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THE BIOPHYSICAL DIMENSION OF THE BRAZILIAN ECONOMY FROM 1970 TO 2008

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Abstract:

This paper analyses the evolution of the Brazilian economy from an ecological-economic perspective for the 1970-2008 period. It does this by adopting a biophysical interpretation of the growth of the Brazilian economy in terms of material consumption (natural and energy resources). The results reveal that the Brazilian economy made no major strides in terms of material use efficiency and that its metabolic rate sharply increased over the study period. Overall, the main results are: i) the biophysical dimension of the Brazilian economy generally expanded in a vertical manner; ii) up to 2005, the relationship between material consumption and GDP growth in Brazil was largely inelastic; and iii) from 2005 onwards, the relationship between material consumption and GDP growth was very elastic. Our main policy recommendation is the need for Brazil to improve its material and energy efficiency to help reduce its resource consumption.

Keywords: ecological-economic scale; material consumption; metabolic rate; efficiency; Brazil.

The impacts on the natural environment depend on how the economic system physically expands. This process is traditionally known as ‘economic growth’ and is conventionally measured by a nation’s Gross Domestic Product (GDP). As for mainstream economic theory, the main policy objective is the need to continuously stimulate GDP growth in the belief that it will increase economic welfare by expanding the consumption choices available to all individuals.

Originally developed by ecological economists, the concept of ecological-economic scale assumes that the economic system is contained within the global ecosystem, which, by definition, is materially closed. Due to this relationship, there is a biophysical limit to the growth of the economic subsystem beyond which there are real risks of disrupting critical points of ecosystem resilience. In this perspective, the main goal of socioeconomic policies must be the search for solutions that are ecologically sustainable, socially desirable, and economically efficient.

This study is aimed at estimating the biophysical dimension (ecological-economic scale) of the Brazilian economy from 1970 to 2008. To do so, we analysed the evolution of the domestic material consumption (natural and energy resources) in Brazil over this

period. The results pointed to a strong increase of the material flow in the Brazilian economy, equivalent to an overall increase of 375.8% (a rise of more than four-fold since 1970) and to an annual growth rate of 4.2%.

In terms of its composition, we found that a large part of the material flows consumed in Brazil comes from biomass (average relative contribution equals to 66.2% over the study period), which – at first glance – may convey the idea that Brazil presents some advantages in terms of ecological sustainability since the material consumption is mostly derived from renewable resources. However, this interpretation must be qualified as the results found in our study raise important questions about the possibility of the Brazilian economy follow a sustainable development path.

Firstly, we noticed that the biophysical dimension of the Brazilian economy presents a dynamics of expansion that is typically vertical, in which increments in the per capita use of materials are crucial. Whilst in 1970 material consumption was approximately 6.4 tons per capita, in 2008 the metabolic rate of the Brazilian economy increased to 15.4 tons per inhabitant, which amounts to rise of 137.9% (increase rate of 2.3% per annum). This is a welcome result in a country that presents a large number of its population under poverty, but we argue this indicator must be carefully monitored.

Secondly, the results show a recent increasing trend in the material and energy intensity of the Brazilian economy. This result distinguishes the Brazilian trajectory from major developed economies, which have increased material and energy efficiency. The econometric estimates undertaken show that the material consumption in Brazil until 2005 presented an inelastic behaviour relative to GDP growth. From 2005 onwards, this pattern is reversed, and the material consumption displays an elastic behaviour relative to GDP growth, which corroborates the conclusions about the loss of efficiency of the Brazilian economy in terms of material consumption.

The results from this study should be analysed in light of the current development phase in Brazil. It is worth mentioning that the significant increase of the metabolic rate was higher than the increase of the material intensity rate, which indicates the adoption of more eco-efficient technologies, although it was not sufficiently strong to prevent a general reduction of the material and energy efficiency of the Brazilian economy due to the higher elasticity of the demand for materials after 2005. This fact should be considered as positive from the socioeconomic point of view, as the GDP growth in Brazil was coupled with *redistribution of income* (mainly in the 2000s), something unprecedented in the Brazilian economic history.

In addition to the static income redistribution through social programs centered on the Brazilian *Bolsa Família* program, in the past few years one can notice a dynamic redistribution of income process in Brazil due to the increase of employment, in particular formal labour, within a period of strong reduction of the birth rate (low population growth). Millions of families rose to the initial level of middle class, which led to a sharp increase in the consumption of durable goods long repressed by income concentration and general social inequalities.

From the ecological economics point of view, it is possible to state there was a greater justice regarding distribution in the access of the population to natural resources, which, admittedly was translated into a larger ecological-economic scale, which is (still) justifiable. If this process continues, a relative diminution in the pressure on the demand for natural resources could be obtained by a more advanced technological composition of new investments to be made. An environmental macroeconomic policy should be articulated to create an adequate structure to increase the eco-efficiency of the production system. If Brazil is to avoid an uneconomic growth pattern, it is paramount to make strides on the efficiency in which natural resources generate income in order to abate the environmental costs of GDP growth.