Exports and Regional Dynamics in the Labor Market: Evidence from Brazil

**Abstract**

This paper studies how foreign demand shocks impact labor market outcomes at the regional level by investigating the case of Brazil. The case of Brazil is particularly interesting because exports were at least three times larger in 2022 compared to 1997 and the exposure to foreign demand shocks is markedly heterogenous across Brazilian regions and sectors. By leveraging the differentials of growth in global exports and exposure of each local labor market to different industries, the paper shows that a 10-percent exogenous increase in exports boosts formal local employment by 2.5 percent in the short run. Real average wages are also positively affected by 1 percent in the year following the shock. Effects on highly skilled workers are more persistent over time and there are small differences in both wage and employment responses among men and women. Estimates from the population census also indicate that regions with higher exposure to exports shocks are less likely to see increases in informal employment.

**JEL:** D3. F16, J16, O19.

Keywords: exports shocks, labor markets, formal employment, wages, Brazil**.**

# Introduction

# Stylized facts about exports in Brazil

Over the last 25 years, Brazil’s exports of goods increased by about three times in real terms. More specifically, the exports figures were close to USD 170 billion (at 2022 prices) in 1997, then reached a peak of more than USD 400 billion in 2010 and declined to slightly more than USD 300 billion in 2023. Figure XXXX depicts the historic evolution considering the 1997-2023 period with data separately for some categories (Agriculture, Forestry and Fishing, Manufacturing and Mining and quarrying). There has been, thus, an increase in exports in real terms comparing 1997 with 2023, but with an important reduction from 2010 to 2023 of about 25 percent. Overall, we note that the trend of the Brazilian export cycle in this period is a combination of a continuous expansion of the agricultural sector, with a large cycle of oil and a volatile manufacturing sector.

Figure XXXX. Evolution of Brazilian exports, separately by sector

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Source: elaborated by the authors using data from the Brazilian Ministry of Industry and Commerce (MDIC), the Brazilian NSO (IBGE) and the Federal Reserve Economic Data (FRED). Notes: Values are denominated in billions of U.S. dollars at 2022 prices.

Figure XXXX. Exports incidence in Brazilian municipalities in selected years

|  |  |
| --- | --- |
| 1. 2002 | 1. 2022 |
| A graph with numbers and dots  Description automatically generated | A graph with numbers and dots  Description automatically generated |

Source: elaborated by the authors using data from the Brazilian Ministry of Industry and Commerce (MDIC), the Brazilian NSO (IBGE) and the Federal Reserve Economic Data (FRED). Notes: values are denominated in U.S. dollars at 2022 prices. Municipality-level population data comes from the official estimates relative to the year of 2022. Bubbles are proportional to total municipal exports and the vertical axis is truncated at USD 1,000.

Triunfo, RS

Anchieta, ES

Belo Oriente, MG

São Francisco do Conde, BA

# A brief review of the literature

Understanding the link between trade policy and trade outcomes (increasing trade) and its connection with the labor market has motivated many empirical studies. The findings that come out of the academic literature strongly suggest that the relationship is very strong. In most cases trade agreements increase trade and, in general, lowering trade costs by reducing trade barriers and tariffs and quotas and non-tariff barriers tend to increase trade to differing degrees. However, there is still limited knowledge of the channels through which trade affects labor market outcomes particularly for exports and in developing countries. Our approach builds upon several recent empirical papers. Pioneering research by Topalova (2010) studies the effects of tariff changes on poverty rates across India’s districts. The author measured the effective changes in tariff rates for districts (zila) by weighting industry-level changes with the number of workers in each district. One of Topalova’s (2010) key contributions was to implement an approach proposed by Bartik (1991). This approach takes advantage of a concentration of production and local labor markets to identify the relationship between globalization and local labor market outcomes. More specifically, Topalova calculates the effective change in import protection for Indian districts after the 1991 trade reform. The variation in the author’s sample comes from differences among districts in their industry and import compositions. The districts with a larger share of import-competing sectors and sectors with larger tariff reductions are exposed more severely to the trade liberalization shocks. Topalova assumes that tariff reductions are exogenous to the districts since they were planned by the central government through international agreements.

Several studies have used variations of this approach but have reached different conclusions. Topalova (2010) shows that poverty rates increased (or decreased more slowly) in districts that were more exposed to the trade shocks. One concern about the Topolova (2010) study, however, is that the study assumes zero tariffs for nontraded sectors such as services, and includes those sectors in the analysis. In reality, however, nontraded sectors face trade costs that are prohibitive, which is more consistent conceptually with infinite tariffs than with zero tariffs. Hasa, Mitra, and Ural (2007) argue that changing the zero tariffs to prohibitive levels generates results that suggest that trade shocks potentially reduced poverty in India. Although their results contrast with Topalova (2010), they use a similar Bartik (1991)-based instrument in their research.

Using an empirical approach suggested by Hasan, Mitra, and Ramasmawy (2007), Krishna, Mitra, and Sundaram (2010) show that the positive impact of trade liberalization on poverty reduction is less significant in lagging regions in India, Sri Lanka, Bangladesh, Pakistan, and Nepal. In a related study, Hasan et al. (2012) show that trade protection is negatively correlated with state-level unemployment; this correlation is especially strong for states that have high employment in exporting industries.

In Brazil, Menezes-Filho and Muendler (2011) find that low tariffs on intermediate inputs were associated with a lower likelihood of unemployment and higher formal sector employment. Kovak (2013) uses an instrument based on tariff changes, like Topalova (2010), to analyze the impact of trade liberalization on Brazil’s labor markets. Unlike the previous research, the study uses a semi-structural approach based on a general theoretical model. Kovak shows the exact specification for the instrument that is consistent with the economic theory. The author argues that the effects of trade shocks on local labor markets are larger when localities are more exposed to trade through higher producer prices, larger employment shares in import-competing sectors, and higher elasticities of labor demand. Dix-Carneiro and Kovak (2017) find that, lower tariffs had the opposite effect, result­ing in higher informality in Brazilian micro-regions that were more exposed to tariff reductions, even 20 years after the trade reform. Similarly, after examining annual vari­ations in tariffs between 1993 and 2001, Sarra and Bombarda (2018) find that regional exposure to Mexican tariff reductions boosted the probability of formal employment in tradable sectors, especially for men. This may have been driven by the fact that export-oriented sectors benefited from the fall in Mexican tariffs as intermediate inputs became cheaper.

For Brazilian workers, empirical evidence shows that the dynamic process of adjust­ment to trade liberalization reforms has been painful, bringing bigger declines in wages and lower employment over time. Between 1991 and 2002, Kovak (2013) finds that microregions in Brazil facing liberalization-induced price declines greater than 10 percent experience 4 percent more declines in wages. Building upon this work, Dix-Carneiro and Kovak (2017) show that microregions facing larger tariff cuts experience prolonged declines in for­mal sector employment and earnings relative to other microregions: the impact of tariff changes on regional earnings 20 years after liberalization is three times the effect after 10 years Workers initially working in tradable sectors are more likely to locally transition to non-tradable sectors, but this response is not enough to offset the strong declines in formal employment in tradable sectors. Workers in non-tradable sectors in harder-hit areas are similarly affected, indicating large spillovers from tradable to non-tradable sectors. Why does this occur? The authors suggest there is a mechanism involving imperfect interregional labor mobility and dynamics in labor demand, driven by slow capital adjustment and agglomeration economies. These unfavorable results are consistent with conclusions by Góes et al. (2019), who deviate from the reduced-form methodology employed by these earlier studies and instead use a general-equilibrium model that aggregates information on production, employment, wages, prices, imports, and exports in 57 economic sectors in Brazil.

Most of the adjustment in Brazil takes place through the informal sector, which acts as a buffer for trade-displaced workers. Dix-Carneiro and Kovak (2017) show that, after Brazil’s trade liberalization in the 1990s, microregions more exposed to foreign competition faced higher unemployment in the medium term relative to the national average. In the long run, however, foreign competition had no effect on unemployment, but there was a significant positive effect on informal employ­ment at the local level. This view of the informal sector serving as a buffer is cor­roborated by Ponczek and Ulyssea (2018), who show that the medium-term effect of liberalization-induced foreign competition on unemployment was larger in microregions where labor market regulations were more strictly enforced, making labor shifts harder. The role of the informal sector as an important margin of labor market adjustment to trade has gained prominence in the literature in last two decades.

What about the effects of an import and export shock on migration across microre­gions and labor reallocation from the formal sector to nonemployment within these regions? Using an instrumental-variable approach, Brummund and Connolly (2019) examine Brazil’s unique trade relationship with China to analyze this question. They find that export exposure reduces the movement of workers from the traded sec­tor to nonemployment and increases the movement of workers from nonemployment to the nontraded sector. These movements are primarily driven by the manufacturing sector. This is in stark contrast to the negative impacts on microregions that are more exposed to imports, which show more reallocation from manufacturing to nonem­ployment, and less movement from the traded sector to the nontraded sector. It thus seems that Brazilian labor markets responded more dynamically to the China shock than they did to the 1990s trade reforms.

Trade liberalization has had mixed effects on poverty in Brazil. While some studies show that trade has contributed to poverty reduction by lowering the cost of goods and creating new job opportunities, others highlight that the benefits are unevenly distributed, often favoring those who are already better off. Consequently, while some individuals have moved out of poverty, others have seen little change or even worsening conditions due to job displacement or wage reduction in vulnerable sectors.

# Data

## Formal employment

To obtain information about the formal labor market in Brazil, we use the Brazilian matched employer-employee data set called RAIS (*Relação Anual de Informações Sociais*), which is an annual census of formal workers in the country. RAIS is an administrative data set administered by the Brazilian Ministry of Labor and that has detailed information about all formal workers in the country. Every year firms must submit information about their employees and are subject to fines if they do not comply with the submission deadlines. For the main analyses, we use the yearly RAIS data sets for the 1995-2021 period and the sectoral classification based on CNAE 95 at the 5-digit level.[[1]](#footnote-1)[[2]](#footnote-2)

## Population Census

We use the Brazilian Population censuses data for 2000 and 2010 to analyze both the formal and informal labor markets at the microregion-sector level considering the 5-digit CNAE 95 categorization. The latest census data available refers to 2010 and the oldest one dates from 1960. Since the interest of our analysis is on the most recent period of exports expansion in Brazil, we restrict the analysis to the 2000 and 2010 census. The specific reason for not using the 1991 census is that the sectoral classification used in RAIS data is CNAE 95, which is was created after the 1991 census was fielded, and the Brazilian NSO does not publish a concordance from the 1991 census-specific categorization to CNAE 95. Therefore, one would need to make several assumptions in an ad-hoc concordance to produce such a mapping, and the quality of the resultant concordance is unknown, what could bring additional noise to the analysis. The definition of formal labor market is based on either having a formal job contract (i.e., “carteira assinada”) or whether the worker contributes to social security.[[3]](#footnote-3)

## Exports data

<Carlos to fill in>

## Emissions data

The information on GHG emissions by sector uses the dataset developed by Cirera and Martins-Neto (2021), which compiled this information at the 3-digit CNAE 95 level based on the Brazilian Initial National Communication to the United Nations Convention about Global Climate Change for the 1994 reference year. The unit of measure is tons of emissions and to use the same level sector classification from RAIS and census data, we converted the 3-digit CNAE 95 data into 5-digit CNAE 95 data.

## CNAE correspondances

# Methodology

* 1. Relevance of the instrument

One assumption of the proposed methodology is that the variable used to instrument the observed growth in exports by region is relevant in the sense that they are strongly correlated. The usual way of testing the relevance of the instrument is by checking the F-statistic of a statistical test on whether the instrument is significantly different from zero. Reassuringly, the F-statistic of the proposed instrument in the first-stage regression is greater than 280, which is remarkably high and suggests a nonnegligible correlation. To further inspect the relevance of the instrument, Figure XXXX depicts a binscatter where the instrument is presented in the horizontal axis, while the endogenous variable is shown in the vertical axis using municipality-level data. As can been seen, there is an unequivocally strong and positive relationship between those variables and a relatively low dispersion of observations around the fitted line.

Figure XXXX. Relevance of the instrumental variable



Notes: this binscatter reproduces the slope of regressing the observed growth in exports on the instrument. The underlying regression has N=34,670, Beta = 2.25 and t-stat=16.76.

* 1. Exclusion restriction

Another assumption of the proposed methodology is that the instrument used only affects the outcomes variables through its impacts on the endogenous variable. This assumption is known as the exclusion restriction and in our context requires that changes in the foreign demand are uncorrelated with the distribution of unobserved factors that drive changes in the local labor markets analyzed.

# Results

To shed light on the impacts of foreign demand shocks on formal employment, Figure XXXXX shows the dynamics of the stock of formal workers in Brazil before and after the exports growth in the 1995-2021 period by comparing more exposed with less exposed regions. We observe that in the five years leading up to the shock, there are no sizable differences among them, suggesting that their evolution in the number of formal workers was similar. However, precisely when the shock hits, an 1-percent exogenous increase in growth exports is associated with an average formal employment rise of approximately 0.25 percent and a persistent effect of approximately 0.15 percent in the next year. In the third and fourth year, these estimates are still statistically different zero and greater than 0.1 percent. Finally, the estimated coefficient declines to around 0.5 percent around the fifth and sixth year following the shock. These results suggest that even though effects on formal employment reduce over time they are persistently positive in a six-year horizon.

Figure XXXXX. Impacts on formal employment



Source: elaborated by the authors using RAIS data for the 1995-2021 period. Notes: xxxxxxxx

When it comes to real average wages, Figure XXXX replicates the same analysis by showing both the pre- and post-shock periods. One may think that formal employment is boosted by the exports rise to meet the increased demand and that no effects would be observed in terms of average wages and wage mass because exporting firms in more exposed regions are probably not required to raise salaries in order to expand their workforce. Although this argument is reasonable, the pattern observed in Figure XXXXX points to a different story, as the impacts on average real wages are statistically significant in at least four of the six post-shock years. Moreover, rather than vanishing over time, the effects are larger six years after the shock than in the very first period, suggesting that wages are likely sticky in the short run and need some time to adjust. One year after the foreign demand rise, average wages go up by 0.1 percent, on average, for every 1-percent exogenous increase in exports. Five years later, the estimated coefficient almost doubles, reaching approximately 0.2 percent.

Figure XXXXX. Impacts on real average wages



Source: elaborated by the authors using RAIS data for the 1995-2021 period. Notes: average wages were deflated using the yearly average deflator from IPCA, the Brazilian official CPI, at 2010 prices.

<Add result on the wage mass>

Figure XXXXX complements the analysis

## Analyses of green sectors

# Conclusions

# References

Cirera and Martins-Neto (2021)

# Appendix A

Appendix Figure A1. Distribution of exports per person at the municipality level, selected years

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| 1. 2002 | 1. 2022 |
| A map of brazil with a graph  Description automatically generated | A map of brazil with different colored areas  Description automatically generated |

Source: elaborated by the authors using data from the Brazilian Ministry of Industry and Commerce (MDIC), the Brazilian NSO (IBGE) and the Federal Reserve Economic Data (FRED). Notes: values are denominated in U.S. dollars at 2022 prices. To improve the visualization, distribution was truncated at USD 2,500+.

# Appendix B

1. RAIS 2022 was available at the time this paper was written but due to methodological changes in the way RAIS was produced in 2022, the Brazilian Ministry of Labor does not ensure comparability with previous years (for details, see the following link: https://www.gov.br/trabalho-e-emprego/pt-br/assuntos/estatisticas-trabalho/rais/rais-2022/nota-tecnica-rais-2022.pdf). For this reason, we restricted the analysis to the most recent year immediately before 2022. [↑](#footnote-ref-1)
2. Several steps were followed to transform the 2000 census- (i.e., CNAE Domiciliar 1.0) and the 2010 census-specific (i.e., CNAE Domiciliar 2.0) sectoral classifications into CNAE 95. These are described in the Appendix. [↑](#footnote-ref-2)
3. More specifically, the formal labor market is composed of both private- and public-sector waged workers, including domestic ones, with a formal job contract and employers that contribute to social security. The informal labor market is made up of the remaining categories of workers in censuses data. [↑](#footnote-ref-3)