economy and the State organized a joint workshop on the Economics of Obesity, with the goal of providing an overview of leading health economics research on the causes and consequences of obesity in the United States. Eight papers covering state-of-the-art health economics research on obesity were presented and discussed in depth. The workshop participants also discussed policy implications and future directions for obesity research. Attendees included health economists and public health experts from academia and the government. This report presents a summary of the papers and discussions presented at the meeting.

Papers presented by Cutler, Glaeser, and Shapiro and by Lakdawalla and Philipson focused on technological change as the preponderant force in the general weight gain among the population. Lakdawalla and Philipson examined weight gain over the past century and argued that technological change has induced weight growth by making work at home and in the office more sedentary and by lowering food prices through agricultural innovation. Physical activity has declined due to a shift from more strenuous to sedentary occupations, and food intake has increased due to lower food prices. An econometric model encompassing such technical change suggests that 40 percent of the recent increase in weight may be due to lower food prices, while 60 percent is due to declining physical activity. Cutler, Glaeser, and Shapiro examined food intake data and time diaries to focus specifically on the rapid weight gain witnessed since the mid-1970s. They contend that, during this period, while calorie consumption increased, physical activity remained flat. The observed increase in calories is primarily attributable to higher consumption of snacks, driven by technological advances in mass-prepared foods. Better technology lowered the fixed and variable costs of meal preparation and led to greater variety and frequency of meals, especially for women, who experienced the largest savings of time and effort and whose average weight grew most rapidly as a result.

Three other trends over the past several decades have been implicated in the rise in obesity: the increase in foods eaten away from home, the decline in smoking, and the increased labor force participation by women. Chou, Grossman, and Saffer examined the first two, while Anderson, Butcher, and Levine investigated the third. Since 1984, the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS) has

been tracking State-level obesity prevalence by collecting data from large samples of individuals. Chou, Grossman, and Saffer combined 1984-99 BRFSS data with several State-level measures to examine increased consumption of food away from home and the reduction of smoking, as well as other factors, as the causes of the escalation of obesity. They found that body weight and obesity prevalence increase significantly as the per capita number of restaurants and the real price of cigarettes go up, suggesting that more eating out and less smoking may have contributed to the rise in obesity.

Anderson, Butcher, and Levine used matched mother-child data from the National Longitudinal Survey of Youth (NLSY) to investigate whether a mother's employment status influences the likelihood of her child's being overweight. Their results suggest that the intensity of a mother's work over a child's lifetime has a positive effect on a child's likelihood of being overweight—between 1 and 4 percentage points—if the child is in a high-income family, with a well-educated or White mother.

One consequence of obesity could be lower wages for the obese individuals. Other things being equal, does obesity lower a person's wage? Cawley investigated this question using panel data from the NLSY from 1981 to 2000. In answering this question, one should recognize that factors that are not measured or observed by the researcher might cause a person to have lower wages as well as higher body weight. After carefully controlling for such effects, Cawley found that increased body weight lowers wages for White females, while no wage effects were found for other gender or ethnic groups.

Due to their higher risk for chronic diseases, obese and overweight people with health insurance impose significant costs on healthy-weight people in the same insurance pool. This "externality" arises because weight-based underwriting of health insurance premiums is not practiced. Bhattacharya and Sood compared how people respond under alternative weight-based health insurance underwriting regimes. With full insurance coverage, there is no incentive for weight loss when underwriting on weight is not allowed. However, if it is allowed, consumers benefit because weight loss decreases their own premiums. Changes in copayments also provide a mechanism to influence weight-loss incentives.

Standard economic models study people's choices under the assumption that people make choices rationally—that is, in their own best interests. But laboratory and experimental evidence suggests this may not always be the case. For example, research shows that people eat more when they are offered bigger portion sizes. Smith discussed the potential causes of such "irrational" behavior and its implications for obesity and economic theory. Based on his model, as well as evidence from a variety of fields, such as behavioral endocrinology, nutritional anthropology, and behavioral ecology, Smith concluded that overeating (and the consequent weight gain) results from a fundamental mismatch between the feast-or-famine environments faced by human ancestors—in which eating preferences evolved—and modern environments in which food is ubiquitous and cheap.

Accurate and reliable data on diets and physical activity are essential for research into the causes and consequences of obesity. Forshee reviewed current methods for assessing diets and physical activity and discussed their

limitations. Methods to measure diet include the 24-hour dietary recall, one of the most common methods in surveys to assess diet, and the Food Frequency Questionnaire, which attempts to record usual intake. All the survey measures represent short-term measures of diet and physical activity, while the phenomenon of overweight and obesity is the result of a long-term imbalance between energy intake and expenditure. Longitudinal data about diet quality and physical activity is required to better understand the links between overweight and obesity and chronic disease risks.

Several questions on the causes and consequences of obesity remain open for future research, as follows:

(1) Research is needed to clarify the effects on the rise in obesity of food assistance programs, such as the food stamp and the school lunch programs, smoking cessation campaigns, advances in medicine, and continuing technological refinement of mass-prepared meals.

(2) The ways in which consumers absorb and act upon new information about nutrition, exercise, and health needs to be studied.

(3) Insights from the field of behavioral economics, which studies people's choices under relaxed assumptions about rationality, may be useful for understanding the importance of self-discipline or self-control in determining body weight.

(4) The rationale for government intervention, including theoretical and empirical evidence on the existence of market failures and externalities, is needed.

(5) Future research could clarify the potential efficiencies and effectiveness of alternative public policy interventions to reduce the prevalence of obesity. In particular, more attention needs to be focused on the evaluation of policy measures that stimulate innovation in food technology and in the pharmacological treatment of obesity and overeating.

Introduction[1]

Obesity is at the top of the public health agenda in the United States today for compelling reasons. Since the mid-1970s, the national prevalence of overweight and obesity has increased rapidly. According to the 1999-2000 National Health and Nutrition Examination Survey (NHANES), 31 percent of U.S. adults between 20 and 74 years of age are now obese, a 100-percent increase since 1976-80. Among children and adolescents, overweight prevalence tripled from 5 percent in the 1970s to 15 percent during 1999-2000. Obesity has increased among both men and women, in all age, racial, and ethnic groups. Overweight and obesity are implicated as major risk factors for a number of chronic diseases, including type 2 diabetes, hypertension, cardiovascular disease, some types of cancer, musculoskeletal disorders, sleep apnea, and gallbladder disease. Recent evidence suggests that increasing obesity may be responsible for the rise in disability among young adults. Each year, obesity causes at least 300,000 excess deaths in the United States, and health care costs of American adults with obesity amounted to approximately $93 billion in 2002. Because obese children are more likely to become obese adults without intervention, the full consequences of increased obesity are still to be faced.

Despite its enormous health, economic, and social impact, much remains unknown about the rise of obesity in America. The causes behind the obesity epidemic are said to be complex, involving metabolic, behavioral, environmental, and other influences. At the basic level, however, obesity and weight gain are the result of choices individuals make about the types and quantities of foods they eat and the amount of physical exertion they undertake. Individuals make such choices in the context of the limited time and income available, in the presence of competing goods and activities, and with the objective of attaining multiple outcomes or goals, only one of which is health. The discipline of economics studies people's choices under precisely these circumstances. The tools of economics can thus be used to gain a deeper understanding of the fundamental causes behind the rise in obesity. By accounting for the fact that people care about multiple goals or outcomes, economics provides a framework for understanding behaviors that may appear suboptimal from a public health point of view.

Only recently have economists begun studying the causes and consequences of escalating obesity (Philipson, 2001). With the objectives of reviewing current work and stimulating future health economics research on obesity, USDA's Economic Research Service and The University of Chicago's Irving B. Harris Graduate School of Public Policy Studies and George J. Stigler Center for the Study of the Economy and the State jointly organized a workshop. Eight papers covering the state-of-the-art in health economics research on obesity were presented and discussed in depth. The workshop participants also discussed policy implications and future directions for health economics research on obesity. Attendees included economists and public health experts from academia and the Government. This report is a summary of the papers and discussions presented at the meeting.

[1]This report summarizes ideas and suggestions discussed at the workshop, and in no way reflects the views of the Economic Research Service or the U.S. Department of Agriculture.

Why Have Americans Become More Obese?

David M. Cutler, Edward L. Glaeser, and
Jesse M. Shapiro, Harvard University

Background

Over the past 20 years, the average weight of American men increased from 168 to nearly 180 pounds, while the average weight of American women grew from 142 to 152 pounds. This increase means that the amount of calories ingested must have grown faster than the calories expended. Individuals burn calories in three ways. The first is through basal metabolism, the energy cost associated with keeping the body alive and at rest. The energy cost of basal metabolism depends on weight, and the more a person weighs, the more energy required to sustain basic bodily functions. The second source of energy expenditure is the thermic effect of food—i.e., the energy required to process food that has been ingested. The third source is physical activity. Based on these biological relationships, one can derive the daily amount of calories that a person requires to maintain a given weight in the steady state. Specifically, the 10- to 12-point increase in median weight observed in recent decades implies that a typical person has a net caloric balance (that is, excess of caloric intake over expenditure) of about 100 to 150 calories per day.

Cutler, Glaeser, and Shapiro hypothesize that increase in caloric intake, not decline in physical activity, is the major factor behind increased obesity, which in turn, is related to technological innovations in food production and transportation that have reduced the real cost of prepared foods. The authors use several indirect measures of changes in intake and energy expenditure to support their hypothesis.

Methods and Findings

A comparison of the 1977-78 and 1994-96 food intake surveys conducted by the U.S. Department of Agriculture (USDA) reveals that reported consumption increased by 268 calories for men and 143 calories for women between the two periods. This increase is more than enough to explain the rise in the average weights of men and women over the same period.[2] Most of the increase in calories is attributable to more calories having been consumed as snacks, while dinnertime calories actually fell somewhat.

The fact that snacking accounts for most of the increased caloric intake leads the authors to reject the thesis that obesity is a result of increased portion sizes in restaurants. If this theory were true, calories at main meals, particularly dinner, would have increased. Similarly, the evidence also works against the view that fattening meals at fast food restaurants have caused the rise in obesity.

[2]Some of the increase in calories observed for this period could be due to changes in interviewing methods and other survey procedures.

Additional indirect evidence on caloric intake can be gleaned from data on total calories available for consumption that are published by USDA's Economic Research Service. The data are from production sources and are adjusted for exports, imports, and feedstock. In recent years, the data have also been adjusted for wastage. Since 1965, the food supply has increased markedly, particularly in the last two decades. In 1978, the food supply was 3,200 calories per person. By 1999, the food supply had risen to 3,900 calories per person. Adjusted for wastage, the increase is 418 calories, again more than required to explain the observed weight gain over the same period.

Trends in caloric expenditure can be inferred from time diaries. The authors use data from Robinson and Godbey (1997) for typical time use in 1965, 1975, and 1985, and provide their own calculations for 1995. An energy expenditure index can be computed as a weighted average of the different levels of energy expenditure associated with the various activity patterns recorded in the diaries. The estimated value of this index fell between 1965 and 1975, but has been quite stable since then.

An important component of caloric expenditure is the energy spent on the job and commuting to work. Between 1980 and 1990, the share of the population in highly active occupations declined from 45 to 42 percent. While it is true that over the past 100 years cars have replaced walking and public transportation as means of commuting, this change had largely run its course by 1980. In 1980, 84 percent of people drove to work, 6 percent walked, and 6 percent used public transportation. In 2000, 87 percent drove to work, 3 percent walked, and 5 percent used public transportation. From these observations the authors conclude that neither changes in the occupational structure of the economy nor commuting patterns can account for the recent increase in obesity.

Similarly, children do not work now, and they did not work in 1980. However, obesity has increased substantially among children and adolescents.

Discussion

In the authors' view, increased caloric intake better explains the rise in obesity than reduced caloric expenditure. As a primary cause for the increase, the authors identify the technological innovations that have given rise to the mass production and preparation of ready-to-eat meals, which in turn have supplanted food preparation at home. The advances in food preparation technology have allowed manufacturers to exploit economies of scale by producing ready-to-eat foods centrally, which has lowered average cost and eventually reduced the retail price of industrially prepared food.

In order to produce food in one location that will be nearly ready for consumption in another one, five main technological obstacles had to be overcome (Kelsey, 1989): controlling the atmosphere, preventing spoilage due to microorganisms, preserving flavor, preserving moisture, and controlling temperature. Innovations in food processing and packaging over the last three decades have improved food manufacturers' ability to address each of these issues.

As the primary cost of food may well have been the time spent in household preparation, rather than the cost of the ingredients, the substitution of "pre-prepared" foods for home-produced foods led to a decline in both the fixed and variable costs of preparing meals.

Reductions in the time cost of food preparation give rise to several predictions:

First, the lower costs of food preparation mean that individuals should eat a wider range of products more often during the day. The increasing frequency and importance of snacks, which are often preprepared, corroborate this prediction.

Second, the increase in food consumption should come mostly in foods that have had an improvement in mass preparation technology (along with complements to those foods). Indeed, food items with low farm value share—a low share of the retail price going to farmers instead of other food preparers—and branded foods, which are more likely to be preprocessed than unbranded foods, registered the largest growth rates over the past decades.

Third, individuals who have taken the most advantage of the new technologies should have had the biggest increase in obesity. Obesity prevalence rose most for married women, who reduced their time preparing food more than any other group.

Fourth, obesity rates should be higher in countries with greater access to technological changes in the food supply. Countries that regulate the food industry more heavily by imposing price controls, tariff and nontariff barriers to trade in agricultural products, and food laws, and that pose more delays to opening a new business, are found to exhibit lower obesity rates than less-regulated countries.

The lower time cost associated with food preparation increases consumers' options and should therefore make them better off. An exception is consumers with self-control problems for whom the high cost of food preparation provided a device that helped them curb an urge to eat that they would later regret. The authors conclude that while the rise in obesity has significant health costs, those costs are likely offset by the dramatic savings in time of food preparation.

Future Research

Implicit in the technical change model is the notion that technology for food preparation has evolved and continues to evolve with sizable improvements in mass production. The switch from individual to mass preparation has lowered the time price of food consumption and led to increased quantity and variety of food eaten, while energy needs have remained stable. As a consequence, body weight increases.

The key idea is that consumers respond to changing costs both in cash and time. The increasing body weight is expected, given changes in economic conditions: the price of food fell, the cost of preparing foods fell, energy needs for work and home fell, and the value of women's time rose.

Future research, will need to consider other economic factors that may affect weight increases, such as food stamps and other feeding programs, which reduce the cost of food for key population groups; reductions in smoking from increasing tobacco prices, and concomitantly, the rise in the cost of appetite control; the lower cost of illness (e.g., heart disease is less costly to the individuals over time); and the improved efficiency of grocery distribution and retailing.

The Growth in Obesity and Technological Change

Darius Lakdawalla, RAND Corporation, and
Tomas Philipson, The University of Chicago

Background

To understand the relationship between job strenuousness and body weight, Lakdawalla and Philipson study how income influences a person's weight. The authors present a model in which income can affect weight directly (the unearned income effect) and indirectly (the earned income effect). The direct or unearned income effect can have an inverted U-shape, so that increases in unearned income will initially raise weight, but at high levels of income, further increases will lower weight. The indirect or earned income effect arises because, to earn income, individuals expend calories that may differ from the amount expended if they didn't work. The earned income effect is monotonic—that is, as income changes, weight will change smoothly with it. The effect will be statistically positive (negative) if on-the-job activity is less (more) strenuous than leisure-time activity.

The authors hypothesize that the energy intensity of work relative to leisure is a function of the economy's level of technological sophistication. In particular, in an agricultural or industrial society, work is strenuous, and the worker is effectively paid to exercise, while in a post-industrial society, such as the United States, most work entails little exercise, and people must pay for undertaking—rather than being paid to undertake—physical activity.

The difference between unearned and earned income effects can help explain why income varies positively with weight across countries where levels of technology and job strenuousness vary considerably (the earned income effect dominates) but negatively within countries where technology levels are more uniform (the unearned income effect dominates).

The model also predicts a negative relationship between food price and weight. Technological change may lead to an expanding food supply, putting downward pressure on the price of food, which in turn stimulates consumption.

Methods and Findings

The authors estimate the effect of job-related exercise on body weight by using data from the National Longitudinal Survey of Youth (NLSY), which was designed to represent the entire population of American youth. To correct for self-reporting error in the NLSY, data from the Third National Health and Nutrition Examination Survey (NHANES III) are used to estimate the relationship between self-reported weight and actual weight and then to predict actual weight in the NLSY from the self-reported data.

In addition to questions about height and weight, the respondents' race, sex, marital status, and age, and their occupation in terms of the 1970 Census

classification, are included in the dataset. The NLSY also asks detailed income questions. In the present study, data on wages earned and the primary source of earned income are used. To identify the level of job-related exercise, the authors rate occupations using the *Dictionary of Occupational Titles, Fourth Edition*, by the U.S. Department of Labor's Bureau of Labor Statistics, which contains ratings of the strenuousness of each three-digit occupational code from the 1970 Census.

A statistical model of the relationship between Body Mass Index (BMI = weight in kilograms (kg)/height in meters$(m)^2$) and a set of variables (including sociodemographic variables and the variable for job strenuousness) shows that a woman who spends 1 year in the least strenuous job has 0.9 units more of BMI than one who spends a year in the most strenuous job. This outcome is the shortrun effect of job-related exercise. The model also reveals the importance of separating strenuousness from strength requirements: A woman in the job demanding the least strength weighs about 1.3 BMI units less than a woman in the job demanding the most. For comparison, an additional year of schooling lowers BMI by 0.16 units. Black women tend to be 2.63 BMI units heavier and Hispanic women 1.1 BMI units heavier than White women. Earned income has a consistently negative effect on weight.

When job strenuousness level and strength requirement are averaged over the respondent's history of jobs held up to 1996, the longrun effects of occupation seem to be almost four times as large as the 1-year effects. After 14 years of working, those in the least sedentary occupations have about 3.5 fewer units of BMI than those in the most sedentary ones.

Discussion

Peoples' choices of occupation may be affected by weight, in that heavier people might sort themselves into more sedentary occupations than lighter respondents. For the sample under study, the authors reject this possibility. They point out that not only are the longrun effects larger than the shortrun effects, but switches into less strenuous jobs are not preceded by increases in BMI, people switching into less strenuous occupations do not already weigh more than the average NLSY worker, people switching into less strenuous occupations have gained more education than the average worker, and those switching into less strenuous jobs reduce their hours worked by significantly less than the average NLSY worker.

Using data from the National Health Interview Survey (NHIS), the authors study the relationship between BMI and time, represented by the year of the survey, as well as the strength requirement of a worker's job, (from the *Dictionary of Occupational Titles*), job strenuousness, a set of variables indicating the quartile of the income distribution to which a worker belongs, and the worker's reported education, age, marital status, and race.

Even after the sociodemographic characteristics are controlled for, the estimated effect of variables representing the years are large and significant, suggesting that the effects of changes in the overall strenuousness of work, along with expansions in the supply of food, may account for a sizable fraction of the growth in mean BMI levels in the population.

Job-related exercise and income have the predicted effects on weight. The strenuousness measure has a negative effect. Income has an inverted U-shaped effect on the BMI of male workers, but seems to exert a consistently negative effect on the BMI of women. This effect is observed consistently, both in the NLSY and the NHIS, and could be due to differences in the effect of earned income for men and women. For example, increases in earned income for women may be raising total labor supply (including household labor supply) by much more than for men.

To decompose the growth in mean BMI into the effects of lower food prices and higher income, the authors construct a dataset with individual weight and other characteristics, along with geographic identifiers that allow them to link individuals to data on relative prices and taxes for different localities. To this end, the NLSY Geocode dataset is used, which provides geographic identifiers for each NLSY individual. Data are reported on the individual's State of residence and Standard Metropolitan Statistical Area (SMSA) of residence. Data from the American Chamber of Commerce Researchers Association (ACCRA) on intercity prices, as well as from the Bureau of Labor Statistics (BLS) on price variation over time and within particular cities, and State sales tax data from a biennial publication by the Tax Foundation (*Facts and Figures on Government Finance*), is merged with the NLSY Geocode data.

The authors find that about 40 percent of the increase in weight over the last few decades may be due to expansion in the supply of food, potentially through agricultural innovation, and the resulting fall in food prices, and about 60 percent may be due to demand factors such as a decline in physical activity at both home and work.

Future Research

The authors suggest five areas of future research:

First, the sources of the growth in weight increase in the U.S. population need to be better understood to improve policy responses to the rising epidemic of obesity. Currently, the major public interventions against obesity involve education programs emphasizing the benefits of good diet and exercise. However, if change in production technology is the major factor driving the trend, information may be less of an issue than incentives. Indeed, consumers may have become more informed over time as weight has increased.

Second, exactly why the relative supply price of food seemed to decline, particularly during the early 1980s, remains to be shown. More detailed analysis of technological change in agricultural production seems the logical next step in a research agenda that aims to understand the economics of weight gain.

Third, the impact of technological change has affected the quality of food as well as the quantity. Future research could clarify whether and how technological advances have affected the relative prices of the different sources of calories, such as proteins and fats.

Fourth, better understanding is needed of the relative importance of labor vs. leisure activities in the impact technological change has had in reducing activity levels. Leisure issues are particularly important for understanding the growth in child obesity that may be due to technological innovations like computers and television, which may have raised the satisfaction of using leisure time, but lowered the calories spent in doing so.

Fifth, although existing data do not allow for a clean, systematic, and convincing decomposition of weight growth into food and exercise components, future surveys aimed at collecting microdata on occupation, demographics, and food consumption could make such an analysis feasible.

An Economic Analysis of Adult Obesity: Results From the Behavioral Risk Factor Surveillance System

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and Michael Grossman and Henry Saffer,
National Bureau of Economic Research

Background

This paper focuses on economic forces that may alter the cost of nutritional and leisure time choices made by individuals. Specifically, it considers the effect of changes in relative prices, which are beyond the individual's control, on these choices. The principal hypothesis is that an increase in the prevalence of obesity is the result of several economic changes that have altered the lifestyle choices of Americans. One change is the increase in the value of time, particularly of women, reflected by the growth in their labor force participation rates and their hours of work. The reduction in their home time, due in part to the slow growth in income among certain groups, has been associated with an increase in the demand for convenience food. Another change is the rise in the real cost of cigarette smoking due to increases in the price of cigarettes, the diffusion of information about the harmful effects of smoking, and the enactment of State statutes that restrict smoking in public places and the workplace. This relative price change may have led to a reduction in smoking, which tends to increase weight. A final set of relative price changes involves the increasing availability of fast food, which reduces shopping and travel time and leads to changes in the relative cost of meals in fast-food and full-service restaurants and of meals prepared at home.

Methods and Findings

Data from repeated cross-sections from the Behavioral Risk Factor Surveillance System (BRFSS) for the years 1984 through 1999 were used. The BRFSS consists of annual telephone surveys of people 18 years and older conducted by State health departments in collaboration with the Centers for Disease Control and Prevention (CDC). Fifteen States participated in the first survey in 1984. The number of participating States grew to 33 in 1987, to 45 in 1990, and to all 51 States (including the District of Columbia) in 1996.

Self-reported data on height and weight were corrected for measurement error, using correction factors obtained by a statistical model relating actual weight and height data to reported weight and height data for people 18 years and older in the Third National Health and Nutrition Examination Survey (NHANES III) for eight demographic groups, defined by race/ethnicity and sex. The corrected measures were then used to compute the Body Mass Index (BMI) and obesity indicator (defined as BMI $\geq$ 30 kg/m^2).

To capture the influence of changes in relative prices, the authors merged State-level variables with the BRFSS data. The number of fast-food and full-service restaurants was taken from the 1982, 1987, 1992, and 1997 Census of Retail Trade (Bureau of the Census, 1986, 1989, 1994, 2000). For other years, these variables were obtained from interpolations and extrapolations of State-specific logarithmic time trends.

The full-service restaurant price pertains to the average cost of a meal in this type of restaurant and was taken from the same source as the number of full-service restaurants. The fast-food price and the food-at-home price were obtained from the ACCRA Cost of Living Index, published quarterly by the American Chamber of Commerce Researchers Association for 250 to 300 cities.

The price of cigarettes was taken from *The Tax Burden on Tobacco* (Orzechowski and Walker, 2002, formerly published by the Tobacco Institute). It includes both Federal and State excise taxes. The clean indoor air regulations (private, government, restaurant, and other) were obtained from the CDC website. Hours worked per week by employed workers, hourly wage rates of employed workers (usual weekly earnings divided by usual hours worked), and employment rates (ratios of employment to population) were obtained from the Current Population Survey (CPS) Merged Outgoing Rotation Groups Files (Bureau of Labor Statistics and Bureau of the Census, 2000) for 64 demographic groups, defined by sex, race (White non-Hispanic and other), marital status (married and other), age (25-44 and 45-64), and years of formal schooling completed (less than 12, 12, 13-15, and 16 and over). The models also included a set of variables identifying the States in order to control for unmeasured determinants of obesity that vary among States but do not vary over time.

Statistical models regressing BMI and the probability of being obese for people 18 and older on the set of variables outlined above show that age has an inverted U-shaped effect; that Black non-Hispanics and Hispanics have higher values of both outcomes than Whites; that males have higher BMI levels than females, but females are more likely to be obese; that married and widowed persons have higher levels of BMI and obesity prevalence than single (never-married) and divorced individuals; and that years of formal schooling completed and real household income have negative effects on BMI and the probability of being obese. At weighted sample means, the income elasticity of BMI is modest (-0.03; that is, a 1-percent increase in income leads to a 0.03-percent decrease in BMI). The income elasticity of the probability of being obese, -0.50, is more substantial. Also, the estimated effect of time shows a secular trend in rising obesity, even after controlling for the variables included in the models.

Per capita number of restaurants and the real price of cigarettes have positive and significant effects on BMI and probability of being obese. Similarly, the real fast-food restaurant price, the real food-at-home price, and the real full-service restaurant price have negative and significant effects, while the effects of the clean indoor air laws do not show a consistent pattern.

The authors also examine the contribution of changes in the composition of the population to the increase in mean BMI and obesity prevalence and find that race/ethnicity, schooling, marital status, and household income contribute little to an understanding in the behavior of obesity over time. Indeed, the last three variables predict reductions in obesity because schooling, real household income, and the divorced fraction of the population grew in the period at issue, while the married fraction of the population declined.

Without the effect of time, the increase in the per capita number of restaurants makes the largest contribution to trends in weight outcomes, accounting for 69 percent of the growth in BMI and 68 percent of the rise in the percentage of people who are obese. The real price of cigarettes ranks second, and the rising prevalence of clean indoor air laws has about the same impact as the reduction in the fast-food restaurant price.

Discussion

The authors emphasize two results: the correlation between the growing number of restaurants per capita and increasing overweight and the correlation between rising cigarette prices and overweight.

The large positive elasticities associated with the per capita number of restaurants—and the importance of trends in this variable in explaining the stability of obesity between 1960 and 1978 and the increase since 1978—suggest that fast-food and full-service restaurants may have played a role in the rise in obesity. At the same time, the authors point out that the growth in these restaurants, especially fast-food restaurants, is to a large extent a response to the increasing scarcity and value of household or nonmarket time.

However, the pooling of different data on food prices in restaurants across years to estimate simple models by least squares may be problematic. Increasing the sample sizes to around a million observations can easily lead to spurious statistical significance. Alternative techniques, such as those for analyzing "repeated cross sections" that often create "pseudo panels" are available.

The positive effect of cigarette price on weight points to an unintended consequence of the anti-smoking campaign, namely that State and Federal excise tax hikes and the settlement of State Medicaid lawsuits have not only caused the real price of cigarettes to rise substantially, but may also have contributed to the upward trend in obesity.

In contrast to this result, Bhargava (2003) estimated a dynamic random effects model for body weight from the Framingham Offspring dataset and found a small negative elasticity of approximately 0.01 of body weight with respect to the number of cigarettes smoked. The elasticity with respect to alcohol consumption was positive and approximately half the magnitude. The evolving patterns in smoking and drinking are apparently different among men and women in different socioeconomic groups.

Future research

The authors propose that a structural approach in which caloric intake, energy expenditure, and cigarette smoking are treated as endogenous determinants of weight be given high priority on an agenda for future research. They suggest repeating the analysis using data from the NHANES. The determinants of childhood obesity, with a focus on factors considered in the BRFSS study and on interactions between fast-food advertising on television and the amount of time spent watching TV, also merit further inquiry.

In addition, it was recommended that the authors consult the literature on nutrition education and interventions for less-educated groups for improving dietary intakes. For example, low-income families are more likely to eat fast foods that are typically energy-dense and inexpensive. While it is true that, with both parents working, mothers have less time for cooking, it is also true that children from low-income households are more likely to eat in fast-food restaurants. Thus, educating parents about children's nutritional requirements and monitoring the contents of food served in restaurants are likely to be helpful in reducing obesity prevalence—i.e., the societal work patterns need not change to stem the obesity epidemic.

Maternal Employment and Childhood Obesity

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and Phillip B. Levine, Wellesley College

Background

Childhood overweight may be one of the most significant health issues facing American children today. In the 1963 to 1970 period, 4 percent of children between the ages of 6 and 11 were defined as overweight; that level had more than tripled by 1999, reaching 13 percent. The rise in women working outside the home coincides with the rise in childhood weight problems. From 1970 to 1999, the fraction of married women with children under 6 who participate in the labor force doubled, rising from 30 to 62 percent, while those with children ages 6 to 17 rose dramatically from 49 to 77 percent. However, time series evidence is not sufficient to imply that these trends are related. This study explores whether the rise observed in both maternal employment and childhood overweight represents a causal relationship between these two phenomena.

Methods and Findings

Using matched mother-child data from the National Longitudinal Survey of Youth (NLSY), the authors employ several econometric techniques to identify whether the relationship between maternal employment and childhood overweight reflects more than a spurious correlation. First, they estimate models relating the likelihood of a child's being overweight on a full range of observable characteristics of the mother and child. Second, they estimate models explaining the change in overweight status over time so as to eliminate any unobserved child-specific and family-specific fixed effects. Finally, they estimate instrumental variables models, using as instruments the variation between States and over time in the unemployment rate, child care regulations, wages of child care workers, welfare benefit levels, and the status of welfare reform in the States. The models were also estimated separately by income, maternal education, and race/ethnicity subgroups.

The key outcome variable, an indicator for whether the child is overweight, is based on the child's Body Mass Index (BMI). Children with a BMI above the age- and sex-specific 95th percentile of the BMI growth chart are classified as "overweight." The authors also capture the child's lifetime exposure to maternal employment through measures such as total weeks worked per year and average hours worked per week, distinguishing between mothers who work at a high intensity, but intermittently, from those who work consistently, but at a lower intensity.

Their results suggest that a 10-hour increase in average hours worked per week will increase the overall probability a child is overweight by 0.5 to 1 percentage point. In the probit models, the point estimate on hours per week

is always positive and increases with income quartile. For mothers in the highest socioeconomic status, the results indicate that a 10-hour increase in average hours worked per week since a child's birth increases the likelihood that the child will be overweight by 1.3 percentage points. Children of more highly educated mothers are significantly more likely to be overweight if their mothers work more hours per week. Overall, the subgroup analyses show that the intensity of mother's work over the child's lifetime has a positive effect on a child's likelihood of being overweight if the child is in a high-income family, with a well-educated or White mother. For these subgroups, a 10-hour increase in average hours worked per week over a child's life is estimated to increase the likelihood that the child is overweight by between 1 and 4 percentage points, depending on the specification. The relationship between number of weeks worked and childhood overweight is insignificant throughout.

Several other results are worth noting. Black children are significantly more likely to be overweight than other groups. Mother's education by itself is negatively and significantly related to the probability that her child is overweight—an extra year of education reduces the probability that a child will be overweight by 0.6 percentage point. Moreover, children who are breastfed are about 2.3 percentage points less likely to be overweight. The interpretation of this finding is unclear: Breast milk may have nutritional value that affects children's health later in life, or mothers who breastfeed may simply be more attentive to their children's nutrition throughout the children's lives. Mother's weight is also found to have a large positive impact on children's weight status.

The results suggest that the mechanism through which maternal employment affects childhood overweight is constraint on the mother's time; hours per week (i.e., intensity of work), not the number of weeks worked, affect children's probability of overweight. The increase in the mother's time constraints may lead to behavioral changes affecting the child's nutrition and physical activity, such as the mother's greater reliance on calorie-dense convenience foods and her lack of time for supervising vigorous play outside. Moreover, the authors demonstrate the importance of examining explanations for childhood overweight separately for subgroups. Working more hours per week only has a deleterious effect on the weight of children in higher socioeconomic status households.

Discussion

Given the limited information in the NLSY data set, the use of the word "causal" should be interpreted carefully. If there is a systematic underlying relationship, it is presumably because working mothers are feeding fast or energy-dense foods to their children and/or not monitoring their physical activities. Because the data on nutrient intakes and physical activity are unavailable in NLSY, these pathways cannot be explicitly included and tested in the models.

Furthermore, modeling the BMI or weight may have been preferable to modeling the indicator of overweight that requires a cutoff point for being overweight (the outcome variable in this paper is a binary variable equal to 1 if the child's BMI is above the 95th percentile for his/her age) and is

controversial for children. Ideally, one would prefer to measure overweight using a measure that reflects adiposity. Because doing so is impractical in large-scale surveys, researchers have employed the BMI, which only requires the measurement of height and weight. It is somewhat questionable when used to assess overweight among children, who experience growth spurts at individual-dependent ages that can weaken the relationship of height- and weight-based measures to adiposity. Moreover, instrumental variables estimation can be interpreted more easily when the dependent variable is continuous.

The results clearly show that Black and Hispanic children are heavier. When the authors run the regressions separately for the three race groups, they find that maternal employment significantly predicts higher weight only for White children. This finding does not imply that we do not need to be concerned about weight gain in Black and Hispanic communities, which may be a more serious problem. Because of the focus on the "causal" effects of maternal employment, less attention has been paid to the role of dietary or activity habits among minorities that lead to weight gain. Such households may need nutrition education and advice. By contrast, White women working long hours likely put their children at greater risk of weight gain because time constraints lead to a less healthy life style. The issues of absolute differences between the races, and also between the education groups, demand further investigation using models for BMI and allowing for several interaction terms.

Future Research

This paper is among the first to grapple with issues of causality and lays the groundwork for future research into the causes of childhood overweight. Further work is required to understand fully the mechanisms through which mothers' working translates into overweight children. For example, how does child care quality affect children's nutrition and energy expenditure? Will better nutritional information for parents promote children's health? A deeper understanding of other direct contributors to childhood overweight is also imperative. For example, we need to know more about children's opportunities for vigorous exercise, including physical education in school, after-school programs, and access to parks or other recreational facilities.

Modeling the length of breastfeeding as a function of hours of maternal employment would be useful. However, the NLYS data may lack information on the number of months the child was breastfed and may contain only a 0-1 indicator. Nevertheless, estimating a model to see if the probability of breastfeeding is reduced by maternal employment may be useful. Supplementary feeding at an early age is a possible pathway through which children may gain weight.

We also need to understand how working mothers select foods, the amount of time they spend at fast-food restaurants, and whether these mothers increase their household consumption of processed foods (i.e., foods with long shelf lives that are quick to prepare) as opposed to fast foods. Furthermore, fast food is a low cost way to obtain deep-fried food, and technological advances in food processing may be driving the trend in childhood overweight instead of time constraints. Fast food tends to be very calorie

dense because of the deep frying involved in its preparation. The demand for fat and sugar has always existed, but technology has made the relative price of fat and sugar lower, stimulating their increased consumption.

To design more effective public policy to curb the obesity epidemic, a more detailed understanding is necessary on how children's lives have changed in recent decades and how these changes affect their intake and output of energy. Children spend the bulk of their time away from home in school. Has the school environment changed in ways that contribute to childhood obesity? Almost half of high school students have no access to physical education classes, and only one-third have daily classes. Almost all high school students have access to vending machines, and about one-quarter are served brand name fast foods in school. Cash-strapped schools have turned to contracts with soft drink and vending companies to increase their budgets, although legislators have recently begun to restrict such deals. Policies that encourage a parent to stay at home are unlikely, so school-based interventions may be more effective. A better understanding of how school finance policies affect school physical education, food, and beverage decisions is needed. Perhaps more important, given recent legislative debates, the way these choices affect children's health is an open question that needs study.

The Labor Market Impacts of Obesity

John Cawley, Cornell University

Background

Cawley studies the effect of body weight on a person's wage. Previous studies have found a negative relationship between weight and wages, but whether the inverse relationship is due to low wages causing high weight, high weight causing low wages, or a third factor causing both low wages and high weight is unclear.

Cawley uses data from the National Longitudinal Survey of Youth (NLSY). The sample spans 13 years, from 1981 to 2000. Wage was measured by the hourly earning of the respondent at his or her primary job. Three measures of body weight were considered separately as the primary explanatory variable of interest: Body Mass Index (BMI), weight in pounds (controlling for height in inches), and an indicator variable for the clinical classifications underweight (BMI < 18.5), overweight ($25 \leq$ BMI < 30), and obese (BMI $\geq$ 30), where the excluded category is healthy weight ($18.5 \leq$ BMI < 25).

Weight and height are self-reported in the NLSY and may be biased as a result. To correct for this reporting error, true height and weight in the NLSY were predicted using information on the relationship between true and reported values obtained from Third National Health and Nutrition Examination Survey (NHANES III).

Other explanatory variables were race (Black, Hispanic, and non-Black/non-Hispanic), sex, age, the age of a woman's youngest child and the total number of children to whom she has given birth, a measure of general intelligence based on 10 Armed Services Vocational Aptitude Battery tests administered in 1980, highest grade completed, mother's highest grade completed, father's highest grade completed, years of actual work experience (defined as weeks of reported actual work experience divided by 50), job tenure, and indicator variables for marital status, region of residence, whether the respondent's occupation is white collar or blue collar, current school enrollment, county unemployment rate, and whether the respondent's job is part-time, as well as a linear time trend.

Methods and Findings

For each race/ethnic group of females, both BMI and weight in pounds have negative and statistically significant effects on wages. The estimate is largest for White females and smallest for Black females. An increase of two standard deviations (64 pounds) from the mean weight in pounds among White females is associated with a decrease in wages of 9 percent, roughly equal in magnitude to the difference associated with 1.5 years of education or 3 years of work experience.

Among men, the results vary by race-ethnic group. For White males, weight does not affect wages. For Black males, higher body weight is associated with higher wages, while the effect of weight on wages for Hispanic males resembles those for females: negative and statistically significant.

When the effect of weight on clinical weight category indicators is studied, both Black men and Black women who are underweight earn less than their healthy-weight counterparts. The pattern of wage effects across the weight classifications has an inverted U shape for White males.

To address the possibility of reverse causality—i.e., that current wages affect current weight—Cawley estimated a model in which the 7-year lagged value of weight is substituted for its contemporaneous value. The fact that the estimated effects of the lagged measures of BMI and weight in pounds are generally similar to those on current weight is consistent with two explanations: (1) current wages have little impact on current weight, or (2) current wages do affect current weight, but because the timewise correlation is so high in both wages and weight, when even distant BMI is used as an explanatory variable, the effect of wages on weight is measured just as strongly.

To reduce the effect on wages of unobserved variables that stay fixed over time (such as systematic genetic differences), Cawley exploited the longitudinal nature of the data and estimated a "fixed-effects" model. The most dramatic difference is that the negative effects of BMI and weight in pounds on wages are much smaller and no longer statistically significant for Black females, Hispanic females, and Hispanic males. This finding suggests that the results that did not account for unobserved effects for these groups are driven largely by unobserved effects that stay fixed over time.

Some unobserved effects may not be constant, but vary over time. To account for such time-varying unobserved effects, Cawley used the econometric method of instrumental variables. The BMI, age, and gender of a sibling are used as extra variables to explain the respondent's BMI, based on the assumptions that the BMI of a sibling is strongly correlated with the respondent's BMI and that the sibling BMI does not affect the respondent's wage directly. The results show that only for White females do BMIs have a statistically significant effect on wages. The estimated effect on wages is roughly 70 percent higher than the initial simple statistical model. Put another way, an increase of two standard deviations (64 pounds) from the mean weight in pounds is associated with a decrease in wages of 18 percent, which is roughly equal in magnitude to the difference associated with 3 years of education, or 6 years of work experience.

Discussion

Results from the simplest statistical model indicate that the relationship between weight and wages varies by race and sex: Heavier Black men earn more, while heavier Black women, as well as both Hispanic men and women, earn less. When the individual fixed effects are removed to eliminate the influence of time-invariant unobserved differences among respondents on weight and wages, the negative correlation between weight and wages is eliminated for all but White females, casting doubt on the hypothesis that

weight plays a causal role in determining wages for the other groups. This result is further confirmed when time-varying unobserved effects are removed by exploiting the correlation of the respondent's BMI with his or her sibling's BMI.

The sociological literature yields one possible explanation for the difference in results between White, Black, and Hispanic females: that obesity has a more adverse impact on the self-esteem of White females than on that of Black and Hispanic females, who report perceiving higher weight as a signal of power and stability. Averett and Korenman (1999) studied 1990 data from the NLSY and found that obesity is associated with lower self-esteem among White females, but not among Black females. However, they also found that controlling for the difference in self-esteem did not explain differences across race in the relationship between obesity and wages.

Future Research

The reason for the differences across race-ethnic and sex categories with regard to the relationship between weight and wages remains to be investigated. In particular, why does weight appear to lower wages for White women but not for other groups? More generally, has the labor market impact of obesity changed as the prevalence of obesity has risen? Will cross-country comparisons yield insight into the relationship between health behavior and labor market outcomes? In terms of public policy, the recent coincident rise in disability insurance rolls and obesity prevalence deserves further attention. Understanding the true effect of obesity on labor market outcomes may be helpful in formulating better disability insurance policy with respect to obesity.

Health Insurance, Obesity, and Its Economic Costs

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and Neeraj Sood, RAND Corporation

Background

According to the literature, the obese contract chronic diseases at a higher rate than the non-obese, and consequently pay more for medical care. The lifetime medical costs related to diabetes, heart disease, high cholesterol, hypertension, and stroke among the obese are $10,000 higher than among the non-obese. Among the overweight, lifetime medical costs can be reduced by $2,200 to $5,300 following a 10-percent reduction in body weight. Obesity also has externalities associated with it—namely, mortality and health insurance costs. Because medical costs are higher for the obese and premiums do not depend on weight, lighter people in the same pool pay for the food/exercise decisions of the obese. Furthermore, the negative health effects of obesity decrease the ability of the obese to pay for government-mandated social programs. Bhattacharya and Sood's paper focused on such health insurance externalities.

Methods and Findings

The authors first develop a model of weight loss and health insurance under two alternative regimes. Regime 1 allows underwriting on weight, and premiums are a function of weight. Regime 2 does not allow this, and premiums do not depend on weight. The authors then analyze welfare under each regime and estimate the change in prevalence of overweight and obesity when Regime 2 changes to Regime 1.

In the model, each consumer has an initial endowment of weight. Consumers can decide on how much weight to lose. Losing weight decreases the probability of falling sick, which in turn decreases expected medical care costs. However, losing weight (exercising, eating less food) causes consumers to lose some utility. Consumers can also purchase insurance to insure against health shocks and decide on consumption (of net calories—that is, calorie intake minus calorie expenditure) after observing their health state. If consumers are fully insured, consumption is the same regardless of their health state.

Regime 1 has two incentives for weight loss. First, weight loss increases expected consumption of net calories because it reduces the probability of falling sick and lowers insurance premiums. Further, as premiums depend on weight, there is no moral hazard problem—the tendency of policyholders to take less care to reduce hazards against which they are insured. Because consumers face the full costs of their weight choice through the health insurance premium, they choose to lose weight even when fully insured, and thus weight loss is at the socially optimal level. Full insurance is optimal when premiums are actuarially fair.

In contrast, under Regime 2, consumers choose their weight without taking into account the effect of their choices on premiums. Premiums are set at the expected level of medical expenditures for the whole insurance pool. As long as consumers have some insurance, but not full insurance, weight loss increases consumption by reducing the probability of falling ill. However, unlike in Regime 1, Regime 2 has no incentive for weight loss through decreased premiums because premiums are independent of weight. Thus, weight loss lowers premiums for everyone in the insurance pool by lowering the expected level of medical expenditures, but consumers ignore this when making individual weight decisions. Weight loss creates a positive externality and is underprovided because consumers are not explicitly rewarded for the benefit they generate. Under Regime 2, full insurance is not socially optimal and consumer heterogeneity is not a necessary condition for this result.

A comparison of weight loss under the alternative regimes reveals that with full insurance, there is no incentive for weight loss when underwriting on weight is not allowed—consumption is the same regardless of the health state. However, if underwriting on weight is allowed, consumers can increase their expected utility as weight loss decreases their own premiums. With less than full insurance, feedback effects introduced by premium changes via the copayment rate are possible—that is, as consumers move closer to self-insurance or no insurance, the effect of premiums on weight loss decreases and less positive externality is created. Although weight loss is likely to be higher under Regime 1, this is ultimately an empirical issue.

To estimate welfare loss, the authors ran a simulation model under the two different regimes. The simulation setup consists of consumers choosing from one of three weight categories—normal, overweight, and obese. The choice of weight determines the distribution of medical expenditures. Differences among consumers are generated from different initial endowments of weight—overweight or obese—and the probability distribution of health shocks (likelihood of getting sick). The effect of weight on this probability distribution depends on different explanatory variables. Simulation parameters include the probability distribution of initial weight, disutility from weight loss, coinsurance, and consumers' utility.

For a given set of parameters of the weight distribution under each regime, expected medical expenditures and welfare loss from not allowing weight-based underwriting (CV) is estimated. Solutions are presented for the actuarially fair and unfair case.

Bhattacharya and Sood report the effects of copayment rates and the cost of losing weight on the different estimations. Optimal weight decreases with cost sharing. Weight is uniformly higher when weight-based underwriting is prohibited (except with no insurance). Per capita medical expenditures are lower with actuarially fair premiums. The difference between actuarially fair and unfair cases is not large, beyond modest copayment levels. At full insurance, the externality is largest, while at no-insurance the results for actuarially fair and unfair coincide. A modest copayment can substantially control the welfare loss when underwriting weight is not used. When losing weight has no cost, everyone does it—even when weight

underwriting is not used. When losing weight is costly, no one does it—even when underwriting is adopted.

Medical expenditures grow more sharply with the cost of weight loss when weight underwriting is prohibited. Welfare loss from the negative externality generated by the lack of weight underwriting grows sharply with the cost of losing weight. It peaks when the costs of losing weight start to become prohibitive, even with actuarially fair premiums. According to the authors, the best estimate of welfare loss is $150 per capita.

Obese and overweight people with health insurance impose significant negative externalities on normal weight people in the same insurance pool. This externality arises because weight-based underwriting of health insurance premiums is not practiced. However, the simulation results indicate that modest copayment can limit these external effects.

Discussion

The model developed by Bhattacharya and Sood is similar to the Ehrlich and Becker (1972) type model of insurance, self-protection, and moral hazard. When health insurers do not underwrite on weight, people are heavier than Pareto optimum.[3] Furthermore, if weight gain promotes poor health, people are also sicker than Pareto optimum. The goal of this study was to estimate the impact of absent or imperfect underwriting on weight and health.

[3]A Pareto optimum refers to a situation where there is no way to reallocate resources in such a way that you can make someone better off without making someone else worse off.

Theoretically, the implications of allowing underwriting in Regime 1 are that the insurance market internalizes the externality associated with obesity. Weight is socially optimal, and, with actuarially fair pricing, full insurance is also optimal. In contrast, when underwriting is prohibited in Regime 2, people ignore the impact of weight on others' premiums and as a result weight loss and full insurance are Pareto suboptimal.

Future Research

Inevitably, the chosen structure of the model imposes restrictions on the finding. A key next step is to understand the impact of each structural assumption, either through theoretical investigation or sensitivity analysis. Conventional intuition about the economics of moral hazard is based on "price effects." Insurance lowers the return on protection, and with underwriting, insurance raises financial return on protection. But two income effects are worth considering. Without underwriting, low-risk types subsidize high-risk types. Introducing underwriting makes high-risk types poorer and low-risk types richer. This effect is complicated by the ambiguity of income effects: Weight loss does not always increase with income. Thus, introducing nonmonotonic effects of income on weight is important. Transferring resources from the no-loss to the loss state can make a person "wealthier"—this is the standard income effect. If protection is a normal good, then it creates some complementarity in insurance/protection. The strength of the income effect will depend on actuarial fairness of pricing and the nature of consumer's absolute risk-aversion (CARA, constant absolute risk aversion, or DARA, decreasing absolute risk aversion). A suggested

sensitivity analysis is to introduce unfair pricing, by degrees, and investigate the impact. The current model should be extended to include weight gain and weight loss, as well as nonmonotonic preferences for weight. Further, actuarially unfair pricing should be considered and the impact of CARA and DARA utility investigated. Ultimately, a realistic structural model needs to be estimated.

Obesity and Nature's Thumbprint: How Modern Waistlines Can Inform Economic Theory

Trenton G. Smith, Washington State University

Background

The modern prevalence and negative consequences of obesity suggest that many people eat more than they should. Smith examined the biological underpinnings of mammalian feeding behavior in an attempt to reconcile this "self-control problem" with the "rational choice" tradition of neoclassical economics. Medical, genetic, and molecular evidence suggest that overeating is a manifestation of the fundamental mismatch between ancient environments—in which preferences for eating evolved—and modern environments. Smith described the phenomenon with a model in which food preferences and expectations about food availability are generated depending on the prevailing environment in the distant past.

Methods and Findings

Smith presented a model of energy allocation as body fat and for other uses in rodents. Specifically, he considered the problem to be solved by natural selection ("Nature") when a wild rodent population faces seasonal food shortages, and considered what might be expected to happen if food security is suddenly improved. In the model (adapted from the "optimal foraging" literature), the optimal level of energy reserves is determined by variations in food availability and constrained by an exogenous endowment of energy income and a constant rate at which energy held in reserves from the previous period can be converted to other uses. Generally speaking, a foraging strategy is optimal—and therefore constitutes a solution to the fitness maximization problem—if no other available strategy results in a greater number of descendants surviving in the distant future.

According to Smith's analysis, an excess of body fat is generated during a feast (when food is plentiful), up to the point at which the associated marginal fitness cost is just offset by the marginal fitness benefit of closing the "gap" between current consumption and consumption in the ensuing famine. And likewise, the dearth of body fat during famine serves the same purpose—consumption smoothing—when food energy is scarce.

This model implies a unique solution to the fitness maximization problem, suggesting an equilibrium population of uniformly plump rodents. However, real populations exhibit considerable variation in body fat, which might arise from asymmetric information or payoffs among groups within the population. If the frequency of food shortages varies over time, behavior

might be sensitive to new information regarding the risk of food shortages, and the optimal strategy will become a function of age and experience.

Suppose that in any given period food will be scarce with a certain probability, independent of the food state obtained in the previous period. Further, suppose that for any given cohort of rodents this probability is unknown at birth but constant throughout life and that it is adjusted in a Bayesian manner as experience reveals information about the true probability.[4] Over time, individual rodents are generated with a variety of prior distributions (subjective knowledge about an event) and a variety of sensitivities to new information, and only those rodents with the correct Bayesian prior and the correct interpretation of new information survive in the long run. The mechanism by which this variety arises is well known to biology: Parental traits are passed to offspring genetically; and genetic variation in traits is generated via the processes of recombination (the "mixing" of maternal and paternal genes) and—much more rarely—random mutation. When the trait is a behavioral trait, such as the propensity to overeat, the most successful rodents (i.e., those who survive in the long run) will have the correct Bayesian prior written into their genes.

[4]The Bayesian method is away of incorporating newly gained knowledge or information about an event, from an observation, for example, to update or modify prior knowledge in order to infer the future probability of the event.

In effect, Nature generates agents who make the best use of regularities in the environment. Thanks to the information provided by Nature (presumably via "feelings" of hunger and satiety), the rodent need not directly assess the fitness implications of his actions; rather, the evolutionary process favors those individuals who behave as if they were aware of the implications. If parental behavior reliably predicts famines, for example, Nature will condition feelings of hunger on parental behavior. So the rodent does not make conscious calculations of the marginal fitness costs and benefits of his choice; he need only eat when he's hungry. However, by taking advantage of regularities in the environment—which is the optimal thing to do, as long as the regularities remain—the rodents leave themselves vulnerable to sudden changes.

Now suppose that the equilibrium rodent population is taken from the environment characterized by episodes of food scarcity and placed in a laboratory environment in which the food supply is constant. In the absence of sufficient time (recall that the strategies that prevail in equilibrium are passed on genetically and thus cannot be altered within a single lifetime) and evolutionary pressure, the inherited behavioral tendencies of the rodent population will continue to dictate the behavior that was fitness-maximizing during the plentiful season. In terms of this simple example, the rodents in the laboratory might—through the process of Bayesian updating—come to behave as though the regime with the lowest probability of food scarcity applies. However, further adaptation is limited by the extent of the distribution found in the wild, under which the evolutionary equilibrium developed. Assuming that food supplies were always uncertain in the wild, the immediate consequence of placing the population in the secure laboratory environment is chronic obesity. Faced with an abundant food supply, the rodents choose a high level of body fat, as would have been optimal when food supplies were variable. The obesity in the laboratory constitutes a state of disequilibrium in the sense that preferences no longer serve to maximize Darwinian fitness; yet it is stable in the sense that preferences cannot be altered within a single generation.

Smith then offered empirical evidence from a variety of fields, such as behavioral endocrinology, nutritional anthropology, and behavioral ecology, to support his model of obesity and why we might expect limits to conscious control over the behavior. In our evolutionary history, such conscious control would at best have been useless, and at worst resulted in starvation. In the language of probability theory, the prior distribution we are born with precludes flexibility; such flexibility would have been harmful to our ancestors, and the preferences they have passed on will continue to haunt us for generations to come. Human evolution has proceeded more slowly than recent advances in modern agriculture and transportation technology. Thus, the actual probability of starvation and the probability implied by our genes are now distinctly mismatched.

Discussion

A close examination of the biological underpinnings of the self-control problem suggests a fundamental flaw in the First Fundamental Theorem of Welfare Economics.[5] Specifically, because preferences necessarily imply a probability distribution over outcomes, a market economy may fail to yield an efficient allocation when the prevailing probability distribution differs from that implied by the preferences of consumers. Allowance might be made, on feasibility grounds, for some error on the part of consumers, but when the error is systematic—as appears to be the case with obesity—then a market failure of a new sort is implied. It is one thing to suggest, as the "stable disequilibrium" of the preceding model does, that, in modern environments, consumers may fail to maximize individual fitness in the biological, Darwinian sense. But it is another thing entirely to suggest that consumers should try to maximize fitness—or that welfare economists should encourage them to do so.

Today's consumers are faced with a very real tradeoff between short-term pleasure and long-term health, and we have no a priori reason to expect that they should be particularly good at making this choice. However, improving the health and welfare of the general population might—in light of the evidence that obesity appears to be exacerbated by poverty, and malnutrition early in life—consist of such antiobesity measures as strengthening the social safety net or providing prenatal care to expectant mothers and proper nutrition to at-risk children.

Perhaps a more fundamental problem for welfare economics is the question of measurement. The equivalence between individual choice and individual welfare commonly assumed in welfare economics allows for estimating and comparing the impacts of various policies through the simple observation of human behavior. Weakening this equivalency—with the qualification that behavior is individually optimal only when subjective probabilities are equivalent to actual probabilities—poses a difficult problem for policy analysts. The other social sciences have long been skeptical of the choice/welfare equivalence in economics, and a number of alternative measures of well-being have been devised that deserve the attention of economists (e.g., Kahneman, 1999; Larson and Fredrickson, 1999).

[5]The First Fundamental Theorem of Welfare Economics holds that, under certain conditions, in a perfectly competitive market economy, any competitive equilibrium is Pareto optimal. As noted earlier, a Pareto optimum refers to a situation where there is no way to reallocate resources so you can make someone better off without making someone else worse off.

The author's central thesis is that "overeating—the most prominent of self-control problems—is best viewed as a manifestation of the difficult problem of energy homeostasis faced by our ancestors." This thesis is widely accepted, but on its own, it does not have implications for welfare economics or for policy. Smith should be mindful of the "Naturalistic Fallacy," that what is by nature is what should be, which may not be necessarily so.

He also suggests that "body fat might be a function not only of season, but also of social status and wealth and there is evidence that this is true in natural environments." The idea that body fat is a function of season, social status, and wealth but is genetically programmed is novel. However, it may not be widely known or accepted as an explanation for obesity among low-income Americans.

Smith claims "the evidence supporting a biological basis for the self-control problem has the troubling consequence of undermining a foundational tenet of welfare economics." As a rebuttal, welfare economics has long recognized that choice and well-being are different. The First Welfare Theorem states, "An equilibrium produced by competitive markets will exhaust all possible gains from exchange." Having a biological basis for decisions about food does not weaken this.

Finally, the author suggests that "today's consumer is faced with a very real tradeoff between short-term pleasure and long-term health." However, this argument has shifted away from "Nature's Thumbprint." The policy implications do not rely on the paper's principal contribution; they are not closely tied to genetics. Smith's article can be viewed as an introduction for economists to the biology of weight regulation.

Future Research

Smith's findings may have important implications for the theory and practice of welfare economics. The unanswered question, if these claims are taken at face value, is whether this approach might be applicable to other realms of economic behavior. If his thesis turns out to apply to body fat and little else, then what he has to offer would be another anomaly for the growing list of behavioral phenomena that do not comfortably fit into a neoclassical framework. But other examples, upon further investigation, will likely be found of cases in which people seem to be acting on the basis of biased subjective probabilities.

Methods of Surveying Diet and Physical Activity

Richard A. Forshee, Virginia Tech

Background

The problem of overweight and obesity results from a long-term imbalance between energy consumed and energy expended. To understand the risks of obesity, we need to understand what people eat and how much energy they expend through physical activity. Forshee reviewed the primary methods for assessing diet and physical activity and discussed their limitations.

Methods and Findings

The 24-hour dietary recall (24HR) is one of the most common methods used by surveys to assess diet. It is considered a reliable estimate of a respondent's diet for the period covered, although underreporting is a common problem. The 24HR uses an interviewer to probe a respondent's diet during the previous 24 hours. The current version used in the Continuing Survey of Food Intakes by Individuals (CSFII) and National Health and Examination Survey (NHANES) is a computer-aided, multipass method that prompts respondents to report commonly forgotten foods such as snacks and between-meal beverages. The new method includes two 24-hour recalls on nonconsecutive days for each respondent, and future NHANES surveys will integrate the CSFII methodology. However, the 24HR captures only a snapshot of the respondent's recent diet, not his/her long-term or usual diet. A major weakness of the 24HR is the reliance on self-reports of dietary intake. These may be affected by memory and intentional misreporting, for instance, overreporting of "good" foods like fruits and vegetables and underreporting of "bad" high-fat snacks. Self-reports of height and weight used in the calculation of Body Mass Index (BMI) also introduce measurement error. For height and weight, statistical corrections are possible using surveys that contain both measured and self-reported height and weight. For 24HR, a method for calculating "usual" intakes from multiple days of 24HR has been developed by Iowa State University.

The Food Frequency Questionnaire (FFQ) attempts to record usual intake, which is food consumption over an extended period. The FFQ method is based on the detailed dietary history interview developed by Burke in 1947. The respondents are given a list of commonly eaten foods and asked to report how often they have eaten each item over the past week, month, or 12 months. The FFQ is intended to provide a more long-term measure of an individual's diet and is generally less expensive and burdensome for respondents than the 24HR. However, it is limited to the foods on the questionnaire, demands more of the respondent's memory than the computer-assisted 24HR, and does not account for food portion sizes. Recent studies have questioned the reliability and accuracy of the FFQ for quantitative dietary assessment.

The constraints of the FFQ and 24HR have motivated efforts to improve methods of assessing long-term diet quality. One approach uses a "food propensity" questionnaire as a supplement to the 24HR. The propensity method assumes that usual intake is a function of the propensity to consume (the probability that a person will eat a specific food or beverage on a given day over a designated time period) and the average amount consumed on a day when the food is actually eaten. Initial validation studies have shown that the FFQ accurately measures propensity as defined for this method and that combining the 24HR and FFQ is a more efficient way to estimate commonly eaten foods in the U.S. diet. However, this approach is still subject to error associated with self-reporting of intake. The Food Propensity Questionnaire (FPQ) will be incorporated into future NHANES, and information will be combined with the 24HR data.

USDA's Economic Research Service (ERS) annually tracks several hundred agricultural commodities in order to estimate the amount of food available for human consumption. Food disappearance data—also called the food supply and use data—measure the flow of raw and semiprocessed food commodities through the U.S. marketing system. The disappearance data measures food supply, not food intake. These data should be treated as food available for consumption. ERS currently uses conversion factors meant to account for waste, spoilage, and shrinkage in the distribution system for most commodities so as to minimize overestimation of food consumption. The long-term nature of these data makes them a unique source for assessing consumption trends.

Large, nationally representative surveys have no accurate methods for estimating physical activity. The CSFII measures of physical activity are extremely limited, but NHANES III has more detailed measures. For adults, NHANES asks how often each respondent engages in a list of about 16 common physical activities and allows for respondents to add other types of physical activities. Each activity is also given an intensity rating to indicate how strenuous it is. For adolescents, the NHANES III asks respondents about participation in team sports and exercise programs and how often they exercise hard enough to break a sweat. CSFII and NHANES measure sedentary behavior by asking about the number of hours spent watching television. As with dietary intake reports, respondents often misreport on physical activity questionnaires, and researchers have questioned the validity of the questionnaire approach, especially among children and adolescents. Moreover, these surveys do not account for individual differences in basal metabolic rate (BMR). The Food and Agriculture Organization and various other agencies have adopted the principle of relying on estimates of energy expenditure, rather than energy intake from dietary surveys, to estimate the energy requirements of adults. Physical Activity Level (PAL), expressed as a multiple of the BMR, provides a convenient way of controlling for age, gender, weight, and body composition. Data on occupational physical activity are available and have been used in some research studies, and they could conceivably be merged with NHANES data. Other studies have measures of physical education and recess opportunities for children in school.

Discussion

All the above survey methods of assessing consumption represent short-term measures of diet, while the phenomenon of overweight and obesity is the result of a long-term imbalance between energy intake and expenditure. The long-term health effects of overweight and obesity require longitudinal data about diet quality and physical activity for better understanding of the links between overweight and obesity and chronic disease risks.

The instruments available in surveys are not strong and reliable measures of a respondent's long-term diet and physical activity. Furthermore, existing surveys tend to focus on either diet or physical activity and have no standardized approaches to collecting and analyzing these data. Standardized approaches, comprehensive surveys, and more research into reporting accuracy are critical to improving diet quality and physical activity. Researchers also need to understand the limitations of the measures in order to use and interpret them properly.

Future Research

Clearly, more data are needed for the economic analysis of obesity. Additional sources include Consumer Expenditure Surveys (CES), scanner data on food spending, food use data (Food Stamp Cashout Studies, National Food Stamp Program Survey), and price data (Bureau of Labor Statistics, scanner data). Currently, few data exist on expenditures in food/nutritional choice surveys and on food choice in expenditure surveys.

There are also methodological issues. Is the statement above, that "standardized approaches, comprehensive surveys, and more research into reporting accuracy are critical," true, or is sufficient precision unattainable? Regardless of the answer, the importance of longitudinal data structure is not diminished. Some structure for studying economic choices about nutrients is needed. The questions in this context are: What nutrition outcomes (e.g., regulation of weight, caloric intake, and essential nutrients) are the objects of choice? What are their prices, and how can the prices be captured in economic models?

Discussion: Federal Role and the Future of Obesity Research

The workshop provided an overview of current health economics research on the causes and consequences of the rise in obesity in the United States. An emerging economic explanation is that both the longrun trend of increasing body mass in the United States over the past century and the more rapid rise since the mid-1970s are related to technological changes that have reduced job strenuousness and increased the consumption of mass-prepared foods. Evidence was presented on some consequences of obesity, such as its impact on wages and insurance costs, as well as on what the rise in its prevalence and some of its potential causes imply for economic theory itself. The importance and challenges of better measurement of energy intakes and expenditures were discussed. Discussion of current work underscored the many questions on obesity that remain open for health economics research.

Future research should seek to consolidate the empirical foundations of consumers' decisionmaking behavior that forms the basis of economic models. These models assume that consumers recognize changes in technology and relative prices and understand how these changes affect the optimality of tradeoffs between short-term pleasure and long-term health. In particular, most models assume that individuals are rational and forward-looking. For instance, lower food prices may or may not induce individuals to raise their food consumption, depending on the importance they place on future health hazards associated with higher weight. However, do individuals fully consider the long-term costs of excessive weight gain when making their current choices? Or despite such knowledge, do individuals face a self-control problem in making appropriate choices? Evidence from behavioral economics suggests that, even if consumers rapidly absorb news about changes in relative prices of current consumption and future outcomes, they may not be able to exercise self-control. Further research should aim to quantify the prevalence of self-control problems in the population and to assess its role in eating and physical activity behaviors.

The behavioral economics framework may also be useful for thinking about the role of the asymmetry in energy balance on food intake and physical activity behaviors—that is, the ease of consuming additional energy vs. the difficulty of expending it. For example, suppose a moderate fast-food meal gives a consumer an extra 600 calories. The physical activity equivalent is approximately 2½ hours of walking, at 3 miles per hour. The opportunity cost of the energy expenditure exceeds the marginal monetary cost of the extra calories by far, unless the future costs of the extra calories and benefits of physical activity are accounted for. Whether consumers consistently account for such time-delayed costs and returns when faced with a current choice is a relevant question.

If the possibility of "irrational" consumer behavior is admitted in economic models, examining producer responses to "irrational" behavior would be worthwhile. For example, would increased marketing and promotion of

calorie-dense foods and increasing portion sizes be an optimal producer response when consumers face self-control problems? Evidence in this regard could influence ways in which public policy alternatives to address obesity are evaluated (Gruber and Mullainathan; 2002, Smith 2003). In the context of producer or industry response, another need is to better understand incentives for firms to supply healthier and less calorie-dense foods. Existing information disclosure policies need to be evaluated to see whether they discourage truthful health claims. At the same time, the response of the food industry to public education programs deserves further inquiry. If manufacturers counter public awareness and behavior modification campaigns by intensifying their advertising efforts, government intervention may not achieve the intended change in consumer behavior.

The extent to which consumers acquire and use information about emerging opportunities, as well as their degree of self-discipline, have been linked to levels of formal education. More-educated individuals may place a higher value on future consumption than present consumption and find choosing activities that carry lower health risks optimal. Education may also increase a person's ability to reassess prior choices in light of new information and accelerate his or her transition to a new optimum. In this context, identifying the aspect of a person's education that leads to variation in acquiring information and the speed of adjustment may be desirable. Indeed, whether formal education is a cause for this variation or whether a third factor, such as time preference, generates the correlation between educational attainment and the choice of body weight is not yet clear.

Consumers' knowledge of the nutrient content of the foods they eat, and of the short-term and long-term risks and benefits of drugs and dietary supplements, constitutes another area of future research. If lack of education in these areas leads individuals to make suboptimal decisions, how federally mandated food labeling regulations and laws regarding the promotion of weight loss products affect consumer choice remains to be shown. In particular, reducing the cost of information may allow consumers to adjust more swiftly to new circumstances.

The relative role of increasing energy intakes vs. the decline in physical activity in the rise in obesity remains a contentious issue. A common ground may be the position that a gradual decline in overall physical activity due to occupational and time-use changes contributed to an underlying long-term trend of increasing body size, and that changes in the amounts and composition of foods have contributed to the more rapid rise of the last two decades. Resolving the energy intake-expenditure split is important in deciding whether policy interventions should focus on food intakes or physical activity.

Disaggregating caloric intake into macronutrient classes (protein, carbohydrates, and fats) also seems worthwhile. Substantial recent attention has focused on this division of caloric intake and its implications for weight gain. According to aggregate production data, consumption of carbohydrates has increased by 28 percent in the past two decades and protein consumption by 18 percent, while fat consumption has increased by only 9 percent. Whether this change in food mix has led to increased weight remains to be investigated.

Another issue concerns the wide disparities in obesity prevalence across demographic groups, as well as the way income affects obesity within demographic groups. For example, while obesity is generally believed to be inversely related to income, data show that body weight may have an inverted U-shaped relationship with income among men. Why these disparities arise is important for resolving questions like the potential coexistence of food insecurity and obesity, as well as for estimating the effect of Federal food assistance programs on obesity.

Future research could seek to identify other potential factors in the rise in obesity, such as smoking cessation campaigns, which may have led successful participants to give up a widely available appetite suppressant; advances in medicine, which may have attenuated the adverse health consequences of obesity by improving both patients' quality and quantity of life; and changing manufacturing patterns in the food industry, which may have made healthy foods more expensive relatively to high-calorie foods with poor nutritive value. Further research is also needed to clarify the direction and magnitude of the effect of food assistance programs on obesity. The effectiveness of nutrition education components in existing programs needs to be assessed, with a view to considering whether further nutrition education investments would be useful.

Future research is also needed on the role of government intervention in addressing the rise in obesity. The presence of externalities is often invoked to justify government intervention. For example, if health care expenditures for the obese are higher than for those of normal weight, obesity prevalence will be socially excessive, unless the cost differential is reflected in weight-specific insurance premiums. Yet whether this externality warrants government intervention, other than allowing insurers to discriminate among enrollees by weight is not clear. Further research should identify circumstances under which private companies cannot internalize externalities and when the government should assist market participants to facilitate coordination and avoid social inefficiencies.

Finally, the unintended consequences of existing government programs should be investigated more closely. This investigation would pertain both to programs that affect food intake, such as measures that effectively tax or subsidize the producers and consumers of food, and to those that affect calorie expenditure, ranging from urban planning to laws regarding the design of workplaces and the regulation of leisure activities. A major area of government regulation is its role in food and drug safety. More research is needed to help minimize obstacles to innovation in the fields of nutrition, food science, and pharmacology to develop solutions to obesity.

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2003 The Economics of Obesity Workshop

April 22, 2003 • Economic Research Service • USDA • Washington, DC

Food Assistance and Nutrition Research Program

Mission: Research for a Healthy, Well-Nourished America

Economic Research Service
U.S. Department of Agriculture

The Economics of Obesity

A Workshop Organized by the Economic Research Service, USDA, the Irving B. Harris Graduate School of Public Policy Studies, and the George J. Stigler Center for the Study of the Economy and the State, University of Chicago

Waugh Auditorium, 3rd Floor
Economic Research Service, USDA
1800 M Street, NW, Washington, DC 20036-5831

8:00–8:30 a.m.
Continental Breakfast

8:30–9:00 a.m.
Welcome and Introduction

Betsey Kuhn . . . . . Director
Food & Rural Economics Division, ERS, USDA

Susan Offutt . . . . . Administrator
ERS, USDA

Tomas Philipson . . . . . University of Chicago

9:00–10:30 a.m.
Causes of the Growth in Obesity

Fred Kuchler . . . . . Moderator
ERS, USDA

Why Have Americans Become More Obese?
David M. Cutler . . . . . Harvard University

The Growth of Obesity and Technological Change
Tomas Philipson . . . . . University of Chicago

Pauline Ippolito . . . . . Discussant
Federal Trade Commission

10:30–10:45 a.m.
Coffee Break

10:45 a.m.–12:15 p.m.
Causes of the Growth in Obesity

Betsy Frazao . . . . . Moderator
ERS, USDA

An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System
Michael Grossman . . . . . National Bureau of Economic Research

Maternal Employment and Overweight Childern
Patricia Anderson . . . . . Dartmouth College

Alok Bhargava . . . . . Discussant
University of Houston

12:15–1:15 p.m.
Lunch

Program Agenda

1:15–2:45 p.m.

Consequences of the Growth in Obesity

Biing Hwan-Lin . . . . . .Moderator
ERS, USDA

The Labor Market Impacts of Obesity

John Cawley . . . . . .Cornell University

Health Insurance: Obesity and its Economic Costs

Jay Bhattacharya . . . . . .Stanford University

Darius Lakdawalla . . . . . .Discussant
RAND Institute for Civil Justice

2:45–3:00 p.m.

Coffee Break

3:00–4:30 p.m.

Implications for Theory and Practice

Craig Gundersen . . . . . .Moderator
ERS, USDA

Obesity and Nature's Thumbprint: How Modern Waistlines Can Inform Economic Theory

Trent Smith . . . . . .University of Bonn

Methods of Surveying Diet and Physical Activity

Richard Forshee . . . . . .Virginia Tech University

Parke Wilde . . . . . .Discussant
ERS, USDA

4:30–5:00 p.m.

Federal Role and Future of Obesity Research

David Smallwood . . . . . .Moderator
ERS, USDA

Jay Variyam . . . . . .Discussant
ERS, USDA

Pauline Ippolito . . . . . .Discussant
Federal Trade Commission

Tomas Philipson . . . . . .Discussant
University of Chicago

5:00 p.m.

Conclusion

Food Assistance and Nutrition Research Program

Mission: Research for a Healthy, Well-Nourished America