

## Introduction

Discussions on **food production**, **population growth** and **food security** have been increasingly present in the literature and it has been part of the global political agenda.

Many policies in the world have taken in account these issues to confront the food insecurity. Despite all the efforts, there still is a **crisis in the global food system** with thousands of hungry people around the world.

Given this context of food insecurity and some actions to radiate the hunger, it has been possible to find some discussion around the impact of **international trade** and **productivity increase** in the literature. Furthermore, Brazil has been pointed as an important economy in terms of **food supplier**.

## Aim

Analyze how an agricultural productivity increase in Brazil & potential trade liberalization agreements between Brazil and UE & Brazil and USA affect the Brazilian economy and the rest of the World.

## Database & Methodology

### Computable General Equilibrium Model:

- Global Trade Analysis Project (GTAP) database – GTAP.9:
- Our CGE model aggregation: **57 sectors**; **8 regions**: 1-Brazil (BRA); 2-China (CHN); 3-Russia (RUS); 4-India (IND); 5-South Africa (ZAF); 6-United States of America (USA); 7-European Union (EU); and 8-rest of the World (ROW).

## Scenarios

### We consider **two** scenarios:

- an increase in agricultural productivity in Brazil (5%) with an elimination of tariffs and export subsidies on trade with USA by Brazil and vice versa.
- an increase in agricultural productivity in Brazil (5%) with an elimination of tariffs and export subsidies on trade with European Union by Brazil and vice versa.

## Results

Welfare Effects of Trade Liberalization & Productivity Increase by Region and by Policy, \$U.S. Millions

| EV  | Total    | BRA Agr. Policy Reform (I) | BRA Agr. Policy Reform (II) | BRA Agr. Policy Reform (III) | BRA NonAgr. Policy Reform | USA Agr. Policy Reform (I) | USA Agr. Policy Reform (II) | USA Agr. Policy Reform (III) | USA NonAgr. Policy Reform | BRA Agr. Productivity (I) | BRA Agr. Productivity (II) |
|-----|----------|----------------------------|-----------------------------|------------------------------|---------------------------|----------------------------|-----------------------------|------------------------------|---------------------------|---------------------------|----------------------------|
| BRA | 26049.36 | -9.05                      | -0.44                       | -22.03                       | -220.41                   | 77.42                      | 0.48                        | 171.95                       | 576.96                    | 14031.15                  | 11443.32                   |
| CHN | -744.58  | -2.44                      | -0.12                       | -1.37                        | -1197.7                   | -13.57                     | -0.11                       | -26.29                       | -139.54                   | 1177.14                   | -540.58                    |
| RUS | 530.37   | 0.11                       | 0.06                        | 0.63                         | -28.84                    | 0.89                       | 0                           | -1.87                        | -3.6                      | 328.71                    | 234.28                     |
| IND | -525.59  | -0.28                      | -0.04                       | -2.54                        | -206.05                   | -1.37                      | -0.01                       | -0.49                        | -19.66                    | -208.2                    | -86.94                     |
| ZAF | 19.47    | -0.01                      | 0                           | -0.49                        | -29.74                    | -0.3                       | 0                           | -0.33                        | -1.51                     | 42.07                     | 9.78                       |
| USA | 4764.79  | 22.88                      | 1.11                        | 155.61                       | 5950.13                   | -16.29                     | -0.16                       | -40.71                       | -95.96                    | -806.86                   | -404.96                    |
| EU  | -850.54  | -0.1                       | -0.14                       | -22.71                       | -1519.93                  | -13.24                     | -0.08                       | -18.82                       | -116.88                   | 870.88                    | -29.53                     |
| ROW | -1993.57 | -13.74                     | -0.29                       | -53.09                       | -2630.89                  | -26.34                     | -0.12                       | -70.08                       | -187.76                   | 1320.34                   | -331.59                    |

Note: Welfare is an equivalent variation measure.

Source: Author's calculation.

## Results (cont.)

Effects of Trade Liberalization & Productivity Increase on Output, % change

| qo | BRA   | CHN   | RUS   | IND   | ZAF   | USA   | EU    | ROW   |
|----|-------|-------|-------|-------|-------|-------|-------|-------|
| pd | 2.96  | 0.02  | -0.3  | -0.07 | -4.33 | -0.82 | -1.72 | 0.02  |
| wh | 30.82 | 0     | -0.59 | -0.02 | -0.82 | -0.31 | -0.35 | -0.5  |
| gr | 2.01  | 0.04  | -0.19 | -0.06 | -0.54 | -0.21 | -0.27 | -0.21 |
| vf | 6.43  | 0.02  | 0     | 0.02  | -0.38 | 0.02  | -0.16 | 0.01  |
| os | 11.79 | -1.51 | -1.14 | -0.33 | -0.97 | -3.63 | -2.34 | -1.36 |
| cb | 2.68  | -0.69 | -0.45 | -0.3  | -0.25 | -0.89 | -0.74 | -1.09 |
| pf | 10.31 | -0.33 | -0.41 | -0.23 | -1.69 | -1.03 | -0.79 | -0.67 |
| oc | 13.11 | -2.74 | -1.65 | -0.36 | -4.41 | -2.18 | -2.62 | -1.56 |
| ct | 5.78  | 0.06  | -0.33 | -0.16 | -0.04 | -0.16 | -0.34 | -0.24 |
| oa | 4.42  | 0     | -0.11 | 0.03  | -0.31 | -0.23 | -0.15 | -0.05 |
| rm | 3.3   | 0.04  | 0.05  | 0.04  | -0.01 | 0.1   | 0.03  | 0.04  |
| wl | 5.97  | 0.1   | -0.15 | 0.03  | -0.77 | 0.02  | -1.16 | -0.12 |
| fr | -0.27 | 0.04  | -0.01 | 0.02  | -0.01 | -0.13 | -0.02 | 0     |
| fs | 6.51  | 0.02  | 0.01  | -0.02 | -0.04 | -0.05 | -0.01 | 0.01  |

Source: Author's calculation.

Welfare Effects of Trade Liberalization & Productivity Increase by Region and by Policy, \$U.S. Millions

| EV  | Total    | BRA Agr. Policy Reform (I) | BRA Agr. Policy Reform (II) | BRA Agr. Policy Reform (III) | BRA NonAgr. Policy Reform | EU Agr. Policy Reform (I) | EU Agr. Policy Reform (II) | EU Agr. Policy Reform (III) | EU NonAgr. Policy Reform | BRA Agr. Productivity (I) | BRA Agr. Productivity (II) |
|-----|----------|----------------------------|-----------------------------|------------------------------|---------------------------|---------------------------|----------------------------|-----------------------------|--------------------------|---------------------------|----------------------------|
| BRA | 36935.91 | -1.48                      | -0.77                       | -74.42                       | 133.57                    | 233.66                    | 2.89                       | 10308.61                    | 338.41                   | 14050.59                  | 11940.42                   |
| CHN | -2791.85 | 0.65                       | 0.12                        | 26.87                        | -1112.72                  | -50.59                    | -0.65                      | -2055.84                    | -70.81                   | 1119.45                   | -648.32                    |
| RUS | 431.68   | -0.23                      | 0                           | -4.84                        | -336.49                   | 4.66                      | 0.11                       | 209.04                      | 3.1                      | 321.79                    | 232.79                     |
| IND | -543.95  | -0.21                      | -0.02                       | 0.43                         | -153.08                   | -4.94                     | -0.03                      | -71.44                      | -7.72                    | -214.31                   | -93.02                     |
| ZAF | -4.97    | 0.06                       | 0.01                        | -0.33                        | -45.96                    | -1.76                     | -0.02                      | -5.31                       | -1.05                    | 40.56                     | 8.9                        |
| USA | -3110.69 | -0.26                      | -0.51                       | -19.74                       | -1465.97                  | -14.19                    | -0.19                      | -204.51                     | -17.28                   | -904.16                   | -486.91                    |
| EU  | 8141.95  | 7.89                       | 1.67                        | 203.53                       | 7545.58                   | -79.95                    | -1.31                      | -513.1                      | -151.11                  | 897.05                    | 272.85                     |
| ROW | -4106.61 | -5.3                       | 0.14                        | -31.93                       | -2964.36                  | -65.92                    | -0.47                      | -1812.91                    | -65.94                   | 1253.52                   | -420.07                    |

Note: Welfare is an equivalent variation measure.

Source: Author's calculation.

Effects of Trade Liberalization & Productivity Increase on Output, % change

| qo | BRA   | CHN   | RUS   | IND   | ZAF   | USA   | EU    | ROW   |
|----|-------|-------|-------|-------|-------|-------|-------|-------|
| pd | 1.22  | 0.04  | -0.14 | -0.06 | -2.51 | -0.32 | -1.31 | 0.03  |
| wh | 14.62 | 0.01  | -0.58 | -0.04 | -0.66 | -0.23 | -0.38 | -0.34 |
| gr | 4.67  | 0.05  | -0.16 | -0.05 | -0.42 | -0.11 | -1.55 | -0.15 |
| vf | 6.7   | 0.01  | -0.03 | 0     | -0.53 | 0.02  | 0.04  | -0.04 |
| os | 4.1   | -0.63 | -0.53 | -0.1  | -0.46 | -1.49 | -0.17 | -0.5  |
| cb | 6.06  | 0.31  | 0.17  | -0.02 | -0.01 | 0     | 11.59 | -0.42 |
| pf | 1.84  | -0.04 | -0.22 | -0.09 | -0.98 | -0.44 | 0.45  | -0.3  |
| oc | 7.06  | -1.52 | -1.02 | -0.23 | -2.73 | -0.88 | -1.92 | -0.89 |
| ct | 33.39 | 0.09  | 0.01  | -0.06 | -0.12 | -0.07 | 12.62 | -0.51 |
| oa | 15.65 | 0     | 0     | 0.01  | 0.13  | 0.13  | -3.19 | 0.04  |
| rm | 3.09  | 0     | 0.05  | 0.01  | -0.03 | 0.03  | -0.19 | 0     |
| wl | 9.39  | 0.17  | -0.06 | 0.01  | -0.62 | 0.46  | 0.2   | -0.02 |
| fr | -1.35 | 0.08  | -0.06 | -0.01 | -0.03 | -0.05 | -0.07 | -0.01 |
| fs | 6.91  | 0     | -0.01 | -0.01 | -0.13 | -0.04 | -0.25 | -0.04 |

Source: Author's calculation.

## Final Remarks

- The trade liberalization between Brazil and USA & Brazil and EU could be good for the Brazilian economy in terms of Welfare.
- Both scenarios could be also good in terms of agricultural output.
- Although we observed positive results, more deep analysis is required.
  - It is necessary to look at the effect in the industrial sectors.
  - It is also necessary to look at the effect in terms of emissions (Food Security x Sustainability).
- More information about the Food Security is also required. In other words, future work will try to better understand the results in terms of food supply.