Economic Growth and Weight Gain: A Dynamic Approach to the Obesity Epidemic

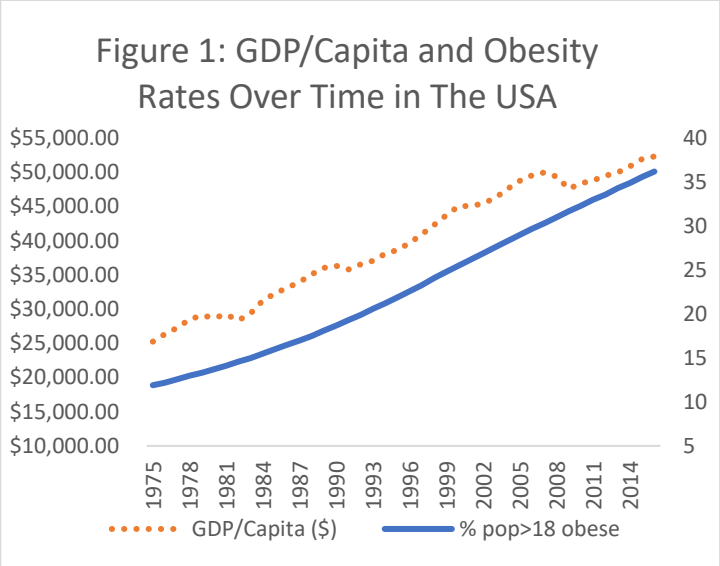
Abstract

Obesity is a health epidemic plaguing many Western countries today. According to an OECD (2019) study, 71% of Americans above the age of 15 are overweight or obese. This is the 3rd largest figure of the OECD countries, which include the regions of North America, Europe and Oceania. Yet, the explanation for ever increasing obesity rates is not well-defined. This thesis will set to establish a link between income growth and the rise in obesity prevalence over time. In order to do this, I will simulate an economy's growth path of income and obesity in Mathematica using an extension of the Ramsey (1928), Cass (1965), and Koopmans (1965) neoclassical growth model, connecting consumption with body weight.

Description

The work done in this thesis will review income and obesity in various countries as there is a positive relationship between income growth and higher obesity prevalence (see Figure 1). In order to establish the link between income growth and the rise in obesity, I will simulate an economy in Mathematica using a variant of the Ramsey (1928), Cass (1965) and Koopmans (1965) (RCK). In order to simulate the growth of income against the growth of obesity, I will adjust

the RCK model by adding the Schofield (1985) equation, which describes weight gain as the net caloric intake of an individual, thereby connecting food consumption to body weight.



This adjusted model will help me predict the evolution of obesity in various countries and understand future policy recommendations that may help the global obesity epidemic. The findings of this thesis will benefit taxation policy in order to guide recommendations to address obesity externalities. As a potential expansion to this model, I will study the potential of junk-food taxes as well as the combination of taxes and subsidies in order to disincentivize the consumption of fattening foods. Overall, this study will work to uncover the underlying mechanisms behind the empirical evidence of a positive relationship between obesity and income to better predict the evolution of obesity over time and shed light on their policy implications

Previous Work

There are many empirical studies conducted in the early 21st century that provide evidence for the link between income and obesity. According to Cawley (2015), income may increase weight depending on gender, income, wealth, as

well as societal preferences. Cawley presents the relationship between income and weight as an inverted U-shaped curve. The first increases in income may be spent on food but, at some point, this marginal utility on food will decline such that additional income will no longer have a large impact on food consumption. It appears that there is a turning point away from increased calorie consumption into health consciousness (Philipson and Posner, 2003; Lakdawalla et al., 2005; Deuchert and Tafreschi 2014).

Deuchert and Tafreschi (2014) tested the theory developed by Philipson and Posner (2003) by offering two propositions, the first being "average body weight is associated with economic development", and the second being "SES-related health inequality is associated with economic development." The results of the first proposition are most relevant to this thesis. This study used DHS data from 1990 to 2008, which are nationally representative household surveys, covering upwards of 30,000 households. This study focused on nonpregnant women aged 15-49 years of age in 52 different countries. Their results suggested support for the theory, for example they found that "in the year 2000, a 10% increase in per capita GDP would increase the obesity rate by 10% in a country with a per capita GDP of $500 but would decrease the share of obese people by 3% in a country with per capita GDP of $3000". These results support the hypothesis that economic development will increase obesity rates to a certain maximum threshold.

The caveat to these articles is that they were measures of a Local Average Treatment Effect. This is a measurement of a localized region of study that is

highly specific and reactive to the results of the studies. It is uncertain if the results of the previous articles and the three following are generalizable. Cawley et al. (2010) conducted measurements on the elderly who benefited from the Social Security Benefits Notch, a program that created increases in retirement benefits for certain birth year cohorts in the United States. A commonality among Cawley et al. (2010), Akee et al. (2013), and Schmeiser (2009) is that all these articles focused on low-income groups in specified regions of the United States. The reason for this trend is that weight appears to be very responsive to income increases among low-income individuals. Parker et al. (2008) studied income and weight by exploiting the natural experiment of government stimulus during the Great Recession. The article estimated that individuals increased food expenditures by 2% of the government transfer received.

There are many empirical studies done in the field of health economics that concern obesity and income; however, there are not nearly as many theoretical works that establish clear relationships between the two economic indicators. The most recent work in this field of economics is from a Bolh and Wendner (2018) paper that found higher-income individuals in industrialized countries tend to have a higher disposition towards low-calorie foods, but the opposite is true in developing countries. This implies that there is a turning point where income and obesity have a negative relationship, but this is only achieved in high-income individuals in industrialized countries, a niche group to say the least. There is also a policy analysis implemented in this paper that continues the thought of the other papers previously reviewed. Philipson and Posner (2008) describe this phenomenon

with the neoclassical weight model. The closer one is to an ideal weight, the more weight acts as a normal good. Underweight individuals will apply more income to weight gain whereas wealthy overweight individuals will apply their income to weight loss. This describes a non-monotonic relationship with food and income within countries. Many economists believe that one solution to the obesity epidemic could be through the use of taxes and subsidies on high- and low-calorie foods, respectively (Cawley 2015, Bolh & Wendner 2018).

The literature sets up a strong basis for the link between obesity and income, but it lacks dynamic foundations. Many of the empirical articles focus on one-time increases in income in specialized populations. A dynamic relationship must be established by looking at the growth of both obesity and income over time. I will do this by creating a model economy with Mathematica which will be calibrated to long-run economic indicators such as average income, interest rates, BMI, and weight. The method for calibration will be further explained in the Calibration section.

Significance

According to World Health Organization (WHO) data, obesity rates for the American population greater than eighteen exceed 30% ("Global Health Observatory"). The WHO defines obesity as someone who has a body mass index (BMI) greater than or equal to 30 ("Global Health Observatory"). Along with these alarming health figures, the US Gross Domestic Product per capita (GDP/capita)[1] is $50,0000 and rising ("GDP per Capita (Current US$)"). These

figures are specific to the US, but this trend of increasing obesity and average income is observable in many other countries as well. Obesity is not only a health concern but also a threat to economic prosperity.

Obesity is an important measure in overall health of a country and increased obesity rates lead to externalities[2] such as increased health insurance and medical care costs (Cawley 2015). Obese workers tend to be compensated less at jobs with health insurance in order to account for higher expected medical care costs (Bhattacharya & Bundorf 2009). There are obvious health implications associated with obesity, but there are also social costs to an economy when obesity rates are on the rise. Annual medical expenditures for obese peoples are $732 more than normal weight people (Finkelstein et. al., 2003). Bhattacharya & Bundorf (2009) find that obesity is an observable attribute which allows insurers to price discriminate, forcing insurance premiums to be higher than necessary. Thus, obesity is not only a concern for the health of individuals afflicted, but also for the health of a country as a whole.

Proposed Methodology

A.) Model Description

This thesis will build on the neoclassical growth model previously mentioned in order to better explain why the growth of income and obesity prevalence are related. In order to accomplish this goal, I will manipulate the RCK model for economic growth by including the Schofield (1985) equation. RCK is a dynamic model that connects consumption to income and wealth which,

[2] Externalities are costs (benefits) that affect parties outside of the market exchange

in turn, describes the relationship between economic growth and the rise in consumption. The Schofield equation (1985) connects weight gain to net caloric intake which depends on consumption. In adding this equation, the model will associate income to food consumption and increases in body weight.

B.) Calibration

This thesis will use computational simulations to construct a model economy. I will use the calibration method outlined by Kydland & Prescott (1996) in order to build my model economy and then simulate growth. First, research is guided by a question—my guiding question is "does income growth lead to higher obesity prevalence." From there, I will review the theory and collect measurements from real-world data in order to construct a model economy. I will calculate some economic indicators such as capital-output (K/Y), consumption-output (C/Y), investment-output (I/Y), and debt-output (G/Y) ratios over long periods of time to calibrate the model. The data is going to be secured from data logs such as those from the Organization for Economic Co-operation and Development (OECD), the Bureau of Labor Statistics (BLS), and the Federal Reserve Economic Data (FRED). These are all governmental bodies for research and are commonly used for economic analysis.

I will create a model economy using the RCK model with the inclusion of the Schofield equation (1985) and estimate parameter values to match long-run trends concerning income and weight. To test the model's robustness, I will run multiple simulations adjusting parameter values to test the sensitivity of the model to these changes. The simulated results will give a quantitative link between income

growth and obesity prevalence both in the short and long run. Finally, the calibrated model will also be used to simulate the effect of policies on obesity

Timeline

Literature review:

The literature review portion of the thesis should be completed by mid-September.

Modeling:

Phase 1: The study of the equilibrium of the core model with simulations will be completed by the end of the Fall semester 2019

Phase 2: Any potential expansions to my core model will be completed by mid-March

Writing:

The writing portion of this thesis will be completed by the end of February. I will hand in drafts to Professor Mathieu-Bolh periodically before this deadline.

Review:

I will submit drafts and they will be revised by Professor Mathieu-Bolh periodically throughout the Spring 2020 semester. The final revision will be handed in before mid-April.

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