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Global Health and the Economy

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ABSTRACT

Recent fluctuations in economic conditions around the world have triggered an academic interest in the effects of economic conditions on indicators of health. Long-run global health issues are of specific interest considering the fact that the world is at an increasing risk of health threats, such as disease outbreaks, epidemics, industrial accidents, natural disasters, and other health emergencies. This study assesses the role of various macroeconomic determinants and country-level health inputs in affecting health outcomes across countries. Specifically, using data from 1960 to 2010 on 198 countries, this study analyzes the effects of per capita Gross Domestic Product (GDP), foreign direct investment (FDI), population density, food supply, education, health care, and employment on measures of mortality and morbidity. These outcomes include the average death rate, life expectancy, infant mortality, obesity, and cholesterol in a country. Both ordinary least squares and fixed effects methodologies are employed to account for unobserved heterogeneity across countries and capture within-country differences. Estimates provide some evidence that, while per capita GDP is often associated with improved health across countries, it is not obvious that changes in GDP are directly correlated with changes in health within a country. Higher per capita GDP is associated with higher obesity rates, both across and within a country. Population density is generally linked to improved health, and total food supply is associated with higher obesity and cholesterol among females. Vegetable food supply is associated with lower death rates.

***Key words**: Global health, GDP, food supply, income, education*

INTRODUCTION

Recent fluctuations in economic conditions around the world have triggered an academic interest in the effects of economic conditions on indicators of health. While it could be argued that economic fluctuations are self-correcting in the long run, the impact economic conditions have on health accumulates over time. Long-run global health issues are of specific interest considering the fact that the world is at an increasing risk of health threats, such as disease outbreaks, epidemics, industrial accidents, natural disasters, and other health emergencies. Moreover, many countries experience a severe shortage of healthcare professionals (WHO, 2007, 2006).

Disparities in human health across counties tend to mimic the disparities in income per capita and socio-economic conditions in general. This study assesses the role of various macroeconomic determinants and country-level health inputs in affecting health outcomes across countries. Specifically, using data from 1960 to 2010 on 198 countries,[1] this study analyzes the effects of per capita Gross Domestic Product (GDP), foreign direct investment (FDI), population density, food supply, education, health care, and employment on measures of mortality and morbidity. These outcomes include the average death rate, life expectancy, infant mortality, obesity, and cholesterol in a country. Both ordinary least squares (hereafter, OLS) and fixed effects (hereafter, FE) methodologies are used in order to account for unobserved heterogeneity across countries and capture *within-country* differences.

Estimates provide some evidence that, while per capita GDP is often associated with improved health across countries, it is not obvious that *changes* in GDP are directly correlated with changes in health within a country. Moreover, we find robust evidence that higher per capita GDP is associated with higher obesity rates (but lower cholesterol), both across and within a country. Population density is generally linked to improved health (with the exception of cholesterol), and total food supply is associated with higher obesity and cholesterol among females. We also find that vegetable food supply is marginally associated with lower death rates.

[1] See the Appendix for a full list.

BACKGROUND

A recent U.S. study found that unhealthy workers cost the country $153 billion due to absenteeism, since some 86% of full-time workers are above normal weight or have at least one chronic condition (Witters and Agrawal, 2011). Some studies have suggested that work itself may be causing poor health, and that strong economies are associated with increases in mortality, acute myocardial infarction, alcohol consumption, smoking, physical inactivity, and other outcomes related to health (Evans and Moore, 2009; Edwards, 2008; Ruhm, 2007; Gerdtham and Ruhm, 2006; Ruhm, 2005; Dustmann and Windweijer, 2000; Ruhm, 2000; Ettner, 1997). Other studies find that exercise declines with increased employment (Colman and Dave, 2011; Xu and Kaestner, 2010), yet Colman and Dave (2011) suggest that the type of exercise is important; while individuals decrease their levels of *recreational exercise* when working, they increase their levels of *physical activity* (such as by walking to work or exertion at work), debatably more important in maintaining good health. Dave and Kelly (forthcoming) find that healthy food intake is procyclical.

With the exception of Gerdtham and Ruhm (2006) and Or (2000), most of these studies are individual-level studies. Gerdtham and Ruhm (2006) use 1960-1997 data from 23 countries to find that deaths from cardiovascular disease, influenza, pneumonia, liver disease, motor vehicle fatalities, and other accidents decline when unemployment increases. They control for year effects, location fixed effects, and country-specific time trends. Or (2000) studies premature mortality in 21 industrialized countries spanning 1970-1992, and finds significant negative effects of healthcare spending, especially among women, negative effects of per capita income, and positive effects of lifestyle factors such as alcohol and tobacco consumption on mortality. However, both of these studies limit their analysis to OECD countries. Our analysis, in contrast, utilizes the most inclusive sample of countries (198 countries across the development spectrum) covering the longest time-series (50 years) studied to date.

While the evidence is surprisingly mixed, all of these studies point to the complexities of the channels through which income and employment may potentially impact health. They underscore the importance of cyclical versus long-terms shifts in income, effects of income per se versus effects of work and labor supply, and competing effects from enhanced resources and access to healthcare versus potentially unhealthy lifestyles (for instance, related to increases in obesity) that may also accompany higher levels of income.

Due to medical advances and other technological improvements, average life expectancy across the world has gone up substantially over time, from 54.02 years in 1960 to 69.31 years in 2009. Yet this increase has not been equally enjoyed by all countries, as the variance across countries remains large. (The standard deviation in our sample is 11.33 years. See Table 1.) While the average life expectancy at birth was 69 years in 2009, the lowest was 47 years and the highest was 83 years.[2] For high income countries, the average life expectancy was 79.56 years in 2009, while for middle income countries, it was 68.83, and for low income countries, 58.44 years. These figures point to significant disparities by income. In spite of these large differences in life expectancy, studies have pointed to the convergence of life expectancy over time. In particular, there has been a large convergence in life expectancy among rich, middle-income, and poor countries between 1940 and 1980 (Acemoglu and Johnson, 2007).

SNAPSHOT 1

Highest Life Expectancy		
Country (population)	**Life Expectancy**	**Rank in Sample**
San Marino (31,359)	83.00	1
Japan (127,600,000)	82.93	2
Hong Kong (7,003,700)	82.72	3
Switzerland (7,743,831)	82.04	4
Israel (7,485,600)	81.55	5
Lowest Life Expectancy		
Country (population)	**Life Expectancy**	**Rank in Sample**
Lesotho (2,149,201)	46.67	193
Central Afr. Rep. (4,318,128)	46.88	192
Sierra Leone (5,739,293)	46.96	191
Guinea-Bissau (1,484,120)	47.31	190
Congo (64,204,304)	47.80	189
Source: World Bank, 2009.		

Snapshot 1 shows the five countries with the highest life expectancy in 2009, and the five countries with the lowest life expectancy in 2009. Snapshot 2, which shows characteristics of the countries with the highest and lowest life expectancies, respectively, further reveals that the country with the highest life expectancy (San Marino) had a per capita GDP in 2008 that was far above average, while the country with the lowest (Lesotho) had a per capita GDP that was much lower than the average.

[2] This information is based on data from the World Bank. Other data sources – such as the CIA World Factbook and the United Nations – may have slightly different rankings. As much as possible, one data source is used in order to be consistent. This is further explained in the *Data* section.

Average obesity rates across the world increased from 17.59% for females and 9.95% for males in 2002, to 21.29% for females and 12.13% for males in 2010. In the United States, the increase mainly occurred in the 1980s; before then, obesity rates were relatively stable (increasing only slightly). This increase has been attributed to several factors, including technological change, increased female labor force participation, decreased smoking rates, and increased urban sprawl (Chou et al., 2004; Lakdawalla and Philipson, 2010; Cutler et al., 2003; Ewing et al., 2003). Others point to possible changes in rates of time preference (Zhang and Rashad, 2009; Smith et al., 2005; Komlos et al., 2004). Prior studies that find countercyclical effects for obesity may be falsely attributing beneficial results in recessions with less convenience due to reduced access to the most efficient technology.

SNAPSHOT 2
Characteristics
SAN MARINO (HIGHEST LIFE EXPECTANCY, 2009)
Death rate, crude (per 1,000 people): 6 (2009)
Life expectancy at birth, total (years): 83 (2009)
Mortality rate, infant (per 1,000 live births): 1.7 (2010)
BMI >=30 kg/m2, males 15-100 (WHO): 15.66% (2010)
BMI >=30 kg/m2, females 15-100 (WHO): 29.67% (2010)
Total cholesterol (mmol/l), males 15-100 (WHO): 5.22 (2010)
Total cholesterol (mmol/l), females 15-100 (WHO): 5.22 (2010)
GDP per capita (constant 20,000 US$): 3199.32 (2008)
Population density (people per sq. km of land area): 525.57 (2010)
Percent not in primary school: 0.43% (2009)
Hospital beds (per 1,000 people): 7.16 (1990)
LESOTHO (LOWEST LIFE EXPECTANCY, 2009)
Death rate, crude (per 1,000 people): 16.19 (2009)
Life expectancy at birth, total (years): 46.67 (2009)
Mortality rate, infant (per 1,000 live births): 64.6 (2010)
BMI >=30 kg/m2, males 15-100 (WHO): 2.27% (2010)
BMI >=30 kg/m2, females 15-100 (WHO): 36.12% (2010)
Total cholesterol (mmol/l), males 15-100 (WHO): 4.44 (2010)
Total cholesterol (mmol/l), females 15-100 (WHO): 4.44 (2010)
GDP per capita (constant 20,000 US$): 48.18 (2010)
Population density (people per sq. km of land area): 71.52 (2010)
Percent not in primary school: 4.61% (2009)
Hospital beds (per 1,000 people): 1.33 (2006)

Figures 1 and 2 show rates of obesity around the world in 2010 for males and females, respectively. The data come from the World Health Organization.[3] As is evident from the figures, the average obesity rate is substantially higher for females than for males. In fact, in our sample, 18.38% of females are obese, compared to 10.03% for males (Table 1).

[3] Please see the *Data* section for more detail.

Snapshot 3 shows the five countries with the highest obesity rates in 2010 for males and females, respectively. Using the standard threshold of 30 kg/m^2 for the body mass index (BMI) in classifying an individual as obese, an overwhelming 85% and 80% of males and females, respectively, are obese in Nauru. The United States is ranked 5 for males (44.22%) and 13 for females (48.28%).[4]

SNAPSHOT 3		
Highest Obesity (Males)		
Country (population)	**Obesity (%)**	**Rank in Sample**
Nauru (9,322)	84.59	1
Cook Islands (11,124)	72.06	2
Micronesia (111,064)	69.11	3
Tonga (104,058)	64.03	4
USA (309,100,000)	44.22	5
Highest Obesity (Females)		
Country (population)	**Obesity (%)**	**Rank in Sample**
Nauru (9,322)	80.46	1
Tonga (104,058)	78.12	2
Micronesia (111,064)	75.32	3
Cook Islands (11,124)	73.42	4
Niue (1,311)	64.73	5
Source: World Health Organization, 2010.		

The countries with the lowest obesity rates are not listed here because they are generally countries with individuals that suffer from malnutrition, rather than being 'healthier' countries with lower rates of obesity. For example, the country with the lowest obesity rate for males is Eritrea (0.02%); for females it is Ethiopia (0.03%). When we limit the sample to OECD countries, Japan in 2010 has the lowest obesity rate for males (2.33%) and females (1.13%).

Particularly in developed nations, scientific and technological advances that have improved health over time, by increasing life expectancy, may have had the unintended consequence of also increasing obesity rates.

DATA

Descriptive statistics for the variables included in this study are provided in Table 1.

Dependent Variables

Data for the crude death rate (per 1,000 population), total life expectancy at birth in years, and the infant mortality rate (per 1,000 live births) come from the World Bank.[5] Data on obesity and cholesterol (measured in mmol/l) are obtained from the World Health Organization (WHO).[6] Comparable

[4] The United Kingdom is ranked 23 for males (23.68% obese) and 56 for females (26.28% obese).
[5] These data are publicly available at http://databank.worldbank.org/ddp/home.do.
[6] See https://apps.who.int/infobase/Comparisons.aspx.

information on these variables across countries is only provided in certain years. While scattered information is available for more years, this information may not be consistent across countries. The WHO confirms that "[c]omparable information that feed the country comparison tools come from a larger repository of data in the WHO Global InfoBase. In order to generate this information [the WHO's] analyst team undergoes a time-consuming adjustment process for these estimates." The reader is referred to their website for more detail.

Independent Variables

Data on per capita GDP, FDI, population density, education, hospital beds, and employment are from the World Bank. Data on food supply (measured in kilocalories per capita per day) come from the Food and Agriculture Organization (FAO).[7]

METHODOLOGY

We start out with 7,396 country-year observations in our sample, representing 198 countries spanning 1960-2010. We estimate production functions for health-related outcomes, which assess the effects of various economic determinants, health inputs, and proxies for production efficiency. Specifically, each dependent variable from the World Bank is regressed on per capita GDP, FDI, population density, food supply (vegetables, meat, and cereal individually), percent not in primary school, hospital beds, the employment to population ratio, and a trend variable to account for unobserved systematic changes over time. Due to the limited sample size for the WHO dependent variables, obesity and cholesterol are regressed on a restricted set of independent variables pertaining to per capita GDP, FDI, population density, total food supply, and a trend measure.

Per capita GDP or income can affect health through various reinforcing and competing channels. Expanded material resources can positively affect health by raising access to medical care and preventive services, allowing for better nutrition and diets as well as housing and shelter, and reducing mental stress. Higher income levels and wage rates also raise the returns from investing in health (Grossman, 1972); since the opportunity cost of illness is higher for a high-income individual (in terms of foregone earnings)

[7] See http://faostat.fao.org/default.aspx.

relative to a low-income individual, investments in preventive care and health-promoting inputs may be higher in the aggregate in high-income countries. At the same time, higher levels of income (that are typically associated with greater labor force participation and work opportunities) may also reduce available non-work time, which may crowd out certain healthy behaviors such as exercise, physical activity, and home-cooked meals. To partly capture this latter effect, we also separately account for the employment ratio, though the intensity of labor supply still remains unobserved. A greater demand for a palatable, high-calorie, high-fat diet due to higher income may also have longer-term adverse effects on health by raising obesity. Foreign direct investment (FDI) may lead to technology and information transfers that may be health promoting. In this sense, FDI can directly or indirectly raise the efficiency of health production. To the extent that developing countries with high growth potential attract more FDI, this measure also proxies for other unobserved characteristics of the country including the skills-set of its workforce, the market's expectations of its long-term growth trajectory, political stability, and infrastructure.

Several studies (Grossman, 1972; Grossman and Kaestner, 1998) suggest that education (proxied in our models by the percent not in primary school) has a causal positive effect on health by raising production efficiency. Educated individuals are found to be *technically efficient*; that is, they are able to "produce" health using fewer inputs. They are also found to be *allocatively efficient*, meaning that they choose a different and more health-promoting mix of health inputs such as greater levels of preventive care and lower levels of smoking and excessive drinking.

In addition, we also assess the role of caloric intake, namely various measures of food supply as described in Table 1, which may be especially important for measuring nutritional deficiencies in low-income countries and over-consumption of calories in high-income countries. We also capture medical care inputs by including the number of hospital beds in the country. This measure may reflect greater availability and access (which would be health promoting) and / or greater need and demand (which would reflect a correlation with poor health). Finally, population density may also affect health through multiple channels. For developed nations, urban sprawl has been linked to obesity, and thus population density partially captures this effect. It may also capture a degree of urbanization and development in a country, as well as a greater competition for resources.

Since per capita GDP is highly correlated with many of these factors, we begin with a parsimonious specification that relates health outcomes only to per capita GDP and the measure of trend, and then introduce the other covariates in alternate models. Comparison of these basic and extended models allows us to assess the conditional effect of per capital income and also potentially informs some of the underlying channels through which higher levels of income may impact health.

In addition to the OLS models described above, fixed effects models that include fixed effects for each country are also estimated. The equation for the fixed effects model is as follows:

$$\text{Health}_{it} = \alpha_1 + \alpha_2(X_{it}) + \alpha_3(\text{trend}_t) + \mu_i + \varepsilon_{it},$$

where Health is the average health (as measured by death rate, life expectancy, infant mortality, obesity, and cholesterol) in country i at time t, X is a vector of variables representing time-varying economic conditions and health inputs, trend is a time variable equal to 1 for year 1960 and 51 for year 2010, μ represents country fixed effects, and ε is an error term. This model exploits within-country variation over time, thus accounting for possible unobserved heterogeneity across countries (such as geography, climate, culture, variation in genetic endowments, time-invariant political structures, etc). It should be noted that fixed effects estimates may be biased toward zero if the variation over time is limited. Since the sample size is reduced, it should also be noted that outliers may drive the results (although this does not appear to be the case for our sample).

RESULTS

Results for the determinants of the death rate are presented in Table 2. OLS results suggest that stronger economies, as measured by GDP and FDI, have lower death rates, as do more densely populated countries. The effect of GDP becomes insignificant, however, in the extended model (3), suggesting that at least cross-sectionally much of the effect of GDP is operating through food supply, education, medical care, and employment. A one-unit increase in vegetable intake lowers the death rate by 0.0247, while meat and cereal intake significantly increases it. The OLS model also suggests that more hospital beds are associated with higher death rates; this is likely due to reverse causality reflecting a greater need or demand, as more hospital beds are required when individuals have chronic illnesses.

Fixed effects results suggest that higher per capita GDP is associated with *higher* death rates, seemingly supporting studies suggesting that health may be counter-cyclical. This may be due to the aforementioned unintended consequences of technological changes and economic activity, such as pollution and more motor vehicle fatalities. It may also reflect the certain negative lifestyle choices associated with development, for instance higher rates of obesity and greater time constraints due to higher labor force participation. The sign is reversed in the last column, yet the substantially reduced number of observations in this model limits the plausibility of the results. We see, however, that having children out of primary school is associated with higher death rates, possibly pointing to the importance of schooling on health (Grossman and Kaestner, 1997).

Results for the determinants of life expectancy are presented in Table 3. We see a similar pattern in these results but opposite signs due to the reversed nature of the dependent variable. Per capita GDP is directly associated with life expectancy, a relationship that turns negative in fixed effects models. Also similarly to the death rate results, vegetable food supply is positively associated with life expectancy in OLS models, while meat and cereal are negatively associated with life expectancy. Primary school participation remains significant health-promoting input throughout.

Results for the determinants of infant mortality are presented in Table 4. Again, we see that per capita GDP appears to reduce infant mortality – until we are presented with fixed effects results, where it appears to significantly increase it. Population density continues to be associated with better health outcomes. Some studies have suggested that higher population density correlates with social capital, which has a protective effect on health (Collier, 2002; Bolin et al., 2003). Patterson et al. (1999) similarly find that the rate of insulin-dependent diabetes among children in Northern Ireland was lower in areas with higher population density, and suggest that greater exposure early in childhood in areas with greater population density may have a protective effect on health later in life. Predicted infant mortality is reduced with increased hospital beds, although the precision of this coefficient disappears in fixed effects models.

Results for the determinants of obesity for males and females, respectively, are presented in the top and bottom panels of Table 5. Unlike in previous models, both OLS and fixed effects results show positive and significant effects of per capita GDP on obesity, reflective of the correct notion that obesity is a ‘disease of affluence,’ affecting developed countries far more severely than developing ones. Higher food supply is associated with higher obesity, particularly for females. Population density continues to have a beneficial effect on health, and is associated with lower rates of obesity.

Results for the determinants of cholesterol shown in Table 6 suggest that higher per capita GDP is beneficial in lowering cholesterol (fixed effects models), perhaps partly due to the availability of cholesterol-lowering statin drugs. Since we are unable to control for education in these models due to inconsistent and missing information, the beneficial effects of GDP (which is highly correlated with education) also partly reflects the allocative efficiency effect of education. Higher-educated individuals in more developed nations are more likely to engage in preventive care and also better able to manage chronic illness conditions through regular contact with healthcare professionals. Also in contrast to other results, population density in fixed effects models *increases* predicted cholesterol levels, *ceteris paribus*. Note that this effect is driven off within-country changes. Thus, to the extent that increase in population density in a given country may also be correlated with higher labor supply, employment, and occupational stress, there may be adverse effects on cholesterol levels (Brotman et al., 2007), though further research is needed to disentangle some of these effects. Moreover, for the first time, we see that FDI is positive and significant in fixed effects models, suggesting that foreign direct investment (or its correlates) is associated with increased cholesterol. Total food supply for females increases cholesterol levels.

DISCUSSION

Using data from 198 countries and territories, this study has shed light on some determinants of health outcomes across the world. By utilizing an extensive panel of nations over time (1960-2010), we are able to account for unobserved time-invariant differences across nations that may otherwise confound the relationship between the various studied factors and health. The specifications recognize the multivariate nature of health production, and assess the separate effects of various inputs and economic factors, including income, education, employment, food supply, medical care, FDI, and population density. We are especially careful in accounting for unobserved time-invariant differences across nations.

Contrary to the observed cross-sectional association between per capita GDP and health, our fixed effects results suggest that increases in per capita GDP within a country are not necessarily associated with improved health. These estimates suggest that much of the cross-national positive correlation between GDP and health is likely driven by unobserved differences across countries. The results also point to the complexities through which higher levels of income may impact health. Conditional on education and employment, higher income reflects greater material resources, access to healthcare, and greater affordability of better nutrition and shelter. Though, at the same time, we find robust evidence that higher levels of GDP are also associated with a greater prevalence of obesity across both males and females in all specifications. Thus, income may have non-linear effects on health. Across the economic development spectrum, increases in income for low-income nations often lead to better health due to better nutrition, though after a certain point higher incomes may also afford certain unhealthy lifestyles that may raise obesity levels. Thus, as an economy develops and incomes rise, the focus shifts form food insecurity to excess caloric intake and obesity.

We also find consistent and robust evidence that education is associated with lower mortality rates and higher life expectancy, both in the OLS and fixed effects models. A one percentage point increase in primary school enrollment is associated, for instance, with a 2-3% reduction in the crude death rate. This is consistent with several micro-level studies that have also uncovered a causal health-promoting effect of schooling (Grossman and Kaestner, 1997). Thus, investments in human capital can impart substantial returns in the form of lower mortality and morbidity.

In models of life expectancy and mortality using the World Bank Data, where are able to control for a richer set of health inputs and economic factors, we also find health promoting effects of population density and FDI. While we forward some potential explanations for these effects, further research is needed to disentangle their influences. Vegetable supply is associated with lower death rates, while meat and cereal supply is associated with higher death rates. While the precision of these results is reduced in fixed effects models, the question remains as to why this association is present. For females, total food supply is significantly associated with higher obesity. Higher levels of food supply correlate with lower food prices, all else equal. Chou et al. (2004) find that a secular decline in food prices partly accounts for the rise in obesity rates in the U.S. The effects of food supply are also complex and multi-faceted, again pointing to the importance of nutritional risk among low-income nations but obesity among high-income nations. Thus, a relative shift in policy focus (or at least concurrent policy that also addresses) from food insecurity to combating obesity may be necessitated with economic development and rising GDP.

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Table 1: Descriptive Statistics

	Mean (St.Dev.)	First Year Available	Last Year Available
Death rate, crude (per 1,000 people)	10.77 (5.20)	1960	2009
Life expectancy at birth, total (years)	63.45 (11.34)	1960	2009
Mortality rate, infant (per 1,000 live births)	53.34 (44.82)	1960	2010
BMI >=30 kg/m2, males 15-100 (WHO)	10.03 (10.17)	2002	2010
BMI >=30 kg/m2, females 15-100 (WHO)	18.38 (13.98)	2002	2010
Total cholesterol (mmol/l), males 15-100 (WHO)	4.94 (0.52)	2002	2010
Total cholesterol (mmol/l), females 15-100 (WHO)	4.94 (0.48)	2002	2010
GDP per capita (constant 20,000 US$)	650.71 (1053.12)	1960	2010
FDI, net (current 2 billion US$)	-0.09 (6.44)	1960	2010
Population density (people per sq. km of land area)	302.52 (1491.83)	1961	2010
Food supply (kcal/capita/day), total vegetables (FAO)	52.88 (37.90)	1961	2007
Food supply (kcal/capita/day), total meat (FAO)	178.73 (147.84)	1961	2007
Food supply (kcal/capita/day), total cereal (FAO)	1002.55 (351.99)	1961	2007
Percent not in primary school	0.02 (0.03)	1970	2010
Hospital beds (per 1,000 people)	4.87 (3.61)	1960	2009
Employment to population ratio, 15+, total (%)	57.65 (10.89)	1991	2008
Trend	29.22 (14.08)	1960	2010
Year	1988.22 (14.08)	1960	2010

Note: The maximum number of country-year observations is 7,396. Standard deviations are shown in parentheses.

Table 2: Determinants of Death Rate Per 1,000 Population

	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES		**OLS**			**FIXED EFFECTS**	
GDP per capita (constant 20,000 US$)	-0.0015***	-0.0012***	-0.0000	0.0022***	0.0025***	-0.0020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI, net (current 2 billion US$)		-0.0474***	0.0194		0.0047	0.0005
		(0.010)	(0.024)		(0.004)	(0.004)
Population density (people per sq. km of land area)		-0.0004***	-0.0020**		-0.0010***	-0.0006
		(0.000)	(0.001)		(0.000)	(0.002)
Food supply (kcal/capita/day), total vegetables (FAO)			-0.0247***			-0.0007
			(0.005)			(0.003)
Food supply (kcal/capita/day), total meat (FAO)			0.0028*			0.0001
			(0.002)			(0.002)
Food supply (kcal/capita/day), total cereal (FAO)			0.0038***			-0.0012
			(0.001)			(0.001)
Percent not in primary school			65.1213***			26.2449***
			(18.857)			(9.620)
Hospital beds (per 1,000 people)			0.6713***			-0.0926
			(0.076)			(0.068)
Employment to population ratio, 15+, total (%)			-0.0215			0.0160
			(0.027)			(0.024)
Trend	-0.1229***	-0.0726***	0.0860**	-0.1666***	-0.1295***	0.0055
	(0.004)	(0.006)	(0.039)	(0.002)	(0.003)	(0.019)
Constant	15.2100***	13.1459***	0.1996	14.2326***	12.9705***	11.8872***
	(0.125)	(0.210)	(2.557)	(0.059)	(0.082)	(1.414)
Observations	7,396	4,802	138	7,396	4,802	138
R-squared	0.208	0.105	0.682	0.489	0.336	0.408
Number of countries				196	174	29

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Determinants of Life Expectancy at Birth

	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES		**OLS**			**FIXED EFFECTS**	
GDP per capita (constant 20,000 US$)	0.0074***	0.0076***	0.0027***	-0.0012***	-0.0013***	-0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
FDI, net (current 2 billion US$)		0.1111***	0.0228		0.0013	-0.0036
		(0.019)	(0.040)		(0.006)	(0.006)
Population density (people per sq. km of land area)		0.0002	-0.0011		0.0015***	-0.0047**
		(0.000)	(0.002)		(0.000)	(0.002)
Food supply (kcal/capita/day), total vegetables (FAO)			0.0254***			0.0029
			(0.009)			(0.004)
Food supply (kcal/capita/day), total meat (FAO)			-0.0008			0.0047**
			(0.003)			(0.002)
Food supply (kcal/capita/day), total cereal (FAO)			-0.0033***			0.0007
			(0.001)			(0.001)
Percent not in primary school			-231.5123***			-23.2779*
			(31.244)			(12.753)
Hospital beds (per 1,000 people)			-0.1450			0.0505
			(0.126)			(0.090)
Employment to population ratio, 15+, total (%)			-0.1612***			-0.0159
			(0.045)			(0.031)
Trend	0.2278***	0.1829***	-0.0415	0.3102***	0.2726***	0.2557***
	(0.007)	(0.011)	(0.065)	(0.003)	(0.004)	(0.025)
Constant	52.7541***	54.7229***	85.1334***	55.2387***	56.7140***	62.0817***
	(0.234)	(0.406)	(4.237)	(0.083)	(0.124)	(1.874)
Observations	7,239	4,744	138	7,239	4,744	138
R-squared	0.427	0.417	0.712	0.666	0.565	0.873
Number of countries				195	174	29

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Determinants of Infant Mortality

	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES		**OLS**			**FIXED EFFECTS**	
GDP per capita (constant 20,000 US$)	-0.0208***	-0.0247***	-0.0069***	0.0187***	0.0243***	0.0090***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)
FDI, net (current 2 billion US$)		-0.4596***	-0.1328		-0.0237	-0.0109
		(0.069)	(0.110)		(0.018)	(0.022)
Population density (people per sq. km of land area)		-0.0046***	0.0002		-0.0084***	0.0080
		(0.001)	(0.004)		(0.001)	(0.008)
Food supply (kcal/capita/day), total vegetables (FAO)			-0.0134			0.0033
			(0.024)			(0.016)
Food supply (kcal/capita/day), total meat (FAO)			0.0050			-0.0007
			(0.008)			(0.008)
Food supply (kcal/capita/day), total cereal (FAO)			-0.0027			-0.0024
			(0.002)			(0.004)
Percent not in primary school			434.6879***			53.2335
			(85.974)			(48.785)
Hospital beds (per 1,000 people)			-0.7010**			-0.0375
			(0.348)			(0.344)
Employment to population ratio, 15+, total (%)			0.6199***			-0.1191
			(0.124)			(0.120)
Trend	-1.1944***	-0.9002***	-0.0149	-1.5843***	-1.3913***	-0.6538***
	(0.030)	(0.043)	(0.179)	(0.012)	(0.013)	(0.097)
Constant	101.1131***	90.7417***	-6.9140	90.0948***	79.4160***	40.9328***
	(1.001)	(1.539)	(11.658)	(0.354)	(0.401)	(7.169)
Observations	7,220	4,870	138	7,220	4,870	138
R-squared	0.377	0.372	0.725	0.729	0.709	0.607
Number of countries				187	171	29

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Determinants of Obesity

	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES		**OLS**			**FIXED EFFECTS**	
Males						
GDP per capita (constant 20,000 US$)	0.0028***	0.0035***	0.0037***	0.0032***	0.0039***	0.0062*
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.004)
FDI, net (current 2 billion US$)		0.0535	-0.1412		-0.0102	-0.0036
		(0.049)	(0.120)		(0.012)	(0.030)
Population density (people per sq. km of land area)		-0.0026***	-0.0042		-0.0046***	-0.0188
		(0.001)	(0.003)		(0.002)	(0.011)
Food supply (kcal/capita/day), TOTAL (FAO)			0.0034**			-0.0012
			(0.002)			(0.002)
Trend	0.2207*	0.4042***	0.0448	0.2415***	0.2684***	0.2793***
	(0.130)	(0.125)	(0.554)	(0.020)	(0.026)	(0.095)
Constant	-2.1345	-10.7667*	-1.7123	-3.4163***	-4.4432***	0.2336
	(6.058)	(5.756)	(24.657)	(0.835)	(1.039)	(3.974)
Observations	528	412	70	528	412	70
R-squared	0.093	0.199	0.223	0.431	0.452	0.567
Number of countries				182	158	36
Females						
GDP per capita (constant 20,000 US$)	0.0016***	0.0014**	0.0019	0.0020	0.0026*	0.0034
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.005)
FDI, net (current 2 billion US$)		0.0267	-0.3575*		-0.0026	-0.0166
		(0.078)	(0.202)		(0.016)	(0.042)
Population density (people per sq. km of land area)		-0.0027**	-0.0007		-0.0033	-0.0046
		(0.001)	(0.006)		(0.002)	(0.016)
Food supply (kcal/capita/day), TOTAL (FAO)			0.0075***			0.0005
			(0.003)			(0.003)
Trend	0.3384*	0.4983**	-0.0400	0.4382***	0.4192***	0.3095**
	(0.185)	(0.197)	(0.936)	(0.026)	(0.034)	(0.133)
Constant	1.5804	-5.6592	-1.4300	-3.3664***	-2.7995**	0.5360
	(8.657)	(9.090)	(41.672)	(1.111)	(1.346)	(5.556)
Observations	528	412	70	528	412	70
R-squared	0.020	0.040	0.138	0.535	0.494	0.436
Number of countries				182	158	36

Standard errors in parentheses *** p<0.01 ** p<0.05 *p<0.1

Table 6: Determinants of Cholesterol

	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES		**OLS**			**FIXED EFFECTS**	
Males						
GDP per capita (constant 20,000 US$)	0.0002***	0.0002***	0.0003***	-0.0002***	-0.0002***	-0.0008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI, net (current 2 billion US$)		0.0091***	0.0149		0.0013**	0.0041***
		(0.003)	(0.010)		(0.001)	(0.001)
Population density (people per sq. km of land area)		-0.0000	-0.0004		0.0002***	0.0011*
		(0.000)	(0.000)		(0.000)	(0.001)
Food supply (kcal/capita/day), TOTAL (FAO)			0.0001			0.0001
			(0.000)			(0.000)
Trend	0.0085	0.0117	-0.0107	0.0142***	0.0093***	0.0142***
	(0.006)	(0.008)	(0.047)	(0.001)	(0.001)	(0.005)
Constant	4.4005***	4.2725***	5.2555**	4.4432***	4.6803***	4.5122***
	(0.294)	(0.347)	(2.093)	(0.040)	(0.048)	(0.192)
Observations	528	412	70	528	412	70
R-squared	0.182	0.200	0.182	0.402	0.221	0.600
Number of countries				182	158	36
Females						
GDP per capita (constant 20,000 US$)	0.0002***	0.0002***	0.0003***	-0.0002***	-0.0002***	-0.0007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI, net (current 2 billion US$)		0.0080***	0.0120		0.0014**	0.0037***
		(0.003)	(0.008)		(0.001)	(0.001)
Population density (people per sq. km of land area)		-0.0000	-0.0002		0.0002***	0.0010**
		(0.000)	(0.000)		(0.000)	(0.000)
Food supply (kcal/capita/day), TOTAL (FAO)			0.0001			0.0001*
			(0.000)			(0.000)
Trend	0.0086	0.0120*	-0.0096	0.0141***	0.0092***	0.0142***
	(0.006)	(0.007)	(0.038)	(0.001)	(0.001)	(0.004)
Constant	4.4051***	4.2658***	5.1294***	4.4449***	4.6842***	4.4239***
	(0.269)	(0.315)	(1.700)	(0.039)	(0.048)	(0.155)
Observations	528	412	70	528	412	70
R-squared	0.194	0.222	0.215	0.401	0.221	0.669
Number of countries				182	158	36

*** p<0.01,** p<0.05,* p<0.1 Standard errors in parenthesis

Figure 1: Obesity Prevalence, Males 15+, WHO 2010

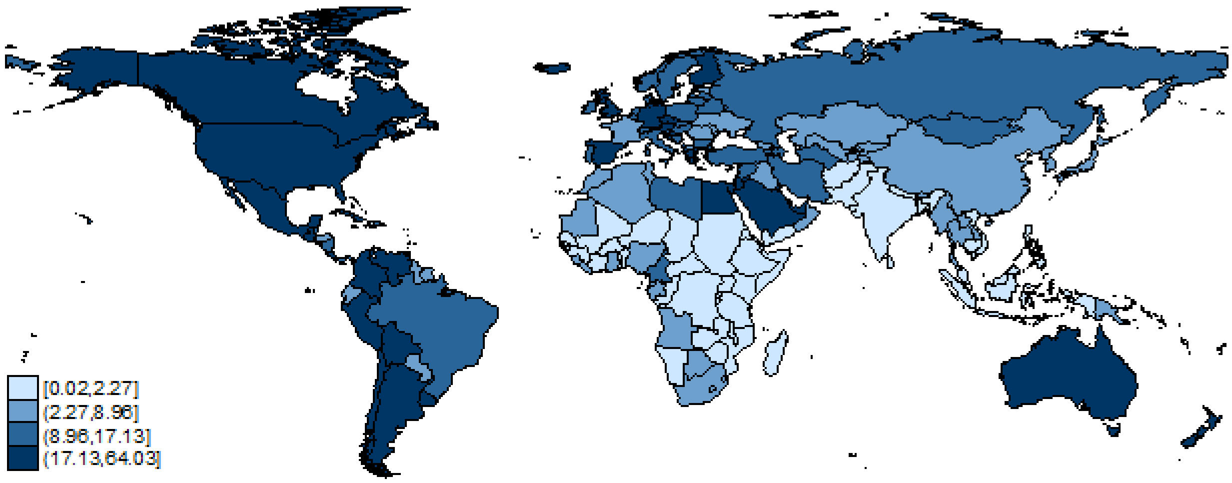
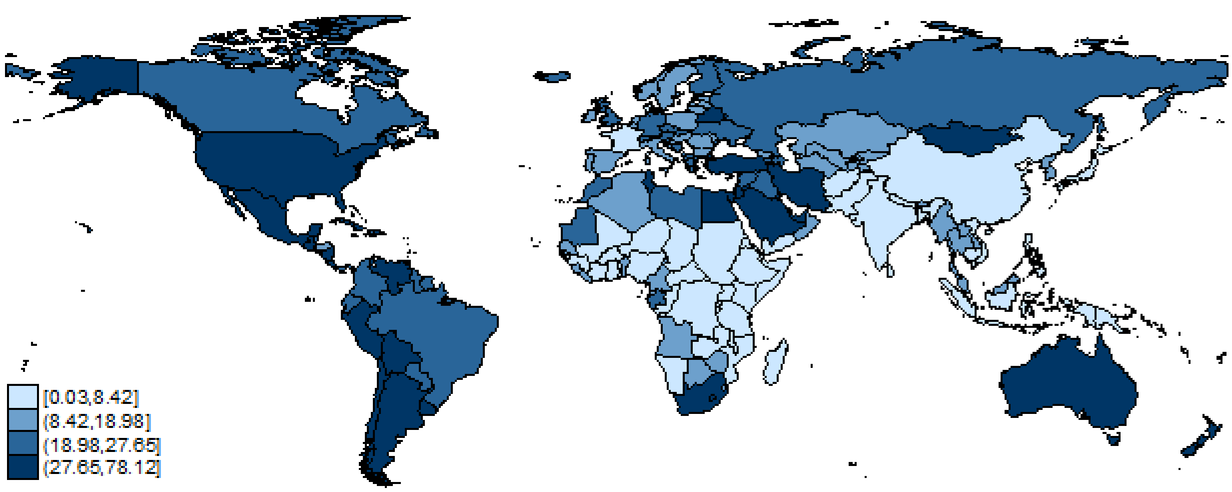


Figure 2: Obesity Prevalence, Females 15+, WHO 2010



Appendix: List of Countries, Territories, Colonies, and Dependencies in Study

Albania
Algeria
Andorra
Angola
Antigua and Barbuda
Argentina
Armenia
Aruba
Australia
Austria
Azerbaijan
Bahamas, The
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Belize
Benin
Bermuda
Bhutan
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei Darussalam
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Cape Verde
Central African Republic
Chad
Channel Islands
Chile
China
Colombia
Comoros
Congo, Dem. Rep.
Congo, Rep.
Costa Rica
Cote d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt, Arab Rep.
El Salvador
Equatorial Guinea
Eritrea
Estonia
Ethiopia
Faroe Islands
Fiji
Finland
France
French Polynesia
Gabon
Gambia, The
Georgia
Germany
Ghana
Greece
Greenland
Grenada
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong SAR, China
Hungary
Iceland
India
Indonesia
Iran, Islamic Rep.
Iraq
Ireland
Isle of Man
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kiribati
Korea, Rep.
Kosovo
Kuwait
Kyrgyz Republic
Lao PDR
Latvia
Lebanon
Lesotho
Liberia
Libya
Liechtenstein
Lithuania
Luxembourg
Macau
Macedonia, FYR
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Islands
Mauritania
Mauritius
Mexico
Micronesia, Fed. Sts.
Moldova
Monaco
Mongolia
Montenegro
Morocco
Mozambique
Namibia
Nepal
Netherlands
New Caledonia
New Zealand
Nicaragua
Niger
Nigeria
Norway
Oman
Pakistan
Palau
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Puerto Rico
Qatar
Romania
Russian Federation
Rwanda
Samoa
San Marino
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
South Africa
Spain
Sri Lanka
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Sudan
Suriname
Swaziland
Sweden
Switzerland
Syrian Arab Republic
Tajikistan
Tanzania
Thailand
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Tuvalu
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States
Uruguay
Uzbekistan
Vanuatu
Venezuela, RB
Vietnam
Yemen, Rep.
Zambia
Zimbabwe