Analyzing Cross-Country Differences in Obesity Rates: Some Policy Implications

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Short Abstract:

Obesity is a growing concern for both developed and developing countries. The aim of this paper is to provide an empirical analysis of cross-country differences in obesity rates in the OECD countries. In particular, we study the effects of different urbanization processes, dietary habits, labor market changes, as well as other public policies undertaken by each country in order to reduce the incidence of obesity. Our results conclude that the urbanization process seems to be playing a major role on explaining obesity growth across countries. However, other changes in dietary habits, which include the daily intake of more calories and a higher participation of females in the labor markets are also important contributing factors.

Analyzing World Health Differences in Obesity Rates: Some Policy Implications

Obesity is a growing concern, for both developed and developing countries. New World Health Organization (WHO) figures indicate that obesity is spreading around the world as a "global epidemic." According to the WHO, globally there are more than 1 billion adults overweight and at least 300 million of them are clinically obese (WHO, 2004). Obesity is a global problem, and it is seriously affecting developing, transitional and newly industrialized countries (See Kan and Tsai, 2004, and Popkin, 1999).

Current obesity levels range from below 5% in China, and certain African regions, to over 75% in urban Samoa (WHO, 2004). In the U.S., obesity is a really serious health problem. Results from the 1999-2000 National Health and Nutrition Examination Survey (NHANES) indicate that about 64 percent of U.S. adults are either overweight or obese. Additionally, the same source indicates that an estimated 15 percent of children and adolescents aged 6-19 years are overweight, which represents a 4 percent increase from the overweight estimates of 11 percent obtained from NHANES III (1988-94).

Obesity is important not only from a social perspective, but also because of the associated economic costs. Currently, in the U.S., health care for overweight and obese individuals costs an average of 37 percent more than for people of normal weight, adding an average of $732 to the annual medical bills of each American

(Connolly, 2004). Further, medical costs connected to obesity and smoking each account for about 9 percent of all health expenditures in the U.S.

The body mass index (BMI) is a common and accepted measure to report obesity rates (see WHO, 1997). BMI is measured as weight in kilograms divided by height in meters squared. Recommended BMI levels are generally between a numerical value of 20 and 25. An individual with a BMI between 25 and 30 is considered overweight, and with a BMI above 30 is obese. On the other hand, individuals with BMIs below 20 are considered thin.

The obesity epidemic has caught many governments and policy agencies by surprise. For example, in Europe, the E.U. Parliament has not yet passed and approved a Directory on mandatory nutritional labeling. Therefore, for policy-making purposes, it is useful and necessary to understand the factors contributing to obesity growth, and the existing differences across countries.

In this paper we look at the role played by preventive public policies in order to reduce or stop the growth of obesity rates in OECD countries, as well as the effects played by other socio-demographic conditions and cultural change. In particular, we analyze the role of calorie consumption, female labor participation, urban concentration, aging populations, health expenditures (including preventive medicine), expenditures in education, and other cultural and environmental conditions. We also look at the effects of other unhealthy habits such as smoking and drinking alcoholic beverages. Hypotheses to be tested, among others, include: a) the percentage of females working outside the house has no effect on obesity rates; b) average educational expenditures have no effect on obesity; c) preventive health expenditures have no effect on obesity; d) income has no effect on obesity; and e) the urbanization process has no effect on the growth of obesity.

In order to conduct our empirical analysis, we employ panel data models, estimating a generalized least squares (GLS) fixed effects and random effects model. In this way, we can account for the potential effects caused by unobservable heterogeneity across countries. The next sections present a literature review of economic studies dealing with obesity. It follows a description of the data employed in this analysis, the empirical application and the obtained results. The last section contains the main conclusions and policy implications.

Literature Review

Although obesity is a growing concern, literature related to this topic is still narrow. Nevertheless, there is a large body of literature that studies the relationship of diverse sources of information and knowledge on health behavior using various measures (See for example Kenkel; 1991, and Variyan, Blaylock and Smallwood; 1996, Nayga 2000).

Previous studies have devoted part of their attention to analyze the role played by income on heath on obesity. In general, a stylized fact in this literature is that income has a positive effect on health expenditures, and a negative effect on obesity, particularly for females.

Other economic studies explain the role played by cultural and socio-demographic factors on obesity rates in the U.S. As it is well-known, obesity is caused by the difference in calories consumed and used per individual. Consequently, most published research justifies the growth of obesity rates analyzing any of the multiple factors that may contribute to this imbalance of calories. A popular argument used to justify the spread of obesity is the increment of fast food consumption and soda drinks in the daily diets of western countries. This new habit has increased the dietary intake of saturated fats, sugar, and calories (Schlosser, 2002). Others argue that female labor participation has been a leading factor in increasing obesity rates, since home made cooked dinners have been widely substituted by TV dinners or restaurant dinners—which frequently take place in fast-food restaurants. Young and Nestle (2002) argue that large serving sizes or portions in restaurants are main contributing factors to higher obesity rates. However, this argument, as well as the fast food argument are somewhat invalidated by Cutler, Glaeser, and Shapiro (2003), who argue that the main contribution to the dietary calorie intake in the U.S. was due to calories consumed outside the main meals (i.e., snacks) and not necessarily due to fast food. They show that Americans nowadays eat more frequently than they used to, and that on the other hand, mean calorie consumption at dinnertime has been somewhat reduced.

Chou, Grossman and Saffer (2002) look at the role played by different factors that may influence the obesity trend in the U.S. In particular, employing cross section data from the Behavioral Risk Factor Surveillance System, they analyze the role of per-capita fast food restaurants, full service restaurants, the price of a meal in each type of restaurant, the price of food consumed at home, the price of cigarettes, clean indoor air laws, hours of work per week and hourly wait rates by age, gender, race, years of schooling and marital status. Their results highlight that years of formal schooling and real household income have negative effects on BMI, and thus, on the probability of being obese.

Recent contributions done by economists in the field of obesity are those by Philipson and Posner (1999), Philipson (2001), and Lakdawalla and Philipson (2002). They all conclude that increases in BMI over time are due to reductions in the strenuousness of work. Philipson and Posner (1999) present a theoretical model arguing that technological change provides the natural interpretation of these long-run obesity effects, but that it also implies that obesity growth is self-limiting. In particular Philipson (2001) suggests other potential explanations to justify the growth of obesity rates, among those, the change from rural to urban societies, as well as a change in habits, such as a higher rate of passive entertainment. Lakdawalla and Philipson (2002) use data from the National Health Interview Survey from 1976 to 1994, and from the National Longitudinal Survey of Youth from the period from 1982 through 1998. They consider the quantitative dimensions and estimate empirically the relationship between obesity and reduction of activity postulated in the previous study. They conclude that about 40 percent of the total growth in weight may be due to expansion in the supply of food, potentially through agricultural innovation, and about 60 percent due to demand factors such as a decline in physical activity in market-and home production.

All these previous findings contribute to the explanation of the growth of obesity in the U.S. The current paper adds to this literature by examining the relative importance of each of the mentioned socio-demographic and technical factors on obesity rates in OECD countries. Thus, the following analysis allows us to study the relationship between obesity rates in OECD members and the endogenous characteristics and educational policies of each country (such as cultural change, labor market participation, and urbanization processes).

Data and Methodology

The data employed in this research come from a variety of international organizations. We obtained data on the percentage of overweight people per country (based on their body mass index), expenditures on health care (total, including private and public), expenditures on preventive health care, GDP for each individual country, total calories consumed, total population, percentage of GDP dedicated to education, and environmental pollution from the *OECD Health Statistics* (2003, 2004). In order to obtain proxies for the time of preparation of food in each country, we also collected data on female labor market participation from the same source. In addition, we collected from the Food and Agricultural Organization (FAO) data on the percentage of rural and urban populations per country and year. BMI data are only available for most countries from 1990, and consequently, we restrict the period of analysis from 1990 to 2003. The lack of data is a major drawback when studying multi-country obesity patterns.

Graph 1 presents the trend over time of the percentage of total population with BMI rates greater than 25 in the OECD countries. Although BMI statistics are affected by the fact that only a few countries report obesity rates in the first years of the series, the general trend is still interesting. As it is clearly observable, the largest increment of overweight population in OECD countries occurred during the 1990s. As in the U.S., overweight rates remain more or less stable during the 1980s. Obesity rates grew significantly in the 1990s. While intra-year variations are affected by the fact that most countries do not report BMI rates in yearly terms, the overall trend is quite significant. According to the latest statistics, about 52 percent of the total population in OECD countries is overweight in 2002, while the corresponding figure in 1980 was about 30 percent for the same set of OECD members. Thus, this trend corresponds to an average yearly increment of 1 percent in the overweight rate during the period of study.

Table 2 presents a summary of the latest BMI data by each OECD country member. As the data show, the United States registers the highest percentage of overweight population (64.5%) in the OECD, while the United Kingdom (with 62%), and Australia (60%) follow closely this trend with values at or above 60 percent. On the other hand, the lowest percentages of overweight population are registered in the Asian countries of Japan (24.6%) and Korea (30.6%). Previous studies have argued that countries with diets rich in fish and vegetables are less likely to suffer weight problems. However, this is not necessary true, since other countries such as Iceland and Spain, with diets rich in fish are now registering obesity rates above 48 percent of the total population. The next empirical application will shed light on the explanatory factors that determine such large differences in obesity rates across OECD countries.

Methodology

In order to study the relationship between obesity and countries' socio-demographic characteristics, living conditions, health habits, income, and health policies, we estimate a GLS model with fixed effects to explicitly account for the non-observed heterogeneity across countries. In this GLS fixed effects application, we model the percentage of individuals with BMI rates greater than 25 as a function of variables identified in previous studies as potential causes of obesity. In particular, the independent or explanatory variables are: calories consumed per capita, percentage of urban population, percentage of females participating in the labor market, budget spent in preventive medicine in each country, budget spent in total medical care, the percentage of GDP spent in education, percentage of smokers, average alcoholic consumption, percentage of total active population, total per capita volume of emissions, and percentage of people over 65 years of age. The estimated regression model has the following functional form:

(1) $$BMI_{it} = \beta_0 + \beta_1 CALORIES_{it} + \beta_2 RURAL_{it} + \beta_3 FEMALEWORK_{it} + \beta_4 GDP_{it} + \beta_5 EXPENDHEALTH_{it} + \beta_6 EXPENDEDUC_{it} + \beta_7 PREVENT + \beta_8 SMOKERS_{it} + \beta_9 ALCOHOL_{it} + \beta_{10} WORKERS_{it} + \beta_{11} OLDER_{it} + \beta_{12} EMISSIONS + \varepsilon_{it},$$

where the variable BMI_{it} equals the percentage of people with a BMI greater than 25 in country i and time t (subscripts omitted from now on); $CALORIES_{it}$ represents the per capita mean calories intake (divided by 100), $RURAL_{it}$ the percentage of individuals living in rural areas, $FEMALEWORK_{it}$ the percentage of females participating in the labor force; GDP_{it} the gross domestic product divided by thousands of people, and expressed in 1995 U.S. dollars; $EXPENDHEALTH_{it}$ represents the percentage of GDP dedicated to health expenditures (including preventive medicine), and $EXPENDEDUC_{it}$ the percentage of GDP dedicated to education; $SMOKERS_{it}$ is the percentage of smokers over the total population, $ALCOHOL_{it}$ the average per capita consumption of alcohol, $WORKERS_{it}$ the percentage of active population in the labor market, and $EMISIONS_{it}$ per capita volume of emissions. Finally, ε_{it} is the stochastic error term.

Exploring Unobserved Heterogeneity

The potential presence of unobserved country heterogeneity is investigated assuming that the error term can be decomposed as follows:

(2) $\upsilon_{it} = \eta_i + \varepsilon_{it}$,

where η_i denotes a random unobservable country specific effect, which is time-invariant, and $E\left[\eta_i\right] = 0$, $E\left[\eta_i^2\right] = \sigma_\mu^2$ and $E\left[\eta_i \eta_j\right] = 0$ for $i \neq j$. Additionally, it is assumed that ε_{it} ~ $IID(0, \sigma_\varepsilon^{\ 2})$, and all explanatory variables are assumed independent of the ε_{it} for all i and t (but not necessarily of η_i). Note that η_i represents factors that are country-specific such as population genetics, eating habits commonly found in some countries (such as snacking), or cultural perceptions about obesity, and others.

Results

Results are presented in Table 2. Fixed effects results are quite insightful and informative. Results correspond with previous studies, and indicate that the urbanization process plays a major role in determining the growth of obesity rates. This is reflected by the fact that the percentage of rural population carries a negative and large coefficient. This may also account for the transition from rural to urban societies, implying a reduction in the strenuousness of work. Even larger is the coefficient denoting the percentage of the active population, which carries a negative

and statistically significant coefficient. Thus, this result in combination with the one above seems to indicate that lower levels of physical activity are crucial factors determining the rise of obesity rates across countries. It has been argued that countries with higher unemployment rates might have higher obesity rates, and our results may confirm this hypothesis. However, our results seem to indicate that although physical activity is very important in determining obesity rates, other contributing factor exists. Paradoxically, countries with higher percentages of older population (which usually are groups with lower physical activity) are less likely to register high obesity rates. This suggests that the effect of obesity is not only due to a reduction in physical activity but is also motivated by other socio-economic factors contributing to changes in health habits and exercising activity, such as the introduction of diets rich in saturated fats and sugars.
No statistical significant relationship was found between obesity rates and the percentages of smokers and consumption of alcohol per capita. Some studies indicate that there is a very strong negative correlation between smoking and lower BMIs (particularly for younger adults), but this result does not hold in this international study. No statistical effect was found either between environmental pollution (which may be a proxy for public policies that encourage high living standards) and obesity rates.

The coefficient associated with total expenditures on education is negative and statistically significant. Hence, countries spending a higher percentage of their GDP on education are less likely to suffer high obesity rates. This is an encouraging finding that supports educational policies and informative programs. They are also consistent with what Nayga (2000, 2001) has found involving the relationship between education and obesity. Nevertheless, this effect is somewhat shaded by the fact that total medical care expenditures have a positive effect on obesity rates. Thus, this may imply that other preventive measures should be put forward, since the coefficient associated with preventive medical expenses is negative and statistical significant.

The relationship between countries GDP and obesity rate is negative and statistically significant. Some argue that wealthier countries are healthier, and consequently should have lower obesity rates. Our results seem to indicate a negative relationship between obesity rates and GDP. However, we should acknowledge that obesity has also multiple cultural connotations, and at times it is a sign of status in low-income countries and groups.

On the other hand, with regard to the factors positively affecting the incidence of obesity, our results confirm the expectation that consumption of more calories contributes in a statistically significant way to the growth of obesity in OECD countries. Furthermore, female labor participation is also contributing to higher obesity rates. Given that statistics that reflect dining out habits and amount of time dedicated to food preparation are not available, this variable may be a good proxy for these socio-economic changes that are affecting dietary habits around the world.

An expansion of the previous fixed effect model is the random effect model. For comparative purposes, we estimated a random effect model with the same set of explanatory variables. In spite of the fact that the model reaffirms some of the previous conclusions, such as the importance of female labor participation on increasing obesity rates, and the role of education and income as mitigating factors, differences with regards other factors are also relevant. This model is not presented here due to the fact that we are employing a small data set, and consequently the analysis is very sensitive to the different specifications of the error term.

Conclusions and Policy Implications

This paper provides an empirical examination of the different factors that have contributed to the long-run growth of an overweight population over the past 14 years. We use aggregate data from OECD countries, showing that the role of urbanization has been crucial in explaining the growth of obesity. Other factors positively affecting the growth of obesity are the average intake of calories and the participation of females in the labor market. Additionally, expenditures on education, and expenditures on preventive medicine have a negative effect in obesity. These findings may encourage public policies that aim to provide information regarding the health consequences of obesity.

Although we acknowledge that access to obesity data is limited, we believe that these results are quite interesting and useful in order to understand the growth of obesity in OECD countries, and the potential role played by preventive policies. Further research is needed to understand the complex links between factors causing the overweight and obesity epidemic around the world.

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Figure 1: BMI trend in OECD countries

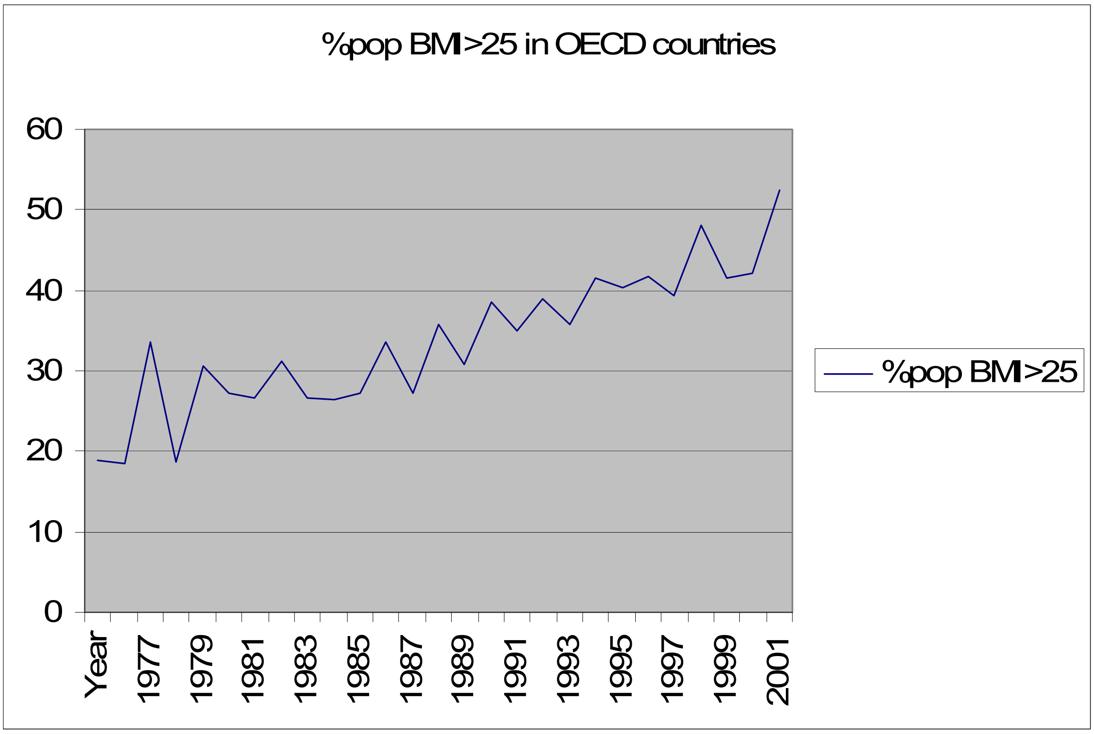

Table 1: Summary of % of population with BMI >25 per country

	Year of report	% pop with BMI >25
Australia	1999	60
Austria	1999	46.1
Belgium		N/A
Canada		
Czech Republic	2002	51.1
Denmark	2000	41.7
Finland		N/A
France	2000	36.2
Germany		N/A
Greece		N/A
Hungary		N/A
Iceland	2002	48.8
Ireland		N/A
Italy		N/A
Japan	2002	24.6
Korea		30.6
Luxembourg		N/A
Mexico		N/A
Netherlands	2001	44.8
New Zealand	1997	52.2
Norway		N/A
Poland	1996	43.1
Portugal		N/A
Slovak Republic	2002	57.6
Spain	2001	48.3
Sweden	2001	42.7
Switzerland		N/A
Turkey		N/A
United Kingdom	2001	62
United States	2001	64.5

Source: OECD Health Statistics, 2003. N/A=data not available for this country

Table 2: Fixed Effects Model: Dependent variable=%individuals with BMI>25.

	Coef	St. Error	T	P-value
Calories/100	0.3939	0.2240	1.76	0.098
% Rural	-94.7816	34.409	-2.75	0.014
% Female Labor	0.9069	0.3216	2.82	0.012
Workers	-530.2762	205.7439	-2.58	0.020
GDP/pop	-0.3945	0.1549	-2.55	0.022
Population>65	-1.7815	0.8207	-2.17	0.045
%Smokers	0.1283	0.1531	0.84	0.414
Alcohol/pop	0.1213	0.3639	0.33	0.743
Expendedu/pop	-1.6097	0.7214	-2.23	0.040
Prevention/pop	-14.5781	7.2041	-2.20	0.060
ExpendHealth/pop	5.5789	1.6087	3.47	0.003
Emissions/pop	33.3845	26.674	1.25	0.229
Constant	19.1255	14.1490	1.35	0.195
R-squared within	0.9232			
R-squared between	0.4201			
R-squared overall	0.1703			