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The relationship between income, economic freedom, and BMI

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ABSTRACT

Objectives: What explains increases in BMI (and obesity) over time and across countries? Although many microeconomic forces are likely explanations, increasingly scholars are arguing that macroeconomic forces such as market liberalism and globalization are root causes of the obesity epidemic. The purpose of this paper is to examine the impact of economic freedom on obesity conditional on the level of income and other factors.

Study Design: We use an unbalanced pooled cross section of up to 135 countries for 1995 and 2000–2009.

Methods: Our statistical model specifications include pooled OLS and fixed effects.

Results: First, we find that controlling for fixed effects siphons off much of the relationship previously documented between economic freedom and BMI. Second, economic freedom is associated with slightly higher BMIs but only for men in developing nations. Lastly, we show that economic freedom increases life expectancy for both men and women in developing countries.

Conclusion: Therefore, policies aimed at reducing obesity that limit economic liberalism may come at the expense of life expectancy in the developing world.

Introduction

There is little dispute that people are gaining weight on average around the world. Body mass index (BMI) calculated as weight in kilos divided by squared height in meters, kg/m^2, is on the rise. This is true not only within the United States but also around the world where low-income countries sometimes face both obesity and undernourishment side by side.[1–3] Global obesity prevalence has more than doubled since 1980; nowadays more than 10% of the adult world population is obese, and being overweight ranks fifth in the list of risks of death globally.[1]

What explains increases in BMI over time and across countries? In order to gain weight, an individual must consume more calories than are expended. Previous research suggests that the current obesity trend is driven mainly by an increase in calorie consumption not due to a decrease in calories expended.[4,5] So the appropriate question is, why are more calories being consumed?

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Although many economic forces are likely explanations, many scholars argue that market liberalism and growing globalization are driving root causes of the obesity pandemic.[6–9] The purpose of this paper is to examine the impact of economic freedom on obesity while controlling for confounding factors such as the level of development, gender, and health care spending.

Using an unbalanced pooled cross section of up to 135 countries for 1995 and 2000–2009, we find that economic freedom is associated with very slightly higher BMIs for men in developing nations. Income levels appear to increase male BMI levels in the developed world. In no case, do we find evidence that economic freedom or income impacts female BMIs. At least as it pertains to economic freedom and development, increasing BMIs appears to be an exclusively male phenomenon. In addition, we find some evidence that public health spending actually increases obesity rates, especially in developed countries.

Overall our findings suggest two things. First, much of the purported impact of economic liberalization on BMI is in fact related to economic development over time. Countries have generally been getting freer, and as a consequence, they are developing rapidly. BMIs are also on the rise. However, controlling for fixed effects siphons off much of the relationship between economic freedom and BMI previously documented in the literature.

Second, we also test the relationship between life expectancy and obesity, income, and economic freedom. We find that economic freedom increases life expectancy of both men and women in developing countries. Therefore, we urge caution when attempting to design policies aimed at reducing obesity such as sugar taxes, outright bans on products with high sugar contents, or selective advertising bans. Our results suggest that limiting economic liberalism or economic growth to manage obesity may come at the expense of life expectancy in the developing world.

Basic economic theory offers some insight into explaining obesity. The increase in obesity may be due to relative microeconomic forces such as price changes, changes in income, and decreased time costs of food preparation, or macroeconomic forces such as economic insecurity, globalization, and economic liberalization. Evidence provided at the state level shows economic variables collectively explain large amounts of the variation in BMI and obesity.[10]

One somewhat obvious explanation is that a drop in food prices or alternatively an increase in real incomes drives obesity. An increase in real income could lead to an increase in demand for food. Prior research is inconclusive regarding the direct relationship between income and obesity. Many studies do not provide strong evidence that income increases BMI.[4,11,8] In contrast, Egger, Swinburn, and Islam[12] find a positive relation between income and obesity but only among low-income countries and no significant association beyond this level. Loureiro and Nayga[11] find an increase in income leads to more overweight individuals but no relationship with obesity. Pickett, Lobstein, Brunner, and Wilkinson[13] and Wilkinson and Pickett[14] document a relationship between income inequality and obesity in OECD countries but no relationship between obesity and average income.

The law of demand certainly holds for food, so decreasing food prices may be an explanation for increased consumption.[5,15–21] The modern era has seen a large decrease in time spent on food production,[4,15,22] so food has become cheaper in time as well as money. It should be mentioned that government agricultural policies have ambiguous impacts on food production and prices. On the one hand, many types of direct subsidies (e.g., price supports) to farmers increase output. On the other hand, some programs (e.g., acreage allotments) are designed to reduce output in order to increase price. The net effect is unclear.

Swinburn et al.[23] further consider the increased supply of cheap calorie and energy-dense products and improved distribution systems as part of the global food system. Similarly, Cutler, Glaeser, and Shapiro[4] suggest that 'mass production' is driving the increases in obesity around the world. They argue that technological innovations, which facilitate packaging, storage, and transportation of foods, have led to a shift from individual to mass preparation of food. This has allowed more consumption of food through decreased time costs of food production and increased, instant, and continuous access to food. An implication of this argument is that when and where technological progress related to food production is more widespread, and where food manufacturers have better and easier access to new production technologies, obesity should be more prevalent.[4]

Similarly, Rashad and Grossman[20] argue that increases in the prevalence of restaurants have increased BMI and obesity. For example, they note that the number of fast food restaurants per person doubled between 1972 and 1997. Anderson and Matsa[24] support this finding. Somewhat related, Courtemanche and Carden[25] find that each additional Walmart Supercenter per 100,000 residents increases average BMI and the obesity rate in the affected communities.

In addition to changes in the price of food, changes in the price of other goods might impact obesity. Chou, Grossman, and Saffer[17] and Baum[26] show a positive impact between cigarette prices and obesity. Gruber and Frakes[27] show cigarette taxes and obesity are negatively related. Baum and Chao[28] find reduced smoking's largest effect on obesity when controlling for a variety of socioeconomic variables including employment, physical activity at work, food prices, the prevalence of restaurants, cigarette smoking, cigarette prices and taxes, food stamp receipt, and urbanization.

Economic insecurity may also impact obesity. Smith, Stoddard, and Barnes[29] argue that perception of economic insecurity, such as risk of unemployment or other income loss, creates stress, which leads to overeating. They test the economic insecurity hypothesis on US individual-level longitudinal data. Using an instrumental variables approach, they find a significant effect with three different measures of economic insecurity (probability of unemployment, volatility of income, and access to safety nets) on body weight, controlling for height and other key individual characteristics. In addition, they find that health insurance and intra-family transfers protect against weight gain.

Wiseman and Capehart[30] explore the possibility that the obesity epidemic is substantially due to growing insecurity, stress, and a sense of powerlessness in modern society where high-sugar and high-fat foods are increasingly omnipresent.

After exploring the link between stress and obesity, the increasing pace of capitalism's creative destruction and its generation of greater insecurity and stress are addressed. The article ends with reflections on how epidemic obesity is symptomatic of a social mistake—the seeking of maximum efficiency and economic growth even in societies where the fundamental problem of material security has been solved.

As a result, the costs of obesity have led public health experts to advocate for public intervention such as fast food regulations and taxes on unhealthy foods.[31–33] The economic justifications for policy interventions are based on the idea that obesity is a market failure where one obese person imposes a negative externality on other people. This implies that an individual does not bear the full cost of decisions related to gaining weight.[34] Anand and Gray[35] argue that obesity is a market failure where economic freedom creates a suboptimal choice environment.

It should be mentioned that the extent to which obese people impose costs on third parties is exacerbated, if not created in the first place, by the existence of health insurance risk pools. The world has seen significant increases in health insurance coverage, especially public health insurance,[34] in recent decades. While this insurance rarely covers all health care costs for the individual, the existence of government-financed health coverage certainly reduces such costs. Thus, to describe the negative externality problem associated with obesity as a market failure is a bit disingenuous to the extent that government-provided or subsidized health care is the major source of this externality. Furthermore, in many instances early deaths attributed to obesity can generate positive fiscal spillovers in state-run nursing and pension systems.[36]

The last set of literature specifically explores the link between economic liberalization and obesity. Some authors argue that the rising consumption of unhealthy foods seen worldwide has been facilitated by trade liberalizatiHon.[37] For example, the average tariff barrier on American imports has dropped precipitously since the late 1940s, which has cheapened an array of imports (including food) while elevating incomes.

Swinburn et al.[23] discuss changes in the food system as key drivers of the increases in BMI. Their framework recognizes what they call *systemic drivers*, such as taxation regimes, regulations, and social and economic policies. By affecting the food system, these systemic drivers also affect the development in BMI.

One example of a food system driver is food marketing, which influences consumption and is regarded as being an important cause of the rise in obesity.[38,39] Food marketing is arguably more pronounced where markets are less regulated and where there is more competition; i.e., when there is more economic freedom. Hence, through different types of regulations, the degree of economic freedom may affect the intensity of marketing actions, which in turn may be an important driver of increases in BMI.

Bleich et al.[5] use absence of price controls and ease of market entry as two regulations to explore whether these are related to the total number of calories supplied in the country. Controlling for time and country fixed effects, they find a positive and significant association between caloric supply and ease of market entry among OECD countries in the 1995 to 2002 period. The relationship between caloric supply and absence of price controls is also positive, but insignificant. Similarly, Cutler, Glaeser, and Shapiro[4] examine 22 high-income countries and find obesity is higher in less regulated countries.

De Vogli, Kouvonen, and Gimeno[9] show that countries adopting what are considered market-liberal policies experience faster increases in both fast food consumption and mean BMI. Relatedly, Meltzer and Chen[40] argue that falling real minimum wages encourage the growth of businesses, such as fast food restaurants, that rely on such workers. Thus, they conclude the lower real minimum wage has contributed to growing obesity.

In addition, Guthman and DuPuis[6] argue that, 'the neoliberal shift in personhood from citizen to consumer encourages (over)eating.' Further, Offer, Pechey, and Ulijaszek[7] conclude that the effects of increasing the supply of cheap and more accessible food have been larger in 'market liberal' countries. Lyungvall[8] explicitly argues that 'the freer the fatter'. An environment with more economic freedom may encourage unhealthy behavior by affecting the quality and quantity of foods available to consumers, by affecting access to safety nets, and by affecting access to environments for physical activity, leading to increases in BMI. The empirical analysis is based on an unbalanced panel of high-income countries. Including controls for GDP per capita, growth, female labor force participation, and education, Lyungvall finds economic freedom is positive and significantly related to levels and increases of BMI. There is some support for nonlinear effects where the effects are larger for more free countries.

There are, of course, many other noneconomic determinants of body weight, including genetic predispositions to obesity and innate impulses that prevent optimal body weight control. These are unlikely explanations for the observed trends in body weight, even if they help explain baseline levels. There is certainly little evidence that we are more irrational or have different genes than our parents or grandparents.

Nevertheless, there is clearly something about modernity that is causing people to consume excess calories. Perhaps the combination of cheap food, high incomes, and freedom of choice contributes to weight gain. In the following section, we attempt to empirically test the relationships between obesity, income, and economic freedom.

Methods

Our dataset consists of an unbalanced pooled cross section of up to 135 countries for the years 1995, 2000–2009, for a total of 2802 observations. The Economic freedom of the World index is available only in five year-intervals prior to 2000. We use both pooled OLS and fixed effects regression specifications. Unlike many of the studies cited above, we examine data for both developing and developed nations. This is for two reasons. First, the BMI/Obesity problem is not restricted to the developed world. Second, the degree of variation in economic freedom is far greater in developing than in developed nations.

In addition, we separate our focus by gender. It is well documented that socioeconomic disparities, including gender differences, exist with regard to obesity rates.[41–45]

Table 1 provides descriptive statistics and source information for the data used in the analysis. Panel A reports the summary statistics, and Panel B reports the list of countries included in the data set. The countries were selected solely based on data availability. The dependent variable throughout will be the average BMI of the population. BMI is measured as a person's weight in kilograms divided by his or her height in meters squared.[46] The average BMI is 24.87 kg/m^2 with a standard deviation of 2.25. The assumption is that higher average BMI values are indicative of a greater incidence of obesity in the population.

The primary independent variable of interest is the Economic Freedom of the World (EFW) index.[47] The EFW index provides a 0–10 economic freedom rating for over 150 nations based on over 40 variables. Nations with lower taxes, sounder property rights, stable money, freer trade, and more limited regulations score higher on this index. The mean EFW score is 6.66 with a 0.99 standard deviation. The EFW index has been used in hundreds of studies as a measure of market liberalism; see Hall and Lawson for a survey of this literature.[48]

Results

Table 2 presents the benchmark results of a pooled OLS model using logged real GDP per capita (log RGDPPC), the EFW rating, public sector share of health spending, health care spending as a share of GDP, and health spending per capita as independent variables.[49]

Table 2 – Economic freedom and BMI Benchmark model. Notes: Dependent variable is BMI. All regressions are unbalanced pooled, cross section, consisting of up to 135 countries for the years 1995, 2000–2009. Column (1) is a pooled OLS regression. Column (2) includes country fixed effects. Column (3) includes year fixed effects. Column (4) includes both year and country fixed effects. Standard errors are in parentheses.* Significant at 90%, ** Significant at 95%, * Significant at 99%.**

	(1)	(2)	(3)	(4)
Log RGDPPC	1.20***	1.58***	1.23***	0.11
	(0.03)	(0.13)	(0.03)	(0.18)
EFW rating	0.13***	0.13***	0.05	−0.08*
	(0.04)	(0.05)	(0.04)	(0.00)
Public share of health spending	0.01***	0.01**	0.01***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Health care share of GDP	0.20***	0.05**	0.19***	−0.01
	(0.01)	(0.02)	(0.01)	(0.02)
Health spending per capita ($1000)	−0.84***	0.19**	−0.83***	−0.19**
	(0.03)	(0.08)	(0.03)	(0.08)
Constant	13.01***	11.85	12.78***	24.57***
	(0.25)	(1.08)	(0.26)	(1.39)
Year fixed effects	N	N	Y	Y
Country fixed effects	N	Y	N	Y
Observations	2802	2802	2802	2802
Adj. R^2	0.55	0.88	0.56	0.89

Economic development may increase BMI (and obesity) as food, as well as other items, will be more plentiful and cheaper in more developed economies. As a result, food consumption may increase. Similarly, economic freedom may indirectly increase BMI if economic freedom directly leads to an increase in income or allows food to be produced more cheaply.

Table 1 – Descriptive statistics and sources. Notes: BMI is body mass index and is collected from World Health Organization (2014).[46] EFW Rating is chain-linked economic freedom rating and is collected from Gwartney et al. (2013).[47] Log RGDPPC is log real GDP per capita, Public Share of Health Spending, Health Care Percent of GDP, Health Care Spending per Capita ($1000), and Life Expectancy are collected from World Development Indicators (2014).[48] EFW*Income is calculate by multiplying EFW Rating and Log RGDPPC.

Panel A: summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
BMI	2802	24.87	2.25	19	31.3
Log RGDPPC	2802	8.17	1.67	3.86	11.38
EFW Rating	2802	6.66	0.99	3.03	8.88
Public share of health spending	2802	55.75	18.93	4.18	96.95
Health care (% GDP)	2802	6.41	2.52	0.14	22.18
Health spending per capita ($1000)	2802	875.92	1449.18	0.07	7629.21
Life expectancy	2802	55.58	10.51	31.23	85.16
EFW*Income	2802	68.39	17.83	14.06	93.02

Panel B: list of countries

Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Democratic Republic of the Congo, Republic of the Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Republic, Latvia, Lesotho, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Rwanda, Senegal, Serbia, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Syria, Tanzania, Thailand, Netherlands, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Zambia, Zimbabwe.

However, once we control for the level of income, the impact of income and economic freedom on BMI may be quite distinct. For example, economic freedom may have no effect on food consumption patterns, thus, not affecting BMI. Furthermore, economic freedom may allow for heathier consumption choices.

It is reasonable that spending on health care would improve health including decreasing obesity. However, more spending on health care may also create perverse incentives and moral hazard concerns whereby better health care 'subsidizes' poor choices including consuming additional calories. This relationship may be more prominent with public sector health spending if individuals view public health as 'free' and, therefore, do not fully pay for their poor health choices.

The four regressions presented in Table 2 differ only based on whether or not country and year fixed effects are included. Regressions 1 and 2 confirm much of the reasoning discussed above that countries with higher economic freedom exhibit higher BMIs, and, thus, presumably more obesity. The coefficient however is vanishingly small, even if significant statistically. A one standard deviation higher EFW rating corresponds with just 1/20th of a standard deviation higher BMI. Regression 3, which includes year but not country fixed effects, shows no significant relationship between economic freedom and BMI. Regression 4, which includes both sets of fixed effect controls, turns the relationship on its head. Here we find that higher levels of economic freedom correspond to lower BMIs, though, again, the coefficient size is miniscule.

Collectively, we interpret these results as suggesting that our baseline regressions, as well as previous findings, do not fully capture all factors impacting obesity across countries and over time. The sensitivity of these results to the inclusion of time fixed effects is not surprising since economic freedom, like BMI, has been (generally) rising over time in most countries. If omitted factors are also increasing over time and we do not include time fixed effects, as in regressions 1 and 2, we may wrongly attribute the rise of BMI over time to increases in economic freedom. Thus, the inclusion of time fixed effects allows us to control for these trends to more accurately understand the underlying association between economic freedom and BMI.

Although we are mainly interested in economic freedom and income, it is interesting to note the relationship between health care spending and obesity. In the first three regressions, total health care spending and government-financed health spending significantly increase obesity indicating possible moral hazard. However, we lose statistical significance once we include both year and country fixed effects. Health care spending per capita lowers obesity and retains statistical significance in all four specifications.

Table 3 presents the model found in Table 2, Regression 4 with two changes: (1) the sample is split four ways both by gender and level of economic development, and (2) an interaction term between the EFW rating and real GDP per capita is added to the model. The cutoff for developed vs developing was a real GDP per capita of $4085. Chow tests verified the validity of splitting the overall sample four ways by development level and gender.

The first change highlights that the problem of obesity may be contingent on whether we are looking at men or women or developed vs developing countries. For example, higher EFW leads to less obesity for men in developing countries (regression 2). Economic freedom is positive but insignificantly related to obesity for women in developing countries. Economic freedom is negative but insignificant for both men and women in developed countries.

Table 3 – Economic freedom and BMI by gender and level of development. Notes: Dependent variable is BMI. Columns (1)–(4) include both year and country fixed effects. Standard errors are in parentheses.* Significant at 90%, ** Significant at 95%, * Significant at 99%.**

	(1)	(2)	(3)	(4)
Sample	Female, LDC	Male, LDC	Female, DC	Male, DC
Log RGDPPC	−0.06	0.03	−0.23	0.33**
	(0.13)	(0.09)	(0.23)	(0.15)
EFW rating	0.06	−0.30***	−0.24	−0.01
	(0.12)	(0.09)	(0.28)	(0.19)
Public share of health spending	0.00	0.00	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Health care share of GDP	−0.01	−0.02**	−0.02	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Health spending per capita ($1000)	0.00	1.38***	−0.31***	−0.19***
	(0.64)	(0.45)	(0.04)	(0.03)
EFW*Income	−0.02	0.04***	0.01	0.00
	(0.02)	(0.01)	(0.03)	(0.02)
Constant	28.53***	25.00***	28.61***	23.20***
	(0.89)	(0.63)	(2.05)	(1.37)
Year fixed effects	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y
Observations	739	739	662	662
Adj. R^2	0.99	1.00	0.99	0.99

The second change focuses on the important interplay between the level of income and economic freedom that may be at work even within the development sub-samples. Because of the interaction term, the impact of economic freedom on BMI will now be contingent on the level of income (and vice versa). Table 4 shows the marginal impact of a one standard deviation difference in the level of economic freedom (income) conditional on three levels of income (economic freedom). Only in the case of males living in developing nations do we find any evidence of a positive relationship between economic freedom and BMI, and the impact gets stronger at higher levels of income. In the case of females, both in developed and developing nations, and in males in developed nations, we in fact find a negative (though small and insignificant statistically) association between the two variables. Throughout, however, the coefficient magnitudes are economically, if not statistically, insignificant.

Income meanwhile is positively related with BMI only in the sample for males in developed nations, and this impact is not a function of the degree of economic freedom. For males in developed nations, a one standard deviation higher income level is associated with a 1/5th standard deviation higher BMI. While not large, this magnitude is certainly worth noting. Otherwise, income is negatively related to BMI (though insignificant statistically) for females in both subsamples, and is essentially unrelated male BMI in developing nations.

We also note that health spending by government is positively and significantly associated with higher BMIs for both men and women in developed countries while total health spending per capita is negative and significant. Combined, these results indicate that overall access to health care can increase one's health outcomes; however, this result reverses if health care is from the public sector.

It is worth commenting on the fact that our concern regarding obesity is a decidedly modern one. In all countries until very recently, and in many to this day, the problem was not obesity; instead it was undernourishment. Obesity certainly heightens various health ailments such as heart disease, stroke, and diabetes, but the list of problems associated with undernourishment is even longer and probably more severe. A higher BMI may improve health outcomes on some margins even if making matters worse on others.[50]

Table 5 contains a set of five regressions similar to those found in Table 3, except the dependent variable is life expectancy from birth and BMI has been moved to an independent variable. Higher BMI is in fact associated with lower life expectancy, and the effect is particularly pronounced in developed nations. For example, among males in developed nations, a one standard deviation higher BMI is associated with a 0.75 standard deviation decline in life expectancy, which is equivalent to almost eight years. For females in developed nations, the impact is about half that of the males. In developed nations, neither income nor economic freedom appears to impact life expectancy.

Our model suggests BMI has little impact on life expectancy in developing nations (though a non-linear relationship has been suggested by others).[50–52] Among males the effect is insignificant, and among females the impact of one standard deviation increase of BMI on life expectancy is about 10% of a standard deviation. Economic freedom and income, in contrast, both matter. The marginal effect of one standard deviation higher EFW score corresponds to about 10% of a standard deviation in life expectancy, and the marginal effect of a standard deviation of higher income yields a 1/3rd greater standard deviation in life expectancy. Also, health spending by government is not significantly related to life expectancy.

Taken together these results confirm the worry about BMI but this worry should be mostly confined to the developed world as opposed to the developing world. Additionally, policies that go against economic liberalization or economic growth, even if made in an attempt to rein in the effects of higher BMIs, may have deleterious effects on life expectancy when applied to the developing world.

We also note that the adjusted R^2 values in Tables 3 and 5 are exceptionally high. This is a reflection first and foremost of the statistical explanatory power of a full set of year and country fixed effects, but secondarily the importance of controlling for income and economic freedom jointly.

Table 4 – Marginal impact of economic freedom and income on BMI. Notes: Marginal effects calculated from Table 3. Bold represents significant coefficients.

Sample:	Female, LDC	Male, LDC	Female, DC	Male, DC
Impact of 1σ in EFW at:				
low income (1σ below avg.)	−0.06	**0.26**	−0.15	−0.01
average income	−0.07	**0.29**	−0.14	−0.01
high income (1σ above avg.)	−0.09	**0.33**	−0.13	−0.01
Impact of 1σ in Income at:				
low EFW (1σ below avg.)	−0.15	0.01	−0.17	**0.28**
average EFW	−0.17	0.05	−0.16	**0.28**
high EFW (1σ above avg.)	−0.19	0.08	−0.16	**0.28**

Table 5 – Life expectancy, economic freedom and BMI. Notes: Dependent variable is life expectancy. Columns (1)–(4) include both year and country fixed effects. Standard errors are in parentheses.* Significant at 90%, ** Significant at 95%, * Significant at 99%.**

Sample	(1) Female, LDC	(2) Male, LDC	(3) Female, DC	(4) Male, DC
Log RGDPPC	8.96***	9.00***	0.33	1.15
	(0.75)	(0.75)	(0.88)	(0.86)
EFW rating	8.15***	8.08***	0.96	1.15
	(0.72)	(0.73)	(1.08)	(1.05)
Public share of health spending	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Health care share of GDP	0.36***	0.36***	−0.12**	−0.07
	(0.06)	(0.06)	(0.06)	(0.05)
Health spending per capita ($1000)	−10.30***	−10.20***	0.40**	0.30*
	(3.80)	(3.80)	(0.20)	(0.20)
EFW*Income	−1.11***	−1.09***	−0.07	−0.08
	(0.11)	(0.11)	(0.12)	(0.11)
BMI	−0.53**	−0.14	−0.93***	−1.87***
	(0.23)	(0.33)	(0.16)	(0.23)
Constant	19.36**	9.47	93.17***	109.81***
	(7.91)	(9.76)	(9.13)	(9.44)
Year fixed effects	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y
Observations	739	739	662	662
Adj. R^2	0.99	0.99	0.99	0.99

Discussion

Overall our findings suggest two things. First, much of the purported impact of economic liberalization on BMI is in fact related to economic development over time. Countries have generally been getting freer, and as a consequence, they are developing rapidly. BMIs are also on the rise. However, controlling for fixed effects siphons off much of the relationship between economic freedom and BMI as demonstrated in Table 2. Beyond that, disentangling the impact of liberalization from development is a difficult task. This paper attempts to do this by separating the sample between developed and developing nations, by gender, and by examining the impact of economic freedom conditional on the level of income.

In summary, we find that economic freedom is associated with very slightly higher BMIs for men in developing nations only, and not otherwise. In contrast, income levels appear to increase male BMI levels in the developed world, and not otherwise. In no case, do we find evidence that economic freedom or income impacts female BMIs. At least as it pertains to economic freedom and development, increasing BMI

appears to be an exclusively male phenomenon. Lastly, policies aimed at increasing health spending by government to reign in obesity may have unintended effects as our results suggest that such health spending, at best, has no significant impact on obesity, and in several instances, may actually increase obesity.

Finally, we urge caution. Attempts to limit economic liberalism or economic growth in an effect to manage obesity (e.g., food taxes, soda bans, children's advertising restrictions, mandatory BMI monitoring of children) may backfire in terms of life expectancy outcomes in the developing world.

Author statements

Ethical approval

Our data is available online and does not involve any ethical considerations such as human test subjects.

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None declared.

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