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Journal of Biosocial Science / Volume 36 / Issue 02 / March 2004, pp 209 - 219
DOI: DOI:10.1017/S0021932003006205, Published online: 17 February 2004

J. biosoc. Sci. (2004) **36**, 209–219

DOI: 10.1017/S0021932003006205

OBESITY AND THE RATE OF TIME PREFERENCE: IS THERE A CONNECTION?

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Summary. It is hypothesized that recent trends in US and worldwide obesity are, in part, related to an increase in the marginal rate of time preference, where time preference refers to the rate at which people are willing to trade current benefit for future benefit. The higher the rate of time preference, the larger is the factor by which individuals discount the future health risks associated with current consumption. Data from the United States, as well as international evidence, suggest that a relationship between these two variables is plausible. The authors encourage researchers to explore the possible link between obesity and time preference, as important insights are likely to result.

Introduction

That obesity worldwide has increased recently is well known (Popkin & Doak, 1998; Flegal *et al.*, 1998; Mokdad *et al.*, 1999; Philipson 2001). Obesity raises the risk of heart attack and diabetes and decreases both labour productivity and life expectancy (Colditz, 1992; Allison *et al.*, 1999). Obesity is also associated with reduced earnings among women (Pagan & Davila, 1997) and lower wealth (J. Zagorsky, unpublished). The economic costs of obesity are substantial: in Germany, for example, the annual costs attributable to obesity are on the order of US$10 billion (Bergmann & Mensink, 1999). In the US, obesity is second only to tobacco consumption as a cause of death that could be prevented by behavioural changes (McGinnis & Foege, 1993).

Biologically, the cause of weight gain is uncontroversial: all animals gain weight if they take in more calories than they expend. Humans gain approximately one pound of fat for every 3500 kilocalories net intake. However, the hypothesized causes of recent increases in the prevalence of obesity are controversial and consequently policy recommendations to combat it are unclear.

Several economists argue that technological change has led to increasing rates of obesity by simultaneously lowering the relative price of food and reducing the amount of physical activity required at work and in daily activity (Philipson & Posner, 1999;

Philipson, 2001; Lakdawalla & Philipson, 2002; Cutler *et al.*, 2003). While agreeing that technological change is an important cause of the rise in obesity, the authors suggest that a complementary factor bears further investigation. It is hypothesized that an increase in the rate of time preference also contributes to the obesity epidemic. Time preference refers to the rate at which people are willing to trade current benefit for future benefit and is used in economics to explain savings and investment behaviour. Various social, cultural and psychological factors influence a person's time preference. One aspect of weight control requires one to forego current consumption in order to gain future potential health benefits, so the rate at which future benefits are discounted will bear directly on the individual's current food consumption decisions. As Offner (2001) notes: 'for weights to rise, it was necessary for people to prefer the immediate gratifications of eating, to the delayed ones of normative appearance,' (p. 84). Similarly, exercise requires the expenditure of time (with its associated opportunity costs) and effort today for the sake of potential future health benefits. Exercise may also require monetary investment (e.g. joining a health club), because jobs are much less physically demanding now than in the past. Taken together, a higher rate of time preference will, *ceteris paribus*, lead to less investment in exercise and greater caloric intake, resulting in weight gain and increased obesity.

The next two sections present this theory in detail. Preliminary empirical evidence using aggregate data is then offered to suggest that the hypothesized relationship between the rate of time preference and obesity is plausible and merits further investigation. Indeed, it is recognized that currently there is not sufficient evidence to rigorously test the role of time preference in the obesity epidemic. The goal of this paper is to propose that the economic theory of time preference may help explain recent trends in obesity. It is hoped that researchers will be encouraged to develop better measures of time preference and incorporate the role of time preference in comprehensive models of obesity.

Hypothesis: a relationship between impatience and obesity

The marginal rate of time preference, σ, is a measure of the rate at which a person is willing to trade current pleasure for future pleasure. The concept of time preference reflects the degree of impatience of an individual, or collectively, of a society. Economists refer to the satisfaction obtained from consumption as 'utility', and the intertemporal discount rate $(1/(1+\sigma))$ is used to calculate the present value of future utility. Thus, the higher is time preference (σ), the lower is the value of future utility, and the greater is the impatience of the individual. An individual with no time preference values utility now as much as utility later. Their $\sigma = 0$ so their discount rate equals 1, making consumption in the future yield the same satisfaction as consumption today. In contrast, a person who does not value future utility at all $(\sigma = \infty)$, has a discount rate of 0. Utility in the future is worth nothing to this person; only current utility matters. Thus, an increase in time preference (σ) implies that individuals value future utility less than they did previously.

The significance of the rate of time preference in health outcomes has been amply recognized, but its connection to obesity has largely remained unexplored. Grossman

(1972) first used the concept of time preference to analyse health choices, basing his work primarily on the theory of investment in human capital (Becker, 1964). According to Fuchs (1986, 1991), differences in the rate of time preference can help explain variations in a number of health-related choices, such as smoking, diet and exercise. Ehrlich & Chuma (1990) predict that higher rates of time preference lead to lower demand for longevity and less investment in health. Bishai (2001) reports evidence that lower rates of time preference are associated with lower alcohol consumption among adolescents. Blaylock *et al.* (1999) assert that American dietary habits suffer despite extensive information on the relationship between health and nutrition, because Americans discount the future heavily. Levy (2002) presents a model of weight that incorporates the rate of time preference and demonstrates theoretically that the utility maximizing equilibrium weight may exceed the medically optimal weight.

In contrast, Becker & Mulligan (1997) reverse the causation and argue that differences in health bring about differences in the rate of time preference. Healthy people expect to live longer and to be able to enjoy utility well into the future. Those with poor health do not expect to live as long, making the sacrifice of current utility in favour of future utility less attractive. Because obesity lowers life expectancy, the Becker–Mulligan model implies that its prevalence would raise the rate of time preference.

Is there any reason to think that the marginal rate of time preference has increased? The increase in legal gambling in the US over the past three decades suggests a shift towards immediate gratification, and thus an increase in time preference (National Gambling Impact Study Commission, 1999). Blaylock *et al.* (1999) note that personal savings in America have fallen and that credit card debt has risen, which also suggest rising time preference. Parker (1999) documents the decline in personal savings since 1980, as well as the decline in private savings and the rise in personal consumption as a percentage of GDP. He investigates the possible causes of rising consumption and reduced savings and concludes that the prime candidates are 'factors that increase the effective discount rate' (p. 32).

An increase in the discount rate may be related to large government transfers to the elderly (social security, Medicare) and to low-income households. It could also result from technological advances, which have increased the speed of delivery of goods and services, and have thus raised our expectations for quick satisfaction. Advertising strategies and increased communication capabilities may also contribute by encouraging impatience and immediate gratification, and convincing consumers that larger meal portions of food are a good economic value. Furthermore, advances in medical technology may have increased expectations for future cures and raised life expectancy to such a high age that the perceived marginal benefit of extending life further (by improved nutrition and exercise) is diminished.

Theoretical considerations

In order to consider the role of time preference in a typical consumer's maximization of lifetime utility (U), assume that U is a function of the consumption of goods and services (C) and health status (H). The latter depends on initial health endowments,

investments in health (I) and past levels of health (H_{t-1}). Health investments include monetary expenditures on health-enhancing goods and services, such as preventative care and exercise equipment, and foregone current utility associated with health-enhancing choices, e.g. skipping high calorie desserts and watching less TV.

Consumers are assumed to choose a time path of consumption and health investment over their lifetime (from time 0 to time T) so as to maximize lifetime utility, given their marginal rate of time preference (σ) (note: Bleichrodt & Gafni (1996) argue that the discount rate is not linear, and that it is higher for more distant years. Their focus is on analysing health policy rather than the incidence of particular diseases.):

$$U_{\max} = \int_0^{\mathrm{T}} \mathrm{e}^{-\sigma t} U\{C_t, H_t(H_{t-1}, I_{t-1})\}\, \mathrm{d}t, \tag{1}$$

subject to a lifetime budget constraint:

$$\text{Present value of lifetime income} = \int_0^{\mathrm{T}} \mathrm{e}^{-rt}(P_{\mathrm{c}t}C_t + P_{\mathrm{I}t}I_t), \tag{2}$$

where $0 \leq \sigma \leq 1$ and $\mathrm{e}^{-\sigma t}$ represents the 'rate of decay' of future utility, r is the market interest rate, P_{c} is the price of consumption, and P_{I} is the price of health investment. Consumers are assumed to be heterogeneous, so that σ varies across individuals and does not necessarily equal the market interest rate (r), as it would if all individuals were identical.

Persons with higher rates of time preference assign lower weights to future consumption and health and thus allocate more of their income to current consumption. In each time period, the utility from consumption C is immediate, whereas the utility derived from health investment occurs in subsequent time periods. Thus, people tend to consume (C) at a higher rate and invest in health less, the higher their rate of time preference. As a population's rate of time preference rises, so will expenditure on non-health-related consumption, whereas expenditure on health investment decreases. Thus, the hypothesis is that one possible cause of rising rates of obesity is a rise in the marginal rate of time preference. (The model could be adapted to account for the uncertainty associated with the health benefits that result from health investment by making H a stochastic function of I.)

If time preference is increasing, why then is significant spending on exercise equipment and health club memberships observed? A major factor motivating people to make such purchases is that they are currently overweight. Their previous choices, influenced by their marginal rate of time preference, have led them to the predicted outcome of excess weight. Furthermore, such purchases may yield some immediate gratification ('I may be overweight, but now I'm a member of a health club!'). However, what matters to body weight is not just whether one buys exercise equipment or joins a health club, but whether one regularly uses such equipment. Health investment (I) is not just the monetary costs of exercise equipment and health club memberships; it also involves the opportunity cost of spending time exercising. People with high time preference will quickly give up on exercising, rarely using their home or health club equipment. Thus, the hypothesized relationship between obesity

and time preference is consistent with the observed paradox of increased obesity over a period of brisk sales of exercise equipment, health club memberships and other weight-loss programmes.

Preliminary empirical evidence

In spite of the considerable importance of the rate of time preference in the theory of intertemporal decision-making, the empirical evidence on the marginal rate of time preference is controversial (Gafni, 1995; Barsky *et al.*, 1997). Two general empirical approaches have emerged: estimation of modelling equations (Euler-equations) using consumption and savings data (e.g. Lawrance, 1991; Samwick, 1998) and survey questionnaires that ask respondents to make hypothetical financial or health trade-offs (e.g. Fuchs, 1986, 1991; Johannesson & Johnansson, 1997). The first approach requires identifying restrictions, for example perfect capital markets, and assumptions about functional form and interest rate levels. The survey approach is subject to the usual problems: sensitivity to the wording of questions and non-response. In addition, good estimates require that survey respondents can predict accurately how they would respond in a variety of hypothetical situations. Further complications for all approaches involve the difficulty of distinguishing time preference from the interest rate and risk preferences.

Given the difficulties associated with the estimation of the marginal rate of time preference, it is not possible to do more at this time than to use some simple proxies to examine the plausibility of the hypothesized relationship. Specifically, the savings rate and consumer debt are used as indicators of the rate of time preference. Both are related to the degree of consumers' impatience, or the relative preference for current as opposed to future consumption (utility). Lower savings rates and greater debt suggest a higher rate of time preference; people are willing to incur debt in order to finance current consumption at the expense of future consumption. Shortcomings of this approach are that these proxies are influenced by factors other than the rate of time preference and that debt includes expenditure for the accumulation of human capital.

Following the medical literature, obesity for adults is defined as having a body mass index (BMI = weight (kg)/height^2 (m)) ≥ 30 (National Center for Health Statistics, 2000). Figure 1 uses this definition and the results from the five waves of the National Health and Nutrition Examination Study (NHANES) surveys to compare trends in the prevalence of obesity and the personal savings rate in the US (The Bureau of Economic Analysis reports the personal savings rate at www.stls.frb.org/fred/data/gdp/psavert). The obesity statistics pertain to adults between the ages of 20 and 74. Because weight gain is likely to lag changes in time preference, Fig. 1 shows current obesity prevalence and the previous period's savings rate. Between the early 1970s and 1980 the rates of obesity and the previous period's savings both rose, even if slightly, contrary to this study's hypothesis. However, thereafter the savings rate fell while the prevalence of obesity increased – at first marginally, but then by the 1990s very substantially. From the 1970s until the end of the century the obesity rate increased by some 112%, while the personal savings rate fell by 83%. Thus, the trends of the past few decades are consistent with the hypothesis. (Similar results are obtained when the ratio of real savings to disposable

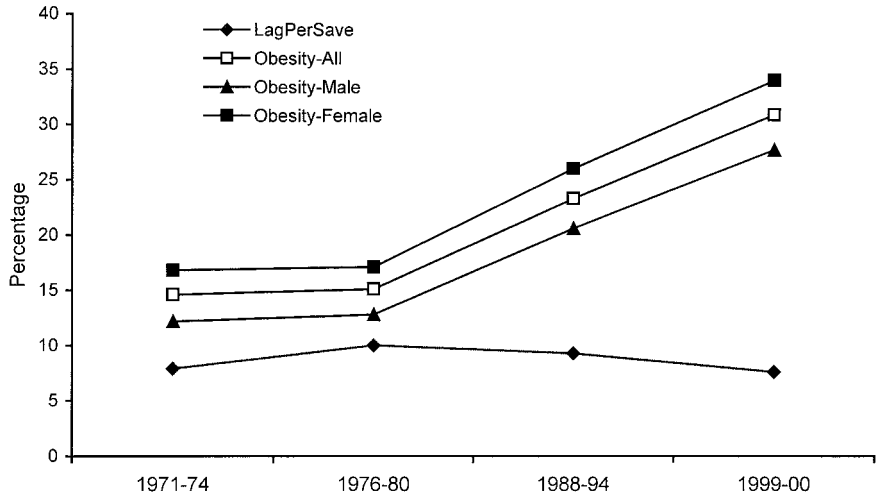

Fig. 1. Trends in obesity prevalence and lagged personal savings. Sources: NHES I (1960–62); NHANES I (1971–74); NHANES II (1976–80); NHANES III (1988–94); NHANES 99/00 (1999–00).

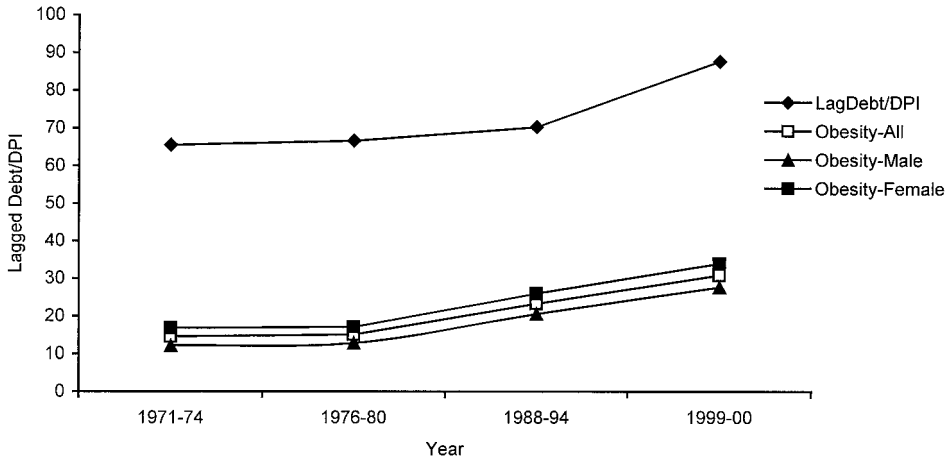

Fig. 2. Trends in obesity prevalence and lagged debt-to-income ratio. Sources: as Fig. 1.

personal income reported by the Federal Reserve Bank of Philadelphia is used: www.phil.frd.org/src/cf/backgrounddata4.htm.)

The trend in lagged private consumer debt, measured as the ratio of household debt to disposable income (Debt/DPI), is also consistent with the hypothesis (Fig. 2). Consumer debt increased from the 1960s to the end of the century, as did obesity rates, with both variables accelerating simultaneously in the 1980s and 1990s. (Similar results are obtained when the ratio of real household debt to real disposable

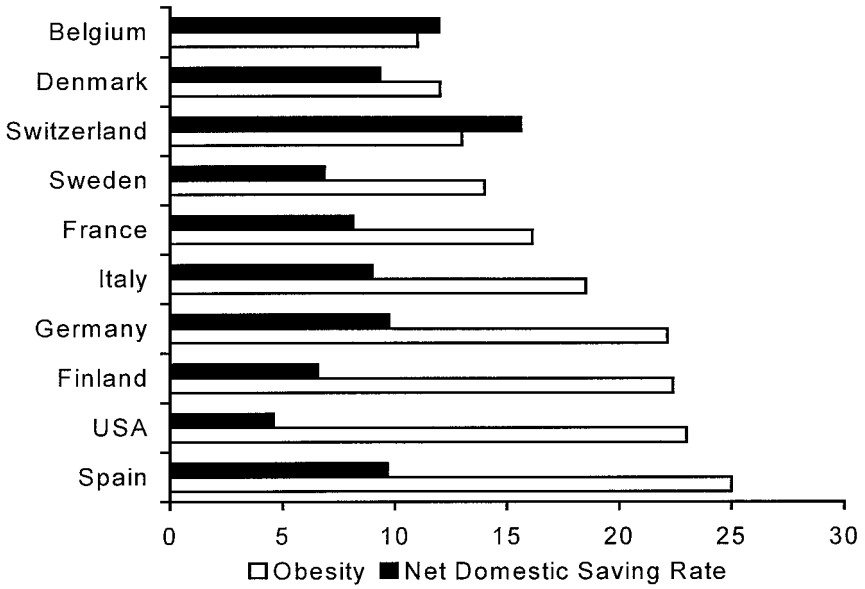

Fig. 3. International comparison of female obesity rates and saving rates.

income (RealDebt/DPI), also reported by the Federal Reserve Bank of Philadelphia, is used.)

Next, international cross-sectional evidence on the relationship between rates of time preference, proxied by savings rates, and obesity is considered. If obesity is positively related to the rate of time preference, as hypothesized, then obesity would be more prevalent in nations with lower savings rates. Figures 3 and 4 compare the prevalence of obesity by gender (Molarius *et al*., 2000) and net domestic savings as a percentage of GDP for a number of developed countries over the period 1989–96. (Data on net domestic savings as a percentage of GDP are from the *World Development Tables*.) While the inverse relationship between the two variables is by no means perfect, it is, nonetheless, suggestive that countries with low savings rates, such as Finland, Spain and the US, have some of the highest obesity rates. The US has the lowest net domestic saving rate (4·6%) and one of the highest obesity rates (among both genders). Conversely, Switzerland and Belgium have the highest net domestic savings rates and their obesity rates are about half that of the US.

Discussion

Insurance companies, employers, governments and health maintenance organizations, as well as individuals, must bear the significant financial burdens associated with obesity. The obese face significant social, psychological and cultural biases as well. Because the financial and social costs of obesity are high an economic approach to its study is warranted. This paper hypothesizes that there may be a positive

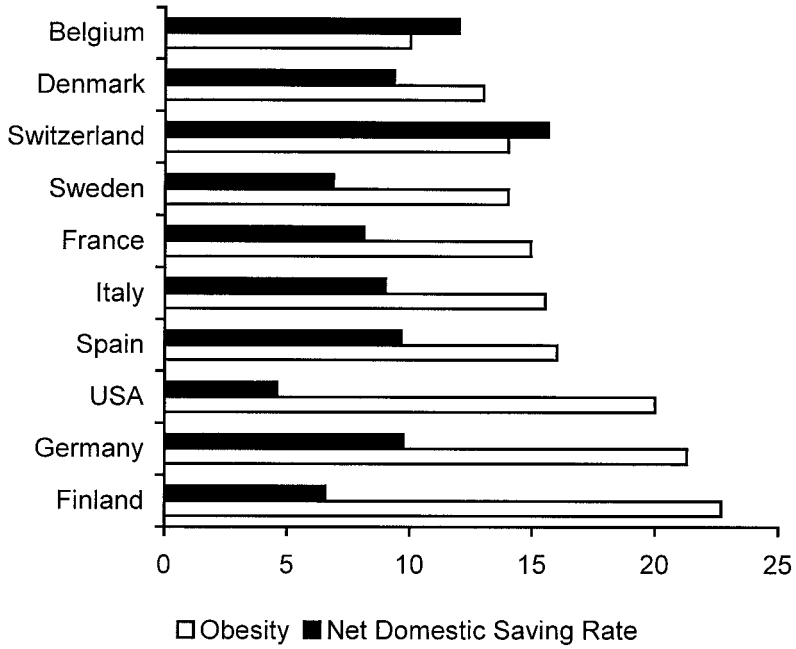

Fig. 4. International comparison of male obesity rates and saving rates.

relationship between the rates of time preference and obesity. Individuals with high rates of time preference will consume more high-calorie foods and non-physically active leisure pursuits at the expense of lower levels of health and utility in the future.

Both US time series data and international cross-sectional data indicate that the hypothesis linking obesity and time preference is plausible. Obviously, more research and better data are needed to rigorously test this model. At the moment parallel trends and causal relationships cannot be distinguished. Nor can it be determined if some unknown factor is simultaneously driving both the rates of time preference and obesity. Above all, better estimates of the marginal rate of time preference are needed, not only for the society as a whole, but also by groups within a society, e.g. by gender and income levels. Such estimates might help explain some perplexing patterns in obesity, such as the strong negative relationship between socioeconomic status and obesity among women in developed societies, a relationship that does not hold for men (Fulwood *et al.*, 1981; Sobal & Stunkard, 1989).

The international cross-sectional evidence is less compelling, but there are many additional cultural and economic factors, such as the rate of taxation and savings subsidies, that influence these variables across different institutional settings for which this analysis does not control. Also, many psychosocial and political influences render the international comparisons difficult. Nonetheless, the international evidence suggests that the rate of time preference may at least play a role in the recent global epidemic of obesity (Ulijaszek, 2003). Development of internationally comparable

estimates of the marginal rate of time preference would greatly improve examination of the possible relationship between this variable and a variety of health outcomes.

An increase in the rate of time preference is certainly not the only cause of obesity. The authors concur with the complementary theory that technological change has also had a significant impact on the propensity to become overweight. Nonetheless, the evidence presented here suggests that a rise in the marginal rate of time preference may also be an important contributing factor to the problem of obesity and warrants both further research and concurrent consideration of policy measures. A policy implication that follows from this model is that measures that would lower the marginal rate of time preference of the population would help stem the obesity epidemic. Telling people to change their diets and exercise more may not suffice to alter their behaviour in the long run, if their marginal rate of time preference does not decrease at the same time. Insofar as time preference is probably formed during childhood (Maital & Maital, 1977), it might well be useful to initially target programmes to lower time preference at parents and their young children.

Acknowledgments

The authors thank Brian A'Hearn, Marco Sunder and Utku Teksöz for comments on an earlier version of this paper.

References

Allison, D., Fontaine, K., Manson, J., Stevens, J. & VanItallie, T. (1999) Annual deaths attributable to obesity in the United States. *Journal of the American Medical Association* **282**(16), 1530–1538.

Barsky, R., Juster, F., Kimball, M. & Shapiro, M. (1997) Preference parameters and behavioral heterogeneity: an experimental approach in the health and retirement study. *Quarterly Journal of Economics* **112**(2), 537–579.

Becker, G. (1964) *Human Capital.* Columbia University Press, New York.

Becker, G. & Mulligan, C. (1997) The endogenous determination of time preference. *Quarterly Journal of Economics* **112**(3), 729–758.

Bergmann, K. & Mensink, G. (1999) Körpermaße und Übergewicht. *Gesundheitswesen* (Special Issue **2**), 115–120.

Bishai, D. (2001) Lifecycle changes in the rate of time preference: testing the theory of endogenous preferences and its relevance to adolescent substance abuse. In Grossman, M. & Hsieh, C. (eds) *The Economics of Substance Abuse*. Edward Elgar Publishing, Northampton, pp. 155–177.

Blaylock, J., Smallwood, S., Kassel, K., Variyam, J. & Aldrich, L. (1999) Economics, food choices, and nutrition. *Food Policy* **24**, 269–286.

Bleichrodt, H. & Gafni, A. (1996) Time preference, the discounted utility model and health. *Journal of Health Economics* **15**, 49–66.

Colditz, G. (1992) Economic costs of obesity. *American Journal of Clinical Nutrition* **55**, 5035–5075.

Cutler, D. M., Glaeser, E. L. & Shapiro, J. M. (2003) *Why Have Americans Become More Obese?* NBER Working Paper No. W9446, January.

Ehrlich, I. & Chuma, H. (1990) A model of the demand for longevity and the value of life extension. *Journal of Political Economy* **98**(4), 761–782.

Flegal, K., Carroll, M., Kuczmarksi, R. & Johnson, C. (1998) Overweight and obesity trends in the United States: Prevalence and trends, 1960–1994. *International Journal of Obesity and Related Metabolic Disorders* **22**(1), 39–47.

Fuchs, V. (1986) *The Health Economy.* Harvard University Press, Cambridge, MA.

Fuchs V. (1991) Time preference and health: an exploratory study. In Culyer, A. J. (ed.) *The Economics of Health*, Vol. I. Edward Elgar Publishing, Great Yarmouth, pp. 93–150.

Fulwood, R., Abraham, S. & Johnson, C. (1981) *Height and Weight of Adults, Ages 18–74 Years, by Socioeconomic and Geographic Variables, United States.* DHHS Publication No. (PHS) 81–1674, National Center for Health Statistics.

Gafni, A. (1995) Time in health: can we measure individuals' 'pure time preferences'? *Medical Decision Making* **15**(1), 31–37.

Grossman, M. (1972) *The Demand for Health: A Theoretical and Empirical Investigation*. Columbia University Press for the National Bureau of Economic Research, New York.

Johannesson, M. & Johansson, P. (1997) The value of life extension and the marginal rate of time preference: a pilot study. *Applied Economics Letters* **4**(1), 53–55.

Lakdawalla, D. & Philipson, T. (2002) *The Growth of Obesity and Technological Change: A Theoretical and Empirical Examination*. NBER Working Paper 8946.

Lawrance, E. (1991) Poverty and the rate of time preference: evidence from panel data. *Journal of Political Economy* **99**(1), 54–77.

Levy, A. (2002) Rational eating: can it lead to overweightness or underweightness? *Journal of Health Economics* **21**, 887–899.

McGinnis, J. & Foege, W. (1993) Actual causes of deaths in the United States. *Journal of the American Medical Association* **270**(18), 2207–2222.

Maital, S. & Maital, S. (1977) Time preference, delay and gratification and the intergenerational transmission of economic inequality: a behavioral theory in income distribution In Ashenfeltar, O. & Oates, W. (eds) *Essays in Labor Market Analysis in Memory of Yochanan Peter Comay*. Wiley Publishing, New York, pp. 179–200.

Mokdad, A., Serdula, M., Dietz, W., Bowman, B., Marks, J. & Koplan, J. (1999) The spread of the obesity epidemic in the United States, 1991–1998. *Journal of the American Medical Association* **282**(16), 1519–1522.

Molarius, A., Sans, S., Tuomilehto, J. & Kuulasmaa, K. (2000) Educational level, relative body weight, and changes in their association over 10 years: an international perspective from the WHO MONICA project. *American Journal of Public Health* **90**(8), 1260–1268.

National Center for Health Statistics (2000) *Health, United States* 2000.

National Gambling Impact Study Commission. *National Gambling Impact Study: Final Report* (1999).

Offner, A. (2001) Body weight and self-control in the United States and Britain since the 1950s. *Social History of Medicine* **14**(1), 79–106.

Pagan, J. & Davila, A. (1997) Obesity, occupational attainment, and earnings. *Social Science Quarterly* **78**(3), 756–770.

Parker, J. (1999) Spendthrifts in America? On two decades of decline in the U.S. saving rate. In Bernanke, B. & Rotemberg, J. (eds) *NBER Macroeconomics Annual 1999*. MIT Press, Boston, pp. 317–370.

Philipson, T. (2001) The world-wide growth in obesity: an economic research agenda. *Health Economics* **10**(1), 1–7.

Philipson, T. & Posner, R. (1999) *The Long-Run Growth in Obesity as a Function of Technological Change.* John M. Olin Program in Law & Economics Working Paper No. 78. University of Chicago Law School, 1999.

Popkin, B. & Doak, C. (1998) The obesity epidemic is a worldwide phenomenon. *Nutrition Reviews* **56**(4), 106–114.

Samwick, A. (1998) Discount rate heterogeneity and social security reform. *Journal of Development Economics* **57**, 117–146.

Sobal, J. & Stunkard, A. (1989) Socioeconomic status and obesity: a review of the literature. *Psychological Bulletin* **105**(2), 260–275.

Van Der Pol, M. & Cairns, J. (2000) Negative and zero time preference for health. *Health Economics* **9**, 171–175.

Ulijaszek, S. (2003) Trends in body size, diet and food availability in the Cook Islands in the second half of the 20th century. *Economics and Human Biology* **1**, 123–137.

Zagorsky, J. (unpublished) *Is obesity as dangerous to your wealth as to your health?* Ohio State University, Center for Human Resource Research.