The Economics of Obesity

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During the past three decades in the United States, many indicators of population health such as life expectancy, the prevalence of smoking, and drug and alcohol use among youths improved significantly.[1] In stark contrast to these trends, over the same period the United States also experienced a doubling of the prevalence of obesity, which is defined as a body mass index (BMI) of greater than or equal to thirty, which corresponds to a weight of 221 pounds for someone six feet tall. As of 2009 to 2010, more than one-third of adult Americans are obese.[2] The United States is not alone; many countries worldwide have experienced a significant increase in obesity, and the World Health Organization estimates that 2.8 million people die each year as a result of excess weight.[3]

This has led to considerable debate about the causes and consequences of obesity and what can be done to prevent and treat it. Answering these questions is complicated because in many cases researchers cannot conduct randomized experiments: it would be unethical to experimentally manipulate individuals' weight. For this reason the empirical methods of economics, particularly the attention to issues of selection and omitted variables, are especially useful for identifying causal effects.

My primary research interest is the economics of risky health behaviors, in particular the economics of obesity. In a series of studies, my co-authors and I have investigated the economic causes and consequences of obesity and evaluated policies and programs to improve diets and increase physical activity. This research summary provides an overview of several recent projects and findings. A broader review of the economics of risky health behaviors that I co-authored with Christopher Ruhm is also available.[4]

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Measurement and Trends

An important limitation of BMI, the standard measure of fatness in epidemiology, is that it does not distinguish fat from lean mass: it simply measures weight for height. A study that I conducted with Richard Burkhauser[5] found that BMI, relative to more accurate measures of fatness such as percentage of body fat, misclassifies substantial percentages of individuals as obese and non-obese. BMI tends to be less accurate at classifying men (among whom there is more variation in muscularity) than women. The use of BMI also results in biased estimates of health disparities; the black-white gap in obesity among women is only half as large if one defines obesity using percentage of body fat rather than BMI. Moreover, the timing of the rise in obesity is sensitive to the measure of fatness used; Richard Burkhauser, Max Schmeiser and I find that if one uses skinfold thickness rather than BMI to define obesity then the rise in obesity becomes apparent 10 to 20 years earlier, which suggests that more gradual or long-run influences may be responsible.[6] It also suggests that the rise in BMI might have been detected earlier, and public health responses initiated sooner, if epidemiological surveillance had not relied so exclusively on BMI. Although many social science datasets continue to collect only self-reported weight and height, some innovative surveys such as the Health and Retirement Study (HRS) and the Household, Income and Labour Dynamics in Australia (HILDA) Survey are collecting additional measures of fatness such as waist circumference.

Economic Causes and Consequences of Obesity

Many theories have been advanced to explain the rise in obesity. To measure the extent to which income affects obesity, John Moran, Kosali Simon, and I exploit the natural experiment of the Social Security Benefits Notch.[7] The Notch is the result of a legislative accident that created variation in retirement income that was large, unanticipated, and beyond the control of the individual, making it a suitable instrument. We estimate models of instrumental variables (IV) using data from the National Health Interview Survey and find little evidence that income affects weight. The small effects are precisely estimated: for a permanent $1,000 increase in Social Security income (in 2006 dollars) our confidence intervals rule out a change in weight of more than 1.4 pounds in either direction for men or women.

Understanding the consequences of obesity is important for evaluating calls for government intervention and for measuring the cost-effectiveness of treatment and prevention programs. One important

potential consequence of obesity is higher medical care costs. Fat releases hormones that lead to insulin resistance and damage the cardiovascular system, with the result that obesity is associated with a wide variety of health conditions such as diabetes, heart disease, and cancer. Previous studies estimated the correlation of obesity with medical care costs, which is difficult to interpret because weight may be correlated with important unobserved factors (such as socioeconomic status) and there may be reverse causality (an expensive back injury may lead to weight gain). To estimate the causal effect of obesity on medical care costs, Chad Meyerhoefer and I exploit the heritable component of weight as a natural experiment.[8] The identifying assumption is that the similarity in weight of biological relatives is caused by genetics rather than shared environment, an assumption that is supported by a large number of studies in genetics. We estimate the IV model using data from the Medical Expenditure Panel Survey, and the results indicate that obesity raises medical costs by $2,741 per obese individual (in 2005 dollars). This is higher than the non-IV estimate because the IV method corrects for both the endogeneity of weight and reporting error in weight. Medical costs are much greater for those whose weight places them well above the threshold for obesity than for those who are only slightly obese. Thus obesity is a heterogeneous category, with much of the medical costs occurring among a small percentage of individuals with extremely high BMI. The results imply that obesity-attributable medical costs for non-institutionalized adults in the United States totaled $190.2 billion in 2005, or 20.6 percent of national health expenditures. These estimates suggest that the magnitude of the obesity-related externalities imposed through public and private health insurance is greater than previously appreciated, and that historically the cost-effectiveness of methods of preventing and treating obesity may have been underestimated.

Given the effect of obesity on health, one would expect obese individuals to experience worse labor market outcomes than non-obese individuals. To estimate the effect of weight on wages, I estimate models of instrumental variables that exploit the heritable component of weight as a natural experiment using data from the National Longitudinal Survey of Youth (NLSY) 1979 Cohort.[9] I find that weight lowers wages for white females: an increase in weight of two standard deviations (roughly 64 pounds) is associated with 9 percent lower wages. In general, the labor market consequences of obesity are greater for women than for men, and greater for white females than for other females. Based on the NLSY data, it is impossible to say whether the labor market consequences of obesity are the result of relatively worse health impairing productivity, or to employer discrimination, but other studies suggest that discrimination plays an important role.

Some occupations and industries are more affected by employee obesity than others. For the military, fitness is an important job requirement and thus rising obesity is a particular concern. Johanna Catherine Maclean and I examine data from the National Health and Nutrition Examination Surveys and find that the percentage of age-eligible civilians who exceed the U.S. Army's weight-for-height requirements more than doubled for men and tripled for women between 1959 and 2008.[10] Excess weight is now the primary reason that applicants to the military are rejected, and a coalition of retired generals and admirals has called obesity a threat to military readiness.

Policies to Prevent or Reduce Obesity

There are a staggering number of policies and programs to prevent and reduce obesity, and an important contribution that economists can make is to evaluate these programs' effectiveness. For example, the Centers for Disease Control, the American Academy of Pediatrics, and the Institute of Medicine have called for increases in physical education (PE) for school children, despite a lack of evidence that it has any impact on youth weight. To assess how PE affects youth physical activity and obesity, Meyerhoefer, David Newhouse and I exploit variation across states in PE requirements.[11] To minimize the risks of policy endogeneity or unobserved heterogeneity biasing the results, we control for a host of state characteristics, such as the prevalence of adult obesity, the socioeconomic status of residents, and resources provided to public schools. Using data on high school students from the Youth Risk Behavior Surveillance System (YRBSS) we find that increasing PE requirements increases physical activity among girls (not boys) but has no detectable effect on weight.

To complement that study of high school students, Meyerhoefer, David Frisvold and I estimate the impact of PE on elementary school children using data from the Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K).[12] The results of the IV model that exploits variation over states and time in PE requirements indicate that an additional 60 minutes per week spent in PE reduces the probability of obesity in fifth graders by 4.8 percentage points. There is no significant effect in earlier grades, which could be attributable to differences in PE curriculum, variation of the treatment effect with age, or to several states instituting substantial PE requirements before the fifth grade wave, increasing the power of the instrument. Taken together, the results suggest that increasing PE requirements increases physical activity and decreases the risk of obesity for certain subgroups, but not for all students. However, the limitations of BMI are relevant here. The YRBSS and ECLS-K datasets contain only height and weight, but no information about body composition. It is possible that increased PE requirements increase muscle mass and decrease fat mass, with little net effect on weight.

An innovative approach is to offer obese individuals financial rewards for weight loss. Insurance companies may face lower claims and employers may experience lower job absenteeism and higher productivity if their enrollees or employees lose weight; as a result, these organizations are increasingly seeking a win-win solution by offering overweight

individuals financial rewards for weight loss. In addition, people with time-inconsistent preferences may be willing to put their own money at risk, hoping that loss aversion will provide them with incentives to lose weight in order to get the money back. To evaluate the effectiveness of these approaches, Joshua Price and I examine outcomes in a workplace wellness program that offers financial rewards and deposit contracts for employee weight loss.[13] Interesting features of this program include its large sample size (2,635 workers across 24 work sites) and long duration (one year). We find that attrition in this program is high: 42.9 percent dropped out by the end of the first quarter, and 68.0 percent by the end of the year-long program. We find modest results in the program. Those offered financial rewards for weight loss have no higher year-end weight loss than those in the control group, and those who make deposit contracts have year-end weight loss that is roughly two pounds greater than that of the control group after adjusting for attrition. An important next step is to determine the optimal structure of such programs, such as the most cost-effective size of financial reward, what should be rewarded (loss of pounds, loss of fat, increase in physical activity), the optimal number and timing of measurements of progress, whether group challenges can be designed to create beneficial peer effects, and how to avoid creating incentives for the use of unhealthy methods of weight loss.

Discouraged by failed attempts at weight loss through dieting and exercise, substantial percentages of Americans have taken over-the-counter (OTC) weight loss products. There is very little, if any, evidence suggesting that these products are effective, and some have potentially fatal side effects. Rosemary Avery, Matthew Eisenberg and I study the impact of exposure to advertising on the probability of consuming such products using data from the Simmons National Consumer Survey merged with data on magazine and television advertising.[14] We measure the extent to which advertisements are deceptive using detailed guidelines developed by the Federal Trade Commission for this specific market. To address the targeting of ads, we control for each magazine read and each television show watched, and we identify the effect of exposure to advertising using changes over time in the number of ads within individual magazines and shows. We find little evidence that advertising of OTC weight loss products expands the size of the market. Instead, advertising seems to be a way to battle for market share.

Future Directions

Given the scarcity and low quality of data on calories consumed and calories expended, it may never be possible to affirm with any degree of certainty the percentage of the rise in obesity attributable to specific factors. However, it will continue to be important to exploit natural experiments in order to determine the extent to which economic variables such as food prices, income, and technological change affect the risk of obesity, and to estimate the various economic consequences of obesity. Measuring the effectiveness, and calculating the cost-effectiveness, of anti-obesity programs and policies will help ensure that the public and private sectors get the biggest "bang for the buck" from their expenditures on obesity prevention and treatment.

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[13] *J. Cawley and J.A. Price, "Outcomes in a Program that Offers Financial Rewards for Weight Loss," NBER Working Paper No. 14987, May 2009, and published as chapter 4 in* Economic Aspects of Obesity, *M. Grossman and N. Mocan, eds., Chicago, IL: University of Chicago Press, 2011, pp. 91–126. See also J. Cawley and J.A. Price, "A Case Study of a Workplace Wellness Program That Offers Financial Incentives for Weight Loss,"* Journal of Health Economics, *32(5) (2013), pp. 794–803.*

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Public Sector Retirement Plans

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Public sector pension plans and retiree health plans have been front page news during the past decade. While the popular press has focused almost exclusively on the underfunding of these plans, economic research has examined how these plans affect state and local budgets, intergenerational equity, and the behavior of public employees. Public employees account for 14 percent of the labor force and employee benefits comprise about 35 percent of the employment cost of public employees.[1] Thus, a clear understanding of the cost and benefits of pension and health plans is central to understanding this sector of the U.S. economy. Along with colleagues, I have examined the labor market effects of public pension plans and retiree health plans. The following describes my research on primary pension plans, retiree health plans, and supplemental retirement plans offered by state and local governments to their employees.

Public Pension Plans

I began my research on public pension plans through a study of the historical origins of retirement plans in the United States. In order to consider current retirement policies, it is important to understand when public sector retirement plans were established, why they were made more generous in the last quarter of the twentieth century, and what human resource objectives they are trying to achieve. The earliest retirement plans can be found in the public sector, dating at least from the early Roman Empire. The first public pension plans in North America were those established in the English colonies which provided benefits for the members of their local militias. During the earliest stages of the Revolutionary War, the Continental Congress established a retirement plan for its naval officers and enlisted sailors. The plan was funded primarily from booty seized on the open seas. (Later a plan was created for the Continental Army.) The history of the Navy Pension Fund offers an interesting narrative of the management of early pension funds, including periodic benefit increases, which ultimately led to the fund's exhaustion and a subsequent U.S. Treasury bailout. This fund was revived and prospered during the Civil War and was eventually rolled into the federal government's pension system for Union veterans and later military plans for "regular" army and navy personnel. At the local level, larger municipalities established pension plans for their police officers, firefighters, and teachers during the late nineteenth century.[2]

By the first decade of the twentieth century, a few states offered plans for public school teachers, but the first pensions for general (that is, non-teacher) state employees were established in the 1910s; however, only after the enactment of Social Security did most states begin to establish retirement plans for their employees, with the last state plan being implemented in the 1960s. Initially, employer-provided pension plans were the only retirement plans available to public employees, because public employees were excluded from the Social Security system until the 1950s. Through the middle of the century, except for several of the country's larger cities, local teacher plans were consolidated into state-managed plans, and in about half of the states, teacher plans merged with plans covering general state employees. By the 1970s, public sector plans had matured and covered most full-time state and local employees.

These early public sector plans were almost exclusively defined benefit plans, providing life annuities to retired public employees. The last quarter of the twentieth century saw public employers increasing the generosity of their plans[3] by: increasing the multiplier for benefits

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Cawley's research concerns the economics of risky health behaviors, with a focus on the economic causes and consequences of obesity and economic approaches to obesity prevention and treatment. He serves on the editorial board of *Health Economics,* is the former co-editor-in-chief of *Economics & Human Biology,* and edited the *Oxford Handbook of the Social Science of Obesity*.

Cawley received his A.B. in Economics from Harvard College in 1993 and his Ph.D. in Economics from the University of Chicago in 1999. Before joining Cornell, he spent two years as a Robert Wood Johnson Foundation Scholar in Health Policy Research at the University of Michigan.

Cawley lives in Ithaca, New York with his wife (and colleague) Rachel Dunifon and their two sons. In his spare time, he enjoys watching hour-long TV dramas with his wife and trying not to cheer too loudly at his sons' soccer games.

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Clark lives in Cary, North Carolina with his wife Mary Kathryn; however they spend their summers at their home at the base of the Grand Tetons in Jackson, Wyoming. He enjoys long hikes through the canyons and observing the moose, elk, bears, deer, and fox he encounters on the trails or as they visit his yard.