The Rate of Time Preference and Obesity: Is there a Connection?

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Abstract: We hypothesize that recent trends in obesity are related to an increase in the marginal rate of time preference. The higher is the rate of time preference, the larger is the factor by which economic agents discount the future health risks associated with current consumption. We present longitudinal data from the United States, as well as international evidence, that suggest that a relationship between these two variables is plausible.

Obesity and the Rate of Time Preference: Is there a Connection?

That obesity has increased recently is well known (Popkin and Doak 1998; Flegal *et al* 1998; Mokdad *et al* 1999; Philipson 2001). Obesity raises medical expenditures in general and the risk of heart attack in particular. It decreases both life expectancy and labor productivity (Colditz, 1992; Allison *et al* 1999). The associated costs are substantial: according to one estimate, the annual costs attributable to obesity in Germany are on the order of $10 billion (Bergmann and Mensink, 1999). In the U.S. obesity is second only to tobacco consumption as a cause of death that could be prevented by behavioral changes (McGinnis and Foege 1993)

Biologically speaking, the cause of weight gain is uncontroversial: animals gain weight if they take in more calories than they expend. Humans gain approximately one pound of fat for every 3500 net kilocalories gained. However, the hypothesized causes of the recent trend in obesity are controversial and consequently policy recommendations to combat it are unclear. Several economists suggest that technological change can explain increasing weights because it has simultaneously lowered the relative price of food and reduced the amount of physical activity required at work and in daily activity (Philipson and Posner 1999; Lakdawalla and Philipson 2000; Philipson 2001). While agreeing with this point of view, we suggest that a complementary cause bears further investigation. We hypothesize that an increase in the rate of time preference probably also contributes to the obesity epidemic. We argue, that insofar as weight control requires one to forego current consumption in order to gain future health benefits, the rate at which future benefits are discounted must bear directly on the individual's consumption decisions.

Similarly, exercise requires the expenditure of time today for the sake of potential future health benefits. The higher is the rate of time preference, *ceteris paribus*, the less time will be spent on exercise. The next two sections present the theoretical considerations in more detail. We then present empirical evidence to suggest that the rate of time preference has increased recently. We conclude that there is probably a connection between obesity and the rate of time preference and that it merits further investigation.

Introduction

The marginal rate of time preference, σ, measures the rate at which a person is willing to trade current pleasure for future pleasure. The intertemporal discount rate, $\frac{1}{1+s}$, is used to calculate the present value of future utility. The more a person prefers current utility to future utility, the higher is their rate of time preference and the lower is their discount factor. Thus, an increase in σ implies that economic agents value future utility less than they did in previous decision-making.

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 analyze 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, and Ehrlich and Chuma (1990) predict that higher rates of time preference lead to lower demand for longevity and less investment in health. Blaylock *et al* (1999) make a direct connection between food choices and the rate of time preference. They assert that American dietary habits suffer from the fact that Americans discount the future heavily, despite extensive

information on the relationship between health and nutrition. They add that the low U.S. savings rate and high levels of credit-card debt indicate a high rate of time preference, without presenting empirical analysis to that effect.

In contrast, Becker and Mulligan (1997) reverse the relationship and argue that differences in health cause differences in the rate of time preference, and not vice versa. 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, hence forgoing current utility in favor of future utility is less attractive to them. They argue that wealthier nations will have more healthy people who will be "more patient" and consequently these nations will enjoy greater economic growth due to higher rates of saving and investment. On the basis of this consideration, we would expect wealthier nations to have lower rates of obesity and higher rates of saving relative to poorer countries with generally lower health status. Moreover, inasmuch as obesity lowers life expectancy, one would expect on the basis of this hypothesis, that its prevalence would lower the rate of time preference.

Theory

We now specify explicitly the role of time preference in a representative consumer's maximization of lifetime utility (U). For the sake of simplicity we 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 and investments in health (I). 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.

The marginal rate of time preference (σ) determines the rate at which the consumer discounts future utility from consumption and health. The consumers' utility problem is to choose the levels of consumption and health investment over their lifetime (from time 0 to time T) so as to maximize lifetime utility: [1]

$$\text{Max } U = \int_0^T e^{-\sigma t} U\{C_t, H_t(I_{t-1})\}\, dt$$

Where $0 \leq \sigma \leq 1$ and $e^{(-\sigma t)}$ represents the "rate of decay" of future utility. Consumers maximize this function subject to a lifetime budget constraint:

$$\text{Lifetime Income} = \int_0^T (P_{ct}C_t + P_{It}I_t)\, dt$$

where P_c is the price of consumption and P_I is the monetary price of health investment. Consumers with higher rates of time preference assign lower weights to future consumption and health, and will 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, consumers tend to consume (C) at a higher rate, and invest in health-promotion less, the higher is their rate of time preference. As a population's rate of time preferences rises, so will expenditure on non-health related consumption, whereas expenditure on health investment decreases. Thus, we argue that one possible result of a general rise in the marginal rate of time preference is an increase in obesity.[2]

Empirical Evidence

In spite of its considerable importance in the theory of intertemporal decision-making, articles on savings and economic growth and on the evaluation of health programs reveal that the empirical evidence on the marginal rate of time preference is controversial (*e.g.*, Gafni 1995; Barsky *et al* 1997). Two general empirical approaches

have emerged: estimation of 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 and Johansson 1997; Van Der Pol and Cairns 2000). The Euler-equation approach requires identifying restrictions, which can be problematic. The survey approach is subject to the usual problems: sensitivity to the wording of questions and non-response. In addition, good estimates require that respondents can predict accurately how they would respond in a variety of hypothetical situations. Further difficulties for both approaches involve the ability to distinguish time preference from the interest rate and risk preferences.

Given the difficulties associated with the estimation of the marginal rate of time preference, and the lack of appropriate alternatives, we follow the conventional practice of using a readily measured proxy (MacKeigan *et al* 1993). In particular, we use the saving rate and consumer debt as proxy measures of the rate of time preference. Both are related to the degree of impatience of economic agents, or put another way, the relative preference for current as opposed to future 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. A shortcoming of this approach is that these proxies are influenced by factors other than the rate of time preference.

We use a definition of obesity often employed in the medical literature: having a body mass index ($\frac{\mathbf{weight(kg)}}{\mathbf{height(m)}^2}$ = BMI) $\geq$ 30 (National Center for Health Statistics 2000). Figure 1 shows the incidence of obesity, the personal savings rate, and the ratio of real savings to disposable personal income (DPI) in the U.S.[3] Between the 1960s and the early 1970s the rates of obesity and saving both rose, even if slightly, contrary to the

considerations outlined above. However, beginning with the late 1970s the savings rate fell while the incidence of obesity increased - at first marginally, but then by the 1990s very substantially. The obesity rate increased by 55%, while the personal savings rate fell by 18%. Thus, the trends of the last two decades conform to the predictions of our theory.[4]

The trend in private consumer debt, measured as the ratio of household debt to disposable income (Debt/DPI), corroborates the above finding (Figure 2). Consumer debt has increased from the 1960's to the early 1990s, as did obesity rates,[5] with both variables accelerating simultaneously in the 1980s and 1990s.

Figures 1 and 2 about here

We next consider cross-sectional evidence on the relationship between rates of time preference and saving rates at the international level. If obesity were positively related to the rate of time preference, then we would observe that obesity is more prevalent in nations with lower saving rates. Figures 3 and 4 compare the incidence of obesity by gender (Molarius *et al*, 2000) with net domestic savings as a percent of GDP (*World Development Tables*) for a number of developed countries. While the inverse relationship between the two variables is by no means perfect, it is, nonetheless, quite revealing that the U.S. has the lowest net domestic saving rate (4.57%) while at the same time being among the countries with the highest prevalence of obesity (among both genders).[6]

Figures 3 and 4 about here

On the other hand, Becker and Mulligan's (1997) theory of the endogenous determination of the rate of time preference is not supported by the results of our simple

analysis. Their theory predicts that healthier (wealthier) nations will have lower rates of time preference, higher rates of saving and lower rates of obesity. As Figures 3 and 4 show, the U.S. is among the wealthiest countries, but has very low savings rate and high obesity rates. Figure 5 compares the rates of obesity and economic growth,[7] placing the countries in order of ascending economic growth. The U.S. experienced the fastest average growth rate (2.44%) and exhibits high rates of obesity, contrary to the Becker-Mulligan hypothesis. At the other end of the spectrum, Finland experienced the lowest average rate of economic growth (0.88%) and also has relatively high rates of obesity. The data suggest the relationship between economic growth and obesity varies by gender. The simple correlation between male obesity and economic growth is –0.176 (p=.63), but when we control for female obesity the correlation becomes –0.56 (p = .12). The correlation between female obesity and economic growth, controlling for male obesity, is –0.56 (p=.12).

Discussion

The economic costs of obesity are high and an economic approach is thus warranted. Insurance companies, governments, and health maintenance organizations, as well as individuals, have to bear the financial burdens associated with obesity.

We hypothesize here that there is a positive relationship between the rate of time preference and the rate of obesity within a society as well as across societies. The former determines the rate at which future utility is discounted, while the latter is an outcome of a rational intertemporal decision-making. Agents increase the rate of current consumption at the expense of lower levels of utility in the future the higher is their rate of time preference. We have presented longitudinal evidence for the U.S. economy in

support of this model. The hypothesis that the two variables are related appears plausible. Obviously more research and data are needed to improve the statistical nature of the confirmation. Above all, we need better estimates of the marginal rate of time preference not only for the society as a whole, but also by groups, *e.g*. by gender and income. With such estimates the relationship could be explored in greater detail.

The international cross-sectional evidence is less compelling perhaps, but one has to keep in mind that there are many other cultural and economic factors, such as the rate of taxation and savings subsidies, that influence these variables across different institutional settings. Also, many psychosocial and political influences make the international comparisons difficult. Nonetheless, the international evidence is also suggestive that the rate of time preference at least does play a role in the recent epidemic. 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.

A policy implication that follows from our theory is that to stem the obesity epidemic we need to adopt measures to lower the marginal rate of time preference of the population. Insofar as this attribute is probably formed during childhood, it might well be useful to initially target parents and younger age groups. Admittedly, the increase in the rate of time preference is not the only cause of obesity in the U.S. or around the globe. We are by no means advocating a mono-causal explanation. We are in agreement with the notion that technological change also has had an impact on our propensity to become overweight.[8] Nonetheless, it appears on the basis of the evidence presented, that the rise in the marginal rate of time preference may be an important contributing factor to the

problem of obesity and warrants both further research and concurrent consideration of policy measures. The rate of time preference seems essential, and, of course, time is again of the essence.

Figure 1. Trends in Obesity and Saving Rates

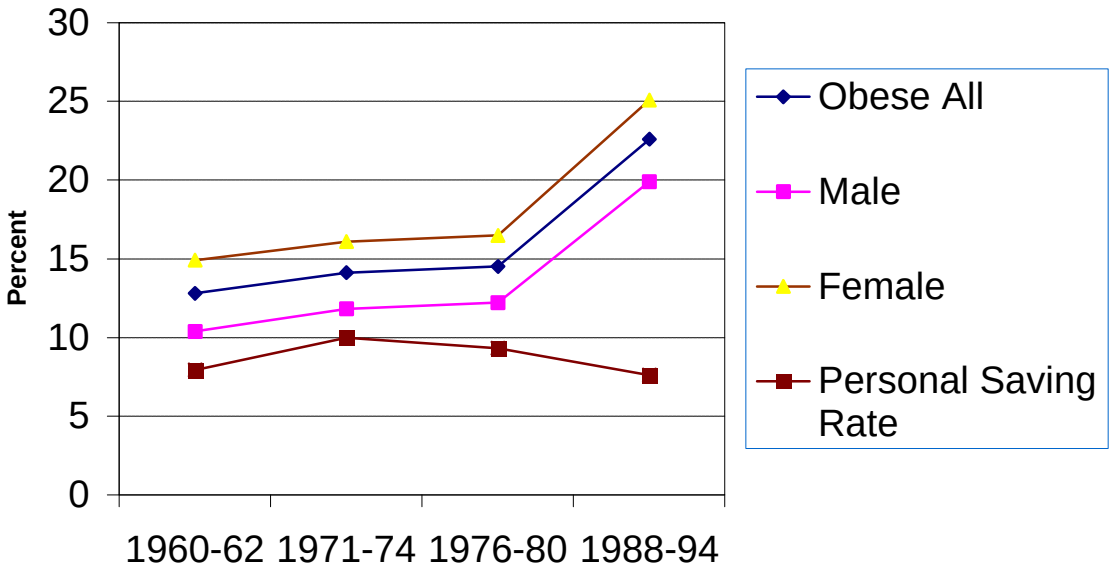


Figure 2. Trends in Obesity and Private Debt

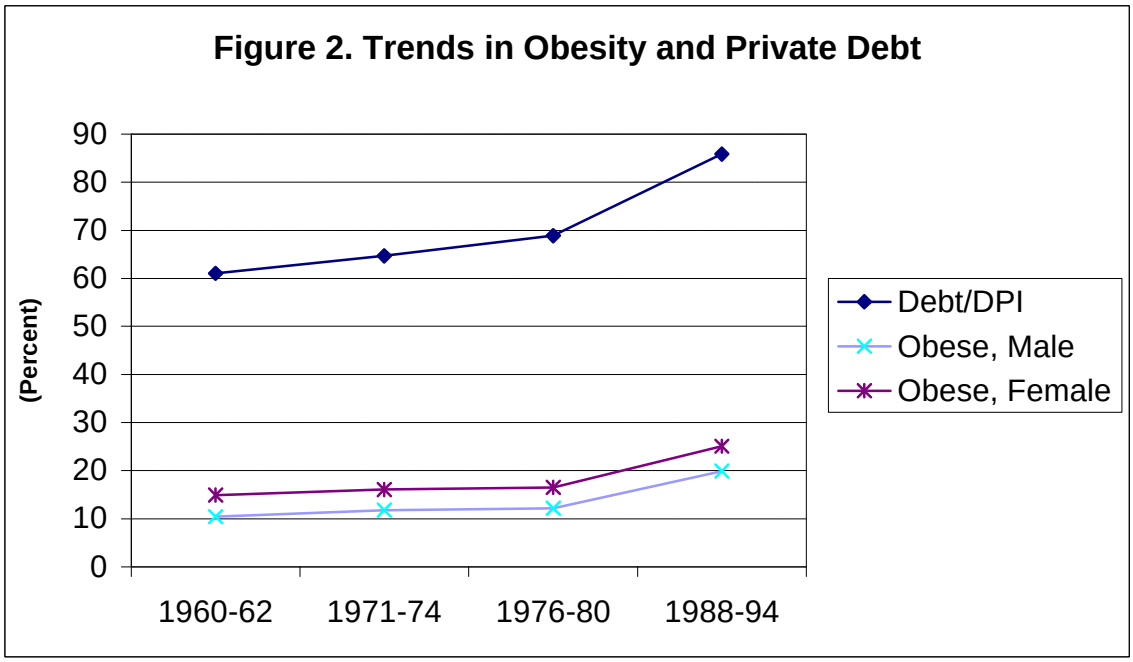
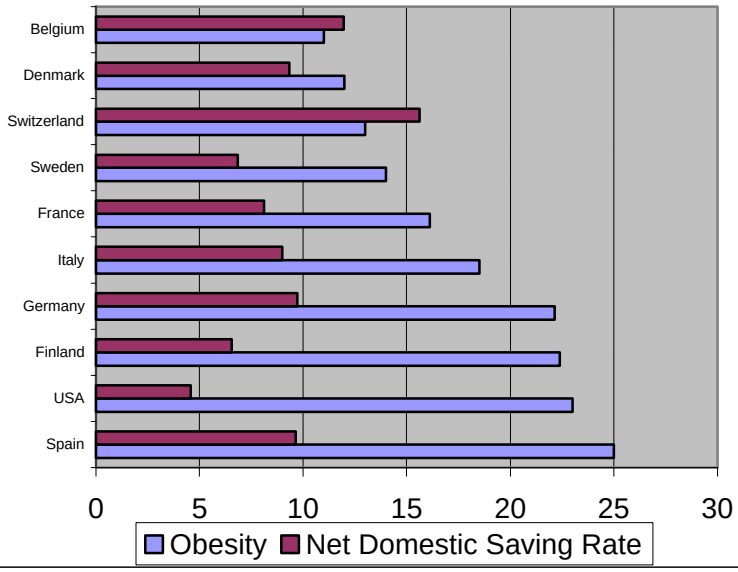


Figure 3. International Comparison of Female Obesity Rates and Saving Rates



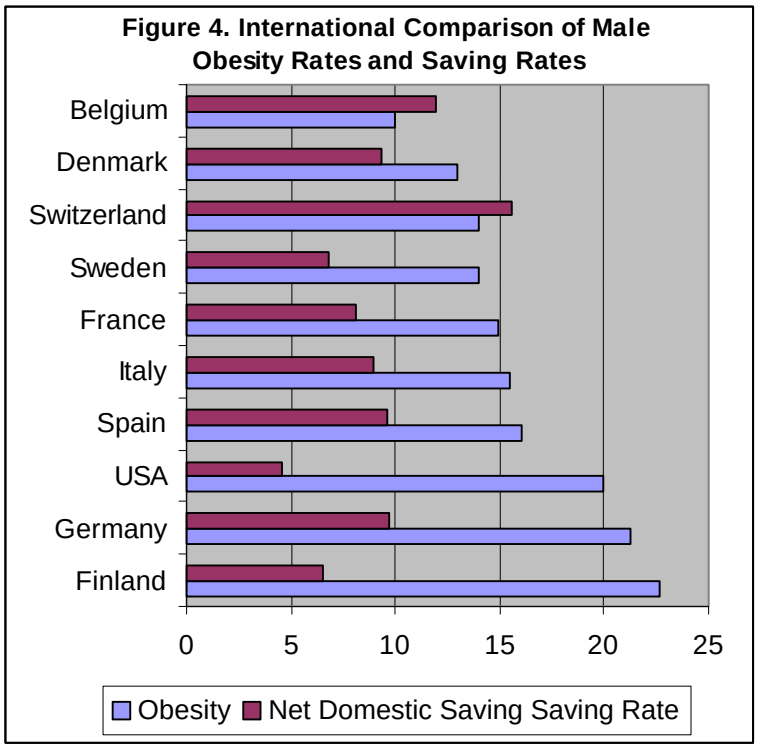
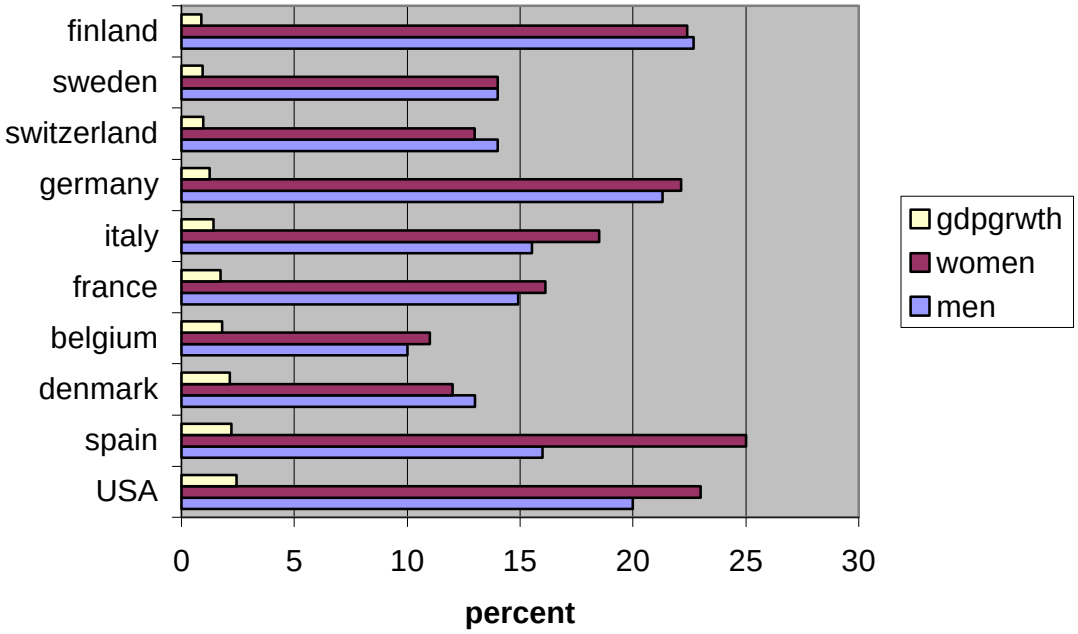


Figure 4. International Comparison of Male Obesity Rates and Saving Rates
Belgium
Denmark
Switzerland
Sweden
France
Italy
Spain
USA
Germany
Finland
0
5
10
15
20
25
Obesity
Net Domestic Saving Saving Rate

Figure 5: Obesity & Economic Growth



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[1] Bleichrodt and Gafni (1996) argue that models that use a constant rate of time discount are too restrictive and are not theoretically supported. They think the discount rate is higher for more distant years. Again their focus is on analyzing health policy and they don't mention obesity.

[2] 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.

[3] The Bureau of Economic Analysis reports the personal savings rate at www.stls.frb.org/fred/data/gdp/psavert and the Federal Reserve Bank of Philadelphia reports the ratio of real savings to disposable personal income at www.phil.frd.org/src/cf/backgrounddata4.htm.

[4] Similar results are obtained when we use the ratio of real savings to disposable personal income; Federal Reserve Bank of Philadelphia.

[5] Similar results are obtained when we use the ratio of real household debt to real disposable income (RealDebt/DPI). Federal Reserve Bank of Philadelphia.

[6] The simple correlation between male obesity and net domestic savings is –0.52 (p=0.12), while that for females is –0.50 (p=0.15).

[7] Measured as the percent change in GDP.

[8] We might also consider that competition among restaurants could contribute to obesity if competition within a price category is not only along quality, but also along the quantity dimension. Markets might clear by restaurants engaging in a Bertrand-type competition in which the size of a meal is one of the control variables.