



# A mass phenomenon: The social evolution of obesity



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## ABSTRACT

This paper proposes a theory for the social evolution of obesity. It considers a society in which individuals experience utility from consumption of food and non-food, the state of their health, and the evaluation of their appearance by others. The theory explains under which conditions poor persons are more prone to be overweight although eating is expensive and it shows how obesity occurs as a social phenomenon such that body mass continues to rise long after the initial cause (e.g. a lower price of food) is gone. The paper investigates the determinants of a steady state at which the median person is overweight and how an originally lean society arrives at such a steady state. Extensions of the theory towards dietary choice and the possibility to exercise in order to lose weight demonstrate robustness of the basic mechanism and provide further interesting results.

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## 1. Introduction

Since about the last quarter of the 20th century we witness an unprecedented change in the phenotype of human beings. In the US, for example, the share of overweight (obese) persons was almost constant at about 45 percent (15 percent) of the population in the years 1960–1980. Since then, the share of overweight adults rose to 64.7 percent in the year 2008 and the share of obese adults rose to 34.3 percent (Ogden and Carroll, 2010). If these trends continue, by 2030, 86 percent are predicted to be overweight and 51 percent to be obese (Wang et al., 2008).<sup>1</sup> The phenomenon of increasing waistlines is particularly prevalent in the US but is also observed globally (OECD, 2010; WHO, 2011). The world is getting fat (Popkin, 2009).

Obesity entails substantial health costs. Obese persons are more likely to suffer from diabetes, cardiovascular disease, hypertension, stroke, various types of cancer and many other diseases

(Field et al., 2001; Flegal et al., 2005). As a consequence, obese persons spend not only more time and money on health care (Finkelstein et al., 2005; OECD, 2010) but they also pass away earlier. For example, compared to their lean counterparts, 20 year old US Americans can expect to die about four years earlier when their BMI exceeds 35 and about 13 years earlier when their BMI exceeds 45 (Fontaine et al., 2003). According to one study, obese persons actually incur lower health care costs over their life time due to their early death (van Baal et al., 2008).

The simple answer for why people are overweight is that they like to eat more than their body can burn. In the US, for example, 70 percent of the adult population in the year 2000 said that they eat “pretty much whatever they want” (USDA, 2001). Although a fully satisfying answer is certainly more complex, involving biological and psychological mechanisms, perhaps the most striking observation in this context is that overeating seems *not* to be driven by affluence. At the beginning of the 20th century, when the developed countries were certainly no longer constrained by subsistence income, the English physiologist W.M. Bayliss wrote that “it may be taken for granted that every one is sincerely desirous of avoiding unnecessary consumption of food” (Bayliss, 1917, p. 1). Indeed, caloric intake per person in the US remained roughly constant between 1910 and 1985. But it then rose by 20% between 1985 and 2000 (Putnam et al., 2002; see also Cutler et al., 2003; Bleich et al., 2008).

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<sup>1</sup> Overweight is defined as a body mass index (BMI) above 25 and obesity as a BMI above 30. In this paper we thus apply the inclusive definition of overweight by the WHO (2011), according to which obese persons are also regarded as overweight. Some other studies apply an exclusive definition according to which only persons with BMI between 25 and 30 are regarded as overweight. The BMI is defined as weight in kilogram divided by the square of height in meters.

Across the population, within countries, the historical association between affluence and body mass actually changed its sign over the 20th century; “where once the rich were fat and the poor were thin, in developed countries these patterns are now reversed.” (Pickett et al., 2005). But while it is true that the *severity* of overweight and obesity is much stronger for the poor than for the non-poor (Joliffe, 2011), it is also true that persons from all social strata are equally likely to be overweight (in the US) and that the secular increase of overeating and overweight is equally observed among – presumably richer – college graduates and non-college educated persons (Ruhm, 2010). Across countries, obesity and calorie consumption appear to be more prevalent in unequal societies (Pickett et al., 2005).<sup>2</sup>

The evolving new human phenotype cannot be explained by genetics because it occurred too rapidly (e.g. Philipson and Posner, 2008). It has to be conceptualized as a social phenomenon. With affluence being an unlikely candidate, the question arises what has caused the social evolution of overweight and obesity? The most popular factors suggested in the literature are decreasing food prices, decreasing *effective* food prices through readily available convenience foods and restaurant supply, and less physical activity on the job and in the household (see e.g. Finkelstein et al., 2005; OECD, 2010). But these explanations entail some unresolved puzzles with respect to the timing of the obesity epidemic.

The most drastic changes of potential causes of obesity occurred well before obesity prevalence became a mass phenomenon. The price of food declined substantially from the early 1970s through the mid 1980s but changed little thereafter, when the obesity epidemic took off. Eating time declined substantially from the late 1960s to the early 1990s, but stabilized thereafter (see Ruhm, 2010). Likewise, the gradual decline in manual labor and the rise of labor saving technologies at home began before the rapid rise in obesity and slowed down afterwards (Finkelstein et al., 2005). This means that calories expended have not decreased much further since the 1980s (Cutler et al., 2003).

From these facts some studies conclude that food prices and caloric expenditure are unlikely to be major contributors to the evolution of obesity because the prevalence of obesity continues to rise after the alleged causes have (almost) disappeared. The present paper proposes an alternative conclusion based on social dynamics. It explicitly considers that one's appearance is evaluated by others. The social disapproval for displaying an overweight body is continuously but slowly updated by the actual observation of the prevalence of overweight members of society. This view provides (i) a social multiplier that amplifies the “impact effect” of exogenous shocks and (ii) an explanation for why we observe an evolving human phenotype long after the impact effect is gone.

The theory establishes two exclusively existing, stable, and qualitatively distinct social equilibria. At one equilibrium the median person is lean and after an exogenous shock that favors overeating (e.g. lower food prices) social pressure leads society back to the lean equilibrium. This means that, although there are overweight and obese persons in society, obesity is not an evolving social problem. At the other equilibrium the median is overweight and after an exogenous shock that favors overeating, society at large converges towards an equilibrium where people are, on average, heavier than before. The historical evolution of BMI in the US, for example, is conceptualized according to the theory as a stable

lean steady state until the 1970s and a transition towards a stable obese steady state afterwards.

The theory explicitly takes into account that preferences and income vary across individuals. Holding income constant it predicts that people with a high preference for food consumption are heavier. Holding preferences constant it predicts that poorer people are heavier, at least if income is sufficiently large and the elasticity of substitution between food and non-food is larger than unity. The reason is that rich persons inevitably consume more (food or non-food) than poor ones. Given non-separable utility, they thus experience higher marginal utility from being lean (or less overweight) and consequently they consume fewer calories. A poor person, in contrast, puts less emphasis on the evaluation of her appearance by others and on the health consequences of being overweight because the scale of consumption (food or non-food) is low. Due to the lower emphasis on weight a larger share of experienced utility results from food consumption, in particular if food prices are low compared to other goods. Since the median is poorer in unequal societies, the theory predicts, that, *ceteris paribus*, unequal societies are more afflicted by the obesity epidemic.

In Section 3 it is shown that the social multiplier produces some perhaps unexpected non-linearities. In particular, an obesity related health innovation (e.g. beta-blockers, dialysis) can go awry. The impact effect of such an innovation is initially better health for everybody. But the lower health consequences of being overweight induce some people to eat more and put on more weight. This may set in motion a bandwagon effect and convergence towards a new steady state at which society is, on average, not only heavier but also less healthy than before the health innovation.

The basic model fails to capture some further aspects of the obesity epidemic, most importantly the role of energy-density of food and that of physical exercise. Section 4 thus extends the model to account for these factors and shows that all basic results are preserved under mild conditions. It also derives some refinements of the original theory. For example, while richer people continue to be predicted to be, *ceteris paribus*, less overweight, leaner bodies are no longer necessarily a consequence of eating less. Instead, richer people are predicted to exercise more for weight loss. In a two-diet model, a rising energy density of the less healthy diet is predicted to increase body mass if the diet is sufficiently cheap and its consumer sufficiently poor. If this applies to the median person, society at large is predicted to get heavier due to the social multiplier.

There exists some evidence supporting the basic assumption that being overweight generates less disutility if many others are overweight or obese as well, that is if the prevalence of being overweight in society is high. Blanchflower et al. (2009) find that females across countries are less dissatisfied with their actual weight when it is *relatively* low compared to average weight. Using the German Socioeconomic Panel they furthermore find that males, controlling for their actual weight, experience higher life satisfaction when their relative weight is lower. In the US, about half of the respondents to the Pew Review (2006) who are classified as overweight according to the official definition characterize their own weight as “just about right”. Etilé (2007) provides similar results for France and argues that social norms and habitual BMI affect ideal BMI, which in turn influences actual BMI. Christakis and Fowler (2007) show how obesity spreads from person to person in a large social network and find that a person's chances to become overweight increase by 57 percent if he or she has a friend who became obese. Trogdon et al. (2008) find that for US adolescents in 1994–1995 individual BMI was correlated with mean peer BMI and that the probability of being overweight was correlated with the proportion of overweight peers. Comparing different periods of observation from the National Health and Nutrition

<sup>2</sup> Many, but not all, empirical studies of the income obesity nexus find it unambiguously negative for all subgroups of society. For example, Lakdawalla and Philipson (2009) document a hump-shaped association of BMI and income for male US American workers but a monotonously negative association for female workers.

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