

# The Growth in Obesity and Technological Change

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## 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)<sup>2</sup>) 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.