The Rise in Obesity Across the Atlantic: an Economic Perspective

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Abstract

We provide comparable evidence on the patterns and trends in obesity across the Atlantic and analyse whether there are economic rationales for public intervention to control obesity. We supply new evidence on such rationales taking into account equity issues as well as efficiency considerations, which are organized around the following categories of market failures: productive inefficiencies, lack of information or rationality and health insurance externalities. We argue that there is support for intervention targeted towards the young on equity grounds. While the evidence that the allocation of resources is (or will be) significantly distorted by the rise in obesity is less clear-cut, there are signs that this is the case due to time inconsistent preferences and because of the resilience of product and labour market imperfections, especially in some European countries.

Keywords: Obesity; Health care costs; Efficiency; Equity.
JEL Codes: I1; D6.

1. Introduction

The United States has the largest incidence of obesity among OECD countries. Moreover, US obesity rates are today two times higher than in the early 1970s (Cutler et al., 2003). It is therefore not surprising that obesity has long been at the centre of the health policy debate and the focus of academic research in the US (Cutler et al., 2003, Chou et al., 2004). European obesity rates are generally lower and have risen less sharply (Sanz-de-Galdeano, 2007; Andreyeva et al., 2007), which probably explains why obesity has only become a growing concern for health policymakers in Europe in recent years. Why do we observe such a stark contrast in the prevalence of obesity across the Atlantic? And why has obesity risen more in the U.S. and the U.K. relative to continental Europe during the 1990s and the early 2000s?

In this paper we argue that the difference in the obesity rates between the U.S. and Europe is mainly due to the higher calorie intake than to the smaller calorie expenditure of Americans. We also document the presence of a statistically significant negative association between changes in obesity rates and changes in the share of manufacturing employment, which suggests that the faster increase of obesity in the U.S. is related to the more rapid shift of its economy from manufacturing to services, at least compared to Europe and Japan.

While obesity is clearly a public health concern, an important question is whether public intervention can be justified on economic grounds. Our goal in this paper is to provide an answer to this question on the basis of new and comparable empirical evidence from several OECD countries and to draw lessons from international comparisons. From an economic perspective, public intervention to reduce obesity is warranted either on efficiency or on equity grounds. Concerning the former, we investigate whether there are inefficiencies in the allocation of resources which are caused by the obesity epidemic.

We add to the potential sources of inefficiencies considered in the literature - lack of information, lack of rationality and inefficiencies related to health insurance externalities - productive inefficiencies, the importance of which has not been assessed in the literature so far. These inefficiencies arise when labour and product markets are not perfectly competitive and obesity affects productivity and/or earnings conditional on productivity. Since the degree of product and labour market imperfections is higher on average in Europe than in the U.S., there is more potential for policy intervention in the former, in spite of the fact that obesity rates are higher in the latter.

Our comparative evidence on the relative importance of economic inefficiencies can be summarized as follows. On the one hand, we find that neither information deficiencies nor the existence of health insurance externalities constitute a rationale for public intervention. The

majority of individuals are aware of the bad consequences of obesity on health and do not feel that following a healthy diet is difficult because of lack of information. As for the potential market failure related to health insurance, our estimates suggest that, even if there were a large health insurance subsidy (as it may well be the case in Northern European countries), the size of the health insurance externality is likely to be small. We view this evidence as not supportive of policy intervention.

On the other hand, and in support of policy intervention, we show that when there are product and labour markets imperfections, private and socially optimal body weight differ because obesity affects productivity and the wages of obese individuals are lower than those received by their equally productive but non-obese counterparts. Importantly, obese employees earn less than the non-obese in countries where it is easier to discriminate against them because of the rents associated to more stringent product market regulations. In spite of the current trend in favour of deregulation, the persistence of barriers to entry in non-manufacturing suggests that these inefficiencies are likely to remain in the near future, especially in some European countries.

Furthermore, we find that a remarkably high proportion of individuals having time inconsistent preferences with respect to weight fail to stick to their self-declared weight-related plans. Overall, our evidence that the allocation of resources is significantly distorted by the increase of obesity is mixed. Even in the absence of efficiency arguments, however, policy intervention can be justified on equity grounds, because of the empirical evidence showing that obesity is not entirely driven by the behaviour of the obese individual. Family background also matters.

The remainder of the paper is organized as follows. Section 2 describes the micro-survey and time-use data sets used for several OECD countries, presents original and cross-country comparable measures of obesity prevalence and trends and discusses the sources of cross-country differences. Section 3 is the core of our analyses and aims at assessing when public intervention to reduce obesity is justified on economic grounds. Section 4 concludes.

2. Obesity across the Atlantic: the Facts.

2.1. Definitions and Data Sources

According to the World Health Organization (WHO, 2000) obesity can be defined as the health condition in which excess body fat has accumulated to such an extent that health may be adversely affected. The body-mass index (BMI) is the common measure used to provide a

clinical classification of weight status for adults. BMI is defined as weight in kilograms divided by the square of height in meters (kg/m2). Adults with a BMI over 30 are classified as obese. The Body Mass Index (BMI), albeit somewhat crude, has been found to be highly correlated with more precise (and more costly to collect) measures of body fat (Revicki and Israel, 1986).[1]

We use several datasets to document the prevalence of obesity in Europe and the United States. Surveys that focus on the general population tend to have good measures of BMI but relatively poor information on health, particularly so in Europe. We use the National Health Interview Survey (NHIS) in the U.S. and the European Community Household Panel Survey (ECHP) for the purpose of establishing prevalence and trends in BMI and obesity in the general population. The NHIS collects data each year on a nationally representative cross-section of the American population while ECHP is a longitudinal study collected from 1994 to 2001 with data on BMI for a subset of countries (Denmark, Belgium, Ireland, Italy, Greece, Spain, Portugal, Austria and Finland) from 1998 to 2001.[2] For the adult British population, we use the 2004 wave of the British Household Panel Survey (BHPS), since this is the first wave including information on BMI. We also make use of aggregate data published by the OECD (the OECD Health database, 2006). The OECD uses multiple sources within each country to construct its figures and provides long time-series for some countries going back to the early 1980s.

Finally, we also use other surveys that focus on the elderly, the so-called "ageing studies". These surveys have both the advantage of containing a battery of health variables which are useful in an analysis of obesity, particularly when looking at health care costs, and are based on larger samples of individuals at advanced ages, thereby providing better estimates for this age group. For the U.S., we use all cohorts available as of 2004 in the Health and Retirement Study, which follows a number of representative samples from cohorts aged 50+ at baseline. As of 2004, the HRS is representative of the age 50+ population in the U.S. when appropriate survey weights are used (individuals born 1954 and earlier). For Europe, we use two sources of data. The Survey of Health, Ageing and Retirement in Europe (SHARE) was collected in 2004 on a nationally representative sample of the age 50+ population in 10 European countries.[3] For England, we use the 2nd wave of the English Longitudinal Study of Ageing (ELSA) collected in 2004-2005. HRS, SHARE and ELSA have been designed with comparability in mind such that questions on a large range of topics are generally comparable.

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[1] It must be acknowledged that self-reported anthropometric variables may contain measurement error with heavier persons more likely to underreport their weight (Palta et al., 1982; Kuczmarski et al., 2001). We take this into account by using regression estimates of true weight and height on self-reported measures stratified by gender and race. We use regression estimates based on U.S. data from Cawley and Burkhauser (2008). As Michaud et al. (2007) report, this does not tend to affect country rankings in terms of BMI or obesity. Sanz-de-Galdeano (2007) finds that the rank correlation between country level self-reported and objective measures of weight is very high.

[2] We have attempted to see if estimates based on longitudinal data were different from those in cross-sectional datasets due to attrition, etc. This is not possible to do in Europe. For the U.S., we have compared the prevalence of obesity in the NHIS with the prevalence from a longitudinal study, the Panel Study of Income Dynamics (PSID). In 2001, the difference in the prevalence of obesity was negligible.

[3] We do not include Switzerland in the analysis because the response rate was low therefore raising concers that the sample is not representative of the population. Data from Belgium was also not available in the dataset used. Hence, we consider 8 countries from SHARE.

2.2. Obesity Across the Atlantic: Levels and Trends

There are substantial cross-country differences in the prevalence of obesity among adults aged 18-50 as can be seen from Figure 1. First, it is clear that the U.S. stands apart as a country with a high prevalence of obesity. In 2001, 22.38% of women and 21.97% of males aged 18-50 were classified as obese, compared with an average 9.61% and 9.06% respectively in the European countries covered by the ECHP data. The U.K. is closer to the U.S. than to the rest of Europe. If we use BHPS data, we find that the estimated obesity rate for the U.K. in 2004 was equal to 16.31% for women and 16.83% for men.[4]

There is no consistent regional pattern in Europe but substantial variation across countries. Some Southern European countries such as Spain and Portugal have high obesity rates while Italy has a much lower prevalence of obesity. In Northern Europe, Denmark and Finland have high obesity rates while Ireland, Belgium and Austria have much lower rates.

**Figure 1 Prevalence of Obesity among Adults (aged 18-50)**
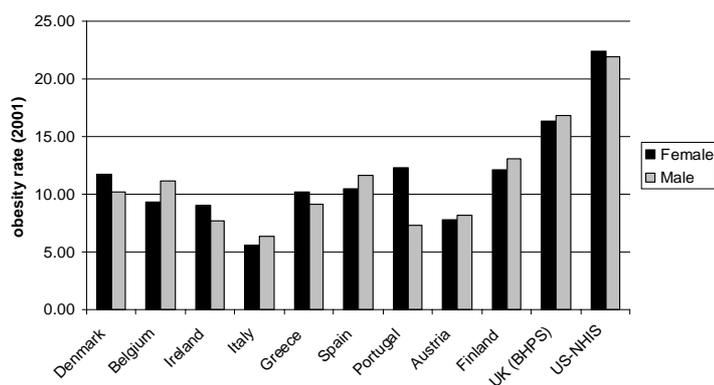
An important question is whether there was always a large difference between obesity rates in the U.S., the U.K. and the rest of Europe. For lack of historical data in Europe it is impossible to completely answer the question. Figure 2 however reports the recent evolution of the obesity rate for the period 1989-2004 in the U.S. relative to that in the U.K., Japan and continental Europe (a weighted average of Sweden, France, the Netherlands, Spain and Finland, where data are available). It is clear that the gap has widened during the period by close to 20 percent with respect to Europe and Japan and by close to 10 percent with respect to the U.K.[5]

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[4] Data are not available for the U.K. in the 2001 wave of the BHPS. We use data from 2004 instead.
[5] Time series data for Europe, the UK and Japan are from the OECD health databank. Missing data are interpolated. Data for the U.S. are from the BRFSS (Behavioural Risk Factor Surveillance System) survey.

Figure 2 Relative obesity rates: U.S. versus Europe, Japan and the U.K.

relative obesity rates 1989-2004
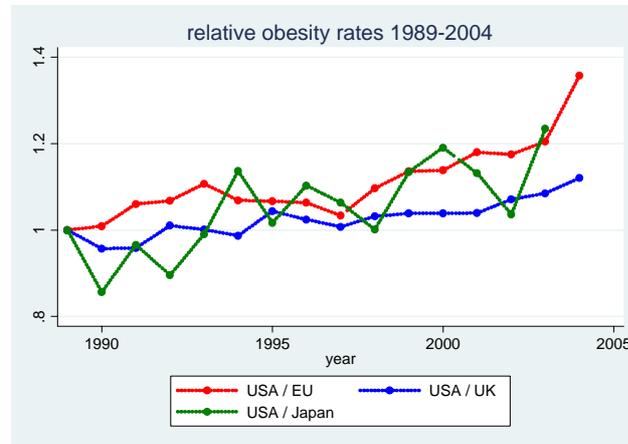
Because BMI tends to increase with age, differences in the rate of obesity across countries are sustained, if not amplified, in the elderly population. The next figure (Figure 3) shows the estimates of the percentage of obese individuals in the age 50+ population using the available ageing surveys (HRS for U.S., SHARE for Continental Europe and ELSA for England). A cross-country pattern similar to that in Figure 1 emerges: older Europeans tend to be lighter than their American counterparts. The only exceptions are England and Spain where obesity is relatively high.

Figure 3 Fraction Obese, Age 50+ Population in 2004-2005
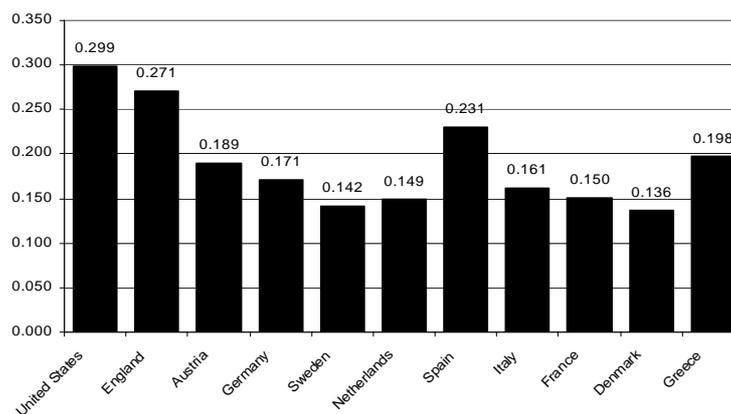
Source: Own calculations from HRS 2004, SHARE 2004 and ELSA wave 2 (2004-2005).

2.3 Explanations for the Rise in Obesity and Cross-Country Variation

Two important questions are raised by the stylized facts in Section 2.2: 1) why do we observe such important differences across countries in the prevalence of obesity? 2) why has obesity risen more in the U.S. and the U.K. relative to continental Europe during the past 20 years? A good place to start to answer both questions is the following observation: weight increases when systematically more calories are consumed than burned. Short-term fluctuations in calorie intake or expenditure are likely to be washed away by an individual's metabolism, which is elastic up to a certain level of daily variation. However, when the excess calorie gain is more permanent, calorie imbalance materializes in weight gain. Hence, one has to either find reasons why calorie expenditure has gone down over the years or calorie intake has gone up, and importantly why this happened in the U.S. and the U.K. but not in the rest of Europe.

Philipson and Posner (2008) argue that time series data on obesity are best explained by technological change, which has reduced both the price of food and the consumption of calories at work. In most developed countries, jobs have shifted away from exercise – intensive agriculture and blue collar work in factories to less physically demanding jobs in the service sector. During the past 20 years or so, the U.S. share of manufacturing employment has slightly increased with respect to the U.K. and decreased significantly with respect to continental Europe and Japan[6]. Is this shift associated to the cross – country differences in the dynamics of obesity? To investigate this, we regress relative obesity rates in three areas – U.S. versus Europe, U.S. versus U.K. and U.S. versus Japan – on area fixed effects and the share of employees engaged in manufacturing. The second column of Table 1 shows that the relative share of manufacturing employment is negatively related to relative obesity rates. The size of the effect is not negligible: a 1 percent increases in the relative share reduces relative obesity by 1.74 percent.

In columns (3) and (4) of the table we add as additional controls relative GDP per capita and relative female labor force participation. While the coefficient attracted by the manufacturing share remains broadly unchanged, only GDP per capita attracts a negative and statistically significant effect. As discussed by Philipson and Posner (2008), the relationship between income and weight is likely to be non-monotonic – weight raises with income for the poor and falls for the well-off. Our results suggest that the last effect prevails.

Table 1. The dynamics of relative obesity rates. 1984-2004

|	[1]	[2]	[3]	[4]
USA/EU fixed effect	1.725	6.797	9.189	9.096
	[50.08]***	[4.93]***	[4.54]***	[4.81]***
USA/JPN fixed effect	5.734	10.296	10.889	10.787
	[33.18]***	[8.32]***	[8.00]***	[8.35]***
USA/GBR fixed effect	0.941	6.18	12.186	12.169
	[106.17]***	[4.36]***	[3.78]***	[3.79]***
relative manufacturing share - employment		-6.115	-6.88	-6.959
		[3.69]***	[3.80]***	[3.29]***
relative GDP per capita			-2.862	-2.897
			[2.89]***	[2.62]**
relative female labour force participation				0.144
				[0.14]
Observations	57	57	57	57
R-squared	0.96	0.97	0.97	0.97

Data source: OECD

Even after conditioning for the time varying explanatory variables in Table 1, cross - country differences in obesity rates remain sizeable. To account for them, one needs to look carefully at the balance of calorie intakes and calorie expenditures. On the calories expenditure side, Cutler et al. (2003) make the point that while calories consumed have risen markedly in the U.S., the amount of physical activity has not gone down but rather slightly up. Figure 4 shows the cross-country variation from the Multi National Time Use Survey (MTUS), an harmonized collection of time use studies for some of the countries covered by our analysis, in the time spent per day doing sports and watching television or listening to the radio. Clearly, even though Americans are more obese than Italians, they are spending more time doing sports.

The story is somewhat different for sedentary activities such as watching TV. Americans spend on average 2.5 hrs per day doing such activity compared to less than 1.5 hrs in Italy. This suggests that substitution is likely to have occurred with other activities and the question is whether less or more energy intensive activities are involved. From 1965 to 1995, Cutler et al. (2003) report that time spent watching TV has increased by 40 minutes per day in the U.S., largely taking up time spent doing household work, which includes food preparation (going from 146 minutes per day to 102). Therefore, the increase in time spent doing sedentary

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[6] Europe has a higher unemployment rate, but the relative rate with respect to the U.S. has not changed much over the past 20 years.

activities has occurred at the expense of home production, which includes food preparation and consumption,[7] and is likely to involve a limited amount of physical work.

Figure 4 Time Spent per Day Doing Physical and Non-Physical Activities
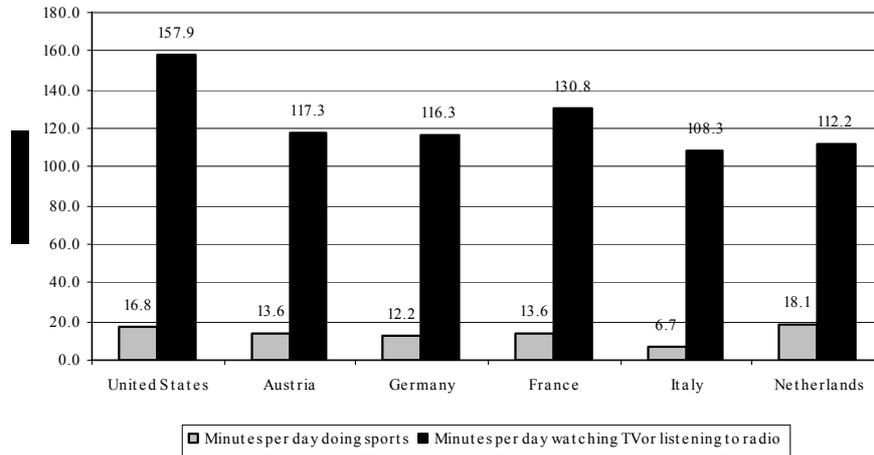
Source: Own calculations from harmonized MTUS sample of aged 20+ respondents. France MTUS sample from 1998, Netherlands 1995, USA pooled 1992-94-98, Italy 1989, Germany 1992, Austria pooled 1992-1997

The substitution away from home production can be documented using data from the MTUS. In Table 2, we show that Americans spend an average of 34 minutes per day preparing meals at home compared to 86.1 minutes in Italy. Furthermore, the time spent eating at home is also much lower (55.8 minutes) in the U.S. than in Western Europe (ranging from 71 to 103 minutes per day).

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[7] Most time-use surveys ask respondents to fill in a diary where they report primary activities. A caveat is that we cannot account for differences in joint activities (working out on a stationary bicycle while watching TV or eating while watching TV).

Table 2 Time-Use Patterns and Calorie Intake Across Countries

	Total Calorie intake per capita	Minutes spent per day			
country		eating on restaurants	eating meals at home	time cooking at home	calorie per minute eating
United States	3774	14.4	55.8	34.1	53.8
Austria	3673	5.7	83.2	63.8	41.3
Germany	3496	5.5	78.4	61.1	41.7
France	3654	25.6	103.3	57.5	28.4
Italy	3671	12.4	101.4	86.1	32.2
Netherlands	3362	4.6	70.9	57.4	44.5
Total	3605	11.1	87.8	66.3	36.5

Notes: Own calculations from harmonized MTUS sample of aged 20+ respondents. Calorie data comes from OECD Health Data 2005 and refers to the year 2002. France MTUS sample from 1998, Netherlands 1995, USA pooled 1992-94-98, Italy 1989, Germany 1992, Austria pooled 1992-1997 samples. Weighted using individual level weights.

Overall, this suggests that – perhaps with the exception of the Netherlands and the U.K. - differences in calorie expenditures while not at work are unlikely to explain the difference in obesity between the U.S. and Europe (excluding the U.K.). As discussed above, differences in calorie consumption while at work may be more relevant, as American workers are more likely to be employed in the less exercise – intensive service industry.

While it is difficult to establish whether Americans spend more calories than Europeans, they certainly consume more per capita. Table 2 shows that daily consumption is larger in the U.S. (3774) than in any other country (ranging from 3300 in the Netherlands to 3673 in Austria). Why do Americans consume more? Cutler et al. (2003) argue that this is due to the decrease in the time cost of food preparation and that this change has not happened elsewhere than in the U.S. The time cost can have several origins: food price, wages, food preparation technology. The variation over time and space in food prices is limited so that it is not clear that this played a large role. Also, the opportunity cost of time is likely to have gone up rather than down over time as wages have gone up for men and employment possibilities have increased for women.

Technology might be the source of differences. If we divide calorie per day by the amount of time in minutes preparing food, we find that Americans consume 42% more calories per minute than Europeans. Hence, this points to important differences in the way calories are consumed and perhaps the type of food which is consumed. Reviewing the legal environment in Europe, Cutler et al. (2003) show that the high number of food statutes and the slow penetration of mass preparation technologies, which encourage rapid consumption of food, might explain the U.S.-Europe difference.[8] Although research based on U.S. variation tends to find a role for

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[8] In 2001, nearly 85% of households had a microwave oven in the U.S. compared to 48.9% in France and 57.3% in the Netherlands (European figures from Eurostat *Consumers in Europe: Facts and Figure* while U.S. figure reported in Cutler et al.

food prices and the quality of food supplied (Chou, Grossman and Saffer, 2004), little international evidence exists on the extent to which food prices, the penetration of technology and regulation are related to the prevalence of obesity. This is likely to be an important research area in the future as better international data is collected.

The rapid growth of obesity in the U.S. relative to Europe over the last 2 decades also allows to dismiss genes or nature as an important factor in determining obesity. Although genetics probably play some role, the gene pool of the U.S. population is likely not to have changed dramatically over the last 30 years and even less relative to that in Europe. Therefore, there has to be a behavioral component to the rise of obesity witnessed in the U.S., whether due to a reaction to the decrease in the time-cost of food preparation and consumption or to some other unmeasured factor leading to lower calorie expenditure. This is an important reason why obesity is not only a public health issue but also an economic problem.

3. Is Public Intervention Justified? Efficiency and Equity Issues

From an economic perspective, public intervention is justified either on efficiency or on equity grounds[9]. Consider first efficiency. As argued by Cawley (2004a), if individuals were perfectly rational and their decisions about food and weight imposed no costs on others in society, if information about the consequences of obesity were accurate and readily available and if markets were perfectly competitive, there would be no market failure and no reason for government intervention. When one or more of these assumptions are violated, market failures occur and the socially optimal level of obesity can differ from that chosen by individuals operating in free markets.

Market failures have been identified and discussed in the literature on obesity in the following three areas: limited information, externalities and lack of rationality[10]. Information about the calorie content of purchased food may be insufficient – or costly to use. Externalities associated to obesity are likely to occur when health and life insurance premiums fail to consider that obese individuals tend to be sicker and have higher healthcare expenditures. This happens when premiums do not reflect weight. In this case, some of the costs are borne by others or by society at large (see Bhattacharya and Sood 2005). Lack of rationality occurs, for instance, when individuals have time inconsistent preferences and self-control problems (Cawley 2004a). Oswald and Powdthavee, 2007, argue that the privately optimal body weight can deviate from the social optimum when individuals care about their relative weight.

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[9] Cawley, 2004, argues that the main economic concern should be efficiency, and that equity considerations should be left to policy makers.
[10] Deviations of privately optimal body weight from the social optimum can also occur if individuals care about their relative weight. See Oswald and Powdthavee, 2007.

Less attention has been paid to the market failures originated by the fact that product and labour markets are often regulated and can deviate systematically from perfect competition. In this case, private and socially optimal outcomes can differ if obesity affects productivity and/or if the wages earned by the obese differ from those received by equally productive non/obese individuals. The contributions of this section are twofold. First, we compare privately optimal weight with the weight that maximizes an utilitarian social welfare function when the product and the labour market are imperfectly competitive. Second, we provide new empirical evidence on the relationship between body weight, productivity and earnings using European data.

3.1 Product and Labour Market Imperfections

Evidence that product markets deviate from perfect competition is abundant. In a recent study of price mark-ups and product market regulation, the OECD finds that price-cost margins are close to 10 percent in manufacturing and to 20 percent in non-manufacturing industries (see Hoj et al., 2007). The US ranks low in the latter but is about average in the former. On the other hand, some European countries (the UK and Sweden) have below average mark-ups and some continental European countries (Italy and Austria) having higher than average values.

There is also abundant literature documenting that wages and marginal products can differ systematically (see for instance Frank, 1984). This can occur because information is less than perfect and the match of workers and firms is characterized by the presence of frictions, or because firms offer contracts which provide insurance to their risk averse workers. Alternatively, there may be firm – specific assets such as training and hiring and firing costs which generate rents and support bilateral bargaining (see Lindbeck and Snower, 1988, Malcomson, 1997). Finally, and especially in Europe, labour market institutions such as employment protection and labour unions can promote rent sharing between firms producing in imperfectly competitive markets and their employees.

We illustrate the implications of imperfectly competitive product and labour markets for optimal body weight with a stylized model where workers – consumers supply labour in-elastically to firms operating in imperfectly competitive product markets. The model – which draws from Blanchard and Giavazzi, 2003 and is presented in more detail in the Appendix – has two key ingredients: first, firms face positive entry costs; second, the presence of product market rents and of labour market imperfections implies that wages are the outcome of the bargain between workers and firms. Further assume that the government has a utilitarian welfare function and maximizes the un-weighted sum of individual utilities and profits. With costless

entry, profits are driven to zero so that only individual utilities matter. With costly entry, however, profits are positive and need to be considered in the definition of the socially optimal level of obesity (weight).

Following Cutler, Glaeser and Shapiro, 2003, we divide consumption goods and services into two groups, the group *C* that does not affect weight and the other group *F* which increases individual weight, and assume that individual utility is linear in the consumption of the former and concave in the consumption of the latter[11]. Therefore utility depends on weight both directly, because consumers are concerned about the negative health effect of being overweight, and indirectly, because the consumption of *F* affects weight. With no saving and with given prices of the two types of goods, the privately optimal level of weight is obtained when the marginal utility from the consumption of *F* is equal to the marginal disutility from increased weight.

Firms in this economy produce output by using labour and the available stock of knowledge. They face a downward sloping demand curve for their product, and can choose the product price so as to maximize profits. In the short run the number of firms is given; in the long run, however, firm entry is regulated by the presence of barriers to entry and other administrative constraints. In the presence of these barriers, firms already in the market earn a rent, which depends on the elasticity of product demand. Wages and employment in each firm are set by Nash bargaining. Depending on their relative bargaining power, workers can obtain a share of the rents gained by firms in the product market. Therefore, total profits are the residual share of product market rents after labour has been remunerated.

Importantly for the purposes of this paper, the presence of positive profits does not necessarily affect the socially optimal level of weight. For this to happen, weight or obesity must affects profits, either because they reduce productivity, or because they affect the bargaining power of workers and their conditional earnings. This could occur if obese workers are discriminated and receive a lower share of the available rents. Suppose that only the negative productivity effect is in place. Then the socially optimal weight is lower than the privately optimal level and there is "excessive" obesity. Next assume that there is only a "discrimination" effect. Since higher body weight increases profits by reducing earnings, the socially optimal weight is above the private optimum and obesity is "too low". Finally, when both the productivity and the "discrimination" effect are in place, privately optimal weight is too high or too low depending on the relative size of these effects. The next two sub-sections consider the empirical support for either effect in some detail, by combining original evidence with a review of the existing knowledge.

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[11] This assumption simplifies the algebra and implies that the choice of the consumption bundle is independent of income.

3.1.1 Body Weight and Productivity

Are the obese less productive than the non-obese? Given the paucity of individual data on productivity, it is useful to frame the discussion of this question within the "health augmented" Solow model of productivity growth[12]. According to this model the steady state level of output per head is a function of total factor productivity, the investment rate and the stock of human capital. Human capital has two dimensions, education and health. Better health increases productivity both directly and indirectly. The former effect occurs because life expectancy raises and disability falls. The latter effect takes place because better health – by lengthening the planning horizon - raises the incentives to invest in education, which affects productivity level and growth[13]. As illustrated in Figure 5, body weight and obesity can affect productivity if they influence health conditions and the incentives to invest in further education[14].

3.1.1.1 Education, health and productivity

Strauss and Thomas, 1998, review the existing microeconomic literature and conclude that evidence exists in favour of a causal impact of health on productivity in low – income countries, where manual work is still important. Bloom, Canning and Sevilla, 2004, use data from a panel of developed countries and show that each extra year of life expectancy raises the productivity of workers by 4 percent. These estimates, however, have been criticized by Weil, 2006, because they fail to deal in a satisfactory way with the endogeneity of health[15]. He uses calibration rather than estimation and finds that a one percentage point increase in the adult survival rate increases productivity by 1.68 percent. Acemoglu and Johnson, 2006, instead, use an instrumental variable technique and find no evidence that the large changes in life expectancy experienced during the second part of the last century led to a significant increase in output per head.

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[12] Imperfect product and labour markets imply that we cannot use wages as a proxy of productivity.

[13] See Acemoglu and Johnson, 2006, and Bloom and Canning and Sevilla, 2004.

[14] As discussed at length by Tosini, 2008, obesity can affect marriage and fertility decisions. However, as long as these decisions do not affect individual productivity, we can disregard them for the purposes of this paper.

[15] Bloom et al., 2004, use lagged measures of health to instrument current health.

Figure 5 The relationship between body weight and productivity
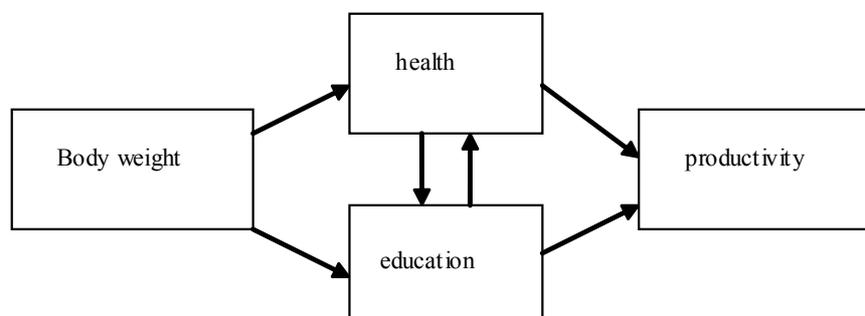
Conditional on life expectancy, average output per head can fall if individuals in poor health or disabled retire earlier from the labour market or spend more time in unemployment and out of the labour force. Over the last 10 years, a number of studies have shown that poor health is clearly one determinant of retirement behaviour (see for instance Lumsdaine and Mitchell, 1999). However, it is unclear how sizeable the effects are. Bound, Schoenbaum, Stinebrickner and Waidmann (1999) report that not only poor contemporaneous health but also the decline in health are important determinants of retirement behaviour, encouraging early retirement.

French (2005) reports that, even with an admittedly crude measure of health, poor health can explain about 10% of the drop in the labour force participation rate between the ages of 55 and 70. Using a richer set of health measures, and correcting for the endogeneity of health, Bound, Stinebrickner and Waidmann (2007) show that health has a sizeable impact on retirement insurance in the U.S. For example, they report exit rates at age 62 that are 5 times as high for those in poor health relative to those with average health. McGarry (2004) shows that changes in health have a strong effect on retirement expectations. The relationship with application for disability insurance is relatively unambiguous: poor health increases the risk of early exit through disability insurance and this tends to be robust across countries (Benitez-Silva et al., 1999; Kerkhofs et al., 1999; Bound et al., 1999)

In comparison, the relationship between health and labour force participation and hours worked at earlier ages has been studied for a longer period. However, Currie and Madrian, 1999, review the US empirical literature and conclude that little consensus has been reached on the magnitude of the associated effects, although researchers have consistently found some

effects of health on labour market outcomes. Such effects tend to vary with the measures of health used (tend to be larger for measures of disability and mental health problems) and most studies narrowly focus on particular demographic groups (white males).

There is also a vast literature investigating the effects of education and years of schooling on output per head and productivity growth. In a recent review of this literature, Sianesi and Van Reenen, 2003, argue that the evidence in support of the fact that education increases productivity is compelling, and conclude that one additional year of education is expected to raise productivity by 3 to 6 percent. In a similar fashion, Arnold, Bassanini and Scarpetta, 2007, estimate a multi-country growth model on OECD data and find that one additional year of education raises output per capita by 6 to 9 percent.

The relationship between education and health is widely studied. Cutler and Lleras Muney, 2007, for instance, estimate the education gradient for several health outcomes, including obesity, and find evidence that education generally matters even after controlling for income and demographic controls. The potential effects of higher life expectancy on human capital accumulation is less widely investigated, and the main point here is that people who live longer have greater incentives to invest in human capital (Soares, 2005). The relationship between health outcomes and education is important in the light of the controversial evidence on the size of the effects of health on productivity, because it suggests that health can matter for output per head also because it leads to more years of schooling.

3.1.1.2 BMI, Education and Health

Does obesity affect education? There are a lot of studies in the medical literature that suggest that obese children have higher absenteeism rates. Datar and Sturm, 2006, for instance, investigate data on US children and find that being overweight is a significant risk factor for girls but not for boys. Kaestner and Grossmann, 2008, examine children ages 5 to 12 in the US NLSY and find that children who are overweight or obese have achievement test scores that are about the same as children with average weight. They also review evidence on the educational achievement of adolescents, and conclude that obesity in this group is associated with lower attainment. Ding et al, 2006, use genetic markers to instrument health and find that the academic performance of female US adolescents is negatively affected by poor physical and mental health outcomes, including obesity.

Another study in this area is Gortmaker et al, 1993, who use the 1979 NLSY and show that girls aged 16 to 23 who were overweight had 0.3 years less education than normal weight girls eight years later. No similar evidence exists to date for a relatively broad group of

European countries. We fill this gap by using the data from the European Community Household Panel, a longitudinal dataset covering the period 1994-2001 for 9 countries with data on BMI[16]. We select the cohort of students aged 16 to 23 in 1999, measure educational attainment both in that year and in the final available year, 2001, and define a dummy variable that is equal to 1 if the observed change in the number of years of schooling is positive and 0 otherwise. In line with Kaestner and Grossmann, 2008, we model the probability that educational attainment increases as a function of age, parental education and BMI.[17]

While we cannot exclude that omitted factors which affect changes in school attainment are correlated with BMI, we try to attenuate reverse causality by using not the current BMI but the first available measure in our data, the body mass index in 1998, one year before our first observation of educational attainment. Probit results are shown in Table 3, which consists of six columns. In the first three columns, one for the full sample and the remaining two for males and females, we assume that the estimated coefficients do not vary across countries. In the latter three columns, we allow for interactions of each explanatory variable with a dummy equal to 1 if the country is located in Southern Europe and to 0 otherwise.

Table 3 The Effect of BMI on Changes in Educational Attainment. Marginal Effects

	All	Males	Females	All	Males	Females
Bmi	-0.006	-0.001	-0.011	-0.003	0.012	-0.022
	[2.26]**	[0.20]	[2.86]***	[0.67]	[1.65]*	[2.74]***
Age	-0.006	-0.004	-0.009	-0.024	-0.026	-0.027
	[1.30]	[0.63]	[1.42]	[2.92]***	[2.14]**	[2.34]**
Low Parental Education	-0.019	0.004	-0.040	-0.012	-0.019	-0.010
	[1.12]	[0.16]	[1.62]	[0.33]	[0.39]	[0.17]
Bmi * South				-0.004	-0.017	0.014
				[0.63]	[2.01]**	[1.55]
Age * South				0.026	0.030	0.026
				[2.63]***	[2.07]**	[1.88]*
Low Par. Ed. * South				-0.008	0.028	-0.033
				[0.20]	[0.50]	[0.51]
Observations	2206	1138	1068	2206	1138	1068

Notes: each regression includes country dummies and a constant term. A gender dummy is included in the first column. T - statistics based on robust standard errors within brackets. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence.

We find that European adolescents with a higher body mass index complete fewer additional years of schooling in the window of time allowed by the data. This is especially the case of female adolescents, as shown in columns (3) and (6) of the table. Our estimates in the

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[16] These countries with data on BMI are: Austria, Denmark, Ireland, Italy, Greece, Spain, Portugal, Finland and Belgium.
[17] We use the highest educational attainment among parents to measure parental education. We have also experimented with a measure of smoking, but with little success.

first column suggest that a 10 percent increase in BMI would reduce the probability of adding at least one year of school in the two – years window by 7.55 percent when evaluated at the mean (-.006*22.51/.179). This effect is larger for females than for males. Furthermore, there is evidence that the effect of BMI on education is significantly different in Southern Europe only in the sub-sample of males. Overall, our results suggest that overweight adolescents are likely to attain lower education than normal weight children and adolescents. Two reasons for this are that obese students are exposed to stigma and psychological pressure, and have a higher number of sick days (Datar and Sturm, 2006)[18].

Finally, consider the relationship between obesity and health. Numerous studies have found that obesity increases the risk of type 2 diabetes (Colditz et al, 1995: a two-fold increase in risk for 10kg gained after age 18), coronary heart disease (Willett et al, 1995: two-fold increase for women with BMI of 28.9 compared to 25), hypertension (Brown et al, 2000: 15% for BMI<25, 42% for BMI>30), stroke, gallbladder disease, osteoarthritis, respiratory disorders and some type of cancer (National Institute of Health, 1998, and Michaud et al, 2001). Hence, the epidemiological literature is quite unambiguous on the effect of obesity on health, conditional on survival. What about life-expectancy? Since obesity is a predictor of all diseases mentioned and these are linked to mortality, one would infer that obesity reduces life-expectancy. However, there is much debate in the literature on this issue since obesity, unlike smoking, might have a protective effect in old-age (Stevens et al., 1998; Calle et al., 1999; Visscher et al., 2000; Grabowski and Ellis, 2001). Moreover, there might be important endogeneity issues at the micro level that might confound the relationship between obesity and mortality. Hence, we test whether such a negative relationship can be observed at the macro level.

To do so, we integrate the cross country data on average life expectancy at birth and public health expenditure in the OECD Health Database with data on the percentage of obese individuals in the population, which we collect partly from the OECD and partly from the ECHP. US data are drawn from the BRFSS. We end up with an unbalanced panel of 12 developed countries covering the period 1979 to 2004[19], which we use to estimate the following error correction specification[20]

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[18] Compared to us, Datar and Sturm find a statistically significant relationship for females but not for males.

[19] A few missing data in the sample are generated by linear ipolation.

[20] Lichtenberg, 2002, models life expectancy as a function of the "health expenditure stock". If such relationship is linear, it can be written in autoregressive form. We deviate from Lichtenberg by assuming that expectancy depends on the lagged rather than on the current stock and by adding additional explanatory factors such as the lagged obesity rate. Lags are introduced here to alleviate the problems associated to the potential endogeneity of regressors.

$$\Delta \ln LE_{it} = \gamma_C + \alpha \ln LE_{it-1} + \beta \ln GDP_{i,t-1} + \delta \ln S_{i,t-1} + \phi \ln OB_{i,t-1} + \lambda \ln TOB_{it-1}$$
$$+ \mu \ln EXP_{it-1} + \psi t + \xi t^2 + \theta_{it} \qquad [1]$$

where LE is life expectancy, OB the share of obese individuals, GDP is real GDP per head, S the number of years of schooling, EXP health expenditure and TOB the percentage of daily smokers. Table 4 presents our results.

Table 4 Estimated effects of obesity on life expectancy at birth. Dependent variable: change in log life expectancy

	1	2
log lagged life expectancy	-0.241	-0.295
	[2.77]***	[2.91]***
log lagged GDP per head	-0.01	-0.01
	[2.80]***	[1.99]*
log lagged schooling	0.023	0.02
	[2.76]**	[2.18]*
log lagged obesity rate		-0.008
		[4.57]***
log lagged health exp/GDP		0.0007
		[0.19]
log lagged tobacco consumption		-0.004
		[1.51]
Observations	155	155
R Squared	0.25	0.25

Notes: see Table 3. Each regression includes country dummies, a linear and a quadratic trend.

The parsimonious specification in column (1) shows that life expectancy is negatively correlated with GDP per head but increases with schooling. The negative correlation between GDP growth and longevity has already been noticed in this literature (see Lichtenberg 2002 and Cutler, Deaton and Muney, 2006). In column (2) we add to the regression the log of the lagged obesity rate, log lagged health expenditure on GDP and log lagged tobacco consumption, and find evidence of a statistically significant negative correlation between longevity and obesity, indicating that a 10 percent increase in obesity rates reduces life expectancy by 0.29 percent. To illustrate, the obesity rate in the USA in 2004 was 23.43% in our data. If we were to bring this rate back to its 1994 value – 14.36 percent – life expectancy would increase by 1.126 percent, slightly less than a year from the baseline of 77.5.

3.1.2 Body Weight and Earnings

At least since the work by Hamermesh and Biddle, 1994, the study of labour market discrimination has been extended from race and gender to other groups of the population,

including the ugly and the obese. Identifying discrimination is a daunting task, because it requires that we compare individuals with identical characteristics and show that they are treated differently because of some observable characteristic – including obesity. The more modest task of this sub-section is to investigate Becker's insight that discrimination is reduced by market competition using both cross country data on the wage penalty or premium associated to weight and measures of product market regulation.

The empirical literature which studies the impact of BMI on wages is vast (see Cawley, 2004b, and Garcia and Quintana-Domeque, 2006, for good discussions of the empirical issues involved). Our overall view is that, while the majority of studies find evidence of a negative relationship between BMI and earnings, especially for females, these estimates are rarely statistically significant at the standard levels of confidence. Moreover, few if any of the available studies try to decompose the uncovered effects into the component associated to differences in productivity and discrimination effects.

An alternative and more indirect route to investigating discrimination effects is to consider its relationship with competition. If some employers have a taste for discrimination against the obese, they will hire fewer workers of this type compared to non discriminating employers. Indulging in their tastes, the former will employ more expensive non obese workers and forego some profits compared to the latter, who hire both types. With freedom of entry, non-discriminators will push discriminators out of the market in the long run and wage equalization between worker types will take place (see Weichselbaumer and Winter-Ebmer, 2007). It follows that, if preferences for discrimination are invariant across countries, its relative importance will be higher in those countries where freedom of entry is more limited and product market competition is more regulated.

To verify this, we use data drawn from the ECHP to compute for each of the 9 countries in the sample the correlation between log earnings and obesity rates, after partialling out a wide range of individual effects which capture differences in observed productivity[21]. To control for self-selection into paid employment, we also add among the regressors the inverse Mills ratio – which we compute after estimating an auxiliary regression of participation in paid employment on the full set of explanatory variables plus additional variables capturing household size, parental education and household income. We then regress these correlations on the OECD index of product market regulation, which measures for the year 1998 the relative importance of barriers to entry and others limits to competition (see Hoj et al, 2007). Under the assumption

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[21] Our controls include age, age squared, marital status, education, household composition, industry, country and occupational dummies, dummies for quality of health, dummies for the type of job (part time, temporary, subordinate), dummies for the public sector and the size of the firm, a dummy equal to 1 if the individual has received training during the past 12 months and the estimated inverse Mills ratio associated to paid employment. We pool data and regress log earnings and obesity on these controls and take the residuals. Next, we compute the country by country correlation and regress this country specific information on the index of product market regulation.

that the bias in the correlation between obesity and earnings induced by reverse causality and unobserved heterogeneity is invariant across countries, this exercise is informative of the presence of discriminatory effects.

Figure 6 presents our results separately for males and females. We notice that the estimated correlation between log earnings and obesity tends to be negative, especially among females. When we regress these correlations on the index of product market regulation, which increases the tighter are the limits to competition, we find evidence of a negative relationship, in line with the prediction of Becker's model. In particular, the negative penalty on obesity is largest in Greece and the countries of Southern Europe.

3.1.3 Summary of Productive Inefficiencies

Obesity can influence productivity if it affects health and education. We have presented original evidence for Europe confirming previous evidence from the U.S. that overweight and obese adolescents tend to complete fewer years of education. Since learning begets learning, this education gap is likely to widen during adult life, with important effects on productivity. We have also shown that obesity affects individual health by influencing life expectancy at birth. Notice that health can deteriorate because of obesity even if life expectancy is unchanged simply because individuals spend more time in disability or early retirement. Finally, we have presented cross-country evidence that the relationship between BMI and wages is negatively correlated to the index of product market regulation and suggested that wage discrimination because of obesity is likely to be a more serious issue for females than for males.

Figure 6 Product market regulation and the BMI log wages correlation
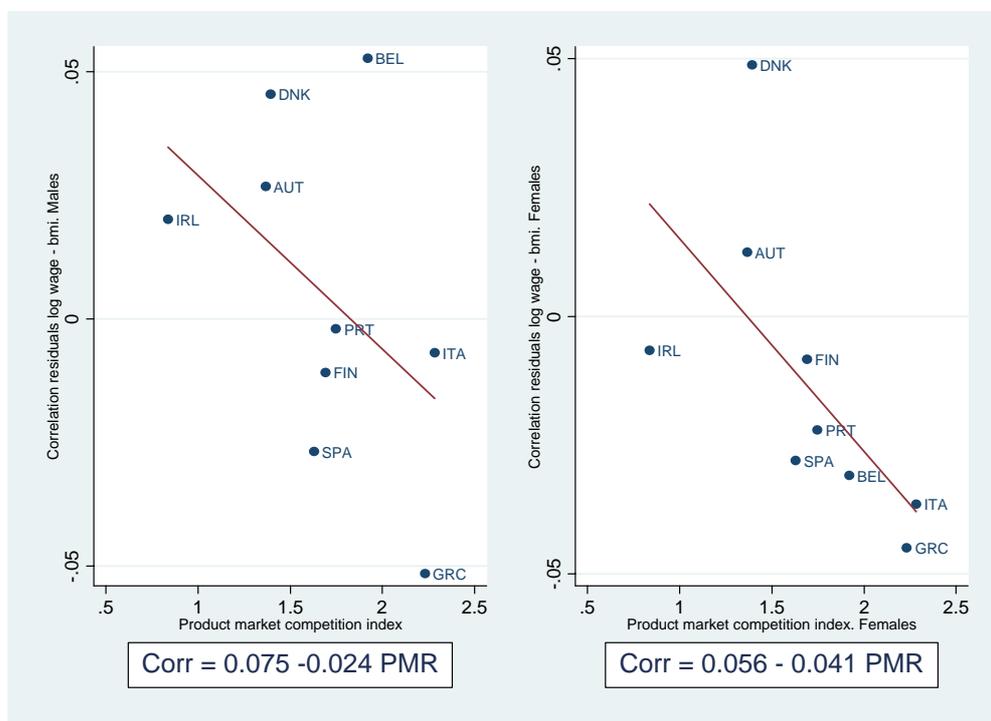
Sources: OECD and ECHP

Overall, our evidence supports the view that obesity generates productive inefficiencies – mainly but not exclusively via education - which are more relevant the larger the deviation of labour and product markets from perfect competition. The direction that policy should take, however, remains unclear, and depends on the relative importance of the productivity and discrimination effects. For instance, our estimates suggest that discrimination effects are less relevant for males than for females. With common productivity effects, this implies that the gap between the socially and privately optimal body weight is negative for males but could take either sign for females.

3.2 Other sources of inefficiency

Lack of information and limited rationality are sources of market failures that have been acknowledged in the obesity literature (Cutler et al., 2003, Cawley, 2004a). However, to the best of our knowledge, there is no systematic evidence on the empirical relevance of such phenomena for obesity.

3.2.1 Lack of information

There are at least three information issues that may be relevant to body weight. First, individuals may not be accurately informed about the health consequences of being overweight or obese. According to a recent Eurobarometer survey[22], the percentage of women and men who are aware that being overweight is bad for their health is at least 70% in most European countries (Table 5). Comparing across countries suggests that lack of information alone cannot account for the existing difference in obesity rates.[23] For example, the percentage of adults who recognize that being overweight has adverse health consequences is below average both in Finland and in Italy, in spite of the fact that Finland's obesity rate is much higher than in Italy. As one would expect, the percentage of informed individuals is related to education, both at the macro and at the micro level. At the macro level, countries and groups with a higher percentage of individuals who think that being overweight is bad for their health are generally also those with a higher average level of education. The Spearman rank correlation between these variables is positive, high (0.45) and statistically significant at the 5% level. At the micro level, we have run probit regressions - separately by gender - of the probability of knowing that being overweight has adverse health consequences on age, education indicators and country dummies.[24] The results of these estimates, not reported here for the sake of brevity, confirm the aggregate correlation in that the likelihood of being aware that overweight is bad for one's health is significantly increased by 4 percentage points for women and by 3.7 points for men who have more than 12 years of schooling with respect to their counterparts with less than 12 years of schooling.

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[22] The Eurobarometer is conducted on behalf of the European Commission in order to monitor the public opinion in the European Union. For detailed information on the Standard and Special Eurobarometer Surveys, see http://www.gesis.org/en/data%5Fservice/eurobarometer/index.htm.
[23] For the purpose of this comparison, the obesity rate for each country and gender was computed from the closest Eurobarometer survey (No. 59.0), which was carried out in year 2003. The spearman rank correlation coefficient between this obesity rate and the percentage of individuals who think that being overweight is bad for their health is indeed low (0.10) and statistically insignificant (p=0.58).
[24] The cross sectional nature of the Eurobarometer 64.3 and its scarcity of economic indicators do not allow one to carry out more sophisticated analyses needed to draw causal inferences.

Table 5 Percent of European Adults who Think that Being Overweight is Bad for their Health

	Women	Men
Germany	85.70	85.96
Denmark	93.09	91.87
Netherlands	85.47	86.16
Belgium	84.69	84.24
Luxembourg	90.38	84.95
France	83.84	80.53
UK	76.06	73.27
Ireland	72.23	69.72
Italy	57.36	63.24
Greece	90.58	87.82
Spain	70.66	67.93
Portugal	71.70	74.05
Austria	70.02	62.58
Finland	66.33	61.72
Sweden	95.34	94.16
All	78.94	78.61

Note: Statistics based on Eurobarometer Survey No. 64.3, 2005.

Notice that, even if most individuals were fully aware that overweight and obesity are hazardous to health, there may still be information deficiencies if they underestimate the risks or fail to consider the cumulative risks associated with gaining weight. In other words, while gaining weight is easy, losing it is harder[25], and individuals may not be fully aware of the long-term consequences of current weight gains. This is an aspect of the question that has been addressed in the smoking literature: for instance, Slovic, 2000, finds that a high percentage of adolescent smokers see no health risk from smoking the "very next cigarette", failing to appreciate the addictive properties of tobacco. Unfortunately, we are unable to provide empirical evidence on this issue due to the lack of suitable data.

Second, there may be lack of information regarding what constitutes healthy habits and, more specifically, the calorie content of purchased foods. This is the information aspect that the obesity literature has, directly or indirectly, referred to most often (Cawley, 2004a, and Cawley and Variyam, 2006). We attempt to assess the relevance of this information deficit by looking at the percentage of European adults who declare that following a healthy diet is not easy because they "lack info about what constitutes a healthy diet", "lack info about the food they eat" and/or think that "information about healthy eating is confusing and contradictory". According to the results reported in Table 6, information problems appear to be particularly rare in two Northern European countries (the Netherlands and the UK) and more severe in Italy, Greece, France and

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[25] Obesity does not meet the definition of addiction as clearly as tobacco consumption does. However, obesity influences the human body's homeostasis and can lead to habitual behaviours that are very difficult to modify (Roth et al. 2004).

Austria, but, on average, less than 9% of European adults declare not to find it easy to follow a healthy diet due to information problems. Hence, if we rely on European adults' self reported answers on the issue, lack of information is clearly not crucial in explaining why individuals do not find it easy to eat healthily.

Table 6 Percent of European Adults who don't Find it Easy to Eat a Healthy Diet due to Information Issues

	Women	Men
Germany	6.29	7.43
Denmark	6.52	9.07
Netherlands	2.15	2.16
Belgium	7.94	8.74
Luxembourg	11.99	12.25
France	13.13	12.69
UK	2.93	3.79
Ireland	5.35	4.13
Italy	15.93	17.95
Greece	13.11	16.63
Spain	6.73	6.28
Portugal	8.45	6.11
Austria	15.46	16.55
Finland	7.08	9.22
Sweden	5.36	6.61
All	8.35	8.80

Note: Statistics based on Eurobarometer Survey No. 64.3, 2005.

Finally, individuals may be unaware that they are overweight or obese even if their weight status should objectively be classified as such. No Eurobarometer survey contains information on both weight status and individuals' perceptions of their own weight. Instead, we rely on a recent sample of US individuals from the National Longitudinal Survey of Youth 1997 (NLSY97), which consists of youth aged 12-16 in 1997 who were subsequently re-interviewed on a yearly basis until 2005.[26] NLSY97 respondents were not only asked about their height and weight[27] but they were also asked to describe their own weight as "very underweight", "slightly underweight", "about right", "slightly overweight" or "very overweight".[28]

In Table 7 we focus on the sample of US youth who are overweight (column 1) and obese (column 2) and report the percentage who misclassify their own weight and describe it as "about

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[26] For further information about the NLSY97, see http://www.bls.gov/nls/handbook/2005/nlshc2.pdf

[27] Self-reported weight and height have been corrected using regression estimates from Cawley and Burkhauser, 2008.

[28] The Center for Disease Control (CDC) in the U.S. recommends using its gender and age-specific growth charts in order to classify weight status among individuals under the age of 21. In particular, youths are classified as "overweight" if their BMI is at or above the gender and age-specific 95th percentile and "ar risk of overweight" if their BMI is between the 85th and the 95th percentile. We use the adult obesity (BMI≥30) and overweight (BMI between 25 and 30) standards for all respondents, including those below 21 years old, to ensure comparability across individuals and over time. However, our results remain basically unchanged when using the CDC classification for youth.

right", "slightly overweight" or "very overweight". The proportion of self-descriptions that do not match the objective BMI classification is remarkably high, especially among young males.

Table 7 US % of Youth who are Overweight (1) or Obese (2) but describe Their Weight Status as Right, Slightly or Very Underweight

	(1) Overweight	(2) Obese
All	32.34	14.00
Females	17.57	7.28
Males	44.78	20.69

Source: NLSY97.

This could be due to some sort of cognitive dissonance (obese individuals might like to think that their weight is not so high because their habits are more justifiable if they do so) and/or to the lack of the necessary information to identify excessive weight. When drawing parallelisms with smoking behaviour, it is worth noting that this latter aspect may be relevant for the obesity phenomenon but of course it is unlikely to be an important issue in the context of smoking.

In sum, our results suggest that the majority of individuals are informed about the bad consequences of overweight and obesity on health and do not feel that following a healthy diet is difficult because of lack of information. Moreover, cross-country differences in obesity prevalence cannot be explained on the basis of lack of information. On the other hand, there is also strong evidence that, at least among teenagers, individuals often fail to properly evaluate their own weight status.

3.2.2   Lack of Rationality

While they do not directly attempt to quantify the importance of self-control problems, Cutler et al. (2003) suggest that lack of rationality may be relevant in explaining food consumption: "…the standard model of consumption involves rational individuals who decide how much to consume on the basis of price and income, fully accounting for the future health consequences of their actions. But at least some food consumption is almost certainly not fully rational. People overeat, despite substantial evidence that they want to lose weight." (p. 112).

In our context, the most common source of lack of rationality is time inconsistency, which refers to individuals constantly re-optimizing over the short term, and quickly abandoning the long-term plan that was originally optimal: what is optimal today for someone to start tomorrow is no longer optimal once tomorrow comes. Finding empirical measures of time inconsistency is

not an easy task. We have been able to build a proxy for dynamic inconsistency for the US by exploiting the longitudinal nature of the NLSY97 as well as its richness of information on weight-related aspects. Specifically, we focus on the sample of youths who, at time t, declare to be trying to lose weight, and compare their BMI at time *t* and *t+1*. In Table 8 we report the percentage of failed weight loss attempts using two alternative definitions of "failed attempt": column 1 displays the percentage of youths whose BMI at *t+1*, despite having declared to be trying to lose weight, is less than a (gender, year and age-specific) standard deviation lower than their BMI at t; column 2 instead uses a less demanding definition and classifies as failed weight loss attempts all those cases in which the BMI at time *t+1* is not lower than the BMI at time *t*.[29]

The message from the first two columns of Table 9 is clear: time inconsistent preferences regarding weight is a very common problem among teenagers, since the majority of them end up failing to reduce their BMI after having declared to be trying to lose weight.[30] One obvious objection to this measure is that some of the unsuccessful weight loss attempts that we have identified could have been the result of a re-optimization taking place between *t* and *t+1* because some unexpected shock occurred during those twelve months. An intuitive example of such a shock is pregnancies, which have already been removed from the above analysis. However, new information arrivals that could make the initial diet plan no longer desirable are not restricted to pregnancy. In order to check how vulnerable our results are to this criticism we have re-computed the percentage of unrealized weight loss attempts on the sample of youth whose family structure remains unchanged between *t* and *t+1* and on the sample of white individuals, who are less prone to earnings instability. Our results are reassuring: the percentage of unsuccessful weight loss attempts remains broadly unchanged even when we focus on these sub-groups of individuals.

Table 8 Failed Weight Loss Attempts (%) among US Youths

	All		Unchanged Family Structure		White	
	(1)	(2)	(1)	(2)	(1)	(2)
All	93.18	57.05	93.50	57.80	93.53	56.55
Females	93.00	53.76	92.98	54.30	93.36	52.58
Males	93.53	63.33	94.45	64.30	93.88	64.48

Source: NLSY97.

Although we find evidence that individuals often fail to properly evaluate their own weight status, our results regarding information problems seem to suggest that their relevance may be limited: most individuals declare to be aware of the health consequences of obesity, a relatively small percentage of them find it hard to eat healthily because of information

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[29] Unfortunately, the lack of suitable data prevents us from construction an equivalent dynamic inconsistency measure for Europe.
[30] Similar results, not reported, are obtained when considering two year intervals.

deficiencies and these indicators are not significantly related to aggregate measures of obesity prevalence. However, we do have stronger evidence on time inconsistency: the majority of teenagers fail to reduce their BMI after having declared to be trying to lose weight. This is an important result because of the welfare implications of technical change when there are self control problems. As Cutler et al. (2003) argue, technological innovation that reduces the time costs of food preparation affects food consumption by reducing the price of food and by reducing the delay before consumption. While the price reduction affects all, the reduced time delay will mostly affect individuals with self control problems, who will spend more than is optimal on food and incur a welfare loss if the health costs of additional weight due to overconsumption[31] are greater than the welfare gain from lower costs of time food preparation.

3.3 Equity Issues

The negative relationship between obesity and socioeconomic status (SES hereafter) has been documented in numerous studies. For example, Chou, Grossman and Saffer (2004) find that years of formal schooling completed and real household income have negative effects on BMI and the probability of being obese for US adults. However, there are two main reasons why giving this negative BMI-SES correlation a causal interpretation may be misleading. First, there is some evidence indicating that obesity lowers individuals' wages (Cawley, 2004b); hence, reverse causality may be playing a role. Second, both SES and BMI could be the consequence of individual choices as well as of circumstances beyond individuals' control. Policy intervention because of equity considerations is justified by the latter but not by the former.

One way to get around these problems is to link individuals' BMI to their parental background rather than to their own SES, given that parental background is not something that individuals get to choose. Moreover, reverse causality is no longer a concern since individuals' BMI is unlikely to determine their parents' SES. One might still be concerned that this empirical strategy does not allow one to disentangle the impact of parental background from the impact of other unobserved factors associated with parental background and that are transmitted from parents to their children. However, our purpose is to assess the importance of equity considerations related to obesity, so inasmuch as these unobservables are intergenerationally transmitted and not a result of individuals' choices, we believe that they are part of the effect that we want to estimate.

In a related study for the US, Baum and Ruhm, 2007, investigate the obesity-SES

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[31] Another welfare cost from overconsumption for an individual with self control problems may be the reduction in consumption from other goods

relationship by choosing as the main proxy for SES the educational attainment of individuals' mothers. To this purpose, they use data on young adults from the National Longitudinal Survey of Youth of 1979. Their main findings are that young adults' BMI is indeed negatively related to their mothers' educational attainment and that these SES disparities in obesity grow with age. This result is in line with the findings of Case, Lubotsky and Paxson, 2002, who analyse other health conditions and health status indicators and conclude that the SES-health gradient in the US becomes steeper as children move from infancy through late adolescence. Two main reasons have been proposed for this steepening gradient: that low SES individuals are both more likely to suffer negative health shocks and less likely to be able to recover from them.[32]

In order to add new obesity-related evidence to this debate we complement Baum and Ruhm's, 2007, analysis in two important ways. First, we provide new evidence for European countries in order to assess whether our conclusions are similar to those reached by Baum and Ruhm, 2007, for US young adults. This is of interest given the contrasting institutional structure of the US and the European countries considered. In order to carry out this analysis, we link ECHP young adults to their parents. Second, unlike previous studies that have solely focused on parental socioeconomic background, we attempt to disentangle the effect of family background into a nature and a nurture component. That is, we analyse how individuals' BMI is influenced by both their parents' SES and by their genetic inheritance. Since empirical measures of genetic predisposition to obesity are unavailable in our datasets, we use the BMI of individuals' biological mother as a proxy. According to Comuzzie and Allison, 1998, 40 to 70 percent of the variation in obesity-related phenotypes in humans is heritable. However, we acknowledge that the impact of maternal BMI is likely to reflect not only the importance of genes but also other unobserved factors, such as eating habits, affecting the BMI of both mothers and their children. Therefore, we make the more humble point that while parental SES is closer to measuring nurture effects, maternal BMI is closer to capturing nature effects. If equity issues turned out to be relevant enough to justify public intervention, this distinction is useful when designing targeted policies.

The household nature of the ECHP only allows one to link children to their parents' characteristics when they are cohabiting. As a result, we are forced to rely on a sample of young adults which is not evenly distributed across European countries. For this reason, the results reported are based on countries were cohabitation rates are higher: Ireland, Italy, Greece, Spain, Portugal and Austria. Young adults in the resulting samples are, on average, between 25 (Austria) and 29 (Greece) years old. We follow Baum and Ruhm, 2007, and use maternal education as our main proxy for parental SES. This choice is not only meant to facilitate

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beyond what a rational person would do. However, Cutler et al. (2003) argue that this is mechanisms is unlikely to be important.

comparability of results but is also motivated by previous studies suggesting that maternal education is more related to child health than fathers' schooling (Currie, Shields and Wheatley Price, 2007) and by the fact that socioeconomic data is more often missing for fathers.

Table 9 The Impact of Family Background on the BMI of European Young Adults: Random Effects Estimates

	Ireland	Italy	Greece	Spain	Portugal	Austria
Female	-0.493***	-1.390***	-1.122***	-1.461***	-0.752***	-0.775***
	[-3.16]	[-15.02]	[-9.83]	[-11.99]	[-5.84]	[-5.14]
Age	-0.026	0.078***	0.073***	0.075**	0.139***	0.148***
	[-0.41]	[3.40]	[2.90]	[2.30]	[4.56]	[3.97]
Mother's Years of Schooling	-0.248**	-0.016	-0.072	-0.038	0.014	-0.137**
	[-2.03]	[-0.48]	[-1.34]	[-0.53]	[0.26]	[-2.03]
Mother's Years of Schooling*Age	0.010**	-0.000	0.001	-0.000	-0.000	0.003
	[2.20]	[-0.11]	[0.92]	[-0.12]	[-0.48]	[1.09]
Mother's BMI	0.071	0.088***	0.068***	0.099***	0.095***	0.116***
	[1.59]	[3.59]	[2.70]	[3.64]	[3.39]	[4.16]
Mother's BMI*Age	0.002	0.001	0.0005	0.001	-0.001	-0.000
	[1.46]	[1.45]	[0.75]	[1.34]	[-1.11]	[-0.82]
N. Obs.	3444	10400	7249	6815	5514	4717

Source: ECHP. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. T-statistics are displayed in square brackets. Additional regressors are year dummies and individuals' years of schooling.

Our country-specific results are reported in Table 9. In line with the previous literature, we find that, even after controlling for education,[33] individuals with higher parental SES (as measured by maternal education) have lower BMI in all countries with the exception of Portugal. However, these effects are far from being statistically significant at standard levels of testing in the Mediterranean countries (Portugal, Spain, Greece and Italy). This lack of significance could be due to the fact that the maternal BMI indicator, also included in the regressions, is positively correlated with maternal education. However, we have replicated our analyses excluding the maternal BMI variable and our results for maternal education remain basically unchanged.[34]

As for the nature component of parental background, our results indicate that the mother's BMI is found to be positively and significantly (with the exception of Ireland) associated with the BMI of her children. Both our parental background measures are interacted with age in order to assess whether the previous relationships are weaker or stronger for older individuals. While Baum and Ruhm (2007) find that the SES gradient in BMI for US young

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[32] The evidence in Currie and Stabile, 2003, favours the former explanation over the latter.
[33] Years of schooling has been shown to be the most important mechanism through which parental background affects individuals' BMI (Baum and Ruhm, 2007).
[34] These results are not reported for the sake of brevity but are available upon request from the authors.

adults steepens with age, our evidence indicates that, with the exception of Ireland, the SES gradient does not significantly change with age in any of the countries analysed. With respect to the impact of maternal BMI, we also find that it does not significantly increase along the life cycle.

Finally, an important question from a policy perspective is whether the magnitude of the estimated effect of maternal BMI (which is significant in most countries, unlike the impact of maternal education) is economically relevant. Our estimates suggest that, in all countries considered and after considering other socioeconomic variables, it takes more than 10 maternal BMI points to increase individuals' BMI by just 1 point. While this is a modest effect, it is worth considering that, within a long run perspective, it is also a cumulative mechanism since it is transmitted from one generation to the next.

3.4 The Health Insurance Externality

Obesity, through its associated health problems, can have a substantial impact on health care expenditures. Health expenditures attributable to obesity are important for two reasons. From a public finance perspective, it is important for policymakers to find out how much obesity costs in terms of health expenditures. This is particularly relevant for developed countries since population ageing is already putting structural pressure on health expenditures. The other reason is the potential externality created by health insurance which leads to inefficiencies in the allocation of resources just like labour market inefficiencies do.

In almost any health insurance system there is some degree of risk pooling, given that weight is not used to charge differentially for insurance coverage. Under actuarial fairness, premiums would be set to equal expected health expenditures and since those expenditures are potentially higher for the obese, premiums would also be higher for them. Generally, if risks differ in the population but individuals pay the same premium, this will create a positive subsidy for some individuals and a negative subsidy for others. The difference between lifetime expenditures and premium contributions gives the size of what is referred too as an insurance subsidy.

There is an important distinction between the insurance subsidy and the insurance externality. The subsidy is a necessary condition for the externality but is not sufficient. There needs to be a change in behaviour in response to the subsidy to yield an externality.[35] As

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[35] If weight is determined exogenously, there is no welfare loss. Those who are born with higher weight receive an implicit subsidy given by the difference in lifetime expenditures and premiums. For some people, weight might be predetermined from early childhood or from genetics as we have seen in section 3.3. There might be support for such transfers on equity grounds and it does not entail a welfare loss because conditional on endowments, resources are efficiently allocated.

Bhattacharya and Sood (2005) demonstrate, those at the margin (those whose expected health expenditures are equal to the premium under risk pooling) will increase their weight in response to a change from actuarial fairness to pooling. The main reason is that the monetary benefit to weight loss (lower premiums) that exists under risk-rating vanishes as the degree of pooling increases.[36] This form of moral hazard leads to a welfare loss.[37] As shown in Figure 7, the size of the externality is proportional to the insurance subsidy and the sensitivity of optimal weight to risk pooling. It is multiplied by the marginal utility of consumption because it is displacing consumption of private goods.

Figure 7 The Insurance Externality

Insurance externality	≈	**Marginal utility of consumption**	X	**Insurance Subsidy (Costs-Premiums)**	X	**Weight gain due to insurance subsidy (Behavioral response)**
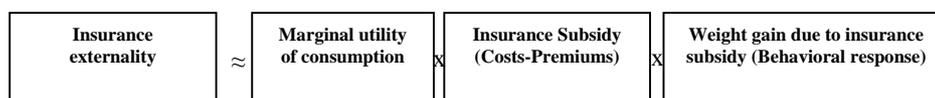
A necessary condition for the externality to occur is that the obese incur higher lifetime costs than the non-obese. So we first estimate such lifetime costs using a micro-simulation approach both in the U.S and Europe. We then look at the extent to which insurance systems in both regions subsidize the obese population. This informs on the second box on the right hand side of Figure 7. We then use existing evidence on the behavioural response to gauge the size of the insurance externality.

3.4.1 Lifetime Health Care Costs of Obese and Non-Obese Individuals

Recent evidence for the US suggests that the annual medical expenditures of obese adults are 37% higher than expenditures of healthy-weight individuals (Finkelstein et al., 2003a; Sturm, 2002; Lakdawalla et al., 2005). Moreover, Wolf and Colditz (1998) and Finkelstein et al. (2003b) estimate that the aggregate annual obesity-attributable medical costs in the US are between 5% and 7% of annual health care expenditures. Comparable evidence from other countries is limited. Detournay et al. (2000) estimate that aggregate annual obesity-attributable

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[36] This result is fairly general for those at the margin: i.e. for those that do not receive an ex ante subsidy due to initial weight. For those that receive a ex ante subsidy, under risk pooling, the change to risk-rated premiums imply both income and price effects that work in the same direction if weight (or more plausibly food consumption) is a normal good: optimal weight will be lower under risk-rating. However, for those receiving a negative subsidy, income and price effects work in opposite direction so that the effect is indeterminate.

medical costs in France range from 0.7 to 1.5% of total expenditures. Laird Birmingham et al. (1999) find an estimate for Canada between 1.1 and 4.6% of total expenditure.

Although annual cost estimates are interesting in themselves, a lifetime measure of costs might be more desirable since early interventions might have long term effects on health and eventually expenditures. Furthermore, from a lifetime perspective, it is a priori ambiguous whether the obese have higher expenditures than the non-obese. Just like smokers, it is possible that obese persons die earlier, hence reducing lifetime expenditures relative to a non-obese person. This is confirmed by the macro evidence in Table 4, showing shorter life spans for obese populations. To our knowledge, there are few studies that find lower lifetime expenditures for the obese. The study of van Baal et al. (2008) is an exception. They find that because of lower life expectancy, obese individuals in the Netherlands actually have lower lifetime spending.

We estimate lifetime costs using a micro-simulation model using data from both the U.S. and Europe.[38] We follow Lakdawalla et al. (2005) and use a transition model that tracks health trajectories of individuals and impute total medical expenditures over the life-cycle. Such a micro-simulation approach recognizes that the early onset of obesity has both a direct effect on expenditures and an indirect effect through health conditions such as hypertension and diabetes, that may elevate the risk of heart disease and eventually mortality.

We consider the age 55+ population where most of health care costs occur. We use panel data from the Health and Retirement Study (HRS) to construct transition rates for six broad health conditions (hypertension, heart disease, stroke, lung disease, cancer, diabetes and mental illness). Mortality and disability (measured by limitations with activities of daily living) are added to the transition model. Each transition across health states depends on current health conditions as well as risk factors such as being obese and being a smoker (or past smoker). It also depends on standard demographic characteristics. For Europeans, we use the Survey of Health, Ageing and Retirement in Europe (SHARE), a longitudinal study similar to the HRS. We have data from Austria, Denmark, France, Greece, Germany, Italy, Spain and Sweden. We adapt the model to Europe by adjusting the baseline transition rates of the U.S. transition model such that we match in simulation the age-specific prevalence rate observed in the SHARE data. Because of relatively small samples in each country covered by SHARE for this exercise, we pool all European countries together.

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[37] Moral hazard exists because there is asymmetric information. The insurer does not know the weight of his policyholders, or is prevented by law from using it to price insurance. Insurers could use characteristics correlated with weight change to perform experience rating (say income) but this would likely be an imperfect proxy.

[38] Technical documentation on the model we used (Global Pharmaceutical Policy Model developed at RAND) is available from the authors upon requests (Lakdawalla et al, 2008).

We compute for each year the average medical expenditures of each individual in the simulation. For this purpose, we average total health expenditure information (including drugs) stratified from the U.S. Medical Expenditure Panel Survey (MEPS) and adjust for differences in pre-existing health conditions as well as demographics and controls for risk factors. Expenditures in Europe are potentially different because of differences in medical practice and/or medical costs or technology. Since information on total health expenditure is lacking in SHARE, we construct an adjustment factor using OECD average health expenditures per capita. We do so by taking account of differences in income and health across countries and use the estimated factor to adjust European predicted expenditures that are derived using U.S. regression estimates. We estimate that keeping income and health constant, health expenditures are 42.2% lower in Europe than in the U.S.

We simulate health trajectories of hypothetical individuals and estimate the difference in life-time costs of obese and non-obese individuals. Since the obese and non-obese differ along other dimensions at age 55 (such as pre-existing conditions, demographics) we consider the difference in outcomes between a scenario where we hypothetically "turn" every respondent obese and another where all respondents are not obese. Table 10 reports the results of the simulation. We find that an obese American at age 55 faces on average an additional $19,989 in health expenditures which represents 8.1% of a non-obese's lifetime health expenditures. Since a 55 year old can expect to live approximately 25 years, the expected loss in yearly consumption (using a 3% real interest rate) is close to $1200. In Europe, the difference in lifetime health expenditures is slightly lower, at $15,567 or 12% of a non-obese's lifetime expenditures, reflecting mostly the differences in average costs across countries but also better baseline health in Europe. As can be seen from the second line in the same table, obese individuals have slightly lower life expectancy. The largest effect of obesity on health, however, is to lengthen the expected amount of time spent disabled.[39] We simulate that the obese should expect to spend about 2 and a half years more as disabled compared to the non-obese. These effects are roughly similar in the U.S. and Europe. Consistent with Lakdawalla et al. (2005) these simulations show that the disability effect dominates the counteracting effect of lower life expectancy both in the U.S. and Europe.

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[39] It is interesting to compare our estimate of the effect of obesity on life expectancy with the macro evidence reported in Table 4. There we found that for a 10% drop in the obesity rate, there was a decrease in life-expectancy at birth of 0.291%. From our estimates, we find that a 63% drop in obesity at age 55 (in 2040) leads to a 0.266 change in life expectancy at age 55. Since life-expectancy at age 55 is 27.2 in the simulation, this represents a 1% change in life expectancy. So the implied change for a 10% drop in obesity is 0.145%. Hence, we can conclude that magnitudes are roughly similar using different approaches.

Table 10 Lifetime Outcomes of Obese and Non-Obese Individuals as of Age 55

Excess (Relative to Non-obese)	U.S.	Europe
Lifetime health expenditures ($)	19,989	15,567
Life expectancy at 55 (years)	-0.401	-0.323
Expected time disabled as of 55 (years)	2.45	2.56

Notes: average for obese minus non-obese over 50 replications

3.4.2 Insurance Subsidy and Behavioural Response

As shown previously in Figure 7, the magnitude of the insurance externality depends on 1) the magnitude of an insurance subsidy, 2) the magnitude of the behavioural response to the subsidy. We have estimated that both in the U.S. and Europe, obese individuals face larger lifetime health expenditures. So the question is whether a subsidy exists or alternatively whether these additional expenditures are born by individuals themselves. Hence, we need to look both at the extent of risk pooling in public and at private insurance schemes and the generosity of health insurance schemes. In Table 11, we present key characteristics of health insurance systems across OECD countries.

The fraction of individuals covered by a public health scheme is likely to be a good proxy for the degree of risk pooling. This is because public insurance schemes will seldom allow for risk rating of premiums for equity reasons but also because expenses are financed either through a flat contribution rate or through taxation. Except for the U.S., public health schemes are predominant in OECD countries and even when public health insurance is provided through sick funds such as in Germany and the Netherlands, strict regulations usually strongly limit risk-rating. In the U.S. about a fourth of the population, mostly the elderly, is covered by public insurance. Only 44% of total health expenditures are financed through the public system. On the other hand, most workers rely on employers to provide health insurance, which means that the U.S. has roughly 60% of its population relying solely on private health insurance.

Private health insurance is unique in the U.S. because for most workers it is provided by the employer. This allows health plans to do risk-rating at the firm level but does not allow to rate workers directly. Hence, there is still some degree of risk pooling, albeit less than in a public system.[40] Total outlay by private insurers represent 42% of total cost in the U.S. while a remaining 14% is paid directly by individuals through deductibles and co-payments for health services (so-called out-of-pocket expenditures).

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[40] Some restrictions also exist that limit risk-rating in the U.S. For example, some states forbid insurers from using health risk classifications when determining premiums or limit the use of geographical variation in setting premiums.

Private insurance is generally less present in European countries, but few restrictions are imposed on how private insurers are allowed to set premiums. It is interesting to note that in many European countries, the amount of total expenditures paid for by individuals themselves (out-of-pocket expenditures) is heterogeneous, ranging from 7.8% in the Netherlands to 44% in Greece. Therefore, in countries such as Greece, Italy and Spain it is unclear how much risk pooling exists. On the one hand the existence of universal health systems gives an indication of high degree of pooling in Europe while on the other hand high out-of-pocket expenditures imply less pooling in some countries. Yet since private health insurance is largely underdeveloped in Europe relative to the U.S. we can conclude that the insurance subsidy is likely to be higher in most European countries, particularly in countries such as France, Germany, U.K., Sweden and Netherlands.

To judge the magnitude of the externality, it is important to attribute total health expenditures to public, private and out-of-pocket (OOP) expenditures. For lack of good micro data, we use the OECD numbers in Table 11 to adjust these expenditure figures. Clearly the out-of-pocket portion of these expenditures should be taken out of the calculation since there is no insurance for that portion of expenditures. Since the share of out-of-pocket expenditures varies across countries in Europe, we can use a range from 10% to 30% to capture this variation and 14.1% in the U.S. The reminder is shared unequally between private and public sectors.

Table 11 Public Provision of Health Care Across Countries

Country	Pop Covered	% Pop Covered	Premiums	Nature	Restriction on Premiums	Out of Pocket Exp as % of Total Health Expenditure	Public Health Expenditures as % of Total Health
		Public Insurance Scheme		Private			
Austria	All employed, self-employed and unemployed, pensioners	~100	Contributions and user charges (7.4% employee employer)	supplementary (38%)	None	17.5	69.3
Denmark	Universal	~100	Taxation	complementary (30%)	N/A	15.8	82.7
France	All employed, self-employed and unemployed, pensioners	96	contributions	complemenary (95%)	N/A	10	75.9
Germany	All employed, (up to income limit) and unemployed, pensioners	87	Sickness Fund contributions (7.15% employer-employee)	primary (high income), 10%	Few, allowed to be based on age of entry, gender and health risks	10.4	78.6
Greece	Universal	~100	Contributions (2.55% employee and 5.10% employer)	duplicate, supplementary (100%)	None	46.5	53.3
Italy	Universal	~100	Contributions & Taxation (1% employee, 13% employer)	supplementary (16%)		19.6	75.1
Netherlands	Universal (earnings below threshold)	75.6	Sickness Funds contributions	supplementary (28%)	None	7.8	66
Spain	Universal	~100	Taxation	supplementary (19%)	None	23.7	71.4
Sweden	Universal	~100	Taxation	inexistant		n.a.	85
U.K.	Universal	~100	Taxation	supplementary (12%)	None	10.9	82.4
U.S.	Persons 65+ or low income	24.7	Contributions & Taxes	voluntary (60%)	restricted at state level for small groups and some limit community rating	14.1	44.2

Source: *Health Insurance Coverage, Public and Private Schemes* (2000) OECD. WHO World Health Statistics 2005, www.who.int

Notes: Figures in last two columns taken as average of 2001-2002. Public health expenditures are defined by the WHO as the sum of outlays on health paid for by taxes, social security contributions and other external sources.

We can classify for our purposes European countries as part of one of two "systems" that emerge from observing the data in Table 11: a system with relatively lower public involvement and higher OOP (representing some Southern European countries such as Greece, Spain and Italy) and a system with high public involvement and low OOP (Central and Northern Europe, except Denmark and Austria). Using the numbers in Table 11, we get the following distribution of additional expenditures in the three regimes (Table 12).

Table 12 Distribution of Additional Health Expenditures By Source

	%	US	%	high OOP	%	low OOP
				Europe		
Out-of-Pocket	14	2,806	30	4,670	10	1,557
Private	42	8,297	10	1,557	10	1,557
Public	44	8,795	60	9,340	80	12,454
Total		19,898		15,567		

Notes: based on OECD figures and simulation results.

In the high OOP regime, it is unclear whether pooling is more important than in the U.S. since a large fraction of additional expenditures are out-of-pocket. The average additional expenditures that would fall under the public regime are roughly similar to those in the U.S. ($9,340 compared to $8,795 in the U.S.). In countries where the public insurance scheme covers a larger share of expenditures, pooling is likely to be more important. The additional expenditures that fall under the public system are higher in these countries than in the U.S. ($12,454 compared to $8,795). Hence, there is likely more pooling in Northern and Central European countries (except Denmark and Austria) than in the U.S. and Southern Europe.

If the behavioural response to the subsidy is similar across countries, one would therefore expect the obesity externality to be higher in these countries than in say Italy, Spain, Greece or the U.S. The fact that obesity is higher in the U.S. than it is in Northern European countries provides a rough indication that the behavioural response is likely to be small despite a large insurance subsidy. This interpretation would be broadly consistent with the finding of Bhattacharya and Sood, who report a modest externality (of the order of less than 150$ per individual). We conclude that the evidence presented supports the view that the obesity externality, although more important in Europe than in the U.S., is unlikely to be a good reason for public intervention.

4. Conclusions

Obesity is higher and has risen faster in the U.S. than in Europe. We have presented evidence suggesting that higher obesity in the U.S. is mainly due to the higher calorie intake than to a smaller calorie expenditure of Americans. We have also shown that the faster recent trend in obesity in the U.S. is positively associated to the faster decline in the share of manufacturing employment.

We have asked whether public policies to reduce obesity justified from an economic perspective, and whether all the economic arguments for public intervention are empirically supported. Our main conclusion, based on cross-country transatlantic evidence, is that some are,

but some aren't. For example, we do not find convincing evidence that lack of information is a relevant issue in the context of obesity among the adult population, and our results suggest that the health insurance externality is unlikely to be relevant enough to justify public intervention.

We have also presented some evidence that obesity is associated with an inefficient allocation of resources. For example, we have shown that in the presence of product and labour market imperfections, which are more widespread in Europe than in the US, private and socially optimal body weight differ if obesity affects productivity and/or the wages of obese individuals are lower than those received by their equally productive but non-obese counterparts. We have shown that obesity affects productivity (although there is no consensus on the magnitude of this effect) and that, conditional on some imperfection in the labour market, the obesity wage gap is bigger in countries with more stringent product market regulations, which make it easier to discriminate against the obese.

A relevant question from a policy perspective is whether these productive inefficiencies are likely to be important in the future. On the one hand, the current broad trend in favour of deregulation, documented for instance by the OECD, suggests that mark-ups are likely to decline in importance in the future as barriers to entry and other quantitative restraints to firm entry are progressively removed. On the other hand, and notwithstanding the recent progress, across most countries a hard core of regulations affecting market entry in non-manufacturing industries still persists (see Conway, Janod and Nicoletti, 2005). Given the rising importance of the tertiary sector in most economies, we believe that productive inefficiencies will remain a source of market failure, especially in those European countries where regulation in non – manufacturing industries is still relatively strong (Italy, Austria and Finland).

Additionally, we find that time inconsistency may well constitute a rationale for public intervention: even if our empirical measures of time inconsistency may be viewed as upper bounds, the proportion of individuals with self-control problems related to weight management is remarkably high. Given that these individuals are those most responsive if the time delay before consumption is reduced, we believe that further research should be devoted to analysing the effects of regulations that affect fast food advertising and the location and access to fast vending machines and fast food establishments (Chou, Rashad and Grossman, 2005, Acs, Cotten and Stanton, 2007, Chou, Grossman and Saffer, 2004).

Current policies to combat obesity, both in Europe and in the US, are primarily focused on education and targeted mostly to children,[41] while coordinated efforts to tackle adult obesity have been less common. This is broadly in line with our results, since our equity analysis indicates that different measures of parental background is generally a significant predictor of individuals' BMI across countries and, moreover, children may be particularly vulnerable to time inconsistency issues, given that they are more unlikely than adults to meet the conditions of "homo economicus". The absence of information deficiencies, the fact that the health insurance externality is economically irrelevant and the ambiguous sign of the gap between socially and privately efficient body weight when markets are not perfectly competitive – especially for females - make us more cautious about unconditionally recommending interventions aimed at reducing adult obesity.

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[41] For example, in the US, 1998 the Nutrition and Physical Activity Program to Prevent Obesity and Other Chronic Diseases (NPAO) was is very much based on informing individuals, particularly the young, about good eating habits and physical activity as well as restricting the offer of junk food and soft drinks in schools. In Europe, the European Charter on Counteracting Obesity, drafted by the WHO Regional Office for Europe, pays special attention to vulnerable individuals, such as lower socioeconomic population groups, children and adolescents and it clearly calls for regulations to substantially reduce the extent and impact of commercial promotions of energy-dense foods and beverages, particularly to children, with an eventual move to adopting an international code of practice.

Appendix A: Obesity, wages, productivity and efficiency

This appendix presents a simple economic model that illustrates reasons why privately optimal and socially optimal body weight can deviate, thereby justifying government intervention. Consider a prototype economy with L ex-ante homogeneous consumers and m firms. The product and labour markets are imperfectly competitive: pricing is a mark-up on marginal costs, consumers-workers bargain with firms about their wages and employment, and there are both costs of entry and adjustment costs, which preclude firms from making make zero profits in equilibrium and the real wage from equating the marginal product of labour.

On the supply side of this economy, each firm bargains with $\frac{L}{m}$ workers over wages and employment. After the bargain is settled, firms use the agreed level of employment to produce output (see Blanchard and Giavazzi, 2003, for a similar setup). On the demand side, consumers-workers, who can be either employed or unemployed, select their consumption of two types of goods to maximize their expected utility.

We start our description of this economy from consumption. Let W be individual weight. Following Cutler, Glaeser and Shapiro, 2003, assume that individual utility is given by

$$U_j = C_j + U(F_j) - hW_j \qquad [1]$$

where j is for the individual and the two consumption bundles F and C differ because only the former affects weight W. Specification [1] conveniently rules out income effects in the consumption of good F, a useful simplifying assumption given our focus on the efficiency costs of weight and obesity.

Individuals gain utility by consuming both goods, but lose utility from being overweight or obese. The value placed on weight is captured by parameter h, which in the static setup of this model reflects also the value of the future and the expected probability of living in the future[42]. Let expected individual income R be fully spent in current consumption, and assume that the prices of good C and F are equal to 1 and p respectively. Using the budget constraint in [1] we obtain

$$U_j = R_j - pF_j + U(F_j) - hW_j \qquad [2]$$

Furthermore, assume that the relationship between the consumption of good F and weight W is regulated by the production technology $W = G(F, Z)$, where Z is a vector of variables affecting weight (for instance exercise and life style). Since the map from good F to weight W reflects the information processed by the individual, limited information, possibly associated to poor education, may imply that the map G significantly differ with respect to the actual map. Using [2] into [1] we obtain

$$U_j = R_j - pG^{-1}(W_j) + U\left[(G^{-1}(W_j)\right] - hW_j \qquad [3]$$

The privately optimal choice of F is given by the following necessary condition

$$U'(F^P) = hG'(F^P)$$

i.e. the marginal utility of consuming more of F is equal to the disutility associated to the increased weight. This choice also yields the privately optimal

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[42] Cutler and Lleras Muney (2007) use a two period model with perfectly competitive product and labour markets. By so doing they can model explicitly the discount factor and the probability of living in the second period.

weight W^P, and the necessary condition for such optimum can be expressed conveniently as follows

$$\Gamma(W_j^P) = 0 \qquad\qquad\qquad [4]$$

Notice that choice of W (or F) is independent of income, because of the quasi-linearity of the utility function. Therefore, $W_j^P = W^P$ and each individual selects the same weight, a convenient result for the rest of the model.

   Next consider the supply side of this economy. Each consumer-worker supplies one unit of labour inelastically, so that total labour supply is L, and each firm produces using the following technology

$$Y_i = A(W)N_i \qquad\qquad\qquad [5]$$

where i is for the firm and productivity is allowed to vary with weight: if overweight or obese individuals are less productive, $A'(W) < 0$, where the prime is for the first derivative.

   With an imperfectly competitive product market, the demand faced by each firm is downward sloping and given by

$$Y_i = \frac{Y}{m}\left(\frac{P_i}{P}\right)^{-\theta} \qquad\qquad\qquad [6]$$

where P_i is the product price, P the average price and Y aggregate demand or total output.

   Let wages and employment in each firm be set by Nash bargaining, and assume that in the event of failure to settle the firm makes zero profit but the worker earns the reservation utility $V(u)$, where u is the unemployment rate. Reservation utility depends on consumption and income from unemployment, leisure and home production. The outcome of the bargain depends on the relative bargaining power of the parties. Let β be the relative power of worker. If heavier workers are discriminated, this parameter declines with weight. Let wages be E and define μ as the product market mark-up, where $\mu = \dfrac{1}{\theta-1}$. Then one can shows that in equilibrium the bargained real wage is[43]

$$\frac{E}{P} = \frac{[1+\beta(W)\mu]}{1+\mu}A(W) \qquad\qquad\qquad [7]$$

equal to the reservation wage when $\beta=0$ and to productivity when $\beta=1$. Notice also that a higher weight W can affect earnings if it reduces productivity and lowers the bargaining power β.

   Using [7] in the definition of profits $\Pi_i = \left[P - \dfrac{E}{A(W)}\right]Y_i$ and noticing that in the symmetric equilibrium $P_i = P = 1$, we obtain that total profits are given by

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[43] See Blanchard and Giavazzi, 2003, for details.

$$mΠ = [1 - β(W)]\frac{μ}{1 + μ}Y \qquad [8]$$

where we drop the subscript i because employed workers and firms are homogeneous. Following Blanchard and Giavazzi, we capture product market imperfections by assuming that entry costs are nonzero and proportional to output. Let these costs per unit of output be equal to c. Then one can show that reservation utility in the long run equilibrium is given by

$$V(u) = \frac{A(W)c}{μ(1 - β)} \qquad [9]$$

Since V is a monotonic (decreasing) function of the unemployment rate u, the natural rate of unemployment is

$$u^* = V^{-1}(\frac{A(W)c}{μ(1 - β)}) \qquad [10]$$

and total profits can be re-written as

$$mΠ = \frac{1 - β(W)}{1 + \frac{1}{μ}}A(W)L\left[1 - V^{-1}(\frac{A(W)c}{μ(1 - β)})\right] = [1 - β(W)]\frac{μ}{1 + μ}Y^*(W)$$

where the natural output Y^* is decreasing in W.

Assume that the government welfare function is a un-weighted sum of total utility and profits, and recall that $R = \frac{N}{L}E + (1 - \frac{N}{L})V$, and define total welfare $Ω$ as

$$Ω = LU + mΠ \qquad [11]$$

The socially optimal choice of W is given by maximizing [11] with respect to W, which yields

$$LΓ(W^s) + \left\{(1 - β)Y'(W^s) - \frac{∂β}{∂W^s}Y(W^s)\right\}\frac{μ}{1 + μ} = 0 \qquad [12]$$

The socially optimal level of weight will differ from the private optimum if:
1. there are externalities and/or the private discount factor differs from the social one. In our simple setup, this occurs if h^p, the private valuation of weight, is different from h^s, the social valuation;
2. agents are short sighted, and fail to fully recognize the implications of their consumption of F on health;
3. the wage is not equal to marginal productivity, so that firms make positive profits. Conditional on $β < 1$, an additional source of variation is the presence of discrimination - or $\frac{∂β}{∂W} < 0$.

Suppose that sources 1 and 2 can be ruled out. Then privately selected weight is lower or higher than the socially optimal value depending on whether the expression within braces in [12] is positive or negative. If the "discrimination" effect prevails on the productivity effect, $W^s > W^p$, and the opposite effect occurs if it is the productivity effect to dominate.

References

Acemoglu D and Johnson P, 2006, Disease and development: the effect of life expectacy on economic growth, MIT Working Paper.

Acs Z J, Cotten A, Stanton K R. 2007. "The Infrastructure of Obesity", in Z. J. Acs and A. Lyles, Obesity, Business and Public Policy, Edward Elgar Publishing.

Andreyeva, T., Michaud, P.-C. and van Soest, A., 2007, "Obesity and health in Europeans aged 50 years and older," *Public Health*, 121, 497-509.

Arnold J, Basssanini A and Scarpetta S, 2007, Solow or Lucas? Testing Growth Models Using Panel Data from OECD Countries, OECD, Paris

Barro R and Lee JW, Sources of Economic Growth, 2004, Carnegie Rochester Conference Series on Public Policy, 40, 1-46

Barro R and X Sala i Martin, Economic Growth, 2005, McGraw Hill, New York

Baum C L and Ruhm C J, 2007, Age, Socioeconomic Status and Obesity Growth, NBER Working Paper 13289.

Behrman J, Rosenzweig M. 2001, The Returns to Increasing Body Weight, PIER Working Paper 01-052 .

Bhattacharya J and Sood N. 2005, Health Insurance and the Obesity Externality, NBER Working Paper 11529

Blanchard O and Giavazzi F 2003, Macroeconomic effects of regulation and deregulation in goods and labor markets, *The Quarterly Journal of Economics*, 879-907.

Bleich, Cutler, Murray and Adams 2007, "Why is the Developed World Obese?" NBER Working Paper 12964, National Bureau of Economic Research, Cambridge MA.

Bloom D, Canning D and Sevilla J, 2004, The Effect of Health on Economic Growth: A Production Function Approach, *World Development*, 32, 1, 1-13

Bloom D and Canning D, 2005, Health and Economic growth: Reconciling the Micro and Macro Evidence, CDDRL working paper, Stanford

Brown C, 2000, Body Mass Index and Mortality in a Prosective Cohort of US Adults, *New England Journal of Medicine*, 341, 15, 1097-105

Bound, J. T. Stinebrickner and T. Waidmann, 2007: "Health, Economic Resources and the Work Decisions of Older Men", NBER working paper 13657.

Bound, J., Schoenbaum, M., Stinebrickner, T.R. and Waidmann, T., 1999, "The dynamic effect of health on the labor force transitions of older workers," *Labour Economics* 6, 179-202.

Benítez-Silva, H., Buchinsky, M., Chan, H-M. Rust, J. and S. Sheidvasser, 1999, "An Empirical Analysis of the Social Security Disability Application, Appeal and Award Process," *Labour Economics* 6, 47-178.

Burkhauser, R V and Cawley J, 2008, Beyond BMI: The Value of More Accurate Measures of Fatness and Obesity in Social Science Research, *Journal of Health Economics*, forthcoming.

Calle, E. E., et al.,1999, "Body-mass index and mortality in a prospective cohort of U S adults." *New England Journal of Medicine* 341(15): 1097-105.

Case A, Lubotsky D and Paxon C, 2002, Economic Status and Health in Childhood: The Origin of the Gradient, *American Economic Review*, 92, 5, 1308-1334.

Cawley J and R.V. Burkhauser (2008): "Beyond BMI: The Value of Model Accurate Measures of Fatness and Obesity in Social Science Research", *Journal of Health Economics* 27:2, pp. 519-529.

Cawley J, 2004a, An Economic Framework for Understanding Physical Activity and Eating Behaviours, *American Journal of Preventive Medicine*, 27, 115-125

Cawley J, 2004b, The Impact of Obesity on Wages, *Journal of Human Resources*, 39, 2, 451-474

Cawley, J and Variyam J N, 2006, Nutrition Labels and Obesity, NBER Working Paper 11956.

Cawley, J., 2000, "Body Weight and Women's Labor Market Outcomes." NBER Working Paper No. 7841.

Chou, S.Y., M. Grossman and H. Saffer, 2004, "An Economic Analysis of Adult Obesity: results from the Behavioral Risk Factor Surveillance System", *Journal of Health Economics* 23, pp. 565-587.

Chou S-Y, Rashad I and Grossman M, 2005, Fast Food Restaurant Advertising on Television and Its Influence on Childhood Obesity. NBER Working Paper 11879.

Colditz G, 1995, Weight Gain as a Risk Factor for Clinical Diabetes Mellitus in Women, *Annals of International Medicine,* 122, 7, 481-6

Conway P, Janod V and Nicoletti G, Product Market Regulation in OECD countries: 1998 to 2003, OECD Discussion Paper n. 419.

Comuzzie A G and Allison D B, 1998, The Search for Human Obesity Genes, *Science*, 280, 5368, 1374-1377.

Currie J and Madrian B, 1999, Health, Health Insurance and the Labour Market, in Ashenfelter O and Card D (eds.), *Handbook of Labor Economics*, North Holland, Amsterdam

Currie A, Shields M A and Wheatley Price S, 2007, The Child/Health Family Income Gradient: Evidence from England, *Journal of Health Economics*, 26, 2, 213-232.

Currie J and Stabile M, 2003, Socioeconomic Status and Child Health: Why Is the Relationship Stronger for Older Children?, *American Economic Review*, 93, 5, 1813-1823.

Cutler, D. M., E. L. Glaeser and J. M. Shapiro, 2003, Why Have Americans Become More Obese? Journal of Economic Perspectives, 17(3): 93-118.

Cutler, D. M. and E.L. Glaeser, 2006, "Why do Europeans smoke more than Americans?". NBER Working Paper 12124.

Cutler D, Deaton A and Muney A, 2006, The Decline of Mortality, NBER Working Paper 11963

Cutler D, Lleras Muney A, 2007, Understanding Differences in health Behaviour by Education, mimeo, Harvard University

Datar A and Sturm R, 2006, Childhood Overweight and Elementary School Outcomes, *International Journal of Obesity*, 1-12

De la Fuente A and Ciccone A, 2003, Human Capital in a global and knowledge based economy, EU Commission, Brussels

Detournay, B., F. Fagnani, M. Phillipo, C. Pribil, M. Charles, C. Sermet, A. Basdevant, E. Eschewege, 2000, "Obesity morbidity and health care costs in France: An Analysis of the 1991-1992 Medical Care Household Survey", *International Journal of Obesity*, 24, pp. 151-155.

Ding W, Lehrer S, Rosenquist JN and McGovern J, 2006, The Impact of Poor Health on Education: New Evidence using Genetic Markers, NBER Working Paper 12304

Finkelstein, E. A., I. C. Fiebelkorn and G. Wang, 2003a, "National Medical Spending Attributable to Overweight and Obesity: How Much and Who's Paying?" *Health Affairs* (Web Exclusive). W3-219-W3-226.

Finkelstein, E. A., I. C. Fiebelkorn and G. Wang, 2003b, "State-Level Estimates of Annual Medical Expenditures Attributable to Obesity?" *Obesity Research*. 12(1): 18-24.

Frank R, 1984, Are Workers Paid Their Marginal Products? *American Economic Review*, 74, 4, 549-71

French, E., 2005, "The Effects of Health, Wealth and Wages on Labour Supply and Retirement Behavior", *Review of Economic Studies*. 72, pp. 395-427.

Garcia J and Quintana-Domeque C, 2007, Obesity, Employment and Wages in Europe, in Bolin K and Cawley J, *The Economics of Obesity*, North Holland, Amsterdam

Goldman, D., et al., 2004, "Health status and medical treatment of the future elderly: implications for Medicare program expenditures." Health Affairs (Milwood).

International Obesity Task Force, 2002, "Obesity in Europe. The Case for Action." Available at www.iotf.org/media/euobesity.pdf

Gortmaker S, Must A, Perrin J, Sobol A, Dietz W., 1993, Social and Economic Consequences of Overweight in Adolescence and Young Adulthood, *International New England Journal of Medicine*, 329, 1008-1012.

Hamermesh D and Biddle J, 1994, Beauty and the Labor Market. *American Economic Review* 84(5); 1174-94.

Hoj J, Jimenez M, Maher M, Nicoletti G and Wised M, 2007, Product Market Competition in the OECD Countries: Taking Stock and Moving Forwards, OECD Working paper 35

International Obesity TaskForce. 2002. "Obesity in Europe. The case for action." Available at www.iotf.org/media/euobesity.pdf.

International Obesity TaskForce. 2003. "Obesity in Europe – 2. Waiting for a green light for health?" Available at http://www.iotf.org/media/euobesity2.pdf.

Kaestner R and Grossmann M, 2008, Effects of Weight on Children's Educational Achievement, NBER Working Paper 13764

Kerkhofs, Marcel, Maarten Lindeboom, and Jules Theeuwes, 1999, "Retirement, financial incentives and health," *Labour Economics* 6: 203–227

Kuczmarski M.F., Kuczmarski, R.J., and Najjar, M., 2001, "Effects of age on validity of self-reported height, weight, and body mass index: findings from the Third National Health and Nutrition Examination Survey, 1988-1994," *Journal of the American Dietetic Association*, 101, 28-34.

Johansson E, Bockmann P, Kiiskinen U an Heliovaara M, 2007, The Effect of Obesity on Wages and Employment: the Difference between having a High BMI and being Fat, mimeo

Laird Birmingham, C., Muller, J., Pelepu, A., Spinelli, J. and A. Anis, 1999, "The Cost of Obesity in Canada", *Canadian Medical Association Journal*, vol 160:4, pp. 483-488.

Lakdawalla D, Bhattacharya J and Goldman D, 2004, Are the Young Becoming More Disabled? *Health Affairs*.

Lakdawalla, D., D. Goldman, B. Shang, 2005, "The Health and Cost Consequences of Obesity Among the Future Elderly", *Health Affairs* W5-R34.

Lakdawalla, D., D. Goldman, P.-C. Michaud, Z. Cong, N. Sood, R. Lempert, 2007, "The Health Effects of New Drugs" RAND Manuscript, Santa Monica.

Levy, D. T. and M. Oblak. 2007. "Tobacco control as a model for trimming the obesity problem", in J. Zoltan and A. Lyles, *Obesity, Business and Public Policy*, Edward Elgar Publishing.

Lichtenberg F, 2002, Sources of US Longevity Increase, 1960-97, NBER Working Paper 8755

Lindbeck A and Snower D, 1988, *The Insider Outsider Theory of Employment and Unemployment*, Cambridge University Press, Cambridge.

Lundborg P, Bolin K, Hojgard S and Lindgren B, 2007, Obesity and occupational attainment among the 50+ of Europe, in Bolin K and Cawley J, *The Economics of Obesity*, North Holland, Amsterdam.

Lumsdaine R and Mitchell O, 1999, New Developments in the Economic Analysis of Retirement, in Ashenfelter O and Card D (eds.), *Handbook of Labor Economics*, North Holland, Amsterdam

Malcomson J, 1997, Contracts, Hold-Up and Labor Markets, *Journal of Economic Literature*, 35, 4, 1916-57

McGarry, K. (2004): "Health and Retirement: Do Changes in Health Affect Retirement Expectations", Journal of Human Resources 39:4, pp. 624-648.

Michaud, P. C., A. Soest, and T. Andreyeva. 2007. "Cross-Country Variation in Obesity Patterns Among Older Americans and Europeans." *Forum for Health Economics & Policy* 10(2): 8.

Michaud D, 2001, Physical Activity, Obesity, Height and the Risk of Pancreatic Cancer, *Jama*, 286, 8, 921-9

National Institute of Health, 1998, *Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults*, Washington.

Norton E and Han A, 2007, Genetic Information, Obesity and Labor Market Outcomes, mimeo.

Ogden, C. L. et al. (2006). "Prevalence of overweight and obesity in the United States, 1999-2004". Journal of the American Medical Association. 295(13): 1549-1555.

Oswald, A. and N. Powdthavee (2007): "Obesity, Unhappiness and The Challenge of Affluence: Theory and Evidence", Economic Journal, 117(521), pp. F441-454.

Palta, M., Prineas, R.J., Berman, R., and Hannan, P., 1982, "Comparison of self-reported and measured height and weight", *American Journal of Epidemiology,* 115(2), 223-230.

Philipson, Tomas, J, Posner, Richard A. 2008, "Is the Obesity Epidemic a Public Health Problem? A Decade of Research on the Economics of Obesity", NBER Working Paper 14010.

Philipson, Tomas J.; Posner, Richard A., 1999, "The long-run growth in obesity as a function of technological change". NBER Working Paper No. 7423.

Paraponaris A, Saliba B, Ventelou B., 2005, Obesity, weight status and employability: Empirical evidence from a French national survey, *Economics and Human Biology*, 3(2), 241-270

Revicki, D.A., and R.G. Israel, 1986, "Relationship between body mass indices and measures of body adiposity," *American Journal of Public Health,* 76(8), 992-994

Roth, J, Qiang, X, Marban, S L, Redelt, H and Lowell, B C, 2004, The obesity pandemic: where have we been and where are we going?, *Obesity Research*, 12, 88S-101S.

Ruhm, Christopher J., 2007, "Current and Future Prevalence of Obesity and Severe Obesity in the United States", *Forum for Health Economics and Policy*, Vol. 10, No. 2 (Obesity), Article 6, 1-26.

Sachs J and Warner A, 1997, Fundamental sources of long term growth, *American Economic Review P&P*, 184-188

Sanz-de-Galdeano, A., 2007, "An Economic Analysis of Obesity in Europe: Health, Medical Care and Absenteeism Costs". FEDEA Working Paper No. 2007-38.

Sargent J and Blanchflower D, 1994, Obesity and Stature in Adolescence and earnings in Young Adulthood. Analysis of a British Birth Cohort, *Archives of Pediatrics and Adolescent Medicine*, 148, 681-687

Sianesi B and van Reenen J, 2003, The Returns to Education: Macroeconomics, *Journal of Economic Surveys*, 2003, v. 17, iss. 2, pp. 157-200

Slovic, P, 2000, What Does it Mean to Know a Cumulative Risk? Adolescents' Perceptions of Short-term and Long-term Consequences of Smoking, *Journal of Behavioral Decision Making*, 13, 259-266.

Soares R, 2005, Mortality Reductions, Educational Attainment and Fertility Choice, *American Economic Review*, June 2005, v. 95, iss. 3, pp. 580-60

Stevens, J., et al., 1998, "The effect of age on the association between body-mass index and mortality." *N England J Med* 338(1): 1-7.

Strauss J and Thomas D, 1998, Health, Nutrition and Economic Development, *Journal of Economic Literature*, 36, 2, 766-817

Sturm, R., 2002, "The Effects of Obesity, Smoking and Drinking on Medical Problems and Costs", *Health Affairs* 21, no. 2: 245-253.

Tosini, N., 2008, "The socioeconomic determinants and consequences of women's body mass", University of Pennsylvania, mimeo.

Van Baal, P. Polder, J. de Wit, G., Hoogenveen, R. Feenstra, T., Boshuizen, H.C., Engelfriet, P. and W. Brouwer, 2008, "Lifetime Medical Costs of Obesity: Prevention No Cure for Increasing Health Expenditure", *PLOS medicine*, Vol 5:2, pp. 242-249.

Visscher, T. L., et al., 2000, "Underweight and overweight in relation to mortality among men aged 40-59 and 50-69 years: the Seven Countries Study." *Am J Epidemiol* 151(7): 660-6.

Weichselbaumner D and Winter Ebmer R, 2007, International Gender Wage gaps, *Economic Policy*, 50, 237-289

Weil D, 2006, Accounting for the Effect of Health on Economic Growth, mimeo, Princeton University

Willett W, 1995, Weight, Weight Change and Coironary Hearth Disease in Women, *Jama*, 273,6, 461-5

Wolf, A.M. and G.A. Colditz , 1998, "Current Estimates of the Economic Cost of Obesity in the United States." *Obesity Research*. 6(2): 173-5.

World Health Organization**.** 2000. "Obesity: preventing and managing the global epidemic", WHO Technical Report Series No. 894. Available at http://whqlibdoc.who.int/trs/WHO_TRS_894.pdf.

World Health Organization. 2006. "10 things you need to know about obesity". WHO European ministerial Conference on Counteracting Obesity. Available at http://www.euro.who.int/Document/NUT/ObesityConf_10things_Eng.pdf.