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The Social and Behavioral Factors that Affect Obesity in OECD countries

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Abstract:

This paper investigates the factors that affect obesity in the population of the member countries of the Organization of Economic Co-operation and Development (OECD). This study incorporates existing information of the most likely variables that would influence obesity in these member countries for a decade (1990-2000). The study looks at contributing factors that are both innate and acquired, such as Alcohol Consumption, Low-birth weight, sugar consumption, smoking (consumption of tobacco), and protein intake and public and private expenditure on education. Using macro-level data from various sources, the results generally suggest that factors like alcohol consumption, low-birth weight and sugar consumption add to obesity whereas smoking and protein intake negatively (favorably) impact obesity.

Key Words: Obesity, social and behavioral factors,

JEL classification: I1, J1,

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1.0 INTRODUCTION:

Obesity is one of the greatest public health challenges of the 21st century. The number of those affected continues to rise at an alarming rate, particularly among children. Obesity is already responsible for 2-8% of all health costs and 10-13% of deaths in different parts of the region. (World Health Organization). Obesity is the extreme condition of being overweight. Obesity can be defined as an adult who has a Body Mass Index (BMI) of 30 or higher. BMI can be calculated by a person's weight (in kilograms) divided by the square of his or her height (in meters). Obesity and its related diseases are more prevalent among groups with low socioeconomic status. Those on lower incomes tend to consume more meat, fat and sugar, and those on higher incomes, more fruit and vegetables. In addition, poorer groups usually have less access to sport and fitness facilities, which limits the exercise they take. (WHO)

Obesity is a health problem in its own right. Physical exercise has become a leisure activity; people have air-conditioned cars and buy their food from supermarkets. Along the same lines, dietary habits have undergone a major change as well. Fat consumption is on the rise, fast food outlets are found everywhere, and an increasing number of people are consuming processed foods at every meal. Obesity is more prevalent amongst the urban poor than the economically affluent. The urban poor live in more crowded and unhealthy conditions and are also subject to severe stress brought about by their marginal situation. (WHO)

The study of obesity is a very vital one in these current times. Obesity has increased sharply in populations that include both children and adults, since the mid-seventies. Data from two NHANES surveys show that among adults aged 20–74 years the prevalence of obesity increased from 15.0% (in the 1976–1980 survey) to 32.9% (in the 2003–2004 survey) the implications to health from being obese are immense. Being overweight or obese increases the risk of many diseases and health conditions, including the following:

- Hypertension (high blood pressure)
- Osteoarthritis (a degeneration of cartilage and its underlying bone within a joint)
- Dyslipidemia (for example, high total cholesterol or high levels of triglycerides)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Sleep apnea and respiratory problems

- Some cancers (endometrial, breast, and colon)
  (Department of Health and Human Services, 2008)

Overall, there are a variety of factors that play a role in obesity. This makes it a complex health issue to address. Obesity results from an energy imbalance. This involves eating too many calories and not getting enough physical activity, when calories consumed is more than energy burned. Body weight is the result of genes, metabolism, behavior, environment, culture, and socioeconomic status. Behavior and environment play a large role causing people to be overweight and obese. These are the greatest areas for prevention and treatment actions.

(Adapted from U.S. Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity, 2001)

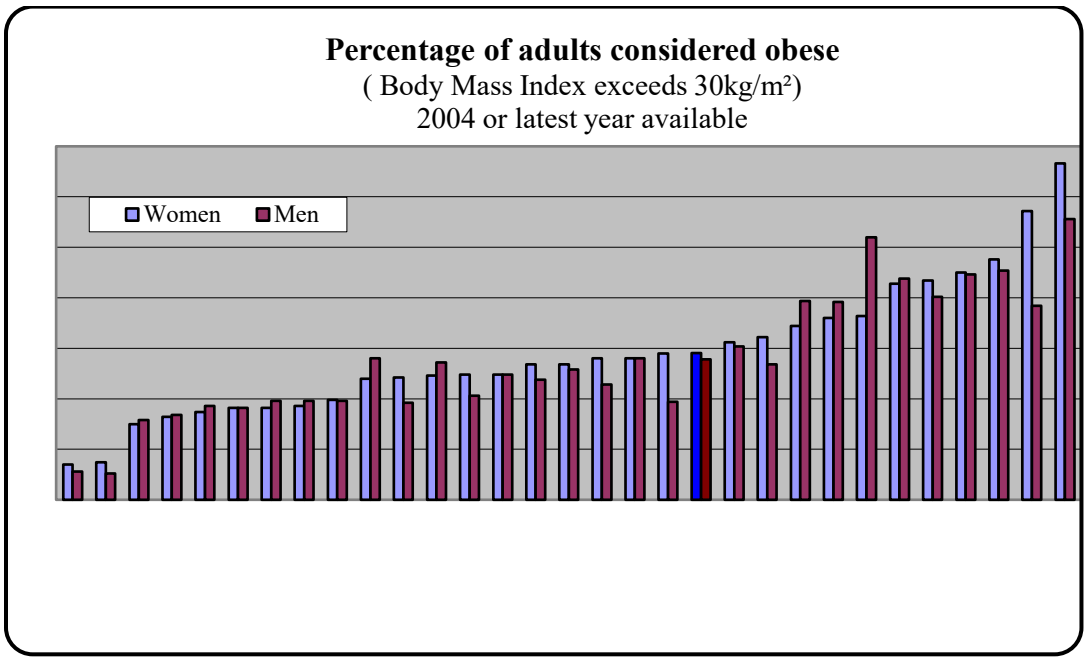
In this study, the latest data of the past decade on obesity and related statistics that were released by the OECD were employed (Health Data). These records are augmented with country-level data pertaining to a wide variety of social, economic, and environmental variables found to be important determinants of obesity-related measures in past studies. This article provides an empirical assessment of the different factors that contribute to the growth of the obese population over the decade (1990-2000) in OECD countries.

2.0 OBESITY TRENDS:

The chart below shows the comparative percentage of adults that can be labeled as obese in the OECD countries; it shows men and women separately. More men than women are overweight, but obesity is pretty evenly distributed in all OECD countries. The upward trend of the obesity rates in OECD countries (both developing and industrial) in the past two decades reinforces the idea of 'globesity'- a global obesity epidemic. This epidemic adversely affects economic costs, according to UCLA researchers, obesity raises a person's health care costs by 36 percent and their medication costs by 77 percent. (OECD health data 2006)

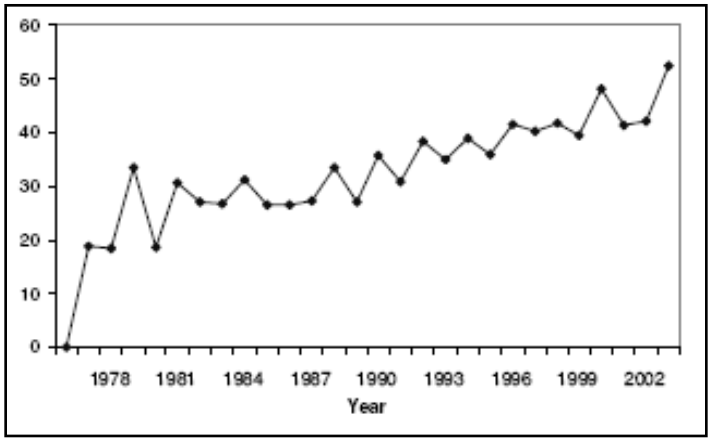
In figure 2, it can be observed that obesity in the OECD countries has increased from approximately 25 units in 1990, to approximately 40 units in 2000 and it can be seen to continue to rise rapidly in 2002. Thus, we can say that obesity truly is one of the greatest health challenges of the 21st century and the number of those affected continues to rise at an alarming rate.

Figure 1 Percentage of adults considered obese in OECD countries.



Source: OECD (2005), *Health at a Glance – OECD Indicators 2005*, OECD, Paris; OECD (2006), *OECD Health Data 2006*, OECD, Paris.

Figure 2 Percentage of individuals with weight problems in OECD countries.



Source: Loureiro, Maria.L, Nayga Rodolfo .M., (2005).

3.0 LITERATURE REVIEW:

With the increasing concerns of the rapidly growing obesity figures across the western world and also in some parts of Asia, the consequent research and studies on this subject matter have also increased. The factors that lead to obesity are financial, economic, biological, social,

and behavioral, which factor is most significant has not been agreed upon unanimously. Some feel that unhealthy eating habits and no exercise causes obesity whereas others blame it on genetics or forced economic conditions.

According to Peralta-Alva Porqueras, (2006) there has been an increase in the obesity rate of both males and females in the United States since the early 1960's. Porqueras goes on to say that the obesity rates have even doubled in that time period, from the early 1960's to 2006. Taking this test a step further, a study done by Richards and Patterson (2007) tested that eating unhealthy foods is the reason that there has been a rise in obesity levels in the United States. Their test reveals that people have a strong addiction to carbohydrates, which cause excessive nutrition intake.

A study done by Rashad (2006) looked at the relationship of things like exercise, smoking among other factors and their relationships to obesity. This study found that people who smoke are less likely to be obese, since they generally have a lower body mass index (BMI). The data also said that higher the number of years that you were educated, lower the risk of being obese. In general terms, if you graduated high school, but did not go on to college, you are more likely to be obese than someone who is a college graduate, but less likely to be obese than someone who did not graduate from high school. The study also found that you are more likely to be obese if you are either married or widowed than if you are divorced.

Smith, Stoddard and Barns (2007) completed a study to find if people's income was a key determinate to why people are obese. The study did find that people who believe that they have a chance of becoming unemployed have a greater chance to gain weight. In other words, a temporarily unemployed person is more likely to fill his insecurity with food rather than productive workouts. The study also found that people with a good job and comfortable health insurance were more likely to have a small weight gain.

Loureiro and Nayga (2005), combined the social and economic factors that contribute to obesity and specifically observed the environment in which their sample population lived – rural or urban, and their country's per capita income. By including things like GDP and rural area, they were able to better determine what causes obesity. They concluded that the population living in rural areas carries negative and statistically significant coefficients, whereas per capita income level affects the incidence of obesity rates.

A study completed by Goel (2006), looked at the obesity rate in developing countries. The study concluded that there are both endogenous and exogenous factors that affect obesity, as well as demand driven (economic and health) factors and supply driven (technology and government) factors. It is important to look at these along with the individual's consumption to get a complete picture of obesity.

The trends of obesity have been increasing rapidly in most developed countries, especially in the OECD member countries (see figure 2). To my knowledge there has been only one other study done on the factors that affect obesity in OECD countries by Loureiro and Nayga in 2005. That study however only looked at socioeconomic factors that affect obesity. To fill the void and to add to the minimal studies done on the concerning topic of obesity this paper looks at the social and behavioral factors that affect obesity in OECD countries.

4.0 DATA AND EMPIRICAL METHODOLOGY

4.1 Data:

The data employed in this research came from a variety of international organizations and databases. Annual data was collected from twenty-seven member countries of the Organization of Economic Development and Co-operation (OECD), with the exception of Luxemburg, Turkey and Greece which were omitted from the country-list due to insufficient data available for the independent variables needed. A cross section of the averages over the decade of 1990-2000 was taken for 27 member countries of the OECD. The log of the averages was taken into consideration for further study.

Data for the dependent variable of OBESITY (total, males and females) and the independent variable of SMOKING and ALCOHOL was collected from the 1st edition of the OECD Health Data 2004. The data for the variables of PROTEIN and SUGAR was collected from the FAO Nutrition Database.

PUB_PRI_EXP and L_BIRTH_WT data was country-specific and was thus collected from individual country databases, the source for the public and private expenditure variable was Education at a Glance, OECD, Paris, 2003 and individual country mappings and national data sources. For low birth weight in Australia, AIHW National Perinatal Statistics Unit 2003; in Canada the Health statistics divisions; Czech Republic from the Czech Statistical Office; in

Denmark the National Board of Health; in Finland, STAKES, National Research and Development Centre for Welfare and Health; Germany Federal Statistical Office - Official population statistics; Hungary Central Statistical Office ;Italy National Institute of Statistics; Japan Ministry of Health, Labor and Welfare-Vital statistics of Japan; Korea National Statistical Office-Annual Report on the Vital Statistics; Mexico's information found from the Ministry of Health; Netherlands' data from the Health Interview Survey; data for New Zealand from the Health Information Service; Norway's data from the Medical Birth Registry of Norway (MBRN); data for Poland from the Central Statistical Office of Poland; Slovak Republic's data from the Statistical Office of the Slovak Republic; Spain-Instituto Nacional de Estadistica, vital statistics and Sweden's information from The National Board of Health and Welfare. The complete list of variable definitions and data sources are presented in Appendix A.

4.2 Methodology:

In this empirical study, we estimate the regressions with ordinary least squares (OLS) to account for the non-observed heterogeneity across countries. Three regression models have been included in this study; the first includes total OBESE population and ALCOHOL, L_BIRTH_WT, SUGAR, SMOKING, PROTEIN and PUB_PRI_EXP as explanatory variables, the second model has OBESE_FM as the dependent variable with the same independent variables and the third model has OBESE_ML as the dependent variable again with the same independent variables. This study distinguishes between total obese population (OBESE), female population who are considered obese (OBESE_FM) and population of males (OBESE_ML) who are considered obese because of clear, observed differences. The regression models have the following functional forms:

$$I) \quad OBESE_{i\,t} = \beta_0\, ALCOHOL_{i\,t} + \beta_1\, L\_BIRTH\_WT_{i\,t} + \beta_2\, SUGAR_{i\,t} - \beta_3\, SMOKING_{i\,t} - \beta_4\, PROTEIN_{i\,t} + \beta_5\, PUB\_PRI\_EXP + \varepsilon_{i\,t}$$

$$II) \quad OBESE\_FM_{i\,t} = \beta_0\, ALCOHOL_{i\,t} + \beta_1\, L\_BIRTH\_WT_{i\,t} + \beta_2\, SUGAR_{i\,t} - \beta_3\, SMOKING_{i\,t} - \beta_4\, PROTEIN_{i\,t} + \beta_5\, PUB\_PRI\_EXP + \varepsilon_{i\,t}$$

$$III) \quad OBESE\_ML_{i\,t} = \beta_0\, ALCOHOL_{i\,t} + \beta_1\, L\_BIRTH\_WT_{i\,t} + \beta_2\, SUGAR_{i\,t} - \beta_3\, SMOKING_{i\,t} - \beta_4\, PROTEIN_{i\,t} + \beta_5\, PUB\_PRI\_EXP + \varepsilon_{i\,t}$$

Subscripts i and t, respectively, denote a country and a specific year. The Variable OBESE equals population of total individuals with BMI greater than 30 kg/m 2 in country $_{i}$ and time $_{t.}$ OBESE_FM is Obese population as a percentage of females with a BMI>30 kg/m2. OBESE_ML is the obese population as a percentage of males with a BMI>30kg/m2. ALCOHOL is Consumption of alcohol in each country in liters per capita (15+); L_BIRTH_WT is the number of live births weighing less than 2500 grams as a percentage of total number of live births; SUGAR is the variable for all quantities of sugar in its centrifugal, refined state, expressed in kilograms per capita per year; SMOKING is the consumption of tobacco, as a percentage of population of daily smokers in each country; PROTEIN is the total protein intake in Grams per capita per day. PUB_PRI_EXP is Total public and private expenditure for educational institutions as a percentage of GDP. Finally, ε_{it} is the stochastic error term. The complete variable definitions and corresponding expected signs are presented in Appendix B. Summary statistics for data are provided in table 1.

Table 1: Summary Statistics of Dependent and independent variables

	obesity	alcohol	L_birth_wt	Protein	Pub_pri	Smoking	Sugar
Mean	0.98	0.97	0.74	2.00	0.75	1.46	1.54
Median	1.00	1.00	0.77	2.00	0.75	1.44	1.57
Maximum	1.38	1.16	0.87	2.07	0.84	1.68	1.66
Minimum	0.34	0.70	0.51	1.90	0.63	1.30	1.21
Std. Dev.	0.24	0.13	0.09	0.04	0.05	0.09	0.11

5.0 EMPIRICAL RESULTS:

As discussed earlier, the OLS regressions were estimated to minimize the sum of the squared residuals of the data. Table 2 represents the results obtained from this estimation. The results reinforce some of the conclusions from previous studies and add significant information regarding the effect of various social and behavioral factors on obesity in OECD countries.

As shown in table 2 under model I, the independent variables that affect the incidence of obesity (OBESE - as a percentage of total individuals with a BMI>30), in a positive and statistically significant way are sugar consumption, Low birth weight and alcohol consumption. Further, other factors such as consumption of protein intake and tobacco consumption in smoking all carry negative and statistically significant coefficients. Other variables, however, such as public and private expenditure are not statistically significant.

In model II, the independent variables that affect the incidence of obesity (as a percentage of female population with a BMI>30), in a positive and statistically significant way are sugar consumption and low birth weight. Further, other factors such as protein intake and smoking all carry negative and statistically significant coefficients. The explanatory variable of public and private expenditure for educational institutions and alcohol consumption is not statistically significant.

In model III, the independent variables that affect the incidence of obesity (as a percentage of male population with a BMI>30), in a positive and statistically significant way are sugar consumption, low birth weight and alcohol consumption. Further other factors such as protein intake and smoking carry negative and statistically significant coefficients. Like the previous two models, public and private expenditure on education as a percentage of GDP is not significant. This set of results reinforces and expands those found by Rashad (2006) and Loureiro and Nayga (2005). In the study done by Rashad (2006) he concluded that people who smoke are less likely to be obese.

Direct interpretation of the coefficients of the explanatory variables helps assess the relative impact of each of the variables, *ceteris paribus*. Based on the results obtained through the OLS models, with an increase in obesity by one unit of BMI in kg/m2, is caused by an increase of 0.690 grams of birth weight in the total obesity population, an increase of 0.695 grams of birth weight in obesity of female population and an increase of 0.667 grams in birth weight of the obesity in male population. Studies have shown that babies who are born large are more likely to end up fat as adults. Scientists say a person's weight at birth, as a preschooler and as a teen seem to have a strong connection to weight problems in adulthood.

Further, an increment of one unit of kg/m2 of the total obesity population is caused by an increase of 1.557 kilograms of sugar consumption, 1.450kgs in female obesity population and an increase of 1.748kgs of sugar consumption in males. The coefficient of sugar consumption in

females is lower than the coefficient of sugar consumption in males because, females are known to be more diet-conscious than their male counterparts are and thus consume less sugar, which then reduces its impacts on obesity.

While the same increase in total obesity and obesity in males is caused by an increase of alcohol consumption by 0.332 and 0.504 liters respectively. In the female population of obesity, alcohol is not a significant factor that contributes to obesity which can be possible because of difference in choice of alcohol consumed and quantity of consumption of alcohol which is greater in males than in females. Females also opt for more light beers and diet mixers like diet coke and zero sprite which are consumed with alcohol in comparison to full sugar content mixers consumed by males. Whereas an increase of a single unit of kg/m2 of obesity is caused by a decrease of 1.924 grams of protein intake for the total population, a decrease of 2.053 grams of protein intake for the obese female population and a decrease of 1.711 grams of protein intake for the male obese population.

Further the same increase in obesity is caused by a decrease of the consumption of tobacco by 1.527 percent of daily smokers of the total obese population, a decrease of 1.532 percent of daily smokers from the female obese population and a decrease of 1.546 percent of daily smokers from the male obese population. The decrease of daily smokers which causes a unit increase in obesity is almost identical across all three models, which means that smoking has the same effect on both males and females who are less likely to be obese. The reason for the negative and statistically significant coefficient for smoking as a factor that influences obesity is that consumption of tobacco which contains high levels of nicotine, suppresses appetite.

Public and private expenditure on education is not a significant factor contributing to obesity because the trend of highly educated population comprising of developed countries like United States, Australia and the United Kingdom have the highest rates of obesity and some developing countries in Asia who also have high rates of obesity do not spend as much on education as do their western counterparts.

Table 2: Regression results

I) OBESITY AND TOTAL

	Coefficient	Std. Error	t-Statistic	Prob.
PROTEIN	-1.924***	0.534	-3.600	0.0019
SMOKING	-1.527***	0.231	-6.591	0.0000
SUGAR	1.557***	0.197	7.899	0.0000
L_BIRTH_WT	0.690***	0.257	2.683	0.0147
PUB_PRI_EXP	-0.094	0.433	-0.217	0.8301
ALCOHOL	0.332*	0.176	1.881	0.0753
C	3.891	1.211	3.212	0.0046
R^2	0.877088			
F-statistic	22.59704			

II) OBESITY AND FEMALE

	Coefficient	Std. Error	t-Statistic	Prob.
PROTEIN	-2.053***	0.530	-3.870	0.0010
SMOKING	-1.532***	0.230	-6.660	0.0000
SUGAR	1.450***	0.195	7.406	0.0000
L_BIRTH_WT	0.695***	0.255	2.724	0.0135
PUB_PRI_EXP	-0.293	0.430	-0.683	0.5028
ALCOHOL	0.217	0.175	1.237	0.2310
C	4.595	1.202	3.821	0.0012
R^2	0.873831			
F-statistic	21.93194			

III) OBESITY AND MALE

	Coefficient	Std. Error	t-Statistic	Prob.
PROTEIN	-1.711***	0.627	-2.728	0.0133
SMOKING	-1.546***	0.271	-5.686	0.0000
SUGAR	1.748***	0.231	7.556	0.0000
L_BIRTH_WT	0.667**	0.301	2.211	0.0395
PUB_PRI_EXP	0.102	0.508	0.202	0.8418
ALCOHOL	0.504**	0.207	2.432	0.0251
C	2.882	1.421	2.027	0.0569
R^2	0.843271			
F-statistic	13.83538			

Note: ***, **, and * denotes significance at the 1%, 5%, and 10%

6.0 CONCLUDING REMARKS:

There has been a relentless rise in obesity in the last two decades in OECD countries in particular. This rising trend is costly both in terms of personal suffering and the associated social and economic costs. In order to minimize these costs, it is urgent to devote more research to finding cost – effective responses to curb the growth of obesity. Using macro-level data from various sources, the results of this study suggest that factors such as protein intake, sugar consumption, tobacco consumption, low-birth weight and alcohol consumption significantly influence obesity in OECD countries.

While this study provides some interesting findings, due to data limitations and collection challenges, a variable like public and private expenditure on education was just a proxy for the education level or more specifically population of educated individuals in OECD countries. This analysis is also just for OECD countries, and it is possible that the same results may not apply to non-OECD countries. This study could be replicated for future studies for other countries like developing countries or a continent to assess robustness of the findings.

6.1 Limitations:

In most countries, data on weight and height are self-reported. Evidence suggests that both men and women underestimate their weight and/or overestimate their height, so leading to an underestimate of the true prevalence of overweight and obesity problems. For example, evidence from Canada is that 13.3% of women and 15.4% of men were obese in 2003 based on self-reported data, whereas when actual measures were used in 2004, 22.5% of women were obese as were 22.3% of men. In Canada, New Zealand, Australia, the United Kingdom and the United States, actual measurements were made. The percentages for these five countries are among the highest in the OECD region. (OECD health at a glance, 2006)

6.2 Policy Implications:

OECD has not yet carried out any rigorous study on the cost-effectiveness of different measures to prevent obesity or treat its health consequences, and so the OECD does not have a ready-made “global strategy” to tackle the epidemic of obesity. However, in the related area of alcohol consumption, they have carried out a recent review of the experience in several OECD countries which shows that a combination of instruments can help achieve the goal of reducing

alcohol consumption[3]. These instruments include public education campaigns, curbs on advertising, restrictions on sales to young people, and increased taxation. Similar instruments are often suggested as prime candidates to curb obesity, but there is little evidence as to their likely effectiveness in this task (Obesity and Health, OECD forum 2004).

Appendix A: Variable Description and Data Source

Acronym	Description	Data source
OBESE	Obese population calculated as a percentage of total population with a BMI>30kg/m2	OECD HEALTH DATA 2004, 1st edition
OBESE_FM	Obese population calculated as a percentage of females with a BMI>30kg/m2	OECD HEALTH DATA 2004, 1st edition
OBESE_ML	Obese population calculated as a percentage of males with a BMI>30kg/m2	OECD HEALTH DATA 2004, 1st edition
ALCOHOL	Consumption of alcohol in each country in liters per capita (15+)	OECD HEALTH DATA 2004, 1st edition
SMOKING	Tobacco consumption, as a percentage of population of daily smokers	OECD HEALTH DATA 2004, 1st edition
PROTEIN	Total protein intake in Grams per capita per day	FAO Nutrition database
SUGAR	All quantities of sugar in its centrifugal, refined state, expressed in kilograms per capita per year.	FAO Nutrition database
PUB_PRI_EXP	Total public and private expenditure for educational institutions as a percentage of GDP.	OECD HEALTH DATA 2004, 1st edition
L_BIRTH_WT	Number of live births weighing less than 2500 grams as a percentage of total number of live births.	OECD HEALTH DATA 2004, 1st edition

Appendix B: Variables and Expected signs

Acronym	Variable	Description	Expected Sign
ALCOHOL	Alcohol Consumption	Consumption of alcohol in each country in liters per capita (15+)	+
SMOKING	Tobacco Consumption	Tobacco consumption, as a percentage of population of daily smokers	-
PROTEIN	Total Protein Intake	Total protein intake in Grams per capita per day	-
SUGAR	Sugar Consumption	All quantities of sugar in its centrifugal, refined state, expressed in kilograms per capita per year.	+
PUB_PRI_EXP	Total public/private education expenditure	Total public and private expenditure for educational institutions as a percentage of GDP.	+/-
L_BIRTH_WT	Low Birth Weight	Number of live births weighing less than 2500 grams as a percentage of total number of live births.	+

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