Exports and Regional Labor Market Dynamics in Brazil

**Abstract**

This paper studies the impact of foreign demand shocks on local labor markets in Brazil. Exports in the country increased three-fold between 1997 and 2022 and the exposure of foreign demand shocks is markedly heterogenous across Brazilian regions. 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 higher and more persistent over time and there are small differences in both wage and employment responses between 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

Academic literature has extensively documented the positive effects on welfare of trade openness around the world. Increases in exports have been largely associated with increases in gross domestic product (GDP) (Balassa,1978; Heitger, 1987; Lee, 1993; Dollar, 1992; Frankel and Romer 1999; Noguer and Siscart 2005). This, and the positive effects of trade in other macro dimensions such as reducing poverty and improving living standards (Harrison 1999) have led developing countries to adopt trade liberalization policies in recent decades. The pronounced boost in exports arising from these policies provoked large increases in labor demand (Robertson et al. 2009 and Lopez-Acevedo et al. 2016), which are somewhat associated with improving labor market outcomes such as wages, informality rates, and female labor force participation (FLFP) (Artuc et al. 2019, Robertson et al. 2020).

Although there is a consensus that trade and growth are positively related, the specific interactions between trade policy, trade flows, and labor market outcomes are not well understood. While in some cases these relationships are straight forward positive (Robertson et al. 2020), some other recent studies (Bezerra de Goes et al. 2023 and Roche Rodriguez et al. 2023) have found mixed results in specific circumstances. Some of this is related to internal country factors (such as industrial policies) or external ones (such as export competition) that, when combined with trade policies fail to improve female labor force participation even if they tend to correlate with lower overall labor informality rates. Other studies (Robertson et al. 2022) have found no significant relationship between rising exports and local labor market outcomes, possibly due to weak comparative advantage in exported goods. The study of individual country cases is necessary to untangle the factors that do or do not lead to better labor outcomes when a country liberalizes its trade policies.

Brazil's trade landscape has undergone significant transformations in the past two decades. The early 2000s witnessed a period of robust export growth, driven primarily by commodities such as soybeans, iron ore, and oil. China's emergence as a global economic powerhouse played a pivotal role in boosting Brazilian exports, making it a crucial trading partner. However, this commodity-dependent trade model rendered Brazil vulnerable to fluctuations in global commodity prices.

The global financial crisis of 2008 and the subsequent decline in commodity prices presented challenges to Brazil's export-led growth strategy. The country sought to diversify its export basket, emphasizing manufactured goods and higher-value products. Efforts were made to enhance competitiveness through industrial policies and infrastructure development. While progress has been made, Brazil still faces hurdles in terms of reducing its reliance on commodities and increasing its share in global value chains.

This paper explores the impact of exports on localized labor markets in Brazil with a focus on green transitions. The paper makes use of two approaches. The first approach is a shift-share “Bartik” (1991) method to enhance our understanding of the effects of exports on local labor market outcomes in Brazil between 20xx and 20xxx. The second approach xxx

The following sections review Brazil’s economic integration into global markets, shedding light on the relationship between exports and local labor markets with an emphasis on green transitions. Section 2 of this paper provides a snapshot of Brazil’s main trade and labor market patterns. Section 3 presents the data. Section 4 discusses the literature review. Section 5 presents the methodology and the shift-share Bartik analysis on how increasing exports relate to local labor market outcomes. Finally, section 6 concludes by providing the main insights derived from this study.

# Trade and labor market trends

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 1 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 1. 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 2 presents the distribution of exports per person in U.S. dollars at 2022 free-on-board prices in Brazilian municipalities both in 2002 and 2022. It is interesting to observe that, in the first years of the Brazilian exports boom of the 2000s, only a few municipalities has exports as an important feature of their economics. Less than 20 percent of the municipalities in 2002 used to have non-negligible values of exports per person and this share grew to almost 40 percent in 2022, with more than 10 percent of them exporting at least USD 2,000. Appendix Figure A.1 complements the analysis by showing the spatial distribution of the exporting cities in the same period. The map demonstrates that, in 2002, exports used to be concentrated in the old manufacturing hubs of the Southeast and South and – while they are still important in 2022,  
the Midwest now has an outsized imprint.

Figure 2. 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.

Brazil's labor market has undergone significant transformations over the past two decades, characterized by regional, gender, and ethnic disparities. The economic boom of the early 2000s led to substantial job creation, particularly in the Southeast and South regions, where industrial and service sectors thrived. This period also witnessed a notable reduction in poverty rates and increased female labor force participation. However, the benefits of this growth were unevenly distributed, with the Northeast and North regions lagging in terms of job creation and income levels.

The economic downturn that began in 2014 exacerbated existing regional disparities. The Southeast and South regions, while impacted, showed greater resilience compared to the Northeast and North, where unemployment rates surged, and informal employment increased. The crisis disproportionately affected young people, women, and Afro-Brazilians, who were more likely to lose jobs or enter the informal economy.

While the Brazilian economy has shown signs of recovery since 2017, the labor market continues to face challenges. The service sector, dominated by female employment, has been a major driver of job creation, but the quality of these jobs often remains precarious. The gap in unemployment rates between white and black workers persists, reflecting historical inequalities and ongoing discrimination. Additionally, rural areas have experienced outmigration as young people seek better opportunities in urban centers, leading to labor shortages in agriculture and related sectors.

The COVID-19 pandemic amplified existing vulnerabilities in the labor market. Women, particularly those in informal sectors such as domestic work and caregiving, were disproportionately affected by job losses and increased care burdens. The pandemic also highlighted the digital divide, with individuals from lower socioeconomic backgrounds facing greater challenges in accessing remote work opportunities.

# A review of the literature

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

We use the Brazilian matched employer-employee data set called RAIS (*Relação Anual de Informações Sociais*) to analyze the formal labor market in Brazil, 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-2)[[2]](#footnote-3)

## 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 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-4)

## Exports data

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## 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

## Empirical strategy

A common empirical strategy to evaluate distributional impacts across geographical areas is to exploit the differential exposure of local labor markets of a given country to international trade shocks. Conceptually, these shocks typically happen at some aggregate level—say, at the industry level—and local labor markets are differentially exposed to aggregate shocks by some pre-existing characteristic—say, by the industry composition of the labor force. A weighted average of its exposure to each shock provides an estimate of local labor market exposure to industry-specific shocks.

Suppose, for instance, that there are two regions (north and south) and two industries (manufacturing and agriculture) in a country. Suppose further that the south has most of its labor force employed in agriculture and the north has most of its labor force employed in manufacturing. If foreign demand for agriculture increases exogenously, then the south will be more exposed to this international trade shock. We capture distributional effects of trade across regions by measuring the relative effect of the most exposed region relative to the least exposed region, which can be thought of as a simple differences-in-differences estimator like the in the previous section.

Methodologically, when there are many regions and sectors, we estimate the distributional effects of trade through shift-share (Bartik) regressions (for details on the methodology, see Borusyak et al., 2020). The intuition above still follows through, and the estimator can still be interpreted by DiD (cf. Chodorow-Reich, 2020). This method has become a standard in the literature used both for import shocks (Autor et al., 2013 and Dix-Carneiro and Kovak, 2015) and export shocks (Robertson et al., 2021 and Góes et al., 2023).

Formally, to measure how exports affect local labor markets, we interact export growth in different industries with differential exposure to industry-specific shocks across different local labor markets. Formally, we define local labor market exposure to exports growth as:

where denotes log total exports of industry at period ; denotes total employment in region and industry ; and is total aggregate employment in region r.[[1]](https://usc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-US&wopisrc=https%3A%2F%2Fworldbankgroup-my.sharepoint.com%2Fpersonal%2Fgacevedo_worldbank_org%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F306340a708be462da987acccfdc94789&wdenableroaming=1&mscc=0&wdodb=1&hid=0D2548A1-602C-6000-1E76-78CE242C68B4.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=5645e7ab-269d-e84a-da09-62ed908a6eff&usid=5645e7ab-269d-e84a-da09-62ed908a6eff&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fworldbankgroup-my.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdorigin=Other&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn1)

Given the shares, our objective is to estimate the dynamic treatment effect of a regressor, which can be done provided that the shifters are as good as random. If this were true, we would be able to recover the dynamic treatment effect by estimating a sequence of local projection regressions as in Jordà (2005).

Given a time-series for some outcome of interest and a vector of control variables , one could estimate a sequence of OLS regressions using:

Note that, in this sequence of regressions, for each t, the right-hand variables are fixed at the time of the shock while the dependent variable changes and denotes the cumulative change of the outcome variable since the reference period. The path of shows a cumulative impulse response function, which can be interpreted as the dynamic average treatment effect of the outcome variable.

Provided that estimation is consistent, as shown by Plagborg-Møller and Wolf (2021), local projections like the one above retrieves impulse response functions that are asymptotically identical to the ones from vector autoregressions (VARs), but with the advantage of being fully flexible models for instrumental variable estimation and not requiring identifying the full matrix of autoregressive coefficients.

Furthermore, more recently, Dube et al. (2023) have shown that a local projections design like this can be generalized as a dynamic DiD estimator. While their paper focuses primarily on a case with binary treatment, the authors argue that it extends to the continuous treatment case, the one we consider in this study with .

These results hinge on the consistency of the estimator. However, there are many reasons to believe that exposure to exports can be endogenous, including the fact that they depend on local human capital, technology, and other factors of production, which can be naturally correlated with unobserved local labor market characteristics. Therefore, one needs to use some plausibly exogenous shifters that are not correlated with domestic demand to consistently estimate.

We propose an instrument that tries to isolate an exogenous part of exports by leveraging the correlation between changes in exports and changes in foreign demand. The idea is that some regions are more exposed to industries and, furthermore, some industries are exposed to particular destinations. For instance, if most of Indonesian exports in agriculture go to China but most of manufacturing exports go to the US, changes in demand in China (such as a fiscal stimulus) will impact agriculture more than manufacturing. Similarly, those regions with most of their employment in agriculture will be more exposed to China than to the US.

Similar to Aghion et al. (2018), we use global demand in each particular industry as a source of exogenous variation. The application by Hummels et al (2014) is closely related to our approach in that they use the growth in global demand interacted with pre-period shares to instrument for exports. Our exposure measure, however, varies over time, as we show here.

Let be the set of countries in the world and let denote the source country, Indonesia. Indonesian exports are its sales to the set of all countries other than itself: . Formally, we define the instrument as:

where denotes country d’s share of industry i’s exports; and is the change in log U.S. dollar GDP in country d. Note that this instrument incorporates every country that Indonesia exports to in every industry, with a higher weight to the higher export partners—likely the six partners emphasized in Figure 2.2—but can differ for industry-specific exports.

Estimation now takes the form of two-stage least squares, with the first stage being:

and the second stage:

where are the predicted values of the first stage regression. Estimation of is consistent if for every d and r pair at every horizon h; that is, if past changes in foreign demand are uncorrelated with the distribution of unobserved factors that drive changes in local labor markets in Indonesia.

Intuitively, global foreign demand shocks can affect small open economies, like individual Indonesian districts. Furthermore, each Indonesian district is itself a small open economy. Therefore, it is unlikely that changes in foreign demand are correlated with the distribution of unobserved factors that differentially drive changes in local labor markets.

[[1]](https://usc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-US&wopisrc=https%3A%2F%2Fworldbankgroup-my.sharepoint.com%2Fpersonal%2Fgacevedo_worldbank_org%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F306340a708be462da987acccfdc94789&wdenableroaming=1&mscc=0&wdodb=1&hid=0D2548A1-602C-6000-1E76-78CE242C68B4.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=5645e7ab-269d-e84a-da09-62ed908a6eff&usid=5645e7ab-269d-e84a-da09-62ed908a6eff&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fworldbankgroup-my.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdorigin=Other&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftnref1) For some countries, there is a time-series of observed exports by district. We could not find a time series of these data spanning the sample time we used in this work. There are, however, advantages in using the indirect measure of exposure to exports because we are directly instrumenting for production through labor force shares. In other countries regional exports are typically recorded at the last point of invoicing. If there is intermediation, then there might be some record distortion, particularly at a lower level of geographic disaggregation.

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.

## 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

## 6.1 Main 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 exports growth 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 investigation by showing the year-by-year effects on the stock of formal workers separately by gender. We observe that there some statistically significant differences in the employment responses between men and women in the first and fourth year following the shock. In both periods, the difference is close to 0.1 percentage points. Overall, the findings are consistent with small differences between men and women. Appendix Figure A.2 depicts the responses separately by gender in terms of average real wages and the conclusion is similar – given that there are no statistically differences between men and women in any post-shock periods.

Figure XXXX. Impacts on formal employment, separately for men and women



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.

An important research question is whether there is a heterogeneity of impacts on formal employment by workers’ skill level because exporting firms are probably different from non-exporting ones in multiple observable and non-observable dimensions. To shed some light on this issue, we present in Figure XXXXXXX the estimated coefficients of the impulse response function separately for low- and high-skilled workers, as captured by their educational attainment. The former are those without a college degree, while the latter are those that do have that. As can be seen, the stock of both types of workers increases immediately after the shock hits and the differences in the point estimates become statistically different from zero from the fifth year onwards. While workers with a college degree experience an increase of about 0.2 percent for each 1-percent increase in exports in the fifth year, the impacts on less skilled ones are not significant in the medium run.

Figure XXXX. Impacts on formal employment, separately by workers’ educational attainment



Source: elaborated by the authors using RAIS data for the 1995-2021 period. Notes: educational attainment is measured as per RAIS classification.

## 6.2 Complementary results

<write about results produced with census data>

Figure XXXX. Impacts on employability and real average wages, considering formal and informal workers separately



Source: elaborated by the authors using the Brazilian Population Census data for 2000 and 2010. Notes: formal workers are employers or self-employed workers that contribute to social security, and waged private-sector workers with a formal job contract. Informal workers are those in the remaining categories.

## Analyses of green sectors

# Conclusions

This paper studies how exports shocks affect labor market outcomes in Brazil by leveraging variation in the exposure of regions to foreign demand shocks in 26-year horizon comprising the 1995-2021 period. This period was marked by XXXXXXXXX. Our main findings indicate that growth in exports is positively associated with increased formal employment and wages, with higher effects on high-skilled workers. Small differences are observed when it comes to results disaggregated by workers’ gender.

These results, although expected, seem to fade over time, which may imply that trade benefits diffuse through the economy over time through labor market integration. Further research is needed to evaluate the degree of dissipation of export effects. It is important to note that while these changes have been positive, they have also had an effect on the rate of informality. This suggests that trade liberalization has driven some economic progress and it has been sufficient to address the deep-rooted issue of labor informality.

Sustained efforts and targeted policies are required to ensure that the benefits of trade and structural transformation are more evenly distributed, leading to inclusive and sustainable economic development in Brazil. First, targeted interventions to formalize the labor market are essential. This could include strengthening labor laws, enhancing social protection mechanisms, and providing incentives for businesses to formalize their operations. Additionally, policies aimed at improving the quality of jobs and ensuring fair wages can help mitigate the persistent high levels of informality.

# 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 in the label (to the right of each map) are denominated in U.S. dollars at 2022 prices. To improve the visualization, distribution was truncated at USD 2,500+.

Appendix Figure A.2. Impacts on real average wages, separately for men and women

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.

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-2)
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-3)
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-4)