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Appendix

# Online appendix of econometric results and statistical procedures: "Growth and stagnation in a dual economy: The case of Brazil"

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## Presentation of variables, data source, codes and time period

Given the nature of the export led-growth model, the variables of the theoretical model represent the growth rate: $g_t, x_t, a_t, p_t, p_t^*, e_t, z_t, w_t, r_t, ra_{jt}, \hat{\tau}_{jt}$, as shown in the table below. These variables and their respective codes are taken from the Penn World Table, version 10.0, which is available at: https://www.rug.nl/ggdc/productivity/pwt/?lang=en

Table A1 – *Export Led Growth model variables*

| Variables | Differential of the natural logarithm ($\Delta ln$) | Codes | Time Period |
|---|---|---|---|
| $g_t$ | Real GDP at constant 2017 national prices (in mil. 2017US$) | rgdpna | 1950-2019 |
| $x_t$ | share of exports at current PPPs/Real GDP at constant 2017 national prices (in mil. 2017US$) | csh_x* rgdpna | 1950-2019 |
| $a_t$ | Real domestic absorption, (real consumption plus investment), at current PPPs (in mil. 2017US$) | cda | 1950-2019 |
| $p_t$ | Price level of Brazilian exports (price level of USA GDPo in 2017=1) for domestic price | pl_x Brazil | 1950-2019 |
| $p_t^*$ | Price level of US exports (price level of USA GDPo in 2017=1) for external price | pl_x USA | 1950-2019 |
| $e_t$ | Exchange rate, national currency/USD (market+estimated) | xr | 1950-2019 |
| $z_t$ | Real GDP for US at constant 2017 national prices (in mil. 2017US$) + Real GDP for China at constant 2017 national prices (in mil. 2017US$) | rgdpna USA + rgdpna China | 1950-2019 |

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| | | | |
|---|---|---|---|
| $w_t$ | Share of labour compensation in GDP at current national prices/Real GDP at constant 2017 national prices (in mil. 2017US$) | labsh* rgdpna | 1950-2019 |
| $r_t$ | Ratio between Real GDP at constant 2017 national prices (in mil. 2017US$) and the number of persons engaged (in millions) multiplied by the average annual hours worked by persons engaged | rgdpna/ emp*avh | 1950-2019 |
| $ra_{jt}$ | Constant in the productivity equation assuming that $g_t = 0$ | constant | 1950-2019 |
| $\hat{t}_{jt}$ | Constant at the price equation assuming that $r_t = 0$ and $w_t = 0$ | constant | 1950-2019 |

## Unit root test with structural break and order of integration

The proxies of the estimated model are measured in growth rate, so they are stationary. According to the unit root test with structural break, all variables are integrated of order I(1).

Table A2 – *Unit root with break, augmented Dickey-Fuller test and order of integration I(d)*

| ***Trend specification*** | ***Intercept only*** | | ***Intercept and trend*** | | ***Intercept and trend*** | | |
|---|---|---|---|---|---|---|---|
| ***Break specification*** | ***Intercept only*** | | ***Intercept only*** | | ***Intercept and trend*** | | **I(d)** |
| **Variables** | ***Level*** | ***1ª dif*** | ***Level*** | ***1ª dif*** | ***Level*** | ***1ª dif*** | |
| rgdpna | 0.927 | –9.19*** | –3.81 | –6.86*** | –3.31 | –7.44*** | I(1) |
| csh_x*rgdpna | –2.71 | –8.28*** | –5.22** | –8.66*** | –4.38 | –8.68 | I(1) |
| cda | –1.96 | –5.95*** | –4.73 | –6.27*** | 5.94*** | 7.00*** | I(1) |
| pl_x Brazil | –2.52 | –12.2*** | –3.72 | –12.3*** | –3.31 | –12.44 | I(1) |
| pl_x USA | –2.42 | –6.84*** | –3.19 | –7.37*** | –3.24 | –7.28*** | I(1) |
| Xr | –3.78 | –6.72*** | –4.31 | –6.80*** | –5.29** | –7.79*** | I(1) |
| rgdpna USA+ rgdpna China | 2.50 | –5.50*** | –0.93 | –6.57*** | –3.16 | –6.83*** | I(1) |
| labsh*rgdpna | –1.36 | –6.09*** | –4.38 | –6.08*** | –4.35 | –5.97*** | I(1) |
| rgdpna/emp*avh | –2.54 | –8.42*** | –3.12 | –8.84*** | –4.00 | –8.86*** | I(1) |

## Breakpoint specification of model equations

The number of structural breaks in the growth rate models varied between 4 and 5 breakpoints, only the productivity equation did not show breaks globally and sequentially, according to the Bai-Perron tests. These tests were used according to criteria that best fit AIC and SIC.

Table A3 – *Breakpoint Specification*

| Equations | Breaks | Break Year |
|---|---|---|
| $g_t = \bar{\delta}_{1j} x_t + \bar{\delta}_{2j} a_t + \epsilon_t$ | 5 | 1961; 1971; 1981; 1991; 2010 |
| $x_t = \bar{\delta}_{3j} p_t + \bar{\delta}_{4j} p^*_t + \bar{\delta}_{5j} e_t + \bar{\delta}_{6j} z_t + \varepsilon_t$ | 4 | 1963; 1982; 1997; 2007 |
| $p_t = \bar{\delta}_{7j} w_t + \bar{\delta}_{8j} r_t + \hat{\tau}_{jt} + \xi_t$ | 5 | 1962; 1972; 1983; 1993; 2003 |
| $r_t = ra_{jt} + \bar{\delta}_{9j} g_t + u_t$ | 0 | |

*Note*: Bai-Perron tests of 1 to M globally and Bai-Perron tests of L+1 vs L sequentially determined breaks.

## Graphs of equation estimates and model stability

Figure 1 of the estimation residuals shows the estimate (fitted) and the observed (current) values of each of the equations of model. All equations were estimated using Last Squares with Breakpoints and exhibited excellent fit, compared to the Last Squares estimator of linear parameters. The Last Squares with Breakpoints estimator estimates the regression by parts separated by Breakpoints. For this reason, there are no structural breaks in the regression residue. The one-step forecast recursive test of figure 2 shows the residual (blue line) with a gap within the confidence interval (dotted line). This shows that the estimates are stable, i.e. they are not vulnerable to exogenous shocks to the estimated relationship. Only the price equation exhibited a tighter confidence interval. However, the productivity equation did not identify significant Breakpoints, according to Bai-Perron tests globally and sequentially.