Exports and Localized Dynamics in the Labor Market in Brazil

**Abstract**

This paper examines the impact of foreign demand shocks on local labor markets in Brazil. Between 1997 and 2022, Brazilian exports tripled, and the exposure to foreign demand shocks varied significantly across different regions of the country. By exploiting variations in global export growth and the exposure of each local labor market to various industries, the paper demonstrates that a 10 percent exogenous increase in exports leads to a 2.5 percent increase in formal local employment in the short run. Additionally, real average wages rise by 1 percent in the year following the shock. The effects are more pronounced and longer lasting for highly skilled workers, with only minor differences in wage and employment responses between men and women. Data from the population census also suggest that regions with higher exposure to export shocks are less likely to experience increases in informal employment.

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

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

# Introduction

Trade openness has been widely recognized for its positive effects on global welfare. Increases in exports have consistently been linked to higher GDP (Balassa, 1978; Heitger, 1987; Lee, 1993; Dollar, 1992; Frankel and Romer, 1999; Noguer and Siscart, 2005). Additionally, trade has demonstrated benefits in other macroeconomic areas, including poverty reduction and improvements in living standards (Harrison, 1999). These favorable outcomes have prompted many developing countries to pursue trade liberalization policies in recent decades. Such policies have driven significant export growth, which in turn has led to substantial increases in labor demand (Robertson et al., 2009; Lopez-Acevedo et al., 2016). This growth has also been associated with improved labor market conditions, such as higher wages, lower informality rates, and greater female labor force participation (FLFP) (Artuc et al., 2019; Robertson et al., 2020).

While there is consensus that trade and economic growth are positively correlated, the interactions between trade policy, trade flows, and labor market outcomes remain complex and not fully understood. In some cases, the relationship is straightforwardly positive (Robertson et al., 2020), but recent studies (Bezerra de Goes et al., 2023; Roche Rodriguez et al., 2023) have produced mixed findings under certain conditions. These variations can be attributed to factors like industrial policies or external pressures such as export competition. When combined with trade policies, these factors may not always lead to increased female labor force participation, even if they are linked to lower overall informality rates. Additionally, some studies (Robertson et al., 2022) have found no significant connection between rising exports and local labor market outcomes, which could be due to a weak comparative advantage in exported goods. Therefore, it is essential to examine individual country cases to understand the specific factors that drive positive labor market outcomes after trade liberalization.

In Brazil, the trade landscape has undergone significant shifts over the past two decades. The early 2000s saw strong export growth, primarily driven by commodities such as soybeans, iron ore, and oil. The rapid economic rise of China further fueled Brazilian exports, making China a crucial trading partner. However, Brazil's heavy reliance on commodities left it vulnerable to fluctuations in global commodity prices. Following the global financial crisis of 2008 and the subsequent decline in commodity prices, Brazil's export-led growth strategy faced challenges, prompting efforts to diversify exports toward manufactured goods and higher-value products. These efforts included industrial policies and infrastructure development to enhance competitiveness. Despite progress, Brazil continues to struggle with reducing its dependency on commodities and increasing its integration into global value chains.

This paper examines the impact of exports on local labor markets in Brazil, with a particular focus on green transitions. It employs two approaches. The first utilizes the shift-share "Bartik" (1991) method to analyze the effects of exports on local labor market outcomes in Brazil from 20xx to 20xxx. The second approach xxx.

The paper is organized as follows. Section 2 provides an overview of Brazil’s trade and labor market patterns. Section 3 describes the data used. Section 4 reviews relevant literature. Section 5 details the methodology and presents the findings of the shift-share Bartik analysis on the relationship between export growth and local labor market outcomes. Finally, Section 6 concludes with a summary of the key 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.

# Literature background

Trade agreements generally lead to increased trade by lowering trade costs through the reduction of barriers such as tariffs, quotas, and non-tariff obstacles. However, the specific channels through which trade influences labor market outcomes, especially in the context of exports and in developing countries, remain underexplored. Our approach builds upon recent empirical studies. Pioneering research by Topalova (2010) investigated the impact of tariff changes on poverty rates across districts in India. Topalova measured effective changes in tariff rates by weighting industry-level changes based on the number of workers in each district. A key contribution of Topalova's work was applying the Bartik (1991) approach, which utilizes the concentration of production in local labor markets to identify the relationship between globalization and local labor market outcomes. Specifically, Topalova calculated the effective change in import protection for Indian districts following the 1991 trade reform, with variation arising from differences in industry and import compositions. Districts with a higher share of import-competing sectors, and those experiencing greater tariff reductions, faced more significant exposure to trade liberalization shocks. Topalova assumed that tariff reductions were exogenous to the districts since they were implemented by the central government through international agreements.

Several studies have used variations of this approach, yielding different conclusions. Topalova (2010) found that poverty rates increased or declined more slowly in districts more exposed to trade shocks. A critique of Topalova’s study is the assumption of zero tariffs for nontraded sectors like services, which were included in the analysis. In reality, nontraded sectors face prohibitive trade costs, akin to infinite tariffs. Hasan, Mitra, and Ural (2007) argue that adjusting zero tariffs to prohibitive levels suggests trade shocks might have reduced poverty in India, contrasting with Topalova's findings. Despite the differing results, both studies employ a similar Bartik (1991)-based instrument.

Using an empirical approach suggested by Hasan, Mitra, and Ramaswamy (2007), Krishna, Mitra, and Sundaram (2010) found that the positive impact of trade liberalization on poverty reduction is less pronounced in lagging regions of India, Sri Lanka, Bangladesh, Pakistan, and Nepal. Relatedly, Hasan et al. (2012) discovered that trade protection is negatively correlated with state-level unemployment, especially in states with high employment in export-oriented industries.

In Brazil, Menezes-Filho and Muendler (2011) found that low tariffs on intermediate inputs correlated with a lower likelihood of unemployment and higher formal sector employment. Kovak (2013) used an instrument based on tariff changes, similar to Topalova (2010), to study the impact of trade liberalization on Brazil’s labor markets. Unlike earlier research, Kovak employed a semi-structural approach grounded in a theoretical model, demonstrating that trade shocks have a more substantial impact on local labor markets when regions have higher producer prices, a greater share of employment in import-competing sectors, and higher labor demand elasticities. Dix-Carneiro and Kovak (2017) found that lower tariffs increased informality in Brazilian micro-regions more exposed to tariff reductions, even two decades after the trade reform. Similarly, Sarra and Bombarda (2018) observed that regional exposure to Mexican tariff reductions raised the likelihood of formal employment in tradable sectors, particularly for men, likely due to cheaper intermediate inputs benefiting export-oriented sectors.

Empirical evidence shows that Brazilian workers faced significant adjustments following trade liberalization, with notable declines in wages and employment over time. Between 1991 and 2002, Kovak (2013) found that Brazilian micro-regions experiencing liberalization-induced price declines greater than 10 percent saw wage declines of 4 percent. Dix-Carneiro and Kovak (2017) extended this work, showing that micro-regions facing more substantial tariff cuts experienced prolonged reductions in formal sector employment and earnings, with the impact on regional earnings 20 years post-liberalization being three times that observed after 10 years. Workers initially employed in tradable sectors tended to shift to non-tradable sectors, though not sufficiently to offset the steep declines in formal employment within tradable sectors. Spillover effects also negatively impacted workers in non-tradable sectors in these regions. The authors suggest that imperfect interregional labor mobility and dynamics in labor demand, influenced by slow capital adjustment and agglomeration economies, contribute to these outcomes. These findings align with Góes et al. (2019), who utilized a general-equilibrium model to aggregate data on production, employment, wages, prices, imports, and exports across 57 Brazilian economic sectors.

Much of Brazil's adjustment to trade liberalization occurs through the informal sector, which serves as a buffer for workers displaced by trade. Dix-Carneiro and Kovak (2017) showed that, in the medium term, micro-regions more exposed to foreign competition experienced higher unemployment than the national average, but in the long term, foreign competition had no effect on unemployment, instead significantly increasing informal employment locally. Ponczek and Ulyssea (2018) corroborated this, showing that the medium-term unemployment impact of liberalization-induced foreign competition was more significant in micro-regions with stricter labor market regulations, which made labor shifts more challenging. The role of the informal sector as a crucial margin of labor market adjustment to trade has gained increasing attention in recent literature.

The effects of import and export shocks on migration across micro-regions and labor reallocation from formal employment to non-employment within these regions are also critical. Brummund and Connolly (2019) used an instrumental-variable approach to study Brazil's trade relationship with China and found that export exposure reduced transitions from the traded sector to non-employment and increased shifts from non-employment to the non-traded sector, primarily driven by the manufacturing sector. This contrasts with negative impacts in micro-regions more exposed to imports, which showed more reallocation from manufacturing to non-employment and less movement from traded to non-traded sectors. These findings suggest that Brazilian labor markets responded more dynamically to the trade shock from China than to the 1990s trade reforms.

Trade liberalization has had mixed effects on poverty in Brazil. While some studies indicate that trade has helped reduce poverty by lowering consumer goods prices and creating job opportunities, others note that these benefits are unevenly distributed, often favoring those already better off. Consequently, while some individuals have moved out of poverty, others have experienced little change or worsening conditions due to job displacement or wage reductions in vulnerable sectors.

# Data and Methodology

## Data

Our primary data source to analyze labor market dynamics in Brazil is a matched employer-employee dataset known as RAIS (*Relação Anual de Informações Sociais*). RAIS is an annual census of formal workers administered by the Brazilian Ministry of Labor, containing detailed information about nearly the universe of formal employees in the country. Employers are required to submit information about their employees to RAIS every year and face penalties for non-compliance with submission deadlines, ensuring higher accuracy of reported information. We observe employees[[1]](#footnote-2) and firm[[2]](#footnote-3) unique tax identifiers and utilize municipality and industry codes of firms and wages and demographic characteristics of workers to aggregate data at the region-industry level.

Domestic workers, interns, and, more importantly, those in the informal labor market are not included in the sample. Hence, we complement our use of administrative data with Population Censuses of 2000 and 2010 to examine both formal and informal labor markets at the region-sector level[[3]](#footnote-4). The formal labor market is defined based on whether a worker has a formal job contract (i.e., *carteira assinada*) or contributes to social security.

Use of Census data allows us to use the same levels of aggregation as with RAIS. Annual labor market surveys are not representative at geographic levels of aggregation finer than 27 Brazilian states. We instead aggregate our data across 558 micro-regions (an official geography similar to commuting zones) and 5000+ municipalities.

Brazilian trade data comes from customs records. The Ministry of Industry and Commerce of Brazil publishes customs records at the municipality level for each HS-4 industry aggregate. Location of imports and exports are recorded based on the address reported by the importing/exporting firm. Flows are classified for each ISIC rev. 3 3-digit industry code.

We also have product level data at the HS 8-digit level (NCM) for flows at the national and state level, but those are not available at the municipality level due to fiscal secrecy laws[[4]](#footnote-5). We observe flows quantities and FOB nominal dollar values and use total FOB dollar as a metric of municipal exports.

For constructing the baseline instrument, we use data from the UNCOMTRADE regarding global exports at the HS 6-digit level, excluding Brazilian exports. We then use the concordances from the United Nations Statistics Division to harmonize the HS vintages and map them to ISIC rev. 3 3-digit industry codes. We then map Brazilian employment to trade data first using the Brazilian national statistical office (IBGE) concordance between the national classification of economic activities (CNAE) at a 5-digit level to ISIC industries at a 3-digit industry level, which, combined with trade data, allows us to construct the Bartik instrument.

## Motivation

Many classes structural models of international trade result in a similar expenditure equation with a gravity structure[[5]](#footnote-6) (see Arkolakis, Costinot & Rodriguez Claire, 2012). Following GDP accounting, they result in an equation that states that total national income of region *r* equals total expenditure on goods produced in region *r*. When there are many industries *k*, the equation will take the following form:

where are income in region *r* andexpenditure on goods produced in region r, respectively; total expenditure can be further decomposed into expenditure on industry *k* of region *r* as well as total expenditure in industry *k* at destination *d* in goods produced in *r*, ; is a term that captures the productivity of sector *k* in region r; is the unit input cost of industry *k* in region *r;* captures the transport cost of shipping a good of industry *k* between *r* and *d*, and is meant to capture both geographical distances and tariffs; captures the average cost of goods in industry *k* at the destination region *d*; and is the trade elasticity, i.e., the responsiveness of trade flows with respect to changes in trade costs.

Define Then, totally differentiating the equation above results in:

where is the initial weight of industry *k*. Using the definition of and following through with total differentiation, we can write:

where is the expenditure share in industry *k* at destination *d* spent in goods produced in *r*.

The first term within the brackets captures relative changes in supply shocks. This channel has been the focus of much of the literature of labor market adjustment to trade, notably by Autor, Dorn & Hanson (2013, 2015), and Pierce & Schott (2016). Both papers focused on the effects of the “China trade shock” across local labor markets, leveraging differential exposure to Chinese import penetration due to plausibly exogenous increases in Chinese productivity.

The second term captures relative changes in trade costs. Most of the literature that uses Brazilian administrative data emphasize this mechanism. For instance, Kovak (2013), Dix-Carneiro & Kovak (2015), and Felix (xxxx) all concentrate on a vector of industry-specific tariff reductions interacted with local-labor market specific exposure weights to trace out labor adjustment.

We focus instead on the last term. This is the impact of changes in global demand in industry *k* due to changes in preferences, sector prices or income. If region *r* is small relative to the world, changes to foreign demand are a plausibly exogenous source of variation of exports in *r*.

## Empirical strategy

We observe exports flows or each local labor market *r* in Brazil for many periods *t*. Using the equations in the previous section as a reference, we map total expenditure to exports as: . The growth in exports is , where is the log of exports of region *r* at period *t.*

If exports were as good as random, we would be able to recover the treatment effect of an increase of expenditures on *r* by regressing some outcome of interest on exports. However, there are many reasons to believe that exposure to exports can be endogenous. Shocks to domestic local technology and costs would drive exports and can be naturally correlated with unobserved local labor market characteristics. Therefore, one needs to use some plausibly exogenous instrument uncorrelated to domestic demand and supply shocks to consistently recover this effect.

Once again referring to the stylized structural model above, global demand shifters are transmitted to domestic income as: . Like Aghion et al. (2018), we use in this paper *world export flow* in each industry as a demand shock. As the industry weights in a local labor market, , we follow Autor et al (2013) and Dix-Carneiro and Kovak (2015), among others, market-specific labor market shares, defining:

where denotes total employment in industry *k* at region *r* at period *t-1*; ; and is the growth of world exports (other than Brazil’s) in industry *k*. In the robustness section, we consider an instrument that leverages changes in dollar income in destination countries.

We are concerned about trade adjustment dynamics. Our approach is to estimate a sequence of local projection regressions as in Jordà (2005). Given either of these instruments, some outcome of interest and a vector of control variables , estimation 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.

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[[6]](#footnote-7).

For the instrument to be relevant, regional exposure of industry-specific global demand shocks needs to be strongly correlated with observed growth in exports. 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.

For validity, the requirement is that our choice of instrument only affects the outcomes variables through its impacts on the instrumented variable – i.e., the exclusion restriction. 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[[7]](#footnote-8).

In the robustness section, we adopt a different instrument that explicitly incorporates export weights for each industry and region:

where is the export share of destination *d* in industry *k* at region *r*; is the log of dollar GDP in destination country *d*. Both the baseline and alternative instrument rely on the fact that each region in Brazil is small relative to the world, and global demand shocks are unlikely to be correlated with the *distribution of domestic unobserved factors* that *differentially* drive changes in local labor markets.

Both instrumental variables largely capture the same patterns, being distributed around small growth rates and being strongly correlated. Figure A.X in the Appendix shows the local regression plot of the two different instruments. As Figure A.Y shows, the instrument constructed from nominal dollar GDP growth rates has a longer left tail, possibly due to recessions in specific countries that do not transmit to the global market. We chose the global exports-based instrument as our baseline because it is more strongly correlated with regional exports but the results are qualitatively unchanged by using the alternative instrument.

# Results

**6.1 Main results**

Our first result shows that labor market adjustment is long-lasting after a positive demand shock in Brazil. When a shock to exports arrives, a 1-percent exogenous increase in exports growth is associated with an average formal employment rise of approximately 0.25 percent. This effect is persistent, with the elasticity of formal employment to exports still being statistically significant and greater than 0.1 six years after the shock. 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 in regions more and least exposed to the export shock. This absence of differential pre-trends is reassuring and suggests that the shift-share instrumentation is likely valid and the effects well identified (see Goldsmith-Pinkham, Sorkin, and Swift, 2020; section 5).

Figure XXXXX. Impacts on formal employment



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

This result confirms the relative slow adjustment of labor markets in Brazil documented in previous studies that leverage increased import competition due to the product market liberalization of the 1990s (e.g., Dix-Carneiro and Kovak, xxxx, xxxx; Felix, xxxx). While in those works a negative shock induces regions more exposed to shocks to see a relative contraction in formal employment, in our setting, intuitively, we find the flip side of the coin: a positive demand shock induces a relative expansion in formal employment. We therefore complement the existing literature by showing that protracted labor market adjustment happens after positive demand shocks and beyond the specific liberalization event of the 1990s.

When it comes to 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. Although this argument is reasonable, the pattern observed in Figure XXXXX points to a different story, as the impacts on average 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 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.

To shed some light on the mechanisms at play, we decompose the employment effect across different groups. The differential effects are larger and more persistent for high- relative to low-skilled worker. On impact, formal employment of all skill levels located in regions more exposed to foreign demand shocks experience faster growth, with short-run elasticities around ~0.25. Over the medium run, though, the elasticities are different. Six years after the foreign demand shock, formal employment elasticity of high skilled workers is 0.3, while that of low skilled workers converges to close to zero.

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.

Figure A.2 shows the dynamic 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.3 depicts the responses separately by gender in terms of average real wages and the conclusion is similar – given that there are no statistically significant differences between men and women in any post-shock periods.

## 6.2 Long run effects and the informal labor market

One of the limitations of using administrative data is, while it covers the universe of formal workers and provides very reliable information, it does not cover the informal labor market. In developing countries, this problem tends to be larger, as the informal labor market accounts for 20-80% of workers (Ulyssea, 2020)[[8]](#footnote-9). In Brazil, depending on the definition of the formal labor market, informal workers are at least 40% of total workers (Ulyssea, 2018)[[9]](#footnote-10).

To complement our analysis, we use data from the Brazilian population census. The population census target sample is the universe of persons in Brazil and its window interval is approximately every ten years. It collects geographic, demographic, and labor market information (among others).

We use two waves of the Census: 2000 and 2010. Those waves coincide with the large increase in aggregate exports in Brazil. After aggregating data at the municipality level, we run analogous models to equation (x), using long differences. Our instrument is:

where denotes total employment in industry *k* at region *r* in 2000; ; and is the log of world exports (other than Brazil’s) in industry *k* at period *t*. We then follow a similar 2SLS approach, with the first stage being:

where is the cumulative growth in exports of region *r* over that decade. The second stage:

where are the predicted values of the first stage regression. Note that now we are using variation only along a cross-section of municipalities rather than exploiting the panel dimension as we were able to in the previous exercise. Despite this fact, the instrument is still quite relevant, with f-statistics above 30, suggesting that growth in foreign demand is a good predictor of growth in exports over longer time horizons.

In our preferred specification, the elasticity of formal employment to exports over this long horizon is 0.052, being statistically significant at the 1% confidence level. This is consistent with the declining trend in elasticities as the horizon increases, as observed in Figure X[[10]](#footnote-11).The response of the average wage of formal employees is also positive and statistically significant, albeit small, at 0.025.

Taking full advantage of Census data, we also calculate the elasticity of informal employment with respect to exports. Notably, the elasticity is negative and statistically significant, meaning that regions more exposed to exports experience slower growth rates in informal employment relative to those least exposed to exports. While this might seem surprising, it is fully consistent with previous findings of the literature that documents labor market dynamics in Brazil. For instance, Dix-Carneiro and Kovak (xxxx; xxxx) find that informal employment grows at a relatively faster pace in regions more exposed to an import competition shock through product market liberalization in the 1990s.

In that sense, formal and informal employment seem to work as substitutes in Brazil, with the latter contracting and expanding in response to shocks to the former. The reason is that exporting firms are more likely to be in the formal sector and workers are unlikely to be very mobile in response to shocks, such that the adjustment happens primarily within the same region and across sectors.

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

## Robustness

# Conclusions

This paper examines how export shocks impact labor market outcomes in Brazil by exploiting regional variations in exposure to foreign demand shocks over a 26-year period from 1995 to 2021. This timeframe was characterized by significant shifts in Brazil's trade policies and global economic integration. Our main findings show that export growth is positively associated with increases in formal employment and wages, with a more pronounced effect on high-skilled workers. Differences in outcomes by workers' gender are minimal.

While these results align with expectations, they tend to diminish over time, which may suggest that the benefits of trade dissipate as labor markets integrate and adjust. Further research is needed to assess the extent to which the effects of exports fade over time. It is also noteworthy that, although these changes have been largely positive, there has been an impact on the rate of labor informality. This indicates that trade liberalization has contributed to economic progress, but it has not been sufficient to resolve the deep-rooted issue of labor informality.

To ensure that the benefits of trade and structural transformation are more widely distributed, leading to inclusive and sustainable economic development in Brazil, sustained efforts and targeted policies are necessary. First, targeted interventions to formalize the labor market are crucial. These could include strengthening labor laws, enhancing social protection mechanisms, and providing incentives for businesses to formalize their operations. Additionally, policies focused on improving job quality and ensuring fair wages can help address 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

|  |  |
| --- | --- |
| 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 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.

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.

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. Natural Persons Registry, *Cadastro de Pessoas Físicas.* [↑](#footnote-ref-2)
2. National Registry of Legal Entities, *Cadastro Nacional de Pessoas Jurídicas.* [↑](#footnote-ref-3)
3. While census data is available from as early as 1960, our focus is on the most recent period of export expansion in Brazil, so we restrict our analysis to the 2000 and 2010 censuses. We do not include the 1991 census because the CNAE 95 sectoral classification used in RAIS data was established after the 1991 census, and no official concordance exists between the 1991 classification and CNAE 95. Creating an ad-hoc concordance would require numerous assumptions, potentially introducing additional noise into the analysis. [↑](#footnote-ref-4)
4. From the Ministry’s FAQ: “Os municípios dizem respeito ao domicílio fiscal da empresa exportadora/importadora. Divulgações mais detalhadas de produtos (como NCM) por municípios acabariam não preservando a privacidade das empresas. Desta forma, nas estatísticas detalhadas por municípios a divulgação precisa ser agregada ao nível de SH4, buscando conformidade com o sigilo fiscal e privacidade da pessoa jurídica, conforme artigo 13 do Decreto nº 11.544 de 1º de junho de 2023, Código Tributário Nacional, arts. 198 e 199 eLei 12.527/2011, arts. 4º, IV, 6, III e 31.” [↑](#footnote-ref-5)
5. [↑](#footnote-ref-6)
6. 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. As concisely put by Jorda (2023), “local projections can translate the familiar language of vector autoregressions and impulse responses into the language of potential outcomes and treatment effects.” [↑](#footnote-ref-7)
7. Here, we that shares as given and the industry-level shocks are as good as random as in Borusyak, Hull, and Jaravel (2018) because this is a more natural interpretation of global demand shocks. One alternative approach would be to take the pre-shock shares as instruments as in Goldsmith-Pinkham, Sorkin, and Swift (2020). In the results section, we argue that the absence of differential pre-trends in the main results is evidence that this different set of identification assumptions would likely also be valid. [↑](#footnote-ref-8)
8. https://www.annualreviews.org/content/journals/10.1146/annurev-economics-082119-121914#right-ref-B105 [↑](#footnote-ref-9)
9. https://www.aeaweb.org/articles?id=10.1257/aer.20141745 [↑](#footnote-ref-10)
10. Note that there is a difference in interpretation in the long-differences specification compared to the dynamic version we presented in the previous section. While the latter shows the cumulative response of the outcome variable with respect to a single year growth in exports, the former shows the cumulative response of the outcome variable with respect to the cumulative growth in exports. In other words, the marginal effect of the initial growth (say, between 2000 and 2001) is likely to be even smaller. [↑](#footnote-ref-11)