

Public Expenditure and GHG emissions in Brazil: A Structural Decomposition Analysis for the 2000-2019 period

Topic: Input-Output Modelling: Sustainable Production and Consumption Policies - II

Author: Marcio Alvarenga Junior

Co-Authors: Huascar Javier Eguino, Lucas de Almeida Nogueira da Costa, Patieene Alves Passoni

Introduction

In the last two decades, primary public spending amounted, on average, to 30.6% of the Brazilian GDP. However, there is a great variation in the period not only in the scale of the public expenditure, but also in its composition. At least two major events resulted in important composition changes: (i) the Growth Acceleration Program, which resulted in the expansion of public investment after 2007, and (ii) the fiscal adjustment and the fiscal ceiling in the second half of the 2010s, which resulted in a sharp contraction of the discretionary expenditures.

To date, several studies have focused on the analysis of Brazilian public spending, seeking to answer a wide range of questions. The most frequent ones refer to the impact of public spending on economic cycles, public debt, inflation, and income distribution.

In a context of environmental crises, the analysis of Brazilian public spending has been gaining new contours. Several studies have been focusing on measuring and evaluating the quality of environmentally related public spending, especially those related to climate.

Nevertheless, the impact of public spending on greenhouse gas emissions is largely ignored in this debate given the methodological difficulties to estimate the emissions from public expenditure. Still knowing the public spending emission profile allows policy makers to design policies to guide public investment and procurement to sectors, goods, services, and technologies with lower emission intensities. It is important to highlight that greening public expenditure may result not only in the decarbonization of final goods and services, but also in important emission reduction throughout the entire production chain.

Research Questions:

Given the knowledge gap in this field, this paper aims at addressing the following research questions:

- (i) How much GHG emissions have been generated by the Brazilian public expenditure from 2000 to 2019?
- (ii) What is the pattern of GHG emissions (intensity, sectoral composition, etc.) from public expenditure in Brazil?
- (iii) What are the main drivers of changes in GHG emissions derived from the Brazilian public expenditure?
- (iv) Which policies can contribute to decarbonize the Brazilian public expenditure?

Objectives:

This paper aims at estimating GHG emissions from the Brazilian public expenditure between 2000 and 2019, identifying the elements behind their growth, and from there, recommending policies capable of decarbonizing public investment and consumption.

Data and methods:

The emissions by Brazilian public expenditure can be obtained from the multiplication of the vector of sectoral GHG emissions intensity (total emissions per unit of gross output), by the Leontief inverse matrix and the matrix of public expenditure, which includes government consumption and public investments.

The definition above represents an environmental extension of the canonical input-output model. The extended model presented here behaves in the same way and operates under the same hypotheses as the original model. However, data availability is a great challenge to carry out analysis like this, as the analysis proposed in this article requires:

- (i) Annual Input-Output tables (IOT).
- (ii) A vector of emission intensity per industry.
- (iii) A vector of public investment per industry.

Given the lack of official data on the topics mentioned above, this article integrates three estimated databases: the satellite accounts for GHG emissions, elaborated by Alvarenga, Costa and Young (2022), the IOT time series at constant prices, developed by Passoni and Freitas (2022), and the investment absorption matrices, developed by Miguez and Freitas (2021). The latter database allows us to estimate the public sector demand for the capital goods produced by each industry.

Furthermore, given the changes in the economic cycle, public investment trajectory, and productive structure over the last two decades, we decompose the public expenditure GHG emissions into:

- (i) Scale effect: emissions changes due to a variation in the level of the public expenditure.
- (ii) Composition effect: emissions changes due to a variation in the share of public investment and government consumption.
- (iii) Product mix effect: emission changes due to de sectoral distribution of the government expenditure.
- (iv) Technological effect: emission changes due to changes in total technical coefficients.
- (v) Trade pattern effect: emission changes due to changes in the proportion of imported inputs used in the production of public expenditure.
- (vi) Emission intensity effect: emissions changes due to changes in the sectoral emission per unit of gross output.

Novelty of the research:

To the authors' knowledge, this article is the first to measure and decomposing emissions derived from public spending. It is believed that the methodology proposed here can guide the estimation of emissions in other countries.