DATA SUPPLEMENT

Why Did Brazil Deindustrialize So Much?
Testing The Dutch Disease And Premature Deindustrialization Hypotheses

May 3, 2025

Abstract

The purpose of this file is to assist in the reproducibility of the paper *Why Did Brazil Deindustrialize So Much? Testing The Dutch Disease And Premature Deindustrialization Hypotheses* by Edmar L. Bacha, Victor S. Terziani, Claudio M. Considera, and Eduardo A. Guimarães. This file includes data sources, detailed explanations of procedures, methodology descriptions, and instructions on how to replicate the study. Additionally, 11 Excel files, 5 R files and 1 csv file are necessary companions to this ReadMe file for reproducing the paper's results.

CONTENTS

1 Data

This section provides a comprehensive guide on how to obtain and process the data in the paper, ensuring it is ready to reproduce the tables and figures.

The *data.xlsx* file contains all the final products described in the following sections, except for the productivity data.

This file has two sheets:

- The first is designed for use with statistical software.
- The second is intended for use by Excel users.

1.1 Brazilian Industrialization Rate and Relative Prices of Manufacturing

The Brazilian Industrialization Rate is measured by the ratio of manufacturing value added to the country's GDP. This ratio is presented in both constant prices and current prices.

Quarterly data for manufacturing value added and GDP are sourced from the file *Tab_Comp_CNT_1T24.xls*, which can be downloaded from IBGE's *Sistema de Contas Nacionais Trimestrais*[1] under the zipped folder *Tabelas_Completas*.[2] In the file *Tab_Comp_CNT_1T24.xls*, the sheet *Valores Correntes* provides current price data for manufacturing value added in column D and GDP in column R. The sheet *Valores Encadeados a Preços de 95* presents the same data in the same columns, but in constant prices of 1995.

Since the data is available only from 1996 onwards, we estimate the data for 1995 using information from FGV-IBRE found in the sheet *Série Encadeada Trimestral* of the file *fgv_ibre_data.xlsx*. We use the quarterly index of the value added of manufacturing volume and the GDP volume.

The file *industrialization_rate.xlsx* performs all the necessary calculations to derive the final industrialization rate series. In this file, the sheet *FGV IBRE Data* calculates

[1] Brazilian expression for "Quarterly National Accounts System"

[2] Link to Tabelas_Completas, as of 03/07/2024: https://www.ibge.gov.br/estatisticas/economicas/industria/9300-contas-nacionais-trimestrais.html?=&t=downloads

manufacturing value added and GDP in constant prices by extending IBGE's series backward using FGV IBRE's volume index series. The sheet *IBGE Data* merges IBGE's data with the newly generated data and converts the series from constant prices of 1995 to constant prices of 2005. Finally, the sheet *Industrialization Rate* calculates the industrialization rates for both current and constant prices and determines the relative prices by taking the ratios of the current prices series to the constant prices series.

1.2 Real Exchange Rate

The file *rer_bcb.xlsx* contains the raw data for the Real/USD exchange rate, sourced from the Central Bank of Brazil (BCB) website. The file also performs the necessary transformations: it uses the BCB index monthly values to calculate the quarterly average and, finally, changes the base of the quarterly series to 2005 (year average = 100).

The file *reer_bcb.xlsx* contains the raw data for the Real/USD exchange rate, sourced from the Central Bank of Brazil (BCB) website. The file also performs the necessary transformations: it uses the BCB index monthly values to calculate the quarterly average and, finally, changes the base of the quarterly series to 2005 (year average = 100).

1.3 Terms of Trade

The file *tot.xlsx* contains the raw data for Brazil's Terms of Trade, sourced from Funcex. The file also performs the necessary transformations: it uses the Funcex monthly index values to calculate the quarterly average and, finally, changes the base of the quarterly series to 2005 (year average = 100).

1.4 Real Broad Dollar Index

The file *dollar_index_fed.xlsx* contains the raw data for two monthly Real Broad Dollar Index time series, referred to as the Old Series and the New Series. Both series were sourced from the U.S. Fed. The file converts the monthly data to quarterly averages by calculating the mean of the monthly observations. It then calculates the average difference between the two series for the four quarters of 2006. Finally, it merges the series by using the New Series from 2006 onwards and subtracting the average difference from the Old Series to extend it backward. The series base is changed by dividing the

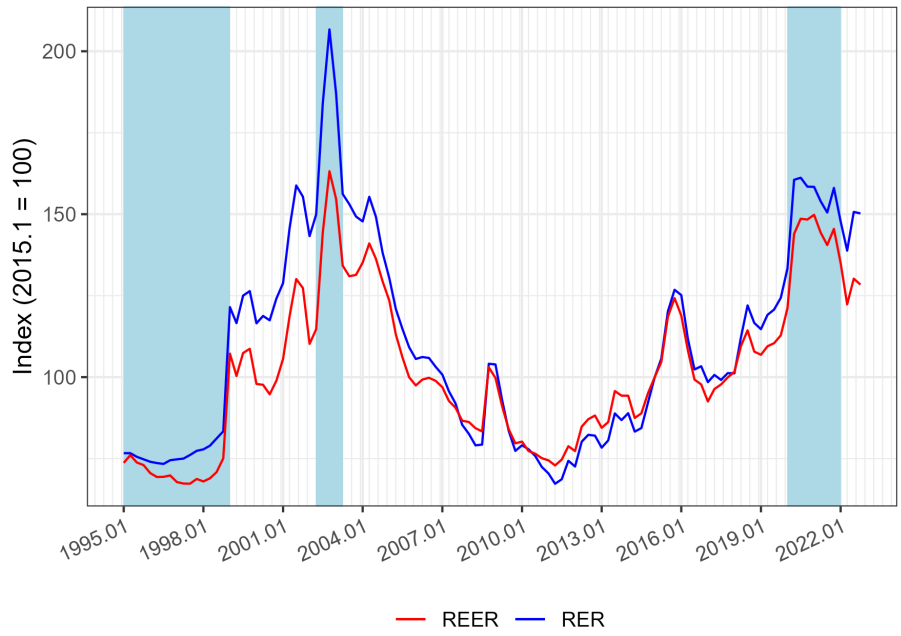
series by its average 2005 value.

1.5 Dummy Variables

Binary variables are determined by historical facts and events. However, the precise timing of when they are set to 1 or 0 is based on the behavior of the Real Exchange Rate. In Figure 1, below, we highlight the timing of the binary variables and illustrate how the level of the Real Exchange Rate changes during these periods. The Real Effective Exchange Rate is also included for comparison. The timings are:

- Managed: 1995Q1 - 1998Q4
- Fear of Lula: 2002Q3 - 2003Q1
- COVID: 2020Q2 - 2021Q4

Figure 1: Exchange Rates and binary variables



1.6 GDP per capita

GDP per capita is computed in the script *gdp_per_capita.R* by dividing Brazilian GDP (in constant 2005 prices) by the corresponding population.

The GDP series is obtained from *industrialization_rate.xlsx*, while population figures are sourced from two files: *ipeadata_population_monthly.csv* (monthly data, 2012–2022) and *ipeadata_population_yearly.xlsx* (annual data, 1994–2022).

The script first reads both population datasets and then applies a cubic spline interpolation function to generate monthly observations for the period 1994–2012. Finally, it calculates the ratio of GDP to population and saves the result in *GDPpc.xlsx*.

2 Tables

2.1 Table 1: Regression Results & Table B1: REER Regression

Table 1 contains all the estimated regressions presented in the paper. The code to generate Table 1 is contained in the file *regression_and_tests.R*. This code performs the following steps:

- Estimates the first stage using the standard *lm* R function.
- Estimates the second and third regressions using the *iv_robust* function, as the standard *lm* function does not properly estimates the standard errors for an IV second stage regression.

The file also sources code from *helper_functions.R* to assist in producing better tables.

Table B1, which uses the Real Effective Exchange Rate for regressions, is generated with code similar to that of Table 1. This code is also found in the file *regression_and_tests.R*.

2.2 Table 2:

The first part of Table 2 reports each coefficient's elasticity evaluated at the sample means. The first column is computed as

$$\epsilon = \frac{\partial \, \mathrm{RER}}{\partial X} \times \frac{\overline{X}}{\overline{\mathrm{RER}}},$$

where $\overline{X}$ is the sample mean of X and $\partial \,\mathrm{RER}/\partial X$ is the marginal effect recovered from the first-stage regression coefficients.

The second part of Table (2) uses the second-stage coefficients from Table (1). In the first column, the RER coefficient is scaled by ten to reflect the effect of a ten-percentage-point depreciation, the GDP effect combines the linear term with twice the quadratic term evaluated at the 2022 mean GDP per capita to capture the marginal impact of raising GDP from its 2022 level, and the time-trend coefficient is multiplied by four to represent a one-year shift. The second column then rescales these values by the factor $(1 - \phi_1 - \phi_2)^{-1}$, where ϕ_k denotes the k-th lag of the industrialization rate.

2.3 Table A.1: Ljung-Box Tests

Table A.1 presents the Ljung–Box test results in the appendix. These are generated by the script *regression_and_tests.R*, which applies the *Box.test* function from the *stats* package. The script also sources *helper_functions.R* to assist in producing better tables.

2.4 Table A.2: Engle-Granger Tests

Table A.2 contains all the estimated Engle-Granger tests presented in the appendix. The code to generate Table A.2 is contained in the file *regression_and_tests.R*. The code performs the Engle-Granger tests by using the *ur.df* function from the *urca* package, which conducts an Augmented Dickey-Fuller test on the residuals of all regressions. The script also sources *helper_functions.R* to assist in producing better tables.

3 Figures

3.1 Figures 1 through 8

Code for figures 1 through 6 and figure B1 are contained in file *figures.R*. It uses the *ggplot2* R package to make plots of the desired variables.

Code for figure 7 is contained in file *regression_and_tests.R*. It uses the *calc.relimp* function from the *relaimpo* R package to estimate the Relative Importance of each regressor.

For Figures 5 and 6, the GDP per capita that maximizes the Industrialization Rate is obtained by solving the first-order condition

$$\beta_{\text{GDP}} + 2\,\beta_{\text{GDP}^2}\,\text{GDP} = 0 \quad \Longrightarrow \quad \text{GDP} = -\frac{\beta_{\text{GDP}}}{2\,\beta_{\text{GDP}^2}}$$

where β_{GDP} and β_{GDP^2} come from the second column of Table 1.

This result is expressed as an index with a value of 100 at the 2005 GDP per capita. The file *maddison_project.xlsx* performs the necessary calculations to approximate the GDP per capita that maximizes the Industrialization Rate in constant 1990 US dollars, using data from the Maddison Project[3].

3.2 Figures A.1 through A.4

Code for figures A.1 and A.2 are contained in file *regression_and_tests.R*. It uses *ggAcf* and *ggPacf* functions from the *forecast* package to make Autocorrelation Function and Parcial Autocorrelation Function plots for the second stage regressions.

[3]For more details, visit https://www.rug.nl/ggdc/historicaldevelopment/maddison/releases/maddison-project-database-2013

4 Files

This section enlists all files contained in the Data Supplement that are essential for the paper's reproducibility.

data.xlsx

dollar_index_fed.xlsx

fgv_ibre_data.xlsx

figures.R

gdp_per_capita.R

GDPpc.xlsx

helper_functions.R

industrialization_rate.xlsx

ipeadata_population_monthly.csv

ipeadata_population_yearly.xlsx

maddison_project.xlsx

reer_bcb.xlsx

regression_and_tests.R

rer_bcb.xlsx

Tab_Comp_CNT_1T24.xls

tot.xls