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# Globesity: Is Globalization a Pathway to Obesity?

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

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**Abstract**

Obesity has risen dramatically at the same time as globalization has surged, which poses the question of whether the two are related. In this paper we analyze whether empirical evidence confirms the association between the different types of globalization (economic, political or social) and obesity using data from 15 up to 23 different countries for up to 15 years, as well as three primary outcomes: obesity, caloric intake and grams of fat consumed and a set of controls for micro-mechanisms that have been found to affect obesity in the economic and health literature. Our results are suggestive of a robust association between globalization and obesity, caloric intake and grams from fat consumed. Once we control for indirect micromechanisms associated with globalization such as food prices, female labor market participation, as well as urbanization and income, the direct impact of economic globalization is not significant, whilst 'social globalization' remains as a having robust and strong effect on the three measures of obesity. A one standard deviation increase in the index of social globalization from the Swiss federal institute of technology Zurich (KOF index) implies a rise of 3 percentage points in the proportion of obese population. It leads to a rise of 217 kcal and of 23.1 grams of fat consumed, respectively. Urbanization has a negative impact on the consumption of fat and caloric intake, while female labor force participation has a positive relationship with the three obesity outcomes.

Keywords: globalization, obesity, calorie intake, health production, development, macro-mechanisms.

JEL: I18, F69,P46

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## 1. Introduction

Obesity is a major cause of excess morbidity and mortality (Rosenbaum et al., 1997), the fifth most important risk factor contributing to morbidity in advanced economies (WHO, 2002), and currently accounts from 5.0 to 5.7 % of national health expenditures in the United States and 2.0 to 3.5% in other advanced economies (Thomson and Wolf, 2001). The prevalence of obesity has been recognized as the source of several serious health complications, and risks later in life (Ebbeling et al., 2002). Moreover, obesity is responsible for a very large proportion of healthcare costs in developed countries (Cawley and Meyerhoefer, 2012) Knai et al., 2007 have estimated the burden of obesity in Europe to represent about 6 percent of healthcare costs and another 6 percent in indirect cost of lost productivity.

The rate of acceleration of body mass index (BMI) since World War II is of unprecedented magnitude and it can be mostly explained by lifestyle changes (Komlos and Brabec, 2011). Obesity today can be regarded as a global epidemic. Indeed, it is estimated that 500 million adults worldwide are obese and 1.5 billion are overweight or obese (Finucane *et al*, 2011). For the first time in human history, the world has a larger share of the population overweight than underweight (Popkin, 2007). The prevalence of obesity has not ceased to increase around the world alongside the intake of kcal and grams of fat per capita (see Figures 1, 2 and 3). The latter is not incompatible with 2009-2010 National Health and Nutrition Examination Survey (NHANES) data suggesting some tailing off at a prevalence of 35.5 to 35.8% (Flegal et al, 2012).

Nonetheless, obesity affects both rich and poor countries and is spreading widely, especially during the last two decades, which nurtures the term "*globesity*" as it is a contemporaneous process to the progressive economic and economic globalization. By globalization we mean the 'integration of economies and societies' defined by the International Labor Organization (ILO, 2004)[1]. The latter has a pure economic dimension which reflects the economic interdependence as well as a social dimension that involves "life and work of people, on their families and their societies" (ILO, 2004). Although it is widely accepted that obesity and overweight result from an energy imbalance where energy intake exceeds energy expenditure (Jéquier and Tappy, 1999), the global nature of the phenomenon calls for the analysis of the underlying micro- and macro-mechanisms at play.

Micro-mechanisms that results from both economic and social globalization include the extension of fast food restaurants (Chou et al. 2008), time constraints from current employment

[1] See http://www.ilo.org/public/english/wcsdg/globali/index.htm (accessed February 2013)

conditions and social lifestyles (Hamermesh 2010), and more specifically some level of sluggish adaptation to energy saving technological change (Cutler et al. 2003, Lakdawalla and Philipson 2009, Philipson and Posner 2003). In contrast, macro-mechanisms operate through environmental as well as other socio- economic constraints and cannot be disregarded (Offer et al. 2013). Indeed, the fact that obesity has increased so greatly during the years when the globalization process has surged raises a question about whether the two, or some components of the two, are related.

**Figure 1. Evolution of obesity in the adult population (15 years of data)**

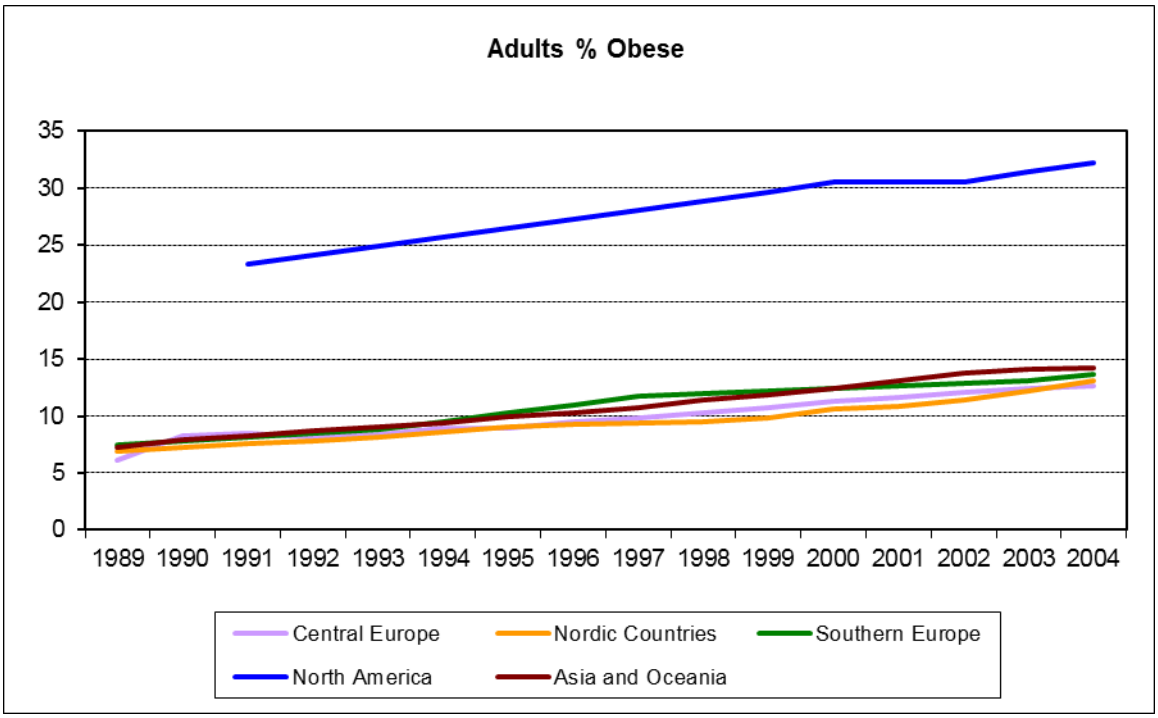


**Figure 2. Evolution of the intake of Kcal per capita over time (1989-2004)**

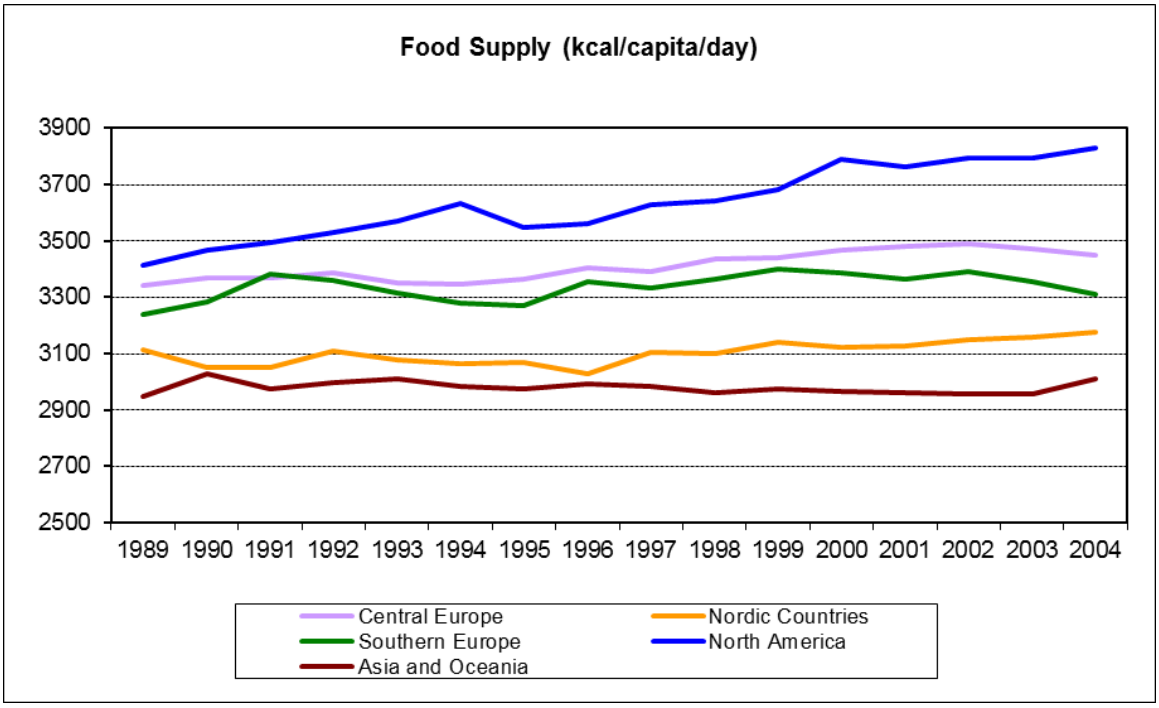
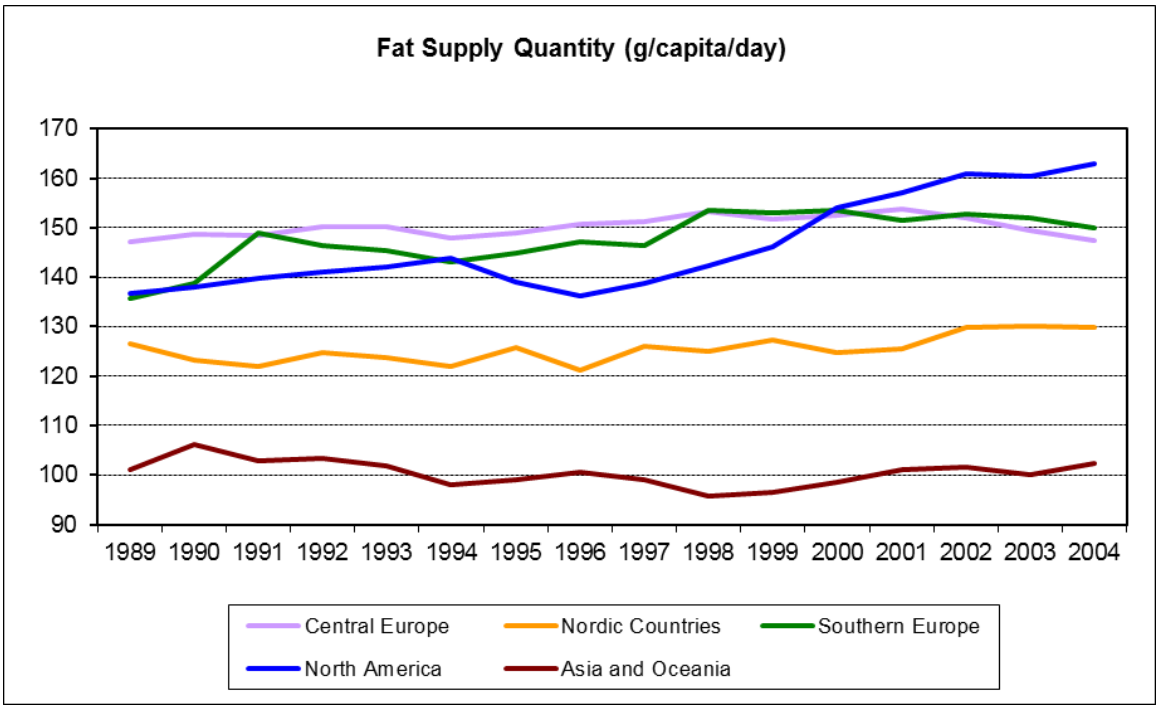



**Figure 3. Evolution of the daily intake of grams of fat per capita**



This paper empirically analyzes the association between globalization (and its several dimensions) and obesity by exploring if the main mechanisms analyzed by the literature and related to globalization could contribute to the recent explosion in obesity. We argue that the effect of globalization can be through its indirect influence on some micro-mechanisms or remain instead as an environmental (or residual) effect. In this paper we measure some of these micro-mechanisms conveying the effects of social globalization (e.g., female labor market participation) or economic globalization (e.g., a reduction in food prices due to trade liberalization) as well as macro mechanisms capturing unobserved residual effects. We show in the paper that once those micro mechanisms were controlled for the residual impact of economic globalization as a macro-mechanism is not significant anymore, whilst the environmental effect of 'social globalization' remains as having a robust and strong effect on the three measures of obesity once a rich set of micro-mechanisms are controlled for. We interpret these results as reflecting a residual variation which reflects in the influence of social environment in influencing individual's health production.

More specifically, we control for some micro-mechanisms considered by the literature, and compare the respective effects *vis a vis* a direct effect of such mechanisms on the consumption of calories and of grams of fat. Some literature has examined the impact of different forms of globalization on life expectancy, and has found some suggestive evidence that it is economic globalization that appears to be correlated with life expectancy extension (Bergh and Nilsson, 2010). However, what are the main mechanisms that trigger such a correlation? What are the main components of globalization that could exert such an influence? This study provides the most detailed investigation to date of the relationship between aggregate changes in a country's globalization and obesity. More specifically, we take advantage of a three-dimensional classification of globalization that consists of social, economic and political characteristics (see Appendix), to ascertain different macro-mechanisms that could underpin an association.

To contribute to this debate, we exploit the cross-country variability in a panel of countries for 15 years and 10 years. We draw upon aggregate data from a large number of countries through three decades. The primary outcomes examined are obesity, caloric intake and grams of fat. Time and country effects are controlled for and a rich list of controls and time trends are included to identify the effect of our variable, and net out the influence of other confounding variables.

Based on the literature on the determinants of obesity, we consider different types of micro-mechanisms some of which convey the effects of globalization. We include the impact of changes in

income and the effect that this would have on food consumption, the influence of female participation in the labor force and the change in relative food price. However, the interaction of such micro-mechanisms with wider macro-mechanisms like globalization has led to a decrease in the price of processed food relative to fruits and vegetables. For instance, the price of beef has dropped an astounding 80 percent, thanks in large part to global trade liberalization (Duffrey *et al*, 2010).

Similarly, it is possible to conceptualize a specific effect of macro-mechanisms corresponding to wider economic as well as *social* determinants of obesity. Those would include, for example, an increasing "Americanization" or "westernization" of the world societies. This could in turn alter tastes, and hence impact micro-mechanisms, by, for instance, triggering a preference for fast and processed food, incentivize changes in the family structure and urbanization alongside an expansion in quantity and quality of working time (which has been shown in the literature to have an effect on child obesity). The comprehensive nature of our data allows us to distinguish the impact of globalization on three main variables: the percentage of population that is obese, total caloric intake and total fat intake. We also include the last two variables because research for developed countries has shown that the primary proximate determinant of a rise in obesity is an increase in energy intake.

The remainder of the paper proceeds as follows: the next section reports the state of the art. Section three reports the data and methods, section four presents the results and finally section five concludes.

## 2. GLOBALIZATION AND OBESITY

The determinants of obesity are multiple and complex, and there is already an extensive literature analyzing them. ***Genetic or physiological factors*** have been found responsible for 20% to 75% of variability in body weight (Hill *et al.,* 2000). However, such an increase in body weight as the one we have observed over such a short period of time cannot be explained by genetic changes. Rather, it is changes between the number of calories consumed and those expended that must be at the core of the *globesity* phenomenon (Bleich et al. 2007; Jéquier and Tappy, 1999; Popkin, 2001).

Frenk, 2012 has already argued that globalization helped promote obesity by speeding the "nutrition transition". Still, to our knowledge, no published study has yet examined empirical evidence between overall and specific types of globalization and obesity. The following are some of the mechanisms by which globalization could promote obesity:

***Reduced energy expenditure***: Changes in technology have transformed the workplace towards activities that require less energy to be performed. Phillipson and Posner, 2003 and Lakdawalla and Phillipson, 2009 find evidence of the link between technological change and obesity. Prentice and Jebb, 1995 argue that the reduction of physical activity is the main cause behind the rise in obesity in Britain. Several low- and middle-income countries have experienced a shift from agriculture and mining to manufacturing or services, reducing the level of physical activity in the workplace. Paeratakul et al., 1998 find evidence of the link between changes in physical activity and the rise in obesity in China. However, most of the changes toward automatism in the workplace have been gradual and are hard to reconcile with the recent dramatic increase in obesity in the developed world (Cutler et al, 2007).

***Decline in the relative prices of food***: If food prices increase less than other prices food consumption is encouraged and it could raise obesity. Powell and Bao, 2009 found that a 10 percent increase in the price of fruits and vegetables was linked with a 0.7 percent increase of BMI in US children. There is evidence about significant dietary changes taking place all over the world (Kim et al. 2000; Monteiro et al. 1995; Hawkes, 2006) known as "nutrition transition". In a nutrition transition, diets change towards more consumption of fat and added sugar and usually an increase in animal food products, while reducing the intake of fiber and cereals. Such changes have been linked to an increase in obesity (Bray and Popkin, 1998; Duffey et al. 2010).

Drewnowski, 2007 reviews the epidemiologic literature and finds that obesity has been repeatedly related to consumption of low-cost food. He also finds that the fact that energy-intensive foods have become relatively cheaper than fresh food has contributed to the rise in obesity.

***Socio-Economic status***: Several studies have found different changes in obesity associated with different socioeconomic environments (McLaren, 2007 or Monteiro et al. 2000; Egger et al. 2012). In a review of around one hundred separate studies, Sobal and Stunkard, 1989 find clear-cut evidence of an association between socio-economic status and obesity. More specifically, some studies find an inverse association between social class and obesity (Sobal, 1991). The British Heart Foundation, 2002 finds that men and women in unskilled occupations are four times more likely to be morbidly obese than those in professional groups. Environmental effects also play a role: for instance, consumption of fatty foods might well be associated with a lower SES whilst obesity prevention is less a matter of concern to the least educated and poorer individuals. Yet, little is known about the potential socio-economic vector underlying the prevalence of obesity and

especially its determinants. While some authors argue that fat storage is linked to SES (Sundquist and Johansson, 1998) more recent studies argue that inequalities in obesity have to do with gender, age and ethnicity (Dreeben, 2001, Zhan and Wang, 2004). In some lower-middle- and middle-income countries, such as China and Brazil, obesity rates are higher or growing more quickly among the poor than among the rich (Monteiro, 2007).

***Urbanization***: rising urbanization is associated with more sedentary lifestyles and more food options (Popkin, 2004). Moreover, urban areas are often associated with greater food variety than rural areas. Bleich et al., 2007 already find a positive relationship between urbanization and obesity in advanced economies. Television viewing and other sedentary activities have been found to be associated with obesity *(*Frank *et al*. 2003, Robinson, 1999).

***Women in the labor force***: The number of women participating in the labor market has been increasing in the last decades in many economies in the world. The proliferation of women in the workforce means that they now have less time to devote to food preparation, as well as to going to the market to get fresh foods on a regular basis. Welch et al., 2009 have recognized the importance of both household purchasing behaviors on the achievement and maintenance of a healthy weight and also the time it takes to do so. Cawley and Liu, 2007 have also found that maternal employment is associated with an increased risk of childhood obesity.

***Other***: Kan and Tsai, 2004 found evidence using quantile regression that knowledge of obesity risk factors affects individuals' obesity and it is different for males and females. Interestingly, Chou et al, 2004[2] examined the specific economic determinants of individuals' obesity, such as the density of fast food restaurants and the prices of meals, and found a significant correlation suggesting some important micro-determinants that can trigger an obesity epidemic

***The socio-cultural environment*** of obesity is less well understood. Given that obesity is a household-produced good, socio-environmental influences such resulting from globalization are likely to play a role in explaining it (Ulijaszek, 2007). Already, some evidence indicates that these factors affect individuals' body mass production significantly (Costa-Font and Gil, 2004, Ulijaszek and Schwekendiek, 2012). Eating and physical activity patterns are likely to be, to some extent, culturally driven behaviour in industrialized nations. A recent paper (Wansink, 2004) suggests that

[2] These authors examine how relative price variations determine positive variations in the BMI and obesity. These price variations include the increase in the value of women's time – reflected by their increased participation in the labour force and hours worked – and the reduction in the relative costs of meals consumed in fast-food restaurants and meals prepared at home.

the eating environment (e.g., time to eat, standard portions and socialization of eating) is associated with the quantity of food intake. At the macroeconomic level, Ruhm, 2000 found, using time series analysis of US states for 1972 to 1991, that obesity increases and physical activity declines during business cycle expansions. Finally, another variable connected with health knowledge is schooling, which potentially increases the efficiency of health production (Kenkel, 2000; Rahad and Grossman,2004), although one might argue – following human capital theory – that education is likely to interact by raising individuals' income. The effect of schooling might as well result from time preference (Fuchs, 1982), which has been empirically explored in Komlos et al., 2004.

Consumption of ***fast-food*** by children has been linked to diet in ways that could increase their risk of obesity (Bowan and Gortmaker, 2004 or Jeffery and French, 1998, Offer at al. 2010), especially among children in that it impacts on the consumption of vegetables and increases that of salts and fats.

Today, social environmental sources are increasingly being recognized as responsible for an "obesogenic environment" (Swinburn et al. 1999; Lake and Townshend, 2006) that predisposes people to being obese if they follow the rules of such an environment. The latter include the built environment characteristics triggering escalator use and transportation systems reducing energy consumed by their passengers. Additionally, social lifestyle factors may reduce neighborhood socialization while increasing the use of information technologies and promoting sedentary technologies including TV, telephone and computer systems (Frank et al. 2003). The latter might create an imbalance if energy consumption patterns do not adapt accordingly. Indeed, consumption patterns are overcome intergenerational high calorie consumption patterns anchored in energy demands of pre-globalization times.

## 3. METHODS AND DATA

### *3.1. Data*

Data for this study includes country-level data obtained from several sources. We create a panel data set from 1989 to 2004. Due to restrictions in data availability, we face a trade-off regarding the number of countries that we can include in our study: we can either aim at a very large number of countries over a short time period, or we can broaden the number of years considered at the expense of reducing the number of countries in the analysis. In order to take this into account we present our regressions using two subsets of data.

Our first group contains data for the period 1989 to 2004 and consists of 11 countries: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, the United Kingdom and the USA. The second group covers the period 1994 to 2004 and contains data from 23 countries: Canada, Denmark, Italy, Norway, Poland, Portugal, Australia, Estonia, Hungary, Ireland, Lithuania and Malaysia, in addition to the eleven countries from the first group.

A summary of the data is presented in Table 1.

**Table 1. Summary statistics (15 years of data)**

| | Mean | Std Dev. |
|---|---|---|
| ***Dependent Variables*** | | |
| Adults % obese (BMI>=30) | 11.53 | 3.46 |
| Kcal/capita/day | 3,273.79 | 2,453.95 |
| gr of Fat/capita/day | 135.21 | 21.69 |
| | | |
| ***Globalization Variables*** | | |
| KOF index of Globalization | 78.55 | 10.19 |
| KOF Economic globalization | 73.89 | 13.49 |
| KOF Social globalization | 76.65 | 10.86 |
| KOF Political Globalization | 87.73 | 12.13 |
| CSGR Globalization Index | 53.89 | 18.98 |
| CSGR Economic Globalization | 13.36 | 3.32 |
| CSGR Social Globalization | 31.99 | 16.63 |
| CSGR Political Globalization | 58.57 | 20.01 |
| | | |
| ***SocioEconomic and Geographical variables*** | | |
| GDP per capita (´000) | 26.12 | 7.80 |
| % of women in labor market | 43.57 | 2.89 |
| Number of McDonald´s restaurants per 10,000 inhabitants | 0.22 | 0.11 |
| % population in urban areas | 79.03 | 6.55 |
| Income top 10%/income bottom 10% >=15 | 0.25 | 0.43 |
| Income top 10%/income bottom 10% | 9.09 | 4.40 |
| Food prices/total prices | 1,051 | 0.070 |
| Latitud | 0.53 | 0.10 |

*KOF index: Index from the Swiss federal institute of technology*

*BMI: Body mass index*

*CSGR Index: index from the University of Warwick*

*GDP: Gross domestic product*

*Datra from 1989-2004*

*Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA.*

### *Obesity Rates*

One of our dependent variables is the percentage of population that is obese in a given country. We have drawn upon data from the OECD Health Data alongside the Global Database on Body Mass Index, World Health Organization[3]. A person is considered obese if her body mass index ($kg/m^2$) is at least 30[4].

### *Daily Intake of Calories and Grams of Fat*

As an alternative approach, we are using two additional dependent variables. Previous literature (Cutler et al. 2007) has found that it is mainly the increase in calorie intake rather that the reduction in energy expended that has been the main driving force behind the increase in obesity. Using Russian data, Huffman and Rizov, 2007 also found a strong positive effect of caloric intake on obesity. Taking this into account we are also going to measure the effect of globalization on the grams from fat consumed and caloric intake.

Data come from FAOSTAT; the Food and Agricultural Organization of the United Nations FAOSTAT, (http://faostat.fao.org/site/610/default.aspx#ancor).

### *Globalization Measures*

In order to disentangle the mechanisms by which more globalization could lead to a rise in obesity, we consider three different types of globalization: economic, social and political globalization.

We use two alternative globalization indices that have already been broadly used in the literature (Potrafke,2010; Dreher, 2006; Bergh and Nilsson, 2010, etc): the *CSGR Globalization Index*, developed by the University of Warwick Globalization project (see Lockwood and Redoano, 2005 for a detailed description) and the *KOF Index*[5] (Dreher, 2006; Dreher and Gaston, 2008 and Dreher et al. 2008). Details about the indices and their components can be found in Appendix A. The description

[3] For detailed information on OECD country surveys: http://www.irdes.fr/ecosante/OECD/814010.html.
Data can be found at http://www.oecd.org/document/16/0,3343,en_2649_34631_2085200_1_1_1_1,00.html and http://apps.who.int/bmi/index.jsp

[4] In a few cases we were missing some data for a few years and we have infered the missing numbers by just imputing the average between the year before and after the missing data

[5] For a detailed description of the KOF index, see Dreher, 2006.

of their components as well as the correlation between the two indices already indicates that the results obtained are expected to be very similar. The main differences appear between the CSGR and the KOF Economic indices that present a correlation of only 0.45, while the social and political indices present correlations of 0.87 and 0.91, respectively.

***Other explanatory variables***

**GDP per capita at current prices (in US Dollars)**: Data extracted from the IMF's World Economic Outlook Database. To take into account the fact that in some countries obesity rates are higher or growing more quickly among the poor than among the rich (Monteiro, 2007), we will control for GDP per capita and we will also interact it with some variables such as inequality or latitude.

**Percentage of women in the active population**: Data obtained from the World Bank's Health, Nutrition and Population (HNP) statistics.

**Urbanization**: the percentage of urban population in a country. The data has been obtained from the United Nations (World Urbanization prospects. Revision 2011). The report contains data for every 5 years. We have imputed the changes corresponding to the remaining 4 years in between.

**Dummy indicating high inequality**: Dummy equal to one for those countries in which the income share of the 10% richest population is more than 15 times higher than the income share of the 10% poorest population in a specific year. In our sample, the 75th percentile of the distribution of the income share of the 10% richest population over the income share of the 10% poorest population is 12.57. Therefore, we are considering just those countries with exceptional inequality compared to the rest of the sample. The countries with high inequality are: New Zealand, Switzerland, Malaysia, South Korea, Brazil and China. These data have been calculated based on data from the UNU-WIDER World Income Inequality Database (WIID).

**Number of McDonald's restaurants per 10,000 persons**: Data obtained from the KOF index providers. We have data from 1994 to 2004. We will present two types of estimates: one that corresponds to the actual data and another one where the number of restaurants has been calculated assuming the same average annual growth from 1990 to 1993 then from 1994 to 1997.

**Latitude (distance to the Equator)**: Using CIA's The World Factbook 2009 data on latitude of the countries, we normalized the latitude over 1, as is usual in the literature (see for example Acemoglu et

al 2000 or La Porta et al 1999). Therefore, latitude equal to zero means that the country is in the Equator and the closer the latitude is to one, the further the country is from the Equator.

**Trade**: The value of imports and exports over the GDP in the country. It reflects the commercial openness of a country. Data obtained from the World Bank's World Development Indicators.

**Food prices**: Index of food prices over the consumer prices index in the country. The data comes from the OECD and Eurostat for most of the countries except for Malaysia and Lithuania, where data comes from FAO[6], and for Spain, where data comes from the National Statistics Institute.

### *3.2 Methods*

To examine the relationship of interest, we use a specification that relates overall globalization as well as economic and social globalization to the variables of interest: obesity, daily calorie intake and daily grams of fat consumed in different countries over time. The basic specification is:

$$O_{tj} = \alpha + G_{tj}\beta + X_{jt}\delta + \gamma T_t + u_j + \varepsilon_{tj} \qquad (1)$$

Where $O_{tj}$ refers to obesity rates in a year t and a country j (or, alternatively, to daily intake of calories or grams of fat), *G* refers to a measure of globalization, *X* includes all the relevant characteristics of the country that – according to the literature – could have an impact on obesity, $u_t$ refers to a country fixed effect, *T* refers to a general time trend and finally we include in the model a regression disturbance where ε is the error term.

In order to check for robustness we use several alternative specifications where we vary not only the number of control variables or the Globalization index (KOF or CSGR) but also the econometric approach. In this regard, all of our OLS specifications are estimated using robust standard errors to correct for potential heteroscedasticity. We also present fixed effects estimators. However, since globalization implies a greater integration between economies, it could very well be the case that errors are correlated across countries. To allow for heteroscedasticity and contemporaneously correlated errors across countries, we also use a panel-corrected standard error procedure (PCSE) as recommended by Beck and Katz, 1995.

[6] OECDstats http://stats.oecd.org/Index.aspx?DataSetCode=MEI_PRICES
FAO http://faostat.fao.org/site/683/DesktopDefault.aspx?PageID=683#ancor
INE http://www.ine.es/

## 4. RESULTS

### *4.1. Baseline estimations*

Tables 2, 3 and 4 presents the OLS results for the relationship between overall globalization, economic globalization and social globalization on obesity, calorie intake and grams of fat consumed, respectively.

**Table 2. Results**

| | Dependent variable: OBESITY | | | | | |
|---|---|---|---|---|---|---|
| | [1] | [1b] | [2b] | [3] | [3b] | [3c] |
| **Variables** | | | | | | |
| ***Measures of Globalization*** | | | | | | |
| **Overall Globalization Index** | 0.115** | | | 0.360*** | | |
| | [0.049] | | | [0.082] | | |
| **Economic Globalization Index** | | -0.246*** | -0.314*** | | 0.006 | -0.043 |
| | | [0.068] | [0.072] | | [0.098] | [0.140] |
| **Social Globalization Index** | | 0.445*** | 0.394*** | | 0.277*** | 0.569*** |
| | | [0.100] | [0.095] | | [0.094] | [0.190] |
| ***Social, Economic and Geographic Controls*** | | | | | | |
| **GDP per capita** | -0.449* | -0.760** | -0.316** | -1.746 | -0.582 | -0.439 |
| | [0.263] | [0.311] | [0.962] | [1.472] | [1.431] | [1.533] |
| **(GDP per capita)²** | 0.009 | 0.015** | 0.031** | 0.017*** | 0.015*** | 0.019*** |
| | [0.007] | [0.008] | [0.009] | [0.006] | [0.007] | [0.007] |
| **Dummy indicating high inequality +** | 15.601*** | 18.725*** | 15.765*** | -11.087*** | -7.725** | 0.498 |
| | [3.064] | [3.450] | [4.092] | [3.924] | [3.554] | [5.676] |
| **Dummy indicating high inequality * GDP per capita** | -0.555*** | -0.720** | -0.614*** | 0.249** | 0.097 | -0.174 |
| | [0.141] | [0.157] | [0.169] | [0.122] | [0.114] | [0.182] |
| **% of Women in the Active Population** | | | 1.126*** | 0.781** | 0.732** | 0.057 |
| | | | [0.181] | [0.355] | [0.345] | [0.635] |
| **Urbanization** | | | -0.633 | -0.266 | 0.117 | 0.053 |
| | | | [0.321] | [0.516] | [0.503] | [0.561] |
| **Urbanization* GDP Per capita** | | | 0.018* | 0.010 | -0.002 | 0.005 |
| | | | [0.010] | [0.018] | [0.018] | [0.019] |
| **Number of McDonald's restaurants per 10,000 population (inferred)** | | | | 52.704*** | 46.834*** | |
| | | | | [6.632] | [4.954] | |
| **Number of McDonald's restaurants per 10,000 population (years 1995-2004)** | | | | | | 54.88*** |
| | | | | | | [7.658] |
| **Latitude** | | | | 3.311 | 0.886 | 57.225 |
| | | | | [11.799] | [18.012] | [29.954] |
| **Latitude * GDP per capita** | | | | -1.109 | -0.909 | -2.593** |
| | | | | [0.733] | [0.697] | [0.953] |
| **Food price/ CPI** | | | | -1.833 | -0.348 | -17.86 |
| | | | | [9.302] | [8.550] | [12.272] |
| **N** | 183 | 161 | 161 | 121 | 161 | 121 |
| **R-squared** | 0.234 | 0.337 | 0.424 | 0.751 | 0.776 | 0.774 |

+ Dummy that equals one if the share of the total income of the 10% richest population in the country exceeds by 15 or more the share of the total income held by the 10% poorest population.

Robust standard error values appear in brackets below the regression coefficient

All regressions include 15 year dummy variables.

Statistically significantly different from zero: * at the 10 percent level; **at the 5% level; *** at the 1% level.

GDP: Gross Domestic Product; CPI: Consumer Price Index

Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA.

**Table 3. Results for globalization and Caloric intake**

| | Dependent variable: CALORIC INTAKE | | | | |
|---|---|---|---|---|---|
| | [1] | [1b] | [3] | [3b] | [3c] |
| **Variables** | | | | | |
| ***Measures of Globalization*** | | | | | |
| **Overall Globalization Index** | 11.085*** | | 23.345*** | | |
| | [1.938] | | [2.567] | | |
| **Economic Globalization Index** | | -15.048*** | | -2.642 | 0.995 |
| | | [1.796] | | [2.351] | [2.484] |
| **Social Globalization Index** | | 31.274*** | | 20.058*** | 20.543*** |
| | | [2.620] | | [2.604] | [3.489] |
| ***Social, Economic and Geographic Controls*** | | | | | |
| **GDP per capita** | -6.480 | -31.080*** | -112.296*** | -89.916*** | -118.899*** |
| | [7.513] | [8.907] | [40.308] | [38.043] | [27.282] |
| **(GDP per capita)²** | 0.099 | 0.575*** | 0.668*** | 0.547** | 0.509*** |
| | [0.185] | [0.203] | [0.205] | [0.191] | [0.157] |
| **Dummy indicating high inequality +** | -140.885 | 54.974 | -85.177 | -166.913 | -200.822 |
| | [102.966] | [93.985] | [112.093] | [109.811] | [125.252] |
| **Dummy indicating high inequality * GDP per capita** | 2.011 | -9.317** | -5.631 | -1.441 | -2.517 |
| | [4.572] | [4.138] | [3.819] | [3.602] | [4.012] |
| **% of Women in the Active Population** | | | 81.997*** | 57.087*** | 82.302*** |
| | | | [12.158] | [12.220] | [11.663] |
| **Urbanization** | | | -48.716*** | -39.336*** | -52.388*** |
| | | | [13.186] | [13.387] | [10.288] |
| **Urbanization* GDP Per capita** | | | 1.222*** | 0.818* | 1.369*** |
| | | | [0.443] | [0.450] | [0.331] |
| **Number of McDonald's restaurants per 10,000 population (inferred)** | | | -468.56 | 50.729 | |
| | | | [278.043] | [165.517] | |
| **Number of McDonald's restaurants per 10,000 population (years 1995-2004)** | | | | | -126.759 |
| | | | | | [159.996] |
| **Latitude** | | | -2087.297** | -1447.563** | -1800.47** |
| | | | [723.524] | [712.607] | [718.659] |
| **Latitude * GDP per capita** | | | -41.933* | -21.832 | -41.243* |
| | | | [24.235] | [25.382] | [21.360] |
| **Food price/ CPI** | | | -429.336 | 119.741 | -283.398 |
| | | | [341.993] | [390.840] | [289.893] |
| **N** | 192 | 192 | 161 | 161 | 121 |
| **R-squared** | 0.248 | 0.596 | 0.837 | 0.849 | 0.892 |

+ Dummy that equals one if the share of the total income of the 10% richest population in the country exceeds by 15 or more the share of the total income held by the 10% poorest population.

Robust standard error values appear in brackets below the regression coefficient

All regressions include 15 year dummy variables.

Statistically significantly different from zero: * at the 10 percent level; **at the 5% level; *** at the 1% level.

GDP: Gross Domestic Product; CPI: Consumer Price Index

Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA.

**Table 4. Results for globalization and grams from fat consumed**

| | Dependent variable: GRAMS OF FAT | | | | |
|---|---|---|---|---|---|
| | [1] | [1b] | [3] | [3b] | [3c] |
| **Variables** | | | | | |
| ***Measures of Globalization*** | | | | | |
| **Overall Globalization Index** | 1.318*** | | 2.54*** | | |
| | [0.142] | | [0.217] | | |
| **Economic Globalization Index** | | -0.914*** | | -0.303 | 0.214 |
| | | [0.147] | | [0.210] | [0.238] |
| **Social Globalization Index** | | 2.566*** | | 2.129** | 1.808*** |
| | | [0.205] | | [0.258] | [0.347] |
| ***Social, Economic and Geographic Controls*** | | | | | |
| **GDP per capita** | -0.668 | -2.276*** | -11.025*** | -10.229** | -11.013*** |
| | [0.627] | [0.634] | [3.267] | [3.149] | [2.531] |
| **(GDP per capita)²** | -1.001 | 0.040*** | 0.059*** | 0.048** | 0.034** |
| | [0.014] | [0.013] | [0.017] | [0.017] | [0.015] |
| **Dummy indicating high inequality +** | -37.615*** | -25.140*** | 5.889 | -21.985** | -37.207*** |
| | [8.278] | [6.352] | [13.333] | [9.412] | [13.131] |
| **Dummy indicating high inequality * GDP per capita** | 1.288*** | 0.412 | -0.231 | 0.392 | 0.645 |
| | [0.338] | [0.262] | [0.391] | [0.323] | [0.430] |
| **% of Women in the Active Population** | | | 7.293*** | 4.657** | 7.021*** |
| | | | [0.930] | [0.979] | [1.071] |
| **Urbanization** | | | -3.984*** | -3.467*** | -4.000*** |
| | | | [1.075] | [1.079] | [0.950] |
| **Urbanization* GDP Per capita** | | | 0.130*** | 0.103** | 0.130*** |
| | | | [0.037] | [0.037] | [0.033] |
| **Number of McDonald's restaurants per 10,000 population (inferred)** | | | -118.94 | -60.848** | |
| | | | [77.863] | [13.320] | |
| **Number of McDonald's restaurants per 10,000 population (years 1995-2004)** | | | | | -80.983*** |
| | | | | | [16.415] |
| **Latitude** | | | 166.906*** | -91.603 | -162.601** |
| | | | [56.335] | [59.999] | [67.957] |
| **Latitude * GDP per capita** | | | -4.521** | -2.612 | -3.315 |
| | | | [1.976] | [2.153] | [2.207] |
| **Food price/ CPI** | | | -42.108** | 24.009 | -3.222 |
| | | | [23.962] | [30.930] | [25.355] |
| **N** | 192 | 192 | 165 | 165 | 121 |
| **R-squared** | 0.501 | 0.743 | 0.866 | 0.866 | 0.882 |

+ Dummy equal oneif the share of the total income of the 10% richest population in the country exceeds by 15 or more the share of the total income held by the 10% poorest population.

Robust standard error values appear in brackets below the regression coefficient

All regressions include 15 year dummy variables.

Statistically significantly different from zero: * at the 10 percent level; **at the 5% level; *** at the 1% level.

GDP: Gross Domestic Product; CPI: Consumer Price Index

Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA.

OLS regressions present a positive correlation between the KOF index of globalization and obesity, calorie and grams of fat intake. What is interesting, however, is to distinguish between the impact of different types of globalization on these variables.

In this respect, when we control only for GDP per capita and inequality measures (Expression 1b), economic globalization is negatively related with the three dependent variables, indicating that factors such as better diets or better access to food diversity (thanks to open markets) might prevail. Social globalization, however, has a positive correlation with obesity and the amount of calories and grams of fat consumed. This confirms that cultural aspects as well as information flows might play a key role in diet and types of food consumed. A one standard deviation increase in social globalization increases obesity by 20 percent and the consumption of calories and fat by 6 and 16 percent, respectively.

However, as we include more variables that could have an effect on population obesity, such as the ones presented in section 2, economic globalization is no longer significant. What truly matters is not the economic globalization index per se, but the underlying mechanisms behind food consumption. This is the case, for instance, of the percentage of women in the labor force, which has a constantly positive and significant effect on obesity, calorie intake and grams of fat. In any case, the impact of social globalization remains.

Looking at the overall impact of globalization –specification [3]- a one standard deviation increase in the KOF globalization index leads to a rise of 3.66 percentage points in the proportion of obese population and to a consumption increase of 237.8 kcal and of 25.8 grams of fat.

If we take as a benchmark expression [3b]-[3c] we can observe that, once we control for the variables that the micro-mechanisms that the economic and health literature has found to explain obesity, the impact of economic globalization does not appear to be statistically significant for any of the three dependent variables. However, social globalization remains statistically significant and positive. A one standard deviation increase in the KOF index of social globalization implies a rise of 3 percentage points in the proportion of obese population. It leads to a rise of 217 kcal and of 23.1 grams of fat consumed, respectively.

The percentage of women active in the labor market has, as expected, a consistent positive relation with the percentage of obese population as well as with caloric intake and the grams of fat consumed. A one standard deviation increase in the active female labor force leads to a rise of 2.1 percentage

points in the share of obese population. It also implies a rise of 165 in the intake of kcal and of 13.5 more grams of fat.

Also as expected, relative food prices have a negative impact on these variables, even though it is only significant for the case of grams of fat consumed.

The percentage of urban population is not associated with the level of obesity. However, it has a consistently negative impact on calorie and fat intake. This result indicates that, even though more urbanization implies more sedentary lifestyles, it also relates to more food availability and this effect prevails regarding the overall relationship between urbanization and obesity. Following the results of Bleich et al. (2007), our regressions also find that this relationship is of a greater magnitude for richer economies. The opposite is the case when we look at the number of McDonalds per capita. It has a positive relationship with obesity; however, it is statistically significant and negative in the consumption of grams of fat.

Finally, our findings show that a rise in income has a negative effect on the percentage of population obesity. However, this impact is less important as countries get poorer.

### *4.2. Sensitivity Analysis*

Table 5 expands the sensitivity analysis already performed in Tables 2, 3 and 4. It lists the effect of different types of globalization on the three dependent variables for several sensitivity tests to see how results change when we use different econometric specifications as well as different sets of countries. All of them include the full set of control variables as used in expressions (3) and (3b). All results are robust with the previous findings.

The first type of sensitivity analysis addresses the possibility of using different econometric specifications. The first three columns include panel-corrected standard errors (PCSE) and fixed effects (FE) estimates. In all cases total globalization has a significantly positive relationship with the three dependent variables. Here as well, as we separate the two types of globalization, it is only the social globalization index that shows a significant positive effect on obesity and on fat and calorie intake.

**Table 5. Sensitivity Analysis**

| Variation | Total Globalization | Economic Globalization | Social Globalization | Political globalization |
|---|---|---|---|---|
| ***OBESITY as dependent variable*** | | | | |
| (3b) with **PCSE** | | 0.001 | 0.292*** | |
| | | [0.044] | [0.0615] | |
| (3) with **PCSE** | 0.360*** | | | |
| | [0.060] | | | |
| (3b) with **fixed effects** | | 0.035 | 0.082** | |
| | | [0.046] | [0.039] | |
| (3) and (3b) adding KOF **political globalization** index | | -0.061 | 0.409*** | -0.193 |
| | | [0.110] | [0.135] | [0.161] |
| (3b) using **CSGR** Globalization Index. | | -0.084 | 0.291*** | |
| | | [0.193] | [0.055] | |
| (3) using **CSGR** Globalization Index. | 0.112** | | | |
| | [0.049] | | | |
| (3b) using **CSGR** Globalization Index. **10 years of data** | | -0.028 | 0.090* | |
| | | [0.055] | [0.047] | |
| (3) using **CSGR** Globalization Index. **10 years of data** | 0.111*** | | | |
| | [0.037] | | | |
| ***KCAL as dependent variable*** | | | | |
| (3b) with **PCSE** | | -1.324 | 19.776*** | |
| | | [2.124] | [1.977] | |
| (3) with **PCSE** | 24.345*** | | | |
| | [1.623] | | | |
| (3b) with **fixed effects** | | 3.715 | -3.299 | |
| | | [2.607] | [2.214] | |
| (3) and (3b) adding KOF **political globalization** index | | -0.837 | 18.852*** | 1.570 |
| | | [2.496] | [3.381] | [3.121] |
| (3b) using **CSGR** Globalization Index. | | 16.511 | 12.772*** | |
| | | [11.878] | [2,163] | |
| (3) using **CSGR** Globalization Index. | 12.936*** | | | |
| | [1.314] | | | |
| (3b) using **CSGR** Globalization Index. **10 years of data** | | -3.241 | 2.252* | |
| | | [2.867] | [1.984] | |
| (3) using **CSGR** Globalization Index. **10 years of data** | 7.293*** | | | |
| | [1.322] | | | |
| ***FAT as dependent variable*** | | | | |
| (3b) with **PCSE** | | -0.189 | 2.081*** | |
| | | [0.157] | [0.132] | |
| (3) with **PCSE** | 2.541*** | | | |
| | [0.126] | | | |
| (3b) with **fixed effects** | | -0.429 | 0.363** | |
| | | [0,268] | [0.172] | |
| (3) and (3b) adding KOF **political globalization** index | | -0.029 | 1.778*** | 0.516* |
| | | [0.205] | [0.288] | [0.312] |
| (3b) using **CSGR** Globalization Index. | | 2.799* | 1.054*** | |
| | | [1.696] | [0.191] | |
| (3) using **CSGR** Globalization Index. | 1.207*** | | | |
| | [0.125] | | | |
| (3b) using **CSGR** Globalization Index. **10 years of data** | | -0.066 | 1.177** | |
| | | [0.262] | [0.184] | |
| (3) using **CSGR** Globalization Index. **10 years of data** | 0.672*** | | | |
| | [0.120] | | | |

All regressions include 15 year dummy variables.

Statistically significantly different from zero: * at the 10 percent level; **at the 5% level; *** at the 1% level.

PCSE: panel-corrected standard error procedure

CSGRindex: globalization index from the University of Warwick

Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA.

Countries included when considering **ten years of data**: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA, Canada, Denmark, Italy, Norway, Poland, Portugal, Australia, Estonia, Hungary, Ireland, Lithuania and Malaysia

Another type of robustness test addresses the role of all the different types of globalization. Specification four also includes the coefficient of political globalization. There is no literature supporting much of a relationship between this type of globalization and obesity. Hence, it is not surprising that we find no statistically significant relationship between political globalization and obesity nor with calorie intake. It shows, however, a positive relation with the amount of fat consumed.

Next we examine the robustness of the results using the CSGR as an alternative globalization index. Once again, results remain robust with total globalization having a positive relationship with obesity and consumption of calories and grams of fat. When distinguishing between economic and social CSGR globalization, once again, the positive relationship between economic globalization and the dependent variables fades away as we include the relevant mechanisms behind obesity as found in the literature. Once again, the positive relationship with social globalization remains. Here, with this set of countries and years of data, a one standard deviation increase in the CSGR index of social globalization implies an increase of 4.8 percentage points in the share of obese population, and a higher consumption of kcal and grams of fat of 212 and 17, respectively.

Finally, we also address the trade-off between having a broader set of countries but with fewer years of data. In the last specification, we show the results with ten years of data and 23 countries. The relationship between globalization and obesity, calories and fat consumed prevails.

To summarize, the relationship between globalization and obesity is very robust and positive. However, when we disentangle the different mechanisms at work, we find that economic globalization per se is not significantly positively related to obesity. What matters are aspects such as food prices, the percentage of women in the active labor force, or income per capita. The same is true for the amount of calories and fat consumed.

Social globalization keeps presenting a positive relationship with obesity, but most likely, if we could perform the same exercise and control for all the potential mechanisms, this impact might also disappear.

## 5. CONCLUSIONS

This paper addresses the question of macro-determinants of the so-called obesity epidemic, and more specifically the relationship between different types of globalization and obesity, alongside calorie and fat intake. We provide an empirical account of such an association by controlling for some of the micro-mechanisms for which there is available data.

Our findings provide suggestive evidence consistent with the hypothesis that social globalization has a positive relationship with obesity, but that the effects of economic globalization are conveyed by micro-mechanisms such as food price decline and female labor market participation. The effect of social globalization – as defined in the data appendix and the data section below – is such that the doubling of that component leads to a large share of the BMI rise of the world population, with elasticity estimates up to 7%. Results are robust to the inclusion of other pathways that might be plausibly considered to influence obesity As we keep controlling for micro-determinants – such as the percentage of women in the labor force, income, and urbanization or food prices –they all capture the overall significance of economic globalization. This could be, in great part, due to the fact that economic globalization might just work through these mechanisms. In contrast, social globalization encompasses environmental effects that are not fully captured by the micro-mechanisms included and hence remains as a significant variable. However, it is important to observe that not all of them affect globalization with a positive sign and that there was no evidence of high multi-colinearity among the variables measuring globalization and its micro-mechanisms. We leave to future research the expansion of other variables that could not be examined here due to data availability constraints.

In addition to this principal result, our analysis also generates the following additional findings: We report effects that are more significant in the case of fat intake, indicating that most likely, before becoming obese, a population exhibits a spike in calories consumed from fat. This might explain why only 10 years of data are enough to identify a larger impact of total globalization or social globalization on grams of fat consumed than on total calories consumed or obesity.

Second, participation of women in the labor force presents a positive impact on all three dependent variables. This effect is particularly significant for fat intake, indicating that again, probably, before becoming obese a population starts by consuming more calories and more calories from fat.

Third, urbanization is found to be related to a lower consumption of grams of fat and of calories but it is not statistically significant in explaining obesity. That is, urbanization can trigger an

expansion in the availability of diverse food and influence sedentary habits. However, as countries become richer urbanization shows more of a positive relationship with the three dependent variables. Finally, we find that income plays a significant role; however, such an effect is heterogeneous across countries. Our results show that a rise in income in rich countries has, if anything, a negative effect on the percentage of population obesity. However, an income increase in poor countries has a positive impact on the percentage of their population that is obese and even more so on their caloric intake.

Our results suggest that, while the micromechanisms that could affect the link between economic globalization and obesity are quite well understood, this is not the case of the ones related to the role of social globalization which might have environmental effects which are not fully captured by micro-mechanisms. Obesity emerges in social and cultural contexts that can lead similar economic environments to have different effects on obesity. Those are important factors that need to be yet fully understood.

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## APPENDIX A

**Table A1.**
**The KOF Index of globalization**

| | Mean and Standard deviation in data* |
|---|---|
| ***Economic Globalization*** | 73.890 |
| | (13.490) |
| *(i) Actual Flows* | |
| Trade (%GDP) | |
| Foreign Direct Investment, stocks (% GDP) | |
| Portfolio Investment (% GDP) | |
| Income Payments to Foreign Nationals (% GDP) | |
| *(ii) Restrictions* | |
| Hidden Import Barriers | |
| Mean Tariff Rate | |
| Taxes of International Trade (% total population) | |
| Capital Account Restrictions | |
| ***Social Globalization*** | 76.647 |
| | (10.861) |
| *(i) Personal Contact* | |
| Telephone Traffic | |
| Transfers (% GDP) | |
| International Tourism | |
| Foreign Population (% total population) | |
| International letters (per capita) | |
| *(ii) Information Flows* | |
| Internet Users (per 1000 people) | |
| Television (per 1000 people) | |
| Trade in Newspapers (% GDP) | |
| *(iii) Cultural Proximity* | |
| Number McDonald´s restaurants (per capita) | |
| Number Ikea (per capita) | |
| Trade in books (% GDP) | |
| ***Political Globalization*** | 87.736 |
| | (12.140) |
| Embassies in Country | |
| Membership in International Organizations | |
| Participation in UN Security Missions | |
| International Treaties | |

*GDP: Gross domestic product*
**Data from 1989-2004*
**Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, USA.*

**Table A2**
**The CSGR Globalization Index**

| | Mean and Standard deviation in data* |
|---|---|
| ***Economic Globalization*** | 13.365 |
| | (3.322) |
| Trade (% GDP) | |
| Foreign Direct Investment (%GDP) | |
| Portfolio Investment (%GDP) | |
| Income (% GDP) | |
| ***Social Globalization*** | 31.998 |
| | (18.634) |
| *(i) People* | |
| Foreign Population Stock (% total population) | |
| Foreign Population Flow (% total population) | |
| Worker Remittances (% GDP) | |
| Tourists (% total population) | |
| *(ii) Ideas* | |
| Phone Calls (per capita) | |
| Internet users (% population) | |
| Films | |
| Books and Newspapers (imported and exported) | |
| Mail (per capita) | |
| ***Political Globalization*** | 58.57 |
| | (20.013) |
| Embassies in country | |
| UN Missions | |
| Membership in International Organizations | |

*GDP: gross domestic product*
**Data from 1989-2004*
**Countries included: Austria, Finland, France, Japan, Netherlands, New Zealand, Spain, Sweden, Switzerland, UK, US.*

**Table A3**
***Correlations between the two different globalization indices***

| | KOF Economic | KOF Social | KOF Political |
|---|---|---|---|
| **CSGR Economic** | 0.45 | | |
| **CSGR Social** | | 0.87 | |
| **CSGR Political** | | | 0.91 |

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