ASSESSING THE IMPACT OF REGION AND INCOME ON ELECTRICITY DEMAND ELASTICITIES IN BRAZIL

José Ronaldo de C. Souza Júnior, FGV Direito Rio, +55 21 97170-6701, jose.souza.junior@fgv.br

Cristiano da Costa da Silva, PIMES Economia, +55 81 9339-3838, cristiano.ccs@ufpe.br

Tarsylla da S. de G. Oliveira, UERJ Economia, +55 11 99447-0905, oliveira.tarsylla@posgraduacao.uerj.br

Pedro Garcia, UFF Economia, +55 21 99570-0332, pedromendes127@gmail.com

# Overview

Brazil's electric energy sector is distinguished by its diverse energy matrix, with a significant emphasis on renewable sources, and a sophisticated regulatory environment designed to maintain stability and efficiency across the country. This sector is a cornerstone of Brazil's economic infrastructure, underpinning various industries and enhancing the nation's competitiveness on the global stage. Despite its strengths, the sector navigates challenges such as integrating renewable energy sources into the grid, managing regional disparities in energy consumption, and ensuring the sustainability of energy production. These issues are critical for optimizing corporate strategies and investment decisions. Understanding consumer demand elasticity in this context sheds light on market dynamics and operational intricacies in a country characterized by its regional economic and climatic diversity.

The assessment of demand elasticity among various consumer types in response to price variations of goods and services is a crucial tool for anticipating the potential impacts of changes in tax policy and pricing strategies implemented by corporations. This analysis is particularly pertinent in the residential energy sector for two primary reasons: (i) the significance of energy provision on regional economic growth and development patterns; and (ii) the variance in residential energy demand responses based on income levels and regional demographic structures (Fouquet, 2014).

A study relevant to the Brazilian context, Uhr et al. (2019) conducted an empirical analysis of energy demand within the São Paulo metropolitan area. The authors highlighted significant variations in consumer responsiveness to price and income changes in the context of residential energy consumption. Importantly, their findings indicated that price elevation policies tend to exert regressive effects on energy consumption patterns. This observation underscores the complexity of designing energy pricing strategies that align with equitable consumption outcomes.

However, Brazil is distinguished by significant regional disparities, both in terms of productive structure/capacity and climatic conditions, showcasing regions at diverse stages of socioeconomic development, each facing various climate-imposed limitations. Such heterogeneity underpins the hypothesis that energy demand sensitivity to price and income alterations may not solely vary in line with income distribution but also due to locational specifics.

Therefore, this study endeavors to explore the elasticity of residential energy demand in Brazil, taking into account price and income variations, with a special emphasis on regional differences. The objective is to ascertain how these fluctuations affect energy consumption across different Brazilian regions.

**Methods**

The database will be developed from the microdata of the Pesquisa de Orçamentos Familiares (POF, or Household Budget Survey) for the years 2017-2018, made by the Brazilian Istitute of Geography and Statistics (IBGE). The survey’s unit of investigation is the household and is conducted through probabilistic sampling, and contains information about the household’s electricity consuption, family income, and property details. The survey’s structure allows for disaggregated results at the level of the nine metropolitan region in urban areas. In this research, we will adopt the most recent availability data from years 2017 and 2018. In order to analyse the impact in different regions and levels of income, the research will be disaggregated from five macro regions of Brasil (North, Northeast, South, Southeast and Midwest) and also from five income quintiles.

To estimate the impact of changes in income on energy consumption, the Engel curve methodology will be utilized. Originally developed for analyzing household expenditure patterns, the Engel curve is adaptable for estimating the influence of income variations on energy consumption. The Engel equation employed in this analysis is based on the approach proposed by Banks et al. (1997). Moreover, to explore the impacts on consumption, this study will incorporate a partial equilibrium approach similar to that utilized by Uhr et al. (2019).

# Results

This study is poised to dissect the intricate relationship between price, income, and regional variances as they influence residential energy demand in Brazil. By harnessing POF 2017-2018 data, Engel curves, and partial equilibrium models, we anticipate delineating the diverse reactions of consumer groups to economic changes. The objective is to provide an in-depth analysis of demand elasticity within Brazil's residential energy sector, offering insights that are crucial for accurately forecasting energy demand. Our findings aim to shed light on the nuanced ways in which demographic and regional distinctions shape consumption patterns.

**Conclusions**

This research is dedicated to unraveling the effects of income variations on energy consumption within Brazil's diverse macroregions, highlighting the unique aspects of each area. Our detailed analysis aims to first delineate specific regional consumption patterns, providing a clearer understanding of how uniform changes in the energy sector could impact different areas. Secondly, by examining the demographic profiles of families and their influence on energy demand in each region, we seek to uncover how the scale of demand varies across the country. The anticipated findings are expected to deepen our comprehension of the energy sector's dynamics, focusing on the interplay between consumer behavior, demographic factors, and energy demand across various regions. This approach aims to enhance the accuracy of forecasting future changes in energy demand, thereby offering a nuanced examination of the sector's complexities.

# References

Banks, James, Richard Blundell, and Arthur Lewbel. Quadratic Engel curves and consumer demand. *Review of Economics and statistics* 79.4 (1997): 527-539.

Fouquet, R. (2014). Long run demand for energy services: the role of economic and technological development. *Journal of Economic History*, 74(3), 842-868.

Uhr, Daniel de Abreu Pereira, André Luis Squarize Chagas, and Júlia Gallego Ziero Uhr. Estimation of elasticities for electricity demand in Brazilian households and policy implications. *Energy policy* 129 (2019): 69-79.