Received: 27 February 2019 | Revised: 22 June 2020 | Accepted: 30 June 2020

DOI: 10.1002/hec.4139

RESEARCH ARTICLE

Health Economics WILEY

Does greater unemployment make people thinner in Brazil?

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Abstract

The study seeks to analyze the impact of macroeconomic conditions on weight measures, such as BMI, overweight, obesity, and severe obesity in Brazil. We examine this relationship in the specific context of a middle-income country that differs in many aspects from the high-income countries usually considered in the literature. The study uses the microdata of VIGITEL in the period from 2006 to 2014 and the state unemployment rate as a proxy for macroeconomic conditions. The results showed that the relationship is robust and presents a procyclical pattern—increases in the unemployment rate reduce BMI, and this reduction is observed throughout the entire distribution, with statistically significant effects for measures of overweight, obesity, and severe obesity. These results agree with the findings for the United States but contradict the results found for Finland and Canada.

KEYWORDS

obesity, overweight, unemployment

1 | INTRODUCTION

Overweight and obesity are one of the main problems faced by public health in the world, killing more than 2.8 million people every year according to the World Health Organization (WHO). Although overweight and obesity are problems historically faced by high-income countries, they have now been seen as a global problem, reaching epidemic proportions. About 39% of the adult world population (18 years or older) is overweight and in practically every region of the world overweight prevalence is higher than underweight[1] (NCD Risk Factor Collaboration, 2016; WHO, 2016).

The consequences of this epidemic affect people's health and move to the economic and social spheres. Obesity is considered a risk factor for noncommunicable diseases (NCDs) and contributes to the emergence of hypertension, type 2 diabetes, cardiovascular diseases, musculoskeletal disorders, and some types of cancer, reducing life expectancy (Bhattacharya & Sood, 2011; Rössner, 2002; WHO, 2016). Those morbidities associated with obesity generate high direct economic costs, increasing medical care expenditures (Bhattacharya & Sood, 2011). Indirectly, obesity leads to a

[1]Except in parts of Sub-Saharan Africa and Asia.

reduction in labor productivity and a loss of human capital accumulation (Hammond & Levine, 2010; Latif, 2014a). In the social sphere, it reduces the quality of life and employment prospects, which leads to stigmatization and lesser social integration (Rössner, 2002).

Studies carried out since the 1970s sought to analyze the relationship between macroeconomic conditions and different measures of health and lifestyle (Ásgeirsdóttir, Corman, Noonan, Ólafsdóttir, & Reichman, 2014; Brenner, 1975, 1979; Di Pietro, 2018; Forbes & McGregor, 1984; Gravelle, Hutchinson, & Stern, 1981; Latif, 2014a, 2014b; Ruhm, 2000, 2015; Stevens, Miller, Page, & Filipski, 2015; Xu, 2013). However, despite being an extremely relevant issue in public health, few studies in the literature have sought to analyze the relationship between macroeconomic conditions and body weight measures.

This relationship had previously been analyzed in Ruhm's (2000) studies, using microdata of the US Behavioral Risk Factor Surveillance System for the period from 1987 to 1995, noting that increases in the unemployment rate reduced body mass index (BMI) and the likelihood of being underweight, overweight, and obese. In a second study, Ruhm (2005), using American data for the period 1987 to 2000, noted that a reduction in the rate of employed persons reduces the prevalence of obesity and severe obesity and that this decline in body weight is concentrated among severely obese individuals, male, African American, and Hispanic. The author presents evidence that variations in lifestyles would be the mechanism that would explain the reduction of body weight.

The evidence for Finland presented by Böckerman et al. (2007), for the period from 1978 to 2002, differ from Ruhm's (2000, 2005) findings for the United States; their results demonstrate that improvements in regional economic conditions reduce BMI. Similar results were found by Charles and DeCicca (2008), for African-American men with poor employment prospects in a sample for the United States, and Latif (2014a), that noted, for Canada, that increases in the unemployment rate increase BMI and the prevalence of severe obesity.

Given the evidence found in Ruhm (2000, 2005), Böckerman et al. (2007), Charles and DeCicca (2008), and Latif (2014a), how to explain the relationship between macroeconomic conditions and body weight? The theoretical foundation for this relationship comes from Grossman's (1972) model of health demand. In this model, health is seen as a consumer good and an investment. As consumption, individuals would demand health services, because having good health provides direct utility to the consumer; as an investment, health is desired because it provides indirect utility, by increasing the number of healthy days and, consequently, increasing the time available for work and income generation. In Grossman's (1972) model, health is treated as a production process that requires consumption and time input. Although the unemployment rate is used as a proxy for macroeconomic conditions, we do not expect the rate itself to affect weight measures, but rather that it is related to other factors that affect weight measures (Milicic, 2016). Two possible mechanisms that may be behind this relationship are discussed in Grossman (1972): the opportunity cost of time and changes in income (real and expected).

The first mechanism suggests that in economically unstable periods the unemployment rate increases, decreasing the number of jobs. Such a decrease reduces the opportunity cost of other nonemployment activities, including health production. Thus, individuals could spend more time on activities that would maintain their health, such as the practice of physical activities and the consumption of homemade meals. The second mechanism is related to the economic instabilities that could result in budget restrictions, which may reduce the income allocated to health-promoting behaviors, leading to the replacement of a healthy diet with a cheaper diet, high in fats and low in nutrients (Charles & DeCicca, 2008; Milicic, 2016).

There is a third mechanism that can be observed in the literature: economic stress. The moments of economic instability would cause greater stress due to uncertainty regarding present and future income. Thus, a high-calorie diet could have a biologically attenuating effect on stress, contributing to the fact that stressed people demand more of these foods (Tomiyama, Dallman, & Epel, 2011).

This study contributes to the literature by analyzing the relationship between macroeconomic conditions and weight measures through data from a middle-income country. Low- and middle-income countries have distinct social and economic characteristics from high-income countries, which are addressed in the literature. In addition, these countries may bear a double burden related to BMI, because they deal with malnutrition while watching the prevalence of overweight and obesity grow rapidly. Thus, unlike high-income countries, underweight and overweight coexist in low- and middle-income countries, making the debate about macroeconomic conditions and BMI in developing countries more relevant (WHO, 2016).

As for Brazil, a middle-income country, data shown by Malta, Andrade, Claro, Bernal, and Monteiro (2014) and Rtveladze et al. (2013) show the evolution of this problem. The prevalence of overweight in the adult population increased from 43.2% in 2006 to 51.0% in 2012, whereas that of obesity increased from 11.6% to 17.4%. Chronic NCDs account for 72% of all deaths in the country. The diseases that kill the most—cardiovascular diseases (31.3%), cancers (16.2%), chronic respiratory diseases (5.8%), and diabetes mellitus (5.2%)—are all linked to obesity (Schmidt et al., 2011). According to Bahia et al. (2012), using data from 2008 to 2010, the estimated total costs for 1 year of all diseases linked to overweight and obesity are US $2.1 billion; US $1.4 billion (68.4% of total costs) due to hospitalizations and US $679 million due to outpatient procedures, and approximately 10% of these costs are attributable to overweight and obesity.

To our best knowledge, this is the first study on the subject in Brazil. The paper uses data from the Brazilian population for the period from 2006 to 2014 and is organized in three sections besides this introduction. In the following section, the methodology is introduced, presenting the database and the empirical strategy. In the third section, we present the results of the empirical exercise and in the final section the discussion of the results and the conclusions.

2 | METHOD

2.1 | Data

The database consists of annual data from the Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (VIGITEL) and covers the period from 2006 to 2014. VIGITEL is a cross-sectional study, representative for the adult population (>18 years old) living in the 26 capital cities of Brazil and the Federal District, which seeks to monitor the frequency and distribution of the main risk and protection factors for chronic NCDs, and also provides demographic and socioeconomic information about the participants.[2]

The data are collected using a two-stage sampling and aims to obtain probability samples of the adult population living in households that have at least one telephone line per year. The first stage consists of a systematic draw of 5,000 telephone lines per city, which is carried out using the electronic registration of residential lines of the telephone companies that cover the cities. The second step is to identify among the drawn telephone lines the ones that are eligible. Then, individuals at the household who are 18 or older are listed, and there is a new draw, selecting one of these individuals for the interview.

About 54,000 telephone interviews are collected annually, 2,000 per capital city, totaling a sample of 486,000 observations for the period 2006–2014. The sample used in this study is limited to individuals between the ages of 25 and 59, considering that they are the most affected by economic fluctuations, because they are in prime-working age. Charles and DeCicca (2008) and Milicic (2016) followed a similar procedure that makes it possible to avoid two important life periods that are affected by labor market conditions, education, and retirement. According to Milicic (2016), younger individuals (under the age of 25) can make decisions about education and work based on labor market conditions. The same goes for the other extreme, individuals at the end of their careers (60 years or older) can choose to anticipate retirement according to market conditions. These decisions made in the face of fluctuations in the labor market may restrict the effects of economic conditions on weight measures, making those groups less responsive. The final sample consists of 283,313 individuals,[3] with information on weight and height.

From the self-reported information on weight (kg) and height (cm) of participants, the indicators of obesity are measured. The dependent variables correspond to the BMI[4] in its gross form (continuous variable) and others, with a dichotomous characteristic, such as underweight (BMI $\leq$ 18.5 kg/m^2), overweight (BMI $\geq$ 25 kg/m^2), obesity (BMI $\geq$ 30 kg/m^2), and severe obesity (BMI $\geq$ 35 kg/m^2).

The unemployment rate was used as a proxy for macroeconomic conditions. Unemployment rate is defined as the percentage of people who sought but did not find paid employment among all people considered active[5] in the labor market. We also used another economic measure, the average household income by state, as control.[6] The two measures at the state level are estimated annually through data from the National Household Sample Survey (PNAD)[7] and made available by IPEADATA. Table S1 presents the descriptive statistics of the variables used in the study.

[2]Further details on sampling and data collection are available in the official survey report (Brasil, 2015).

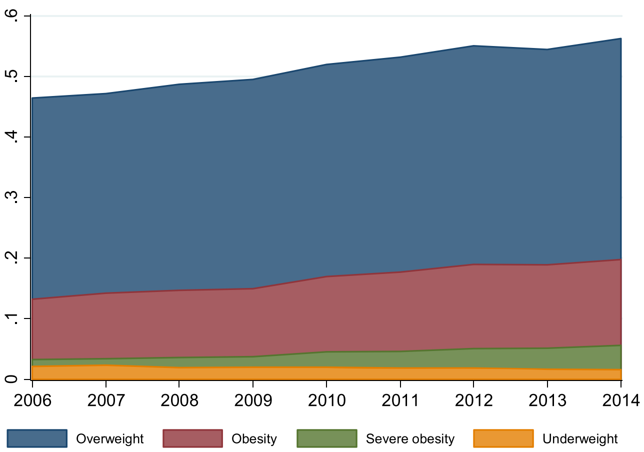
[3]Pregnant women were removed from the sample.

[4]BMI is defined as the weight in kilograms divided by the height in meters squared.

[5]Every person aged 10 or older who were looking for employment or working in the reference week of the PNAD.

[6]In real terms for the year 2014, updated according to the deflator for income of the PNAD presented by IPEADATA.

[7]The use of PNAD data to measure the unemployment rate reduces the possible bias of administrative data, which normally do not consider the informal labor market.



Source: VIGITEL AND IPEADATA. Prepared by the author.

FIGURE 1 Evolution of variables linked to body weight over the period from 2006 to 2014 [Colour figure can be viewed at wileyonlinelibrary.com]

2.2 | Empirical strategy

The main specification is presented as follows:

$$Y_{ijt} = \alpha_j + \boldsymbol{X}_{ijt}\beta + U_{jt}\gamma + \lambda_t + \alpha_j T + \varepsilon_{ijt}, \tag{1}$$

where Y_{ijt} is the dependent variable (BMI, underweight, overweight, obesity, and severe obesity) of individual i, who lives in state j, and was interviewed in year t; $\boldsymbol{X}_{ijt}$ is a vector of individual characteristics (age, skin color, gender, marital status, and education); U_{jt} is the measure of macroeconomic conditions; α_j is the state fixed-effect, which controls for the time-invariable characteristics that vary among states; λ_t represent the year fixed-effects, which control for factors that vary uniformly across states over time; $\alpha_j T$ is a vector of linear time trends specific to the state, in order to capture the factors that vary within the states throughout time; and ε_{it} is the stochastic error. The parameter γ provides the estimated effect of the variable of interest and is identified by within-state variation in unemployment rates.[8] Because of the nature of the dependent variables, the ordinary least squares (OLS) models were estimated for the continuous dependent variables and logistic regressions were used in the estimations of the dichotomous dependent variables. Sampling and poststratification weights, provided by VIGITEL,[9] were used to bring the sample in line with the adult population of each city. Robust standard errors were calculated by clusters at the state level.

3 | RESULTS

Figure 1 shows the evolution over the years of variables linked to body weight for Brazil. The percentages presented in the figure below were calculated annually from the dichotomous variables already presented. We can observe that the percentages for overweight, obesity, and severe obesity increased over the years, going from 46%, 13%, and 3% in 2006 and to 56%, 19%, and 5% in 2014, respectively. The contrary is observed for the percentage of underweight. This percentage reduced by about 24% over the period from 2006 to 2014. In Figure S1, we can see an increasing tendency in the percentage of obese persons for each of the 26 Brazilian states and the Federal District.

Table 1 presents the main results for the BMI analysis for different specifications (columns 1–4). In addition to analyzing BMI in level (row 1), we followed Böckerman et al. (2007) and Charles and DeCicca (2008) and also analyzed the BMI in logarithm (row 2). In general, the results show a statistically significant and negative relationship between macroeconomic conditions and BMI. The only exception was the BMI in logarithm in the specification that includes state fixed effects and year dummies (column 3), where we did not find a statistically significant relationship. For the more

[8]The coefficient of determination between state and national unemployment rates is less than 0.5 for 14 states and exceeds 0.9 in only two states. This indicates the existence of substantial independent macroeconomic fluctuations between states over time.

[9]The final weight attributed to each individual is calculated using the Rake method and allows statistical inference of the results for the adult population of each city (with and without a landline).

TABLE 1 Macroeconomic conditions and BMI

	(1)	(2)	(3)	(4)
BMI				
Unemployment rate	−0.05908* (0.03125)	−0.07707** (0.03449)	−0.03197* (0.01874)	−0.06827*** (0.02405)
BMI log				
Unemployment rate	−0.00224* (0.00115)	−0.00282** (0.00130)	−0.00102 (0.00065)	−0.00245** (0.00090)
State fixed-effect	No	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes
State time trends	No	No	No	Yes
Observations	274.013	274.013	274.013	274.013

Note: All specifications control for average household income by state and individual characteristics (age, age squared, years of education, years of education squared, skin color, gender, and marital status) and the coefficients are estimated by ordinary least squares (OLS). The observations were weighted by the sample weights provided by VIGITEL. Robust standard errors, clustered at the state level, are shown in parentheses.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

general specification, which controls for state fixed effects, year dummies, and state-specific linear trends (column 4), the increase of one unit in the state unemployment rate leads to a BMI reduction of approximately 0.07 (row 1—BMI in level), which represents a reduction of 0.27% in the sample mean.

The same procyclical pattern can be observed when analyzing the effect of macroeconomic conditions on the probability of being overweight, obese, and severely obese (Table 2). The results in Table 2 were estimated through a logistic regression, and the estimates presented represent the marginal effect. The increase of one percentage point in the state unemployment rate reduced the probability of being obese by 0.46 percentage points. This represents a decrease of 2.78% in the mean. Decreases of 0.38 (0.74%) and 0.11 (2.6%) are observed for overweight and severe obesity, respectively. However, the observed outcome for underweight does not suggest the existence of a statistically significant relationship.

In order to explore the movement along the BMI distribution, we estimate a ordered logistic model in which the dependent variable presents a value of 1 if the individual is underweight, 2 if the weight is normal, 3 if he is overweight, 4 if he is obese, and 5 if he has severe obesity. The results are presented in Table 3 and show the expected negative sign, indicating a decrease along the distribution. The marginal effects for each category also follow the expected signs, with positive effects for underweight and normal weight and negative for overweight, obesity, and severe obesity.

In order to analyze whether the relationship between macroeconomic conditions and weight measures differs between population groups, we estimate the baseline specification for different subsamples based on demographic and social characteristics. These results are presented in Table 4 and demonstrate that macroeconomic conditions affect the weight of both men and women but that this effect is substantially greater for the female population. Non-white individuals appear to be the most affected by economic fluctuations, presenting a significant association for four out of the six variables analyzed. As for education, the results suggest a negative association for those participants with lower education (8 years or less) for BMI and obesity variables. On the other hand, the more educated individuals (9–11 or 12 years or more of study) present a positive relationship for underweight. Observing the results by age groups, they were homogeneous for BMI, but for overweight, obesity, and severe obesity, the positive effects were concentrated in the oldest age groups (35–44 years and 45 years or older).

TABLE 2 Macroeconomic conditions and underweight, overweight, obesity, and severe obesity

	Underweight	Overweight	Obesity	Severe obesity
Unemployment rate	0.00049 (0.00077)	−0.00384* (0.00225)	−0.00458** (0.00208)	−0.00112* (0.00057)
Observations	274.013	274.013	274.013	274.013

Note: All specifications control for state-specific fixed effects, year dummies, state-specific linear trend, average household income by state, and individual characteristics (age, age squared, years of education, years of education squared, skin color, gender, and marital status). Marginal effects are estimated by logistic regression. The observations were weighted by the sample weights provided by VIGITEL. Robust standard errors, clustered at the state level, are shown in parentheses.
*$p < 0.1$.
**$p < 0.05$.

TABLE 3 Effect of macroeconomic conditions along the BMI distribution

	Ologit coefficient	Underweight	Normal	Overweight	Obesity	Severe obesity
Unemployment rate	−0.02095** (0.00849)	0.00036*** (0.00013)	0.00464** (0.00189)	−0.00221** (0.00090)	−0.00195** (0.00079)	−0.00084** (0.00033)
Observations	274.013	274.013	274.013	274.013	274.013	274.013

Note: All specifications control for state-specific fixed effects, year dummies, state-specific linear trend, average household income by state, and individual characteristics (age, age squared, years of education, years of education squared, skin color, gender, and marital status). Marginal effects are estimated by an ordered logistic regression. The observations were weighted by the sample weights provided by VIGITEL. Robust standard errors, clustered at the state level, are shown in parentheses.
**$p < 0.05$.
***$p < 0.01$.

The evidence presented so far demonstrates a procyclical relationship between macroeconomic conditions and BMI, but it is possible that this effect is the result of migratory flows. Variations in state economic conditions can strongly influence migratory flows, affecting the outcome variables in the states. Such mobility can attenuate a positive effect on a healthier lifestyle when the economy is in a worse situation, as migrants tend to be young and healthy and typically move to areas with more stable economies. However, this effect may also go in the opposite direction, recently migrated people may not be familiar with the target destination, spending a long time to establish themselves in their new places of residence, thus increasing the cost of adopting healthy behaviors (Ruhm, 2005).

To test the possibility that the migratory flow is affecting our results, we restricted the analysis initially to the 10 states that presented the lowest population growth during the period from 2006 to 2014. Given that the number of 10 states represents a still high percentage of the total number of states (37%), we restricted the sample even further by analyzing only the five states that had the lowest population growth in the period. Variations in population terms are rare in these groups of states, so no or small effects are expected if the relationship between macroeconomic conditions and BMI is a result of migratory flow. The results presented in Table S2 show that the increase of the unemployment rate reduces the BMI both in level and in logarithm, and this effect is observed for the two samples of the groups of 10 and five states with lower population growth. The procyclical variations found in these subsamples are substantially larger than those previously observed in the sample that includes all 27 federative units.

We also analyzed how the relationship between unemployment rate and BMI developed in the period of the 2008 financial crisis. Although the country did relatively well during the crisis, the highest unemployment rate for the period 2006–2014 is presented in 2009. Thus, it is interesting to analyze how this particular period (2008–2009) affects the relationship. To do so, we modified Equation 1 including a dummy for the crisis of 2008 (equal to 1 for the years 2008 and 2009) and an interaction between this variable and the unemployment rate. The results are presented in Table S3 and do not show any indication that the crisis of 2008 changed the relationship between the unemployment rate and the outcome variables, because no interaction had a statistically significant effect in the analysis.

In our results, we used a sample of people from 25 to 59 years old, as this age group would be the most affected by economic fluctuations. The hypothesis is that the economy affects obesity via fluctuations in employment, so it is expected that age groups outside prime-working age will not be affected. In order to test this hypothesis, we carried out a placebo test for the age groups of 18 to 24 years old and 60 years or older. The results are presented in Table S4 and follow what was expected—we did not observe any statistically significant results for either age groups.

As a robustness check, we tested two other business cycle indicators, namely, the employment to population ratio (EPOP) and GDP growth, for which the results are presented in Table S5. For EPOP, we observed the same procyclical behavior previously presented for BMI, BMI logarithm, overweight, and obesity, but for GDP growth, despite observing the sign of the expected correlation for most outcomes, we only found a statistically significant relationship for obesity, following the procyclical pattern.

In addition, we checked the robustness of our estimates by performing the following analyses: (i) replacing the year dummies with a linear time trend; (ii) replacing the state-specific linear trend with a region-specific linear trend; and (iii) replacing the state-specific linear trend for a state-specific quadratic trend (Table S6). We estimated several subsamples removing each year and federative unit at a time to ensure that the results are not conducted by a specific subsample (Tables S7 and S8). All these tests validate the evidence presented in Table 2—the relationship between macroeconomic conditions and BMI is procyclical for Brazil.

TABLE 4 Heterogeneous effects of macroeconomic conditions (unemployment rate) on weight measures

	BMI	BMI log	Underweight	Overweight	Obesity	Severe obesity
All (n = 274,013)	−0.06827*** (0.02405)	−0.00245** (0.00090)	0.00077 (0.00057)	−0.00384* (0.00225)	−0.00458** (0.00208)	−0.00112* (0.00057)
Men (n = 112,873)	−0.06127** (0.02899)	−0.00222** (0.00106)	0.00009 (0.00077)	−0.00495 (0.00411)	−0.00415* (0.00224)	−0.0007 (0.00076)
Women (n = 161,140)	−0.07854** (0.03320)	−0.00281** (0.00127)	0.00151** (0.00068)	−0.00321 (0.00214)	−0.00517** (0.00249)	−0.00203** (0.00089)
White (n = 112,106)	−0.04904 (0.04573)	−0.00163 (0.00171)	0.00165* (0.00097)	−0.00105 (0.00372)	−0.00277 (0.00232)	−0.00104 (0.00109)
Non-white (n = 161,907)	−0.07199** (0.02678)	−0.00263** (0.00100)	0.00029 (0.00054)	−0.00480* (0.00265)	−0.00488* (0.00274)	−0.00098 (0.00084)
8 years of education or less (n = 61,033)	−0.08579* (0.04843)	−0.00300 (0.00183)	−0.00078 (0.00091)	−0.00618 (0.00431)	−0.00666* (0.00395)	−0.00163 (0.00138)
9–11 years of education (n = 110,072)	−0.05120 (0.03397)	−0.00205 (0.00127)	0.00166* (0.00092)	−0.00202 (0.00401)	−0.00336* (0.00197)	0.00095 (0.00105)
12 or more years of education (n = 102,908)	−0.07047 (0.04620)	−0.00227 (0.00157)	0.00176* (0.00094)	−0.00235 (0.00336)	−0.00372 (0.00254)	−0.00334** (0.00142)
25–34 years old (n = 79,502)	−0.06268** (0.02517)	−0.00242** (0.00091)	0.00170* (0.00091)	−0.00351 (0.00271)	−0.00348 (0.00230)	−0.00060 (0.00094)
35–44 years old (n = 85,110)	−0.04724* (0.02605)	−0.00141 (0.00105)	0.00011 (0.00080)	−0.00063 (0.00385)	−0.00229 (0.00325)	−0.00196* (0.00109)
45 or older (n = 109,401)	−0.09091** (0.04322)	−0.00334** (0.00161)	0.00044 (0.00099)	−0.00721* (0.00437)	−0.00788*** (0.00215)	−0.00071 (0.00137)

Note: All specifications control for state-specific fixed effects, year dummies, state-specific linear trend, average household income by state, and individual characteristics (age, age squared, years of education, years of education squared, skin color, gender, and marital status). The coefficients of BMI and BMI log were estimated by ordinary least squares (OLS) and the marginal effects of the dichotomous variables (underweight, overweight, obesity, and severe obesity) were estimated by a logistic regression. The observations were weighted by the sample weights provided by VIGITEL. Robust standard errors, clustered at the state level, are shown in parentheses.

*$p < 0.1$.

**$p < 0.05$.

***$p < 0.01$.

4 | DISCUSSION

This work explored the association between macroeconomic conditions and BMI using microdata from the Brazilian population for the period from 2006 to 2014. The results show that the relationship for Brazil is robust and presents a procyclical pattern—increases in the unemployment rate reduce BMI, and this reduction is observed throughout the distribution, with statistically significant effects for measures of overweight, obesity, and severe obesity. The underweight measure did not present a statistically significant effect in the analysis for the whole sample, but in the analysis by subgroups, we found evidence that the prevalence of underweight increased, and this increase is concentrated in the female, white, and with good education group (9–11 and 12 years or older) and in the age group 25–34 years. As more than 50% of the sample is overweight and only 4% is underweight, the negative effect observed for BMI presumably results in improvements in health.

It is possible that these differences are due to the different income levels of the countries analyzed. Studies show that the relationship between socioeconomic status and overweight/obesity differs according to the country's level of development. In developed countries, the relationship would be negative—the prevalence of overweight and obesity would tend to decrease as socioeconomic status increases—and in developing countries, the relationship would be positive—the prevalence would increase as there is an increase in socioeconomic status (McLaren, 2007; Sobal & Stunkard, 1989). Studies about the theme corroborate this possibility. Goryakin and Suhrcke (2014) found a positive association between GDP logarithm and overweight in women for a sample of middle-income countries. In the same study, the authors also test work status and note that work is positively correlated with being overweight. In another study, Wittenberg (2013) noted that, for most South Africans, increases in economic resources are positively associated with increased body mass.

Some evidence in the Brazilian literature suggest that this effect may be guided by changes in dietary habits, caused by an income effect (Almeida, Mesquita, & Silva, 2016; Cardoso, 2015; Da Costa Silva, 2016; IBASE, 2008; Pereda & Alves, 2012). Pereda and Alves (2012) observed that positive changes in income lead to increases in the demand for cholesterols and lipids, especially in poorer households. Cardoso (2015) finds that increases in purchasing power result in higher BMIs, both for men and women, and that higher income increases the consumption of sugary beverages such as soft drinks and processed juices. Other studies for Brazil have observed a positive effect of income on the consumption of food outside the home and ready-made meals, whereas for healthy foods such as rice and beans consumption, the effect has the opposite direction, increases in income reduce the probability of consuming these foods (Bertasso, 2006; Schlindwein & Kassouf, 2007). Similar results are also evidenced with participants in the Bolsa Família program. The program would contribute positively to the demand for sweets and industrialized products (Da Costa Silva, 2016; IBASE, 2008). According to Almeida et al. (2016), although the program contributes to the diversification of food consumption, it does not lead to improvements in terms of food quality. This evidence in the literature suggests that the demand of Brazilians for nutrients would be sensitive to shocks in income.

The negative associations observed for BMI, overweight, obesity, and severe obesity show that in times of economic difficulty, a greater number of people manage to reach their ideal weight, that is, a worse macroeconomic condition represents an improvement in the health condition. Although this effect is important in terms of public health, one cannot rely on economic crises and instability to improve their health. The ideal scenario would be to discover the mechanism behind this relationship so that policymakers can devote their efforts efficiently so that these health gains are not undermined by economic instability.

Changes in working hours, household income, mental health, and having financial assets could help to better understand the relationship between macroeconomic conditions and BMI. Unfortunately, we do not have data to analyze these possible mediators. The study also has other limitations. Weight and height are self-reported and therefore subject to information bias. Some studies suggest that people often overestimate height and underestimate weight when reporting this information (Gorber, Tremblay, Moher, & Gorber, 2007; Shields, Gorber, & Tremblay, 2008). This possible information bias would lead to an underestimation of the prevalence of overweight, obesity, and severe obesity.

Another limitation of the study is inherent to the database used. VIGITEL restricts its sample to individuals living in state capitals and the Federal District, which limits its representativeness and keeps us from extrapolating the results to other municipalities in the country. The basis also does not make it possible to know whether individuals have migrated in recent years—local economic conditions can influence the migratory flow, thus affecting health outcomes. We tried to address this issue with the exercise presented in Table S2, but we know that it is not enough to solve it. Finally, our biggest concern is the impossibility of controlling individual fixed effects. We include in our models fixed effects of years and states and state-specific linear trends, yet it is possible that unobserved heterogeneity at the individual level is a source of bias. However, we do not have longitudinal data or a broader database to deal with possible variables omitted at the individual level.

Despite its limitations, this study provides an important contribution to the literature when analyzing the relationship between macroeconomic conditions and BMI for a developing country, which presents economic and social characteristics distinct from the other countries explored in the literature. Given the limitations, additional work must be done.

ACKNOWLEDGEMENTS

Lívia Madeira Triaca thanks the doctorate scholarship provided by CAPES (Brazilian government agency). We appreciate comments from reviewers that have been helpful for article improvements. Remaining errors are the authors' responsibility.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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How to cite this article: Triaca LM, Jacinto PA, França MTA, Tejada CAO. Does greater unemployment make people thinner in Brazil? *Health Economics*. 2020;29:1279–1288. https://doi.org/10.1002/hec.4139