OBESITY RATES IN OECD COUNTRIES: AN INTERNATIONAL PERSPECTIVE

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Analyzing Factors Affecting Obesity Rates in OECD Countries

Obesity is a growing concern. New World Health Organization (WHO) figures indicate that obesity is spreading around the world as a "global epidemic." According to the WHO, there are more people suffering overweight related problems than malnutrition. Globally there are more than 1 billion adults who are overweight and at least 300 million of them are clinically obese, while 800 million suffer malnutrition (WHO 2004). 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, while an individual with a BMI above 30 is considered obese. Individuals with BMIs below 20 are considered thin.

Clinical research has long suggested a connection of obesity with a variety of diseases. For example, past studies have revealed a strong association between the prevalence of obesity and diabetes, hypertension, heart disease, and cancer (U.S. Department of Health and Human Services). Being overweight has also been found to be correlated with increased morbidity and mortality. Hence, there is overwhelming evidence that obesity can cause adverse health effects. According to Sturn, obesity has roughly the same association with chronic health conditions as does twenty years of aging, and this exceeds the association of smoking or alcohol drinking with chronic health conditions.

Obesity is important not only from a health perspective, but also from a social perspective. The social consequences of obesity are serious, and multiple studies have shown that obesity affects, in a negative and statistically significant way, personal and working relations, earnings, and wages, particularly for females (Harper; Cawley).

The economic costs due to obesity can also be burdensome. 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). Medical costs connected to obesity and smoking each account for about 9 percent of all health expenditures in the U.S (Finkelstein, Fiebelkorn, and Wang).

The obesity epidemic has caught many governments and policy agencies by surprise, particularly in the member countries of the Organization for Economic Cooperation and Development (OECD). Figure 1 reflects the increasing trend of OECD countries' percentage of population with body mass index (BMI) greater than 25, which is a measure of overweight and obesity. Consequently, many OECD countries are now contemplating various measures to reverse this trend or reduce obesity rates. For example, in Europe, the E.U. Parliament has plans to introduce a Directory on mandatory nutritional labeling of processed food products sold in supermarkets to help consumers make informed purchase and consumption decisions. The U.S. government has also focused on reducing the incidence of obesity through various nutritional programs and campaigns and by redesigning its Dietary Guidelines for Americans. It is, therefore, useful and necessary to understand the factors contributing to weight problems and obesity growth in OECD countries. In order to answer this question, we employ the latest data on obesity and overweight related statistics released by the OECD (Health Data). These records are augmented with country level data pertaining to a wide variety of social, economic, and environmental variables, which in previous studies were found relevant to explain the spread of obesity.

In order to conduct our empirical analysis, we first estimate ordinary least squares (OLS) regressions. We then explore the panel structure of the data by estimating a generalized least squares (GLS) random effects models to account for the potential effects caused by unobservable heterogeneity pertaining to each specific country[i]. Given that the included explanatory variables may play a different role when assessing their effects on overweight and obesity populations, we separately model the incidence of overweight and obesity. In this paper, we define an overweight individual as a person that has a BMI of greater than 25 and an obese individual as a person with a BMI of greater than 30. Hence, overweight individuals would include those who are obese (severely overweight).

This paper is structured as follows. The next section presents a literature review of economic studies dealing with obesity, then followed by a description and discussion of the data employed in this analysis, the empirical application, and the obtained results. The last section contains the concluding remarks.

Literature Review

As Kan and Tsai alluded to in their paper about obesity and risk knowledge, the issue of obesity is generally seldom studied in the economics field. Until very recently, obesity was considered by many as the result of private individual choices, and hence, economics was not seen as a science in which important contributions were to be made. However, the intervention of economists is always justified when the actions of an individual affect others (thus, there are externalities), and also when the economic paradigm may fail, and agents may not act under the assumption of full information and rational behavior (such as in the case of food choices made by children).

There is, however, 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; Variyam, Blaylock, Smallwood; Nayga 2000). Furthermore, previous economic studies have devoted part of their attention to analyzing the role played by income on health. In general, a stylized fact in the health economics literature is that income has a positive effect on health (Pritchett and Summers; Smith). All things being equal, it should consequently lead to a negative effect on obesity, although this may not be necessarily the case, since obesity is in some cultures a sign of status and wealth.

Obesity is a complex phenomenon. Several recent economic studies explain the role played by different cultural and socio-demographic factors on obesity rates. Leaving genetics aside, obesity is caused by consumption of too much calories and/or low expenditures of calories (i.e. low physical activity). Consequently, most published economic research provides a justification for the increased growth of obesity rates by analyzing any of the multiple factors that may contribute to this imbalance of calorie consumption and expenditure. A popular justification used to explain the spread of obesity is the growth of fast food and soda drink consumption, which has increased the dietary intake of saturated fats, sugars, and calories in the daily diets of western countries (Schlosser). Young and Nestle argue that the large portion or serving sizes in restaurants is the main contributing factor to higher obesity rates. However, other researchers argue that female labor participation is a leading factor in increasing obesity rates, since more healthy home cooked dinners have been widely substituted by T.V. dinners or restaurant dinners—which frequently take place in fast-food restaurants. For example, Anderson, Butcher and Levine find that a child is more likely to be overweight if his/her mother works more hours per week over the child's life. This is especially the case for children whose mothers have higher socio-economic status.

In line with this calorie consumption argument, Cutler, Glaeser, and Shapiro argue that Americans have become more obese over the past 25 years primarily due to the consumption of more calories. Analyzing changes in food consumption between the mid-1970s and the mid-1990s for male and females, they show that the growth in calorie consumption is enough to explain the increase in weight. However, to a certain extent, they invalidate the fast food argument, since as they point out, the main reason for increased dietary caloric intake in the U.S. was due to calories consumed outside the main meals (i.e., snacks). They show that Americans nowadays eat more frequently than they used to even though mean calorie consumption at dinnertime has been somewhat reduced. To a certain extent they also invalidate the female labor participation argument, since they show that obesity is not the result of more women working. According to their calculations, only 10 percent of increased obesity is due to more men in families where women work, or because females are themselves working.

Other recent contributions provided by economists in the field of obesity are those by Philipson and Posner, Philipson, and Lakdawalla and Philipson. They all conclude that increases in BMI over time are related to a lower use of calories (due to reductions in the strenuousness of work). Philipson and Posner 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 suggests other potential reasons to explain the growth of obesity rates, which are among others, the change from rural to urban societies, as well as a change in cultural habits, such as a higher rate of passive entertainment. Lakdawalla and Philipson use data from the National Health Interview Survey from 1976 to 1994, and from the National Longitudinal Survey of Youth from the period 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 sixty percent due to demand factors such as a fall in physical activity in market-and home production.

Chou, Grossman and Saffer look at the role played by different factors that may influence the obesity trend in the U.S. In particular, by employing cross sectional data from the Behavioral Risk Factor Surveillance System (BRFSS), 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 suggest that years of formal schooling and real household income have negative effects on BMI, and thus, on the probability of being obese.

Mancino and Kinsey contribute to the understanding of the reasons why aggregate quality of diets seems not to be improving in the U.S. even though large efforts are being made in terms of public awareness and consumer information. They illustrate the role of other situational factors which drive individual's food choices and affect caloric intake such as the role of the level of hunger when making food choices, the number of hours worked, and the amount of times eating away from home. They conclude that omitting these types of behavioral variables may introduce bias in the typical demand analysis for nutritional quality.

All these previous findings suggest an explanation for the growth of obesity mainly in the United States. However, an international perspective is needed in order to understand the spread of overweight and obesity problems, particularly in OECD countries where obesity rates are rising. The current paper adds to this literature by examining the relative importance of each of the afore-mentioned socio-economic and technical factors on obesity rates in OECD countries.

Data and Methodology

The data employed in this research comes from a variety of international organizations and databases. Based on the previous studies discussed above, we collected data on the percentage of overweight and obese people per country (based on their BMI), GDP for each individual country, total calories consumed per capita, percentage of GDP dedicated to education, percentage of females active in the labor market, percentage of smokers, percentage of individuals older than 65 years, and environmental pollution levels from the *OECD Health Statistics*. In addition, we collected data from the Food and Agricultural Organization (FAO) about the percentage of rural and urban populations per country and year. Data on agricultural subsidies, and volume of agricultural output were obtained from the *Producer and Consumer Support Estimates OECD Database*, while data on driving intensity of passenger cars were recorded from the *OECD Environmental Statistics*. Unfortunately, the lack of data is a major drawback when studying obesity patterns. BMI data are only available for most countries from 1990, and consequently, we restrict the period of our empirical analysis from 1990 to 2002.

Preliminary Data Analysis

Descriptive analysis of data can be insightful. Figure 1 presents the trend over time of the percentage of total population who are overweight or with BMI levels greater than 25 in the OECD. 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 is clearly observable, the largest increment of overweight population in OECD countries occurred during the 1990s. As in the U.S., overweight rates remained more or less stable during the 1980s, and then grew enormously in the 1990s. According to the latest statistics published by the OECD, about 52% of the total population in OECD countries was overweight in 2002, while the corresponding figure in 1980 was about 30% for the same OECD members. Thus, this trend corresponds to an average yearly increment of 1% in the overweight rate during the period 1980-2002.

Table 1 presents a summary of the latest BMI data by each OECD country member[ii]. As the data show, the United States registers the highest percentage of population with overweight problems (64.5%) in the OECD, followed by Mexico (with 62.3%), the United Kingdom (with 61%), and Australia (58.4%). The lowest percentages of population with overweight problems are registered in the Asian countries of Japan (25.8%) and Korea (30.6%). Previous studies have argued that countries with diets rich in fish and vegetables are less likely to suffer overweight problems. However, this is not necessarily true, since countries such as Iceland and Spain, both with diets rich in fish are now registering percentages above 48% of the total population with overweight problems. Analysis of the data also reveals that obesity is more prevalent among women, particularly in countries with lower income levels.

Previous research indicated that there is a strong correlation between obesity growth and the presence of Anglo Saxon cultures (Culter, Glaeser and Shapiro). Although it is true that obesity has dramatically increased in the United States, U.K, and Australia, it should be noted that this is not an exclusive phenomenon occurring in these countries. This finding cannot fully be generalizable either, given that obesity growth in Canada is more moderate than that of the U.S. and Australia. Furthermore, countries with very different socioeconomic and cultural dimensions, such as Mexico and Spain, register a rapid growth of obesity rates, with percentages of individuals with overweight problems close to those registered in the U.K and Australia.

What are the Main Reasons Behind the Obesity Growth?

It is difficult to generalize a theory on obesity growth that is valid internationally. Culter, Glaeser, and Shapiro suggest that the growth of obesity in the U.S. is mainly due to a growth in daily caloric intake. Their conclusions could be extended to many other countries. According to the OECD data, the growth of daily intake of calories in the U.S. between 1973-1999 was about 716 calories per individual during the entire period. This is certainly a large amount that can account for the growth of obesity. On average, an increase of 3,500 calories implies a gain of a pound of weight, while an imbalance of about 100 to 150 calories per day could increase the median weight by about 10 to 12 pounds a year (Cutler, Glaeser and Shapiro). More moderate, but still important is the calorie growth in other countries such as The Netherlands, New Zealand and Spain. Overall, it is difficult to assess the role of calorie intake internationally. As an example, in Australia, the percentage of individuals with weight problems between 1980-1999 has grown by 23.4 percent, while the daily calorie intake during the same period has changed by a moderate 87 calories per capita. Thus, the rising incidence of obesity cannot be caused entirely by higher calorie intake. This suggests that other contributing factors such as the transition from rural to urban societies, change in habits, and the reduction in strenuous work (Philipson; Lakdawalla and Philipson) could also play significant roles in explaining the growth in obesity.

An interesting finding when assessing the importance of the urbanization processes in obesity rates is that countries with a higher percentage of urban population are more likely to register large obesity rates. For example, as is shown in Table 2, countries with higher percentages of urban populations (such as Australia, Netherlands, U.K, all with almost 90% of the total population living in urban areas) register large rates of overweight population.

Although the statistics presented in Table 2 show a positive relationship between obesity, calories consumed, and the urbanization process, it is necessary to estimate the magnitude of such relationships when different agricultural policies, agricultural productivities, and other socio-demographic, environmental and cultural factors are taken into consideration. Within this context, in the next section we empirically estimate the relationship between these variables and the growth of overweight and obese population[iii] in OECD countries.

Methodology

In this empirical exercise, we initially estimate the models with OLS, and later with GLS random effects to account for the non-observed heterogeneity across countries. In both applications, we estimate a model for overweight (the percentage of individuals with BMIs greater than 25) and a model for obesity (individuals with BMIs greater than 30) as a function of a common set of explanatory variables[iv] identified in previous studies and discussed above. The estimated regression models have the following functional form:

$$(1) \quad BMI_{it} = b_0 + b_1 CALORIES_{it} + b_2 RURAL_{it} + b_3 FEMALEWORK_{it} + b_4 GDP_{it} + \\ + b_5 EXPENDEDUC_{it} + b_6 CARS_{it} + b_7 EMISSIONS_{it} + b_8 SMOKERS + b_9 AGPRODUCTIVITY + \\ b_{10} CSE + b_{11} OLDER + e_{it},$$

where the variable BMI_{it} equals the percentage of people with a BMI greater than 25 (overweight or obese individuals) and with BMIs greater than 30 (obese), respectively, in country i and time t (subscripts omitted from now on); $CALORIES_{it}$ represent the per capita mean calorie intake; $RURAL_{it}$ the percentage of individuals living in rural areas; $FEMALEWORK_{it}$

the percentage of females participating in the labor force; GDP_{it} the per capita GDP expressed in 1995 U.S. dollars; $EXPENDEDUC_{it}$ the percentage of GDP dedicated to education; *CARS* the volume of traffic road in million of kilometers driven in each country by private automobiles; $EMISSIONS_{it}$ indicates the per capita volume of emissions; $SMOKERS_{it}$ the percentage of smokers over the total population; $AGPRODUCTIVITY_{it}$ is a measure of agricultural productivity per worker in terms of the monetary output; CSE_{it} is the consumer support estimate or policy variable, which measures the gross transfers from consumers to agriculture via food prices over the total volume of support[v]; and $OLDER_{it}$ the percentage of population older than 65 years of age. Finally, ε_{it} is the stochastic error term. Complete variable definition and corresponding summary statistics are presented in Table 3.

Exploring the Panel Data Structure
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 $E[\eta_i] = 0$, $E[\eta_i^2] = \sigma_\mu^2$ and $E[\eta_i \eta_j] = 0$ for $i \neq j$. Additionally, it is assumed that ε_{it} ~$IID(0, \sigma_\varepsilon^2)$, and that all explanatory variables are assumed independent of the ε_{it} for all i and *t*. Finally, strict exogeneity in addition to orthogonality between η_i and x_{it} is imposed. 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

OLS Results
Results are presented in Tables 4 and 5. Results from the OLS model are quite insightful and informative. Overall, obtained results are consistent with the conclusions of previous studies, and indicate that higher calorie intake plays a major role in determining the growth of individuals with weight problems. Other factors such as the transition from urban to rural societies (Philipson), and the effect of consumers' contributions to the agricultural sector, as well as the percentage of smokers seem to be also important in this first analysis of the problem. Some studies (Klesges et al.) indicate that there is a very strong negative correlation between smoking and lower BMIs given that nicotine has an appetite suppressant effect. Our estimates confirm this result in the OLS model. Furthermore, female labor participation and agricultural productivity do not contribute to the growth of weight problems. Without taking into consideration the specific unobserved heterogeneity across countries, it may appear that females participating in the labor market care more about their image than their counterparts staying at home. The variable denoting total emissions per capita has a positive effect on the incidence of weight problems, although it is not statistically significant at conventional levels.

In the case of the obesity equation, three explanatory variables are statistically significant: the number of kilometers driven by private cars, the volume of emissions per capita, and the income transfers from consumers to the agricultural sector. Results indicate that per capita volume of environmental emissions is positively related to obesity rates. This finding implies that more polluted countries are more likely to have higher rates of obesity. In the same regression, the coefficient associated with the variable denoting the number of kilometers driven by private vehicles (a proxy of sedentary life styles) is also positive and statistically significant. In addition, the CSE variable, which is a proxy for food taxes used to finance agricultural production, is negative and statistically significant. Previous studies indicate that agricultural policies may also play a role in explaining rising obesity rates (Tillotson). OLS results show that if agricultural policies are activating the contribution of consumers to the agricultural sector, then the opposite effect arises. Our results do not support the extended hypothesis that the growth of agricultural productivity (measured by the value of agricultural output per worker in the agricultural sector) has increased overweight problems or obesity rates. Although agricultural productivity could be a potential factor to consider, in an international dimension, we should also expect that other factors such as more open trade policies are as relevant as agricultural productivity when it comes to increasing food availability.

Results in Table 4 also show that the coefficient associated with higher expenditures in education is negative although not statistically significant when modeling incidence on weight problems or obesity**.** Paradoxically, although obesity is affected by variables denoting a reduction of physical activities, the variable corresponding to the percentage of population older than 65 years (assumed as the less active segment) is not a statistically significant factor affecting the incidence of overweight or obesity problems. Thus, at the present time, weight problems are not directly linked to older populations, although in the near future this may become a bigger concern, given the progressive nature of obesity over age and the large proportion of children and adolescents with weight problems. Furthermore, the relationship between countries´ per capita GDP and the proliferation of weight problems and obesity is not statistically significant either. Some argue that wealthier countries are healthier, and consequently, they should have lower obesity rates. Philipson and Posner suggest that income increases the demand for thinness, although our initial results do not back up this assertion. Furthermore, we should acknowledge that obesity has multiple cultural connotations, and at times it is a sign of status in some countries.

GLS with Random Effects Results

As previously discussed, we also estimate GLS regression with random effects to take into account the panel structure of our data. Table 5 presents the results obtained from this estimation. The results reinforce some of the conclusions from previous studies, although they add new relevant information regarding the effect of the different socio-economic characteristics and agricultural policies on obesity and overweight problems in OECD countries. The statistical significance of the included variables also increased.

The random effects equation for the obese and overweight individuals (individuals with BMI>25) shares similar features with the OLS results. As we can see in Table 5, the variables affecting in a positive and statistically significant way the rate of individuals with unhealthy weight in OECD countries are the per capita calorie intake and the percentage of female labor participation. Other factors such as the percentage of GDP expenditures in education, the percentage of smokers, and the transfers from consumers to the agricultural sector via food prices (CSE) all carry negative and statistically significant coefficients. Other variables, however, such as the per capita GDP, the number of kilometers driven by private cars, the volume of environmental emissions, the percentage of older population, and the variable denoting agricultural productivity are not statistically significant.

When assessing the role of different factors on obesity rates, the amount of calories consumed, the percentage of females working outside the house, as well as the number of kilometers driven by cars are all positive and statistically significant. In addition, the percentage of smokers, the transfers from consumers to the agricultural sector, and the percentage of rural population are all negative and statistically significant. As in previous studies conducted for the U.S., smokers are less likely to be associated with weight problems. The fact that variables that denote a more sedentary lifestyle are statistically significant on modeling the incidence of obesity is interesting. Thus, the role of new lifestyles seems to be crucial to the spread of obesity, but not so to the share of population with unhealthy weight (overweight and obese). The other factors which were significant in decreasing the number of individuals with weight problems (when considering both obesity and overweight population together) are not so effective when dealing with obesity. In particular, expenditures in education are not statistically significant variables when modeling their effects on obesity. Further, it seems that countries that require high contributions from consumers to support the agricultural sector are more successful controlling the spread of obesity. This is reflected in our model by the fact that the volume of agricultural transfers from consumers (CSE) is statistically significant. Consequently, according to our results, the factors that influence obesity growth rates are: consumption of higher intake of calories, contributions to the agricultural sector via taxes of food products, and changes in lifestyle (such as female labor market participation, the urbanization process, and the reduction of physical activity proxied by the kilometers driven in private cars). These changes that refer to a more sedentary life style are not statistically significant when modeling their incidence on overall weight problems.

Direct interpretation of the coefficients allows us to assess the relative impact of each of the explanatory variables, *ceteris paribus*. Based on the results obtained via GLS models with random effects, an extra 100 calories in the daily calorie intake correspond to an average growth of 1.13 percent in the number of individuals with overweight problems and an average growth of 0.4 percent in the number of obese individuals, *ceteris paribus*. Further, an increment of 1 percent of females working outside the house increases the number of overweight individuals by 0.91 percent and increases the number of obese individuals by 0.66 percent. Mitigating factors such as expenditures in education and contributions from consumers to the agricultural sector seem to also have a higher impact on reducing general overweight problems than on reducing obesity exclusively. A 1 percent increase in the percentage of CSE contributions decreases the percentage of individuals with general weight problems (overweight and obese) by 0.18 percent and the number of obese individuals by 0.07 percent. In terms of expenditures in education, a 1 percent increase in GDP dedicated to education decreases the incidence of weight problems (obesity and overweight) by 2 percent, while the incidence on obesity is not statistically significant. The importance of the change from rural to urban societies and the reduction of physical activity on obesity is reflected by the magnitudes of the variables denoting the percentage of rural population and the number of kilometers driven by cars. In particular, a 1 percent increment of rural population decreases the obesity rate by 0.27 percent and overweight rate by 0.23 percent. Further, an additional million of kilometers driven by private cars increases on average the obesity rate by 0.008 percent and decreases overweight rate by about 0.002 percent.

Concluding Remarks

This paper provides an empirical examination of the different factors that are contributing to the growth of overweight and obese population over the last decade in OECD countries. Using macro-level data, our results generally suggest that factors such as higher female labor participation and higher intake of calories, significantly influence overweight and obesity rates in OECD countries. The positive effect of calorie intakes on obesity rates is self-evident and is consistent with Cutler, Glaeser, and Shapiro's findings. The positive effect of labor force participation rate of women on obesity rates is also intuitive. Previous studies (i.e. Nayga 1996) have revealed a positive relationship between labor force participation rate of women and food away from home expenditures, and several of the studies discussed in the previous section (e.g., Schlosser; Young and Nestle) have argued that increase in food away from home expenditures or consumption is driving the increase in U.S. obesity rates.

Our findings also imply that urbanization or the transition from rural to urban societies (as proxied by the *RURAL* variable) have a positive effect on overweight and obesity rates. In addition, our results show that expenditures in education, and the application of agricultural policies contributing to higher CSE levels (which may result in higher food prices) have negative effects on overweight rates (considering all individuals with a BMI>25).

Past studies have analyzed the factors affecting obesity rates in the U.S. but no known study has evaluated the factors affecting overweight and obesity rates in multiple countries. Our study represents a step in filling this void, particularly for the OECD countries. Interestingly, the factors that we found affecting obesity rates in OECD countries in general are also some of the factors that were found by past studies to significantly affect obesity rates in the U.S.

While our study provides some interesting findings, due to data limitations and collection challenges, a number of the variables we used in the analysis are just a proxy for some of the factors that we wanted to examine (e.g., the variable *CARS* as a proxy for level of physical activity). Our data also only come from OECD countries. It would be interesting to postulate a theory of overweight and obesity that can be globally applied. Hence, despite data collection challenges, future studies should attempt to test the robustness of our findings by analyzing data not just from OECD countries but also from elsewhere. Obviously, it is possible that our results may not be applicable to many non-OECD countries. Further interdisciplinary research is also needed to understand the complex links between social, ethnical, and cultural factors causing the overweight/obesity epidemic not just in OECD countries but also in other parts of the world.

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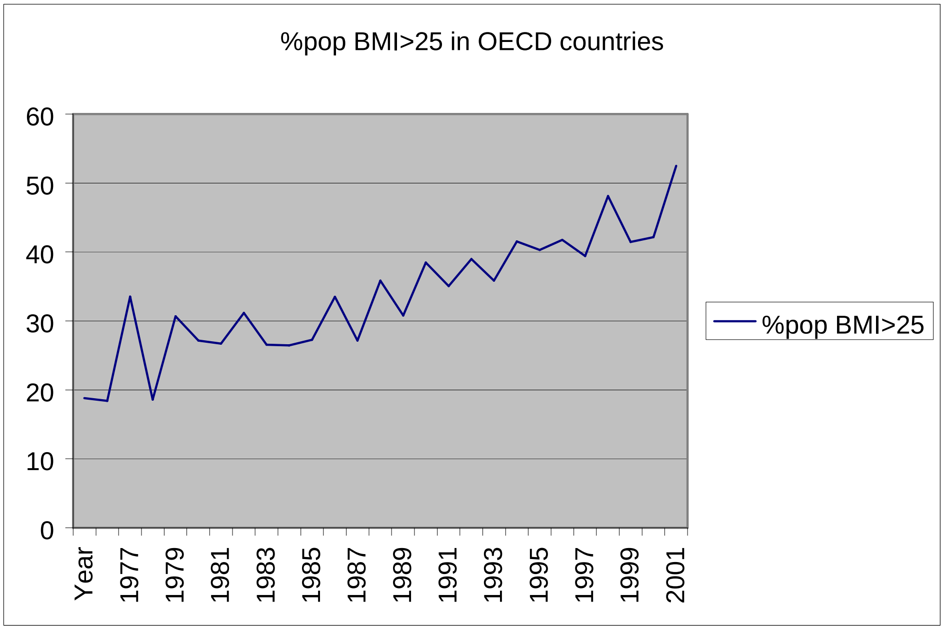
Figure 1: Percentage of individuals with weight problems (obese and overweight)



Source: 2004 Health Statistics Data, OECD.

Table 1: Percentage of obese (with BMI >30) and overweight or obese population (with BMI>25) per country

	Year of report	% pop with BMI >30	% pop with BMI >25
Australia	1999	21.7	58.4
Austria	1999	9.1	46.1
Belgium	2001	11.7	44.1
Canada	2001	14.9	N/A
Czech Republic	2002	14.8	51.1
Denmark	2000	9.5	41.7
Finland	2002	11.8	N/A
France	2002	9.4	37.5
Germany	1999	11.5	N/A
Hungary	2000	18.2	51.4
Iceland	2002	12.4	48.8
Ireland	2000	10	N/A
Italy	2000	8.6	N/A
Japan	2002	3.6	25.8
Korea	2001	3.2	30.6
Mexico	2000	24.2	62.3
Netherlands	2002	10	45.0
New Zealand	1997	17	52.2
Norway	2002	8.3	42.7
Poland	1996	11.4	43.1
Portugal	1999	12.8	49.6
Slovak Republic	2002	22.4	57.6
Spain	2001	12.6	48.3
Sweden	2002	10.4	44.8
Switzerland	2002	7.7	37.1
United Kingdom	2002	22	61
United States	2001	30.9	64.5

Source: 2004 OECD Health Statistics, 2004. N/A=data not available for this country

Table 2: Trends of Population with Weights Problems (BMI>25), Calorie Intakes, and Urbanization Processes

Country	Period	% of Overweight-data first year period	Total growth of overweight individuals during period	Calories intake-first year series	Growth in calories per capita	%Urban population-first year	Growth %Urban population
Australia	1980-1999	36.6	23.4	3055	87	85.75	4.95
Czech Republic	1993-2002	47	4.6	3035	69	74.63	-0.07
France	1990-2000	29.7	6.5	3512	79	74.04	1.48
Japan	1976-2001	18.8	5.8	2718	44	76.06	2.83
Netherlands	1981-2001	33.3	11.5	3013	281	88.39	1.21
New Zealand	1989-1998	43.1	9.1	3144	75	84.52	1.12
Spain	1987-2001	37.2	11.1	3150	203	74.66	3
U.K.	1980-2000	36	26	3114	220	88.63	0.68
U.S.	1973-1999	47.7	16.8	3031	716	73.73	3.25

Source: 2004 Health Statistics Data, OECD.

Table 3: Summary Statistics of Relevant Variables

Variable	Definition	Mean	Standard Deviation
CALORIES	Per capita calories	3188.24	256.94
RURAL	% Rural population	29.890	0.1530
FEMALEWORK	% Female labor market	38.3070	6.4107
GDP	Per capita GDP/1000	10.4865	9.8694
EXPENDEDUC	% of GDP dedicated to education	5.7297	0.9665
CARS	Millions of kilometers driven by private vehicles	178.51	4.2230
EMISSIONS	Per capita volume of environmental emissions (thousands of MT)	0.2408	0.1737
SMOKERS	% of Smokers	33.6140	8.5690
AGPRODUCTIVITY	Share of value of agricultural output per worker (in thousands of dollars)	286.0756	992.9157
CSE	Agricultural transfers from consumers (in percentage terms over the total support)	28.335	17.113
OLDER	% of individuals older than 65 years	11.2441	3.4003

Table 4: OLS Regressions Modeling the Incidence of Overweight and Obesity

	BMI>25 (overweigth and obese)				BMI>30 (Only obese)			
Variables	Coef.	Std. Err.	T	P>|t|	Coef.	Std. Err.	t	P>|t|
CALORIES	0.014363	0.004053	3.54	0.001	0.001846	0.001741	1.06	0.295
RURAL	-0.21863	0.124288	-1.76	0.088	-0.01559	0.045305	-0.34	0.733
FEMALESWORK	-1.59245	0.566979	-2.81	0.008	0.085329	0.210604	0.41	0.687
GDP	0.116651	0.201784	0.58	0.567	-0.06684	0.101107	-0.66	0.512
EXPENDEDUC	-1.7835	1.484128	-1.2	0.238	-0.52721	0.592182	-0.89	0.379
CARS	-0.00214	0.002485	-0.86	0.396	0.004151	0.001245	3.33	0.002
EMISSIONS	11.40943	7.192612	1.59	0.122	10.26834	3.490431	2.94	0.005
SMOKERS	-1.20472	0.414803	-2.9	0.007	-0.17721	0.126418	-1.4	0.169
AGPRODUCTIVITY	-0.01037	0.005741	-1.81	0.08	0.002397	0.002945	0.81	0.420
CSE	-0.28315	0.147357	-1.92	0.063	-0.13029	0.061723	-2.11	0.041
OLDER	0.146528	0.899333	0.16	0.872	0.119764	0.295127	0.41	0.687
CONSTANT	115.2846	40.48462	2.85	0.008	8.934205	14.29327	0.63	0.535
Ajusted R-squared				0.8263				0.8011
N				107				107

Table 5: GLS Random Effects Regressions Modeling the Incidence of Overweight and Obesity

	BMI>25 (overweigth and obese)				BMI>30 (Only obese)			
	Coef.	Std. Err.	Z	P>|z|	Coef.	Std. Err.	Z	P>|z|
CALORIES	0.011349	0.004286	2.65	0.008	0.004981	0.001539	3.24	0.001
RURAL	-0.23736	0.357285	-0.66	0.506	-0.27884	0.11574	-2.41	0.016
FEMALESWORK	0.913689	0.423657	2.16	0.031	0.664221	0.150435	4.42	0.000
GDP	0.04543	0.072593	0.63	0.531	0.03421	0.030645	1.12	0.264
EXPENDEDUC	-2.00609	0.806924	-2.49	0.013	-0.46723	0.296068	-1.58	0.115
CARS	0.002072	0.005215	0.4	0.691	0.00802	0.001852	4.33	0.000
EMISSIONS	-13.8494	11.62613	-1.19	0.234	-1.24639	3.809816	-0.33	0.744
SMOKERS	-0.53747	0.253453	-2.12	0.034	-0.22273	0.097436	-2.29	0.022
AGPRODUCTIVITY	-0.01031	0.020104	-0.51	0.608	-0.00486	0.006306	-0.77	0.441
CSE	-0.18064	0.05648	-3.2	0.001	-0.06956	0.022681	-3.07	0.002
OLDER	0.028006	0.338432	0.08	0.934	-0.18745	0.132725	-1.41	0.158
CONSTANT	4.204503	28.33028	0.15	0.882	-17.3162	9.762701	-1.77	0.076
$c^{2}_{(11)}$				102.86				204.07
P-value				0.0001				0.0000

Endnotes

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[i] The selection of the random effects model is mainly driven by the fact that some of the explanatory variables vary very little during the period of analysis for some countries. This fact complicates the analysis if a fixed effect model is selected.

[ii] Obesity rates in continental Europe are based on self-reported data while data on others are based on actual measurement of people's height and weight. We acknowledge that the European data may not be fully accurate, since they are based on self-reported data on height and weight. However, these data are the only official data available.

[iii] In this group we consider all individuals with weight problems, thus, with BMIs>25, includes also obese people.

[iv] The variable representing the consumer price index for food and beverages products has been dropped from the empirical equation, given that it was not statistically significant in any of the estimated models, and it was highly correlated with the consumer support estimate.

[v] The consumer support estimate (CSE) is defined by the OECD (Producer and Consumer Support Estimates, OECD Database, 1986-2003) as: "an indicator of the annual monetary value of gross transfers (from) consumers of agricultural commodities, measures at the farm gate level, arising from policy measures which support agriculture, regardless of their nature, objective and impacts on consumption of farm products." Usually it is negative, showing that the transfer from consumers is equivalent to a tax on agricultural commodities. In the current application, to facilitate the interpretation of the results, the CSE has been recoded multiplying it by -1.