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Abstract

In this paper, we estimate the the effects of trade on mortality in Brazilian municipalities, using data with the universe of deaths and the China shock as a natural experiment. We employ an instrumental variable shift-share approach to find that both exports and imports from China reduce mortality. With regards to mechanisms, we show that exports increase employment and household income, reducing poverty-related deaths, such as malnutrition. Meanwhile, imports increase the employment rate among youngsters, increasing the opportunity cost of crime and reducing homicides.

Keywords: international trade; mortality; crime; Brazil; China.

JEL Codes: D31, F13, F16, I18, K42

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1 Introduction

The effects of international trade on mortality have long been discussed in the public health and economics literature.[1]. Trade liberalization, for example, can affect mortality and health outcomes through several channels, with positive effects stemming from knowledge diffusion and availability of medical services, and negative effects arising from detrimental labor market shocks or increases in inequality. Still, causal identification remains a challenge. As many studies are cross-country analyses focusing on child mortality (e.g. Olper et al. (2018); Owen and Wu (2007); Levine and Rothman (2006)), there is a gap in the literature when it comes to overall mortality, especially in developing countries.

This paper sheds light on the effects of trade on mortality in developing countries by exploring a plausibly exogenous trade shock in Brazil. When China joined the WTO in 2001, there was a dramatic increase in its participation in global markets. This event — which became known as the China Shock (Autor et al., 2016) — has been widely used to estimate causal effects of trade. A large and growing body of literature documents effects of the China Shock on several socioeconomic outcomes in different countries.[2] However, most of the literature on the China Shock focuses on the (mostly negative) effects of imports, while there are also expressive effects from demand-driven increases in exports in developing countries. This makes the Brazilian context an interesting case study, as growth in the demand for Brazilian exports led to gains in labor markets particularly in regions specialized in commodities (Costa et al., 2016). Moreover, there is growing evidence that imports from China had positive economic effects in developing countries due to productivity gains, as opposed to the mostly negative effects usually found in developed countries (Alfaro et al. (2022); Halpern et al. (2015); Goldberg et al. (2009)). Finally, while existing research links trade and mortality through channels that affect spe-

[1]For a review, see the Lancet series on trade and health (Blouin et al., 2009). Examples in the economics literature include Pierce and Schott (2020) and Bombardini and Li (2020).

[2]See Autor et al. (2021) for a thorough review of the literature.

cific causes of deaths, such as those from overdose (Pierce & Schott, 2020; Autor et al., 2019), pollution (Bombardini & Li, 2020), and crime (Dix-Carneiro et al., 2018; Dell et al., 2019), whether trade impacts overall mortality is still an open question.

In this paper, we use data with the universe of registered deaths in Brazil and employ a shift-share strategy to study effects of imports and exports on mortality between 2000 and 2010. Our identification strategy relies on the fact that due to different economic structures across municipalities, changes in exports and imports have heterogeneous effects according to regional specialization. We use an instrumental variable strategy to address the endogeneity of industry specialization, following previous work in the literature (Autor et al., 2013; Costa et al., 2016). We then estimate import and export shocks for each municipality to assess the effect of the China Shock on mortality. In order to investigate mechanisms, we also analyse the effects of the trade variables on economic outcomes such as employment rates and wages for specific demographic groups.

Our results show that both import and export shocks are associated with reductions in all-cause mortality. For exports, the effect is significant across different age groups and for different causes of deaths. The results are also robust to several sensitivity and placebo tests. We find that for an increase of USD 1,000 in exports, all-cause age adjusted mortality is reduced on average by 6.9 deaths per 100k people. This corresponds to a decrease of 8.5 deaths per 100k people for a one standard deviation increase in exports. Meanwhile, the import shock led to a decrease of 5.5 deaths per 100k people for a one standard deviation increase in imports.

We then analyse mortality by cause. We find that the export shock reduced mortality mainly due to causes that are associated with poverty, such as malnutrition, infectious and parasitic diseases and respiratory disorders (Rasella et al., 2013). The mortality reductions caused by the import shock, on the other hand, are almost entirely driven by reductions in homicides. An increase of one standard deviation in the import shock leads to a reduction of 2 homicides per 100k people, while the same increase for the export shock leads to a reduction of 0.9 homicides per 100k people.

We also explore important heterogeneities of the main effects by age and race. We find that imports leads to violent mortality reductions mainly among young adults, and the coefficients are larger for blacks. The export shock leads to poverty-related mortality reductions mainly among the elderly, and particularly older blacks. This confirms that while both shocks reduce overall all-cause mortality, the mechanisms are different. While the export shock drives reductions especially among older adults, by reducing mortality from diseases and deficiencies associated with poverty, the import shock reduces violent mortality, particularly among young adults.

To explain the finding that the trade shocks impact mortality through different channels, we turn to the heterogeneous effects on labor markets. The exports shocks lead to increases in household income and employment, and reductions in poverty. This is consistent with the findings that the most significant reductions were in poverty-related deaths, such as those from malnutrition and parasitic diseases. The import shock, however, has its effects concentrated on the labor market. In line with previous studies (Costa et al., 2016), we show that the import shock had distinct effects depending on the sector. There was a contraction of the manufacturing sector, while the primary sector expanded and wages in non-traded sectors increased[3].

Hence, while exports are associated with increases in income and wages, the import shocks main benefits are due to employment gains, particularly among blacks. By analyzing the racial distribution of workers across sectors, we find that young black workers are concentrated in the primary sector that expanded with the import shocks. Due to persistent and severe racial and socioeconomic inequalities, this demographic group is the most affected by violent crime in Brazil (Reichenheim et al., 2011; Malta et al., 2021). We suggest that this helps explain the violent mortality results, since different studies have shown that labor market conditions can affect homicide rates due to changes in the

[3]Recent research has shown that imports may positively impact productivity, especially through inputs that embody technological change. See Alfaro et al. (2022); Halpern et al. (2015); Goldberg et al. (2009).

opportunity cost of crime (Draca & Machin, 2015).

This paper innovates by examining the effects of trade on overall mortality in a developing country. This is particularly relevant because labor market effects can be quite different depending on the economic structure of each country. We thus contribute to different strands of the literature. First, we add to the growing literature that investigates the relationship between trade and mortality. Though there has been research on the theme, our main contribution is that we exploit an exogenous shock — the China Shock — to estimate causal effects. Our paper is more closely connected to Pierce and Schott (2020) and Autor et al. (2019), who study mortality effects of the China Shock in the United States. They show that adverse employment effects from the China Shock led to increases in fatal drug overdoses, particularly among white males. Fernández Guerrico (2021) finds the China Shock led to increases in diabetes mortality and obesity rates in Mexico, where there also were significant negative consequences for manufacturing employment due to import competition (Mendez, 2015). However, trade can affect mortality from various causes, through different channels, and there is little evidence on the net effect for all-cause mortality, especially in developing countries, where trade shocks affect labor markets in different ways.

More generally, our work is related to a body of literature about economics shocks and mortality (Browning & Heinesen, 2012; Classen & Dunn, 2012; Ruhm, 2000; Hone et al., 2019). This literature is usually focused on the effects of recessions and unemployment, with a large emphasis on deaths of despair, such as suicides and overdose, or stress-related mortality, such as cancer and cardiovascular diseases. We contribute to this branch of the literature by providing evidence that economic shocks that have heterogeneous effects across sectors and groups can impact mortality in distinct manners.

In this sense, we also contribute to a third branch of literature that studies the relationship between trade and crime. An important reference in this topic is Dix-Carneiro et al. (2018) that shows that in Brazil, tariff reductions in the 1990's, which increased import competition and unemployment, led to increases in the rate of violent crime. In a similar manner, Dell et al. (2019) shows that displacement in the manufacturing sector in Mexico led to increases in deaths due to drug related violence. Our results complement the findings of these two papers, as we show that the export shock in Brazil, which had positive employment effects for young workers, led to decreases in the homicide rate.

A fourth dimension in which we contribute is to the literature relating poverty and mortality. There is a considerable amount of research in the public health field focusing on the relationship between different socioeconomic indicators and mortality, but causal evidence and detailed explanations of mechanisms remain scarce (Fiscella & Franks, 1997; Duncan et al., 2002; Galea et al., 2011). We contribute by providing causal evidence that a trade shock that reduced poverty and increased household income led to reductions in mortality.

Finally, we add to the literature about the effects of the China Shock. Most papers focus on effects of imports in developed countries, especially on labor markets (Autor et al., 2013; Acemoglu et al., 2016). We contribute by exploring effects of the shock in a developing country, where not only there were positive effects of exports (Costa et al., 2016), but imports also had positive productivity effects (Alfaro et al., 2022).

The structure of the paper is as follows. The next section provides a brief review about the effects of trade with China on the labor markets in different countries, and presents our measure of local exposure to the trade shock. We then discuss our data and empirical strategy. Next, we show our results for mortality, as well as for different economic outcomes that help explain the mechanisms behind our findings. We also discuss robustness tests that support the validity our analyses. Then, we discuss some interpretations, limitations and implications for our results, and conclude.

2 The China Shock

China's participation in international trade has grown significantly since its entry into the World Trade Organization in the beginning of the 2000s, with considerable impacts on the countries involved (Autor, 2018). The seminal work by Autor et al. (2013) andAcemoglu et al. (2016) relates the competitiveness of imports from China to the throughout the first decade of the 21st century with a significant increase in unemployment in the manufacturing sector in the United States, in addition to negative impacts on the American labor market as a whole. An already expressive body of literature studied the effects of this so-called "China Shock" on the labor markets of local economies in different settings, as well as its consequences on variables such as housing prices, migration, mortality, marriage, government transfers, and poverty (Autor et al., 2021).

Brazil provides an interesting framework for studies aiming to assess different impacts of the China Shock, which are not limited to its effects on the labor market. Figure 1 shows the rapid ascension of China's participation in the country's trade balance. As argued by Autor et al. (2016), such an unexpected rise can be considered as an exogenous shock in individual countries, making it a quasi-natural experiment that allows for causal inferences in several settings. A growing body of research has investigated associations of the China Shock in Brazil with environmental degradation (Dornelas & Chimeli, 2019; Carreira et al., 2022), changes in the gender gap (Connolly, 2022; Benguria & Ederington, 2021), and worsening perceptions of local residents and legislators in regards to economic relations with China (Campello & Urdinez, 2021). But, there is no evidence so far on the effect of the China Shock on overall mortality in developing countries.

Balsvik et al. (2015) calculate that the China shock was responsible for about 10% of the decline in the manufacturing sector's share of the Norwegian labor market between 1996 and 2007. Similar results have been observed in many other countries, such as Denmark (Utar, 2018), France (Malgouyres, 2017), and Mexico (Mendez, 2015). In Brazil, Paz (2019) found the China Shock led to deterioration of employment and wages in the manufacturing sector. Despite the negative effects from import competition, it is possible that the Chinese demand for exports – mainly commodities – brings benefits that may outweigh the negative effects in the labor market. This would be even more likely in countries in which the share of participation in the trade balance is greater for primary goods than manufactured products, as is the case in developing countries. Autor et al. (2013) find that the aggregate result was negative for the U.S, even when considering net imports. Nevertheless, the authors report that there are differences depending on the level of industrial specialization in the region analysed, due to the distinct effects of greater competitiveness and increased exports to China.

Using a similar identification strategy in combination with a gravity-based instrumental variable methodology that uses estimates of supply shocks in the United States, Feenstra et al. (2019) show that job losses due to import competition were almost entirely offset by job gains due to export expansion depending on the period considered in the analysis. Similar findings were observed in Germany, where a substantial increase in trade occurred not only with China but also with Eastern Europe (Dauth et al., 2014). In South Korea, the China Shock had a net positive effect on job creation due to rising demand for intermediate inputs and capital goods (Choi & Xu, 2020).

Meanwhile, Costa et al. (2016) show that in Brazil regions that were most affected by competition from Chinese imports saw slower wage growth in the manufacturing sector between 2000 and 2010. At the same time, the authors found an opposite effect – acceleration in wage growth – in regions where the labor structure benefited from rising demand for commodities from China over the same period. They also find some indication of employment growth from export expansion in these regions.

Moreover, even import shocks may have positive labor market effects in developing countries through increased access to intermediate inputs that lead to gains in productivity (Goldberg et al., 2009, 2010; Halpern et al., 2015). This was observed in Japan, where there were employment gains in the manufacturing sector (Taniguchi, 2019). In

Belgium, Mion and Zhu (2013) show that trade with China led to significant within-firm skill upgrading, which brings about gains in productivity. Alfaro et al. (2022) show that imports from China had positive effects for firms in Brazil, as import sourcing increased revenue productivity and product diversification. In summary, though several studies have shown negative labor market effects of the China Shock, there are positive effects depending on each country's institutional settings and sectoral composition, particularly when considering export expansion due to increased Chinese demand and productivity gains from technological upgrades.

Local effects of the trade shock

To quantify the local effects of the China Shock, following Costa et al. (2016), we built trade shock variables by calculating labor shares between industries for each municipality, which we use as weights to distribute the total value of imports and exports for each product. Specifically, using a notation adapted from Borusyak et al. (2022), we define measures of the shocks referring to export demand (XD) and import supply (IS), respectively, as:

$$XD_m = \sum_j s_{jm} g_{j,XD}$$

$$IS_m = \sum_j s_{jm} g_{j,IS}$$

where m indexes the municipality and j indexes economic sectors. s_{jm} are the shares of labor allocated in each sector for each municipality, calculated as:

$$s_{jm} = \frac{L_{mj,2000}}{L_{m,2000}}$$

We define $L_{mj,2000}$ as the size of the workforce in sector j in municipality m in the year

2000, and $L_{m,2000}$ as the total size of the workforce in municipality m in the year 2000. Meanwhile, $g_{j,IS}$ and $g_{j,XD}$ are the growth rates for exports and imports of products from each sector, calculated as the total variation, in thousands of dollars, of products exported and imported between Brazil and China referring to sector j, between 2000 and 2010, scaled by the size of the national workforce in each sector:

$$g_{j,XD} = \frac{\Delta X_j}{L_{Bj,2000}}$$

$$g_{j,IS} = \frac{\Delta I_j}{L_{Bj,2000}}$$

In other words, the estimated index uses fixed weights to distribute the national traded value in each sector across regions. The weights are given by the participation of each sector in the workforce of each region in the year 2000. Table A1 shows descriptive statistics by sector, and Figure 2 shows the geographic distribution of the municipalities in the first quintile of the trade shock variables. Note the concentration of high values of the export exposure variable in areas typically producing commodities, such as Minas Gerais, Pará and Mato Grosso. At the same time, the highest values of the import shock are concentrated in regions with greater industrial and technological production, in the Southern and Southeastern regions of Brazil.

3 Data and empirical strategy

Data

In this paper, we use detailed individual-level mortality data that come from SIM, a system maintained by the Brazilian Ministry of Health that contains anonymized microdata on all registered deaths nationwide, with detailed information such as date of birth and death, municipality of residence, race, and others[4]. We apply the standard methodology of calculating age adjusted mortality rates (e.g. Pierce and Schott (2020)). To do so, we calculate, for each municipality, the number of deaths in 2000 and 2010 across different age groups (0-1 year, 1-5 years, 5-10, ..., 75-80 and 80+). For each municipality and year, we calculate crude mortality rates by dividing the number of deaths in each age group by the number of people in that age group. We then calculate age adjusted mortality rates as a weighted average of the crude rates in all age categories, using the share of each group in the Brazilian population in 2000 as weights. We also calculate mortality rates for different subcategories according to age and race, as well as mortality rates by cause.

To build the China shock variables, we extracted microdata at the individual level with information such as income, age and main job activity of the population from the 2000 and 2010 Population Census[5]. Then, the database on international trade was extracted from BACI CEPII[6], which compiled and adjusted numbers reported by the United Nations. We extracted export and import values, by product category, between Brazil and China, as well as between China and other countries in the world, for the years 2000 and 2010. We deflated the values in BRL for the year 2000 using the IPCA [7] for 2010 values, and dollar values with the US GDP price deflator calculated by BEA [8]. In order to aggregate the observations, we grouped the individual data by municipality [9]. We used a correspondence of minimal comparable areas to be able to consider the modification of boundaries

[4] Brazilian Ministry of Health. DATASUS. https://datasus.saude.gov.br/transferencia-de-arquivos/

[5] Brazilian Institute of Geography and Statistics (IBGE). Demographic Census. https://www.ibge.gov.br/estatisticas/sociais/populacao/22827-censo-2020-censo4.html

[6] Centre d'Etudes Prospectives d'Informations Internationales (CEPII). Product Level International Trade Database (BACI). http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=37

[7] Brazilian Institute of Geography and Statistics (IBGE). Extended National Consumer Price Index (IPCA). https://www.ibge.gov.br/estatisticas/economicas/precos-e-custos/9256-indice-nacional-de-precos-ao-consumidor-amplo.html?=&t=series-historicas

[8] U.S. Bureau of Economic Analysis (BEA). Implicit Price Deflators for Gross Domestic Product. https://www.bea.gov/data

[9] As we are interested in demographic effects of the labor market shock, and not in the labor market effects per se, we follow Dornelas and Chimeli (2019) and use municipalities as our unit of observation instead of following Costa et al. (2016) who used microregions. We also conduct the analysis at the microregion level as a robustness test.

or the creation of new municipalities over the years (Reis et al., 2008), obtaining 4,267 municipalities in our sample. In order to associate the economic sectors of the Census — where activities are classified according to the National Classification of Economic Activities (CNAE) — to the classifications of products of the trade database — that use the HS96 international harmonized classification —, we used a correspondence created by Costa et al. (2016) that groups the sectors according to the focus of the main productive activity (82 traded sectors).

Table 1 shows summary statistics for our main variables. It suggests that municipalities with greater exposure to import shocks are on average larger, richer, and whiter than those with a more expressive exposure to export shocks. Moreover, Figure 3 depicts the distribution of changes in mortality between 2000 and 2010 across municipalities, showing the the reductions in violent mortality were concentrated in the center-west part of Brazil, where agriculture prevails.

Empirical Strategy

Our aim is to estimate the magnitude of the export and import shock for each Brazilian municipality, to assess the impacts of such shocks in several variables. The average municipality in our sample had an import shock from China of USD 202 per worker, and an export shock of USD 485 per worker. Nonetheless, this variation in traded values is likely endogenous, depending on Brazilian economic conditions that also affect other indicators of interest. Therefore, we employ an instrumental variable strategy. For this, we again follow Costa et al. (2016). Instead of using the variation in trade between Brazil and China, we calculate the growth of imports and exports from sectoral fixed effects estimated with the following auxiliary regressions:

$$\frac{\Delta \tilde{I}_{ij}}{\tilde{I}_{ij,2000}} = \alpha_j + \psi_{Chinaj} + v_{ij}$$

$$\frac{\Delta\tilde{X}_{ij}}{\tilde{X}_{ij,2000}} = \gamma_j + \delta_{Chinaj} + \mu_{ij}$$

where the expressions on the left represent the growth rate of imports and exports of country i in sector j, excluding trade with Brazil. α_j and γ_j are industry fixed effects, while ψ_{Chinaj} and δ_{Chinaj} are dummies that capture China's impact on industry trade j relative to the average of all countries. From there, we used these estimates to represent the local impact with the instrumental variables, using the same shares s_jm that we use for the endogenous trade variables. The instruments are therefore given by:

$$ivXD_m = \sum_j \frac{L_{mj,2000}}{L_{m,2000}} \frac{\Delta\hat{X}_j}{L_{Bj,2000}}$$

$$ivIS_m = \sum_j \frac{L_{mj,2000}}{L_{m,2000}} \frac{\Delta\hat{I}_j}{L_{Bj,2000}}$$

where $\Delta\hat{I}_j = I_{j,2000}\hat{\delta}_{Chinaj}$ and $\Delta\hat{X}_j = X_{j,2000}\hat{\psi}_{Chinaj}$, with $X_{j,2000}$ and $I_{j,2000}$ defined, respectively, as the values of exports from Brazil to China in sector j in 2000, and the values of imports of Chinese products to Brazil in sector j in 2000. In simpler terms, the trade shock is instrumented by trade between China and all countries other than Brazil, and therefore is arguably uncorrelated with any Brazilian characteristics that could violate the exclusion restriction.

We include controls for the economic structure in 2000 to account for the labor distribution in the shift-share instrument. Specifically, we control for the share of the population employed in the agricultural, manufacturing, primary, and informal sectors in the year 2000, the size of the workforce in 2000, the percentage of workers residing in rural areas in 2000, and a cubic polynomial of income per capita in 2000. We also add state fixed-effects and weight regressions by municipality size. Our final methodology is thus to estimate, using Two Stage Least Squares (2SLS), the following equation:

$$\Delta lnY_m = \beta IS_m + \theta XD_m + \lambda X'_m + \alpha_s + \varepsilon_m \quad (1)$$

where Y_m is the outcome of interest (different variables of mortality, as well as labor market outcomes), IS_m and XD_m are the import and export shocks, X'_m are the controls for the economic structure in 2000, and α_s are state fixed-effects. To allow for heteroskedasticity and geographical correlation between error terms, we follow Dornelas and Chimeli (2019) and cluster standard errors by microregion.

Identification and inference

Since the seminal paper by Bartik (1991) that pioneered the use of shift-share instrumental variable (SSIV) regressions, there have been many recent econometrics developments in this front. Goldsmith-Pinkham et al. (2020) present a rationalization of the SSIV design according to which identification is based on exogeneous differences in the exposure to common shocks. They show that the SSIV estimator is equivalent to a generalized method of moments (GMM) estimator, which uses the local sectoral shares as instruments. This would be most appropriate in cases when there is a single shock, but regions are differently exposed due to different labor distributions between regions.

Differently from this so called ”shares” approach, which emphasizes the exogeneity of labor shares, Borusyak et al. (2022) introduce a perspective that requires exogeneity of shocks instead. Under this framework, exogenous shares are sufficient but not necessary for causal identification: endogenous shares do not necessarily violate the exclusion restriction. They show that the orthogonality between the instrument and unobserved residuals is equivalent to the the orthogonality between the shocks and a shock-level unobservable. That is, as long as the shocks are as-good-as-randomly assigned, and there are many independent shocks, the instrument is valid. They develop a procedure to empirically test these assumptions. However, applying these procedures to the Brazilian data is not practical because of the reduced number of industries, as the sector divisions are therefore relatively broad (see Costa et al. (2016) for more details), which means we are not able to disaggregate our sectors into broader categories, as suggested by Borusyak et al. (2022).

Still, their framework provides support to the empirical strategy in our setting. Since our instruments are built using labor shares in 2000 as the allocation weights, it is not reasonable to assume that these shares are exogenous. Moreover, as discussed by Borusyak et al. (2022), the independent shocks assumption can be relaxed to allow correlation within clusters of industries, which is useful in our setup because our industry aggregation is broader than the one used by Autor et al. (2013), especially considering we also include primary sector activities such as those in agriculture and mining.

However, we cannot allow our sector aggregation to be too broad, as that would mean some regions might specialize in only a few industries and hence the number of independent shocks would be quite limited. This requires the Herfindahl–Hirschman index across regions to be small, more so considering that some regions might have a large share of workers employed in non-traded sectors. Nevertheless, Borusyak et al. (2022) also show that in settings in which the shares s_{jm} do not add to unity (as is ours, because we do not include non-traded sectors), controlling for the sum of the shares allows a weaker version of the Herfindahl–Hirschman condition that does not require the share of workers employed in non-traded sectors to be small. In our case, this is attended by the inclusion of the sectoral controls discussed in the previous section. The Herfindahl–Hirschman index in our sample with 82 traded industries is 0.0369, which shows that labor is reasonably dispersed across the traded industries.

When it comes to inference, Adão et al. (2019) show that geographically clustered standard errors in shift-share designs are likely to be inadequate because of correlation of residuals between regions with similar sector compositions. They propose alternative standard errors that take into account unobserved shift-share terms that may cause residuals to be correlated between regions independent of their geographical location. Their method is originally derived for regressions that use one instrumental variable only, but Dornelas and Chimeli (2019) propose a way to adapt the methodology to the setting based on Costa et al. (2016) with two instruments ($ivXD_m$ and $ivIS_m$). In practice, it essentially requires running separate regressions for each instrument, adding the other instrument as a control. We conduct this procedure as a robustness exercise, but as this adaptation procedure is not standard practice and we are not able to appropriately follow the method developed by Adão et al. (2019) due to our setting with multiple instruments and a smaller number of industries, we keep the geographically clustered standard errors as our main specification.

4 Results

Mortality

Table 2 displays our main results. Column (2) presents our main specification following Equation 1 for mortality, defined as the total number of age-adjusted deaths per 100k residents. It shows that both trade shocks are associated with reductions in mortality. For each USD 1,000 increase in exports from Brazil to China, the age adjusted mortality rate was reduced by 6.9 deaths per 100k residents on average — or by 8.5 deaths for one standard deviation increase in exports. This is expressive, considering the mean mortality rate in our sample is 563 in 2000 and 491 in 2010 (Table 1). The effect of imports is also large: 17.7 less deaths per 100k people for each USD 1,000 increase in imports — or 5.5 deaths per 100k in terms of standard deviations. The lower panel displays first stage results, showing our instrumental variables for the trade shocks are valid.

We conduct a number of robustness tests to ensure our results are not driven by arbitrary specification choices. In particular, we control for previous trends in mortality, estimate unweighted regressions, use different fixed-effects and aggregation approaches, exclude municipalities with a small number of deaths, as well as test different standard errors (see Section 3). Additionally, we include the change in several socioeconomic outcomes that could drive changes in our dependent variables. Namely, we control for the variation between 2000 and 2010 of the share of white workers in the workforce, mean age of workers, access to plumbing and electricity, ownership of a refrigerator, number of residents per household, and educational distribution (percentage of workers in each of the following categories: illiterate, literate only, elementary school, high school and higher education). We also conduct an alternative construction of our instrumental variables, following Autor et al. (2013). In this case, the instruments are defined as:

$$ivXD_m = \sum_j \frac{L_{mj,2000}}{L_{Bj,2000} L_{m,2000}} \Delta I_{China,j}$$

$$ivIS_m = \sum_j \frac{L_{mj,2000}}{L_{Bj,2000} L_{m,2000}} \Delta X_{China,j}$$

where $\Delta X_{China,j}$ e $\Delta I_{China,j}$ are, respectively, the change between 2000 and 2010 in China's exports to the rest of the world (excluding Brazil) and imports from the rest of the world to China (excluding Brazil).

Table 3 shows the results from these tests. It indicates that our results for exports are robust, remaining negative and significant in all models. While also always negative, the coefficient for imports is not statistically significant in some specifications due to a large confidence interval. In the Appendix we add each socioeconomic control separately. Figure A1 compares coefficients when we add the change in each of the socioeconomic outcomes. It shows that results remain largely unchanged when compared to our baseline specification. This suggests that exogenous factors that might have altered factors related to health and education do not explain the change in mortality that we observe. Table 4 compares confidence intervals built with alternative standard errors. Again, it confirms the robustness of our results for exports, while showing that the result for imports is less robust.

We also conduct a dynamic analysis by using the change in mortality between 2000 and different years, from 1996 to 2019, as the dependent variable. The regressors remain the same; the trade shock variables are always calculated using the changes in trade between 2000 and 2010. Thus, besides investigating long-term effects of the trade shocks (when estimating effects on the trade shock between 2000-2010 on mortality rates in 2011 and onwards), this analysis serves as a thorough robustness test and placebo test (when using data prior to 2000). [10] Figure 5 shows coefficients considering all-cause mortality. As expected, the placebo regressions using data from before 2000 yield statistically null coefficients. Though confidence intervals are wide, coefficients between 2001 (when China joined WTO) and 2010 are mostly negative. This is likely due to the fact that trade patterns in 2010 are correlated with trade patterns between 2001 and 2009. The coefficients after 2010 remain negative, showing that there are persistent negative effects of the export shock on the mortality rate. The effects of imports are again shown to be less robust.

Table 5 displays estimates by cause, showing that the mortality declines due to the export shocks hold across many causes, especially deaths from causes that are commonly associated with poverty rates, such as infectious and parasitic diseases and nutritional deficiencies (Rasella et al., 2013). This suggests mechanisms related to reductions in starvation and malnutrition due to income increases are likely driving the overall improvement in all-cause mortality due to exports. Meanwhile, the import shocks are particularly significant for violent deaths, which seems to be driving most of the reduction in all-cause mortality associated with imports. In terms of the magnitude of the impact, the export shock is associated with a reduction of 0.9 homicides per 100k people for an increase of one standard deviation in exports, while the import shock leads to a reduction of 2 homi-

[10] Moreover, because we do not have data on the age distribution across municipalities for all years, we are not able to age-standardize the mortality rates in this case. This analysis therefore considers death rates per capita, and hence is a robustness test for the choice of standardizing death rates.

cides per 100k people for an increase of one standard deviation in imports.

To further understand what explains the different results for the import and export shocks, we run separate regressions by age group. Panel A of Table 6 shows the effect on violent deaths seems to be concentrated among teenagers and young adults, which is in line with previous studies that show this is the group most affected by violent crime (Malta et al., 2021). More specifically, young black men are at the highest risk of being involved with crime and dying from violent deaths (Reichenheim et al., 2011). This can be seen in our sample as shown in Table 7: the violent mortality rate for young adults is more than twice as large for blacks than it is for whites. It could therefore be that this group is affected in a particularly different way by the import shock, which could explain why it led to such reductions in violent mortality. Figure 4 shows the results for all-cause mortality rates by age and race, and also hints to this narrative: the import shock has a negative effect for both whites and blacks, but larger for blacks, and concentrated in people younger than 30 years old. The effect of the export shock, however, is negative for older and black adults, though the reduced sample size in this case leads to large confidence intervals [11].

Results for all-cause mortality rates by age group are displayed in Table A2, showing that exports reduce all-cause mortality across all adult groups [12]. For the import shock, coefficients are negative and significant for people aged under 30 years old, while for the export shock they are significant across all adult age groups. Table A6 and Table A7 show results for violent and poverty-related mortality rates by age and race. Coefficients for the effect of imports on violent deaths are negative and significant across all adult groups, both for blacks and whites. The largest coefficient is for black young adults: an increase of one standard deviation in imports leads to a reduction of 4.5 homicides per 100k blacks aged 15-29 years. The negative effect of exports on poverty-related deaths,

[11] The overall effect by race is shown in Table A3, which displays results for all-cause age-adjusted mortality by gender and race. The results for mortality are all negative, but only significant for the impact of exports on the deaths by gender, both for males and females, and significant at the 10% level among blacks.

[12] See Table A4 and Table A5 in the Appendix for results for separate causes of deaths for these age groups

however, is only significant for blacks.

Figure 6 depicts the dynamic analysis considering mortality by cause. Again, the placebo exercise shows the estimated coefficients are not statistically significant, while the coefficients are significant and negative after 2001. They remain negative after 2010, showing persistent effects of the import shock on reductions in violent mortality. Figure 7 shows coefficients for poverty-related mortality, confirming the negative result of exports are robust and enduring, while there is no effect for imports[13] .

Mechanisms

To understand the possible mechanisms for these results, we analyze the effect of the China shocks on economic variables. In line with findings by Costa et al. (2016), Table 8 shows that the export shock is associated with income increases and informality reductions. We also find it leads to reductions in extreme poverty and increases in employment. Meanwhile, the import shock also leads to reductions in unemployment and increases in wages, but the results for income and informality are not significant. However, it does not have any effect on the employment rate, defined as the employed to population rate. This result is consistent with findings by Connolly (2022), which show that both shocks led to reductions in the unemployment rate, but only the export shock affected the employed to population ratio. She suggests these differences are related with differential ways in which the shocks affect groups of workers, such as men and women.

These results shed some light into the mechanisms driving our mortality results. The positive effects of exports on household income and poverty are consistent with the findings that mortality reductions are mainly explained by reductions in poverty-related causes. On the other hand, it is not yet clear why imports reduced homicide rates, since both shocks reduce unemployment, and the effect of the import shock is null on the employment to population rate. We then turn to estimating the heterogeneous effects of the trade

[13] For the complete table of robustness tests for these causes, see Table A8.

shocks across different groups of workers. In line with Costa et al. (2016), Table 9 shows that the import shock leads to a contraction of the manufacturing sector, but expands the commodity-focused primary sectors. The export shock, on the other hand, expands the primary sector while reducing the share of the non-traded sectors in the economy. Panel B shows that the export shock leads to income gains in the manufacturing and non-traded sectors.

Thus, we have shown that the shocks affect each sector differently. We argue that because of different sociodemographic compositions in each sector, the shocks also have differential effects by education and race[14]. Table 10 shows workers in the primary sector have less formal education than workers in the manufacturing and non-traded sectors. Because of inequalities of opportunities that lead to disadvantages in education (Marteleto, 2012), this translates into a similar pattern when looking at the racial distribution.

Table 11 shows that black workers are the majority in the primary sector, especially when it comes to young workers, while in the manufacturing sectors, white workers are the majority. This provides more clarity into the possible mechanisms: the import shock harms employment in white-dominated industries, while it leads to gains in sectors that have a high concentration of black young workers. Table 12 shows that the import shock increases employment among less educated workers (precisely because it benefits the primary sector). These patterns are then reflected in the analysis by race. Indeed, Table 13 shows the effect of the trade shock on employment-to-population rates by age and race, showing that the import shock increases employment particularly more among black workers — the effect is not statistically significant for other workers. When it comes to the unemployment rate, though there are reductions for all groups, the effect on young black workers is almost twice as large than it is for white workers (Table A9). The export shock, on the other hand, reduces unemployment similarly across groups. Table 14

[14]Though we present the analysis of the effects on employment by education and race, we are not able to conduct the analysis by educational group for mortality due to lack of data

shows that the import shock reduces the gap between employment rates of whites and blacks, again showing that young black workers benefit from the import shock in terms of employment.

In summary, our findings in terms of heterogeneous effects on mortality put together with the effects on labor markets shed some light on the underlying mechanisms at play. The export shock brings overall income gains across different groups as the value of traded commodities expand and economic gains are shared across different sectors [15]. Therefore, this shock leads to reductions in mortality rates, especially those related to poverty. The import shock, on the other hand, has distinct effect across industries, resulting in a decline in manufacturing and an upsurge in the primary sector. It thus positively impacts employment for workers in the primary sector, which due to educational inequalities are the sociodemographic group most affected by violent crime. Hence, the import shock reduces violent mortality.

5 Discussion

We show that exposure to an increase in exports led to a decrease in the overall mortality rate, which is mostly explained by decreases in poverty-related deaths. Moreover, exposure to an increase in imports led to a significant decrease in violent mortality. The results of the previous sections give some indications of potential explanations for these findings. Differently from the US and other developed countries, the China Shock in Brazil led to income and employment gains with the rise in export demand and productivity gains stemming from imports of intermediate inputs (Costa et al., 2016; Connolly, 2022; Alfaro et al., 2022).

We find that the coefficients of the impact of export shocks on mortality are negative across several groups and for different causes of death. There is a substantial body

[15]See Table A10 and Table A11 for the coefficients on income and wages by education, race, and age.

of literature showing that household income and poverty rates are associated with mortality from several causes, although mechanisms are not yet fully understood. Factors that have been suggested to modulate this relationship include risky behaviors such as smoking and drinking, access to leisure and physical activity, stress levels, differences in education that impact health knowledge and attitudes towards hygiene, access to healthcare providers and services, and access to healthy food options, among others (Fiscella & Franks, 1997; Duncan et al., 2002; Galea et al., 2011). Previous literature has suggested that increases in employment rates lead to reductions in all-cause mortality in Brazil though mechanisms such as pyschosocial stress, access to medicine and healthcare, as well as general poverty related illnesses (Hone et al., 2019).

Specifically, we find that the export coefficient is particularly significant for reductions in poverty-related deaths such as malnutrition and parasitic diseases (Rasella et al., 2013). As we control for the change in several socioeconomic variables such as access to plumbing and education, our results are not explained by general improvements in sanitary and living conditions. Instead, we suggest these are driven by income gains derived mainly from improvements in the primary and the non-traded sectors.

The coefficient for violent deaths is significant for both shocks and is in line with what Dell et al. (2019) observed in Mexico, where displacement caused by import competition led to higher rates of drug related homicides. The relationship between unemployment and violent crime is well documented (Britto et al., 2022). Here, the same mechanism could be at play in the opposite direction: lower unemployment may have diverted young Brazilians from crime, reducing the incidence of violent deaths. This seems to drive most of the reductions in all-cause mortality that we observe for the import shock. Indeed, the fact that this effect is different than the one for the export shock (which is smaller and less robust) suggests that the mechanism is through employment, and not income. We show that the import shock improves employment especially for young black workers, because they are more likely to work in primary sectors. This is the group that is most likely to be involved in violent crime and die from homicides (Murray et al., 2013; Malta et al., 2021). Put together, these findings suggest that employment gains reduced the opportunity cost of crime, leading to decreases in violent mortality.

Our study brings the important contribution of shedding some light into different segments of recent literature by comparing trade shocks that have different impacts on economic variables. Imports and exports affect employment and income in different ways. By showing that these effects extend to mortality rates, this article contributes to the understanding of how trade shocks impact demographic outcomes.

6 Conclusion

Our study investigated the effects of the China Shock on mortality variables in Brazil. We employed a shift-share instrument approach and estimated import and export shocks for each municipality. We then used nationwide microdata on deaths to estimate the effect of the China Shock on mortality.

Our results showed that both import and export shocks are associated with reductions in all-cause mortality, though the result is more robust for the export shock. For the export shock, these reductions are mostly driven by poverty-related deaths. We show that export shocks lead to positive effects on income and employment growth, which likely helps explain these findings. The import shock, on the other hand, reduced homicides. We show that imports reduced unemployment particularly among young black workers, the group most affected by crime, which suggests the reduction in violent mortality was due to an increase in the opportunity cost of crime.

Our findings contribute to the literature on the China Shock, as well as to the broader literature that studies the effects of trade and economic shocks on crime and health. Further research is needed to better understand the mechanisms behind these effects and to evaluate their implications for long-term demographics.

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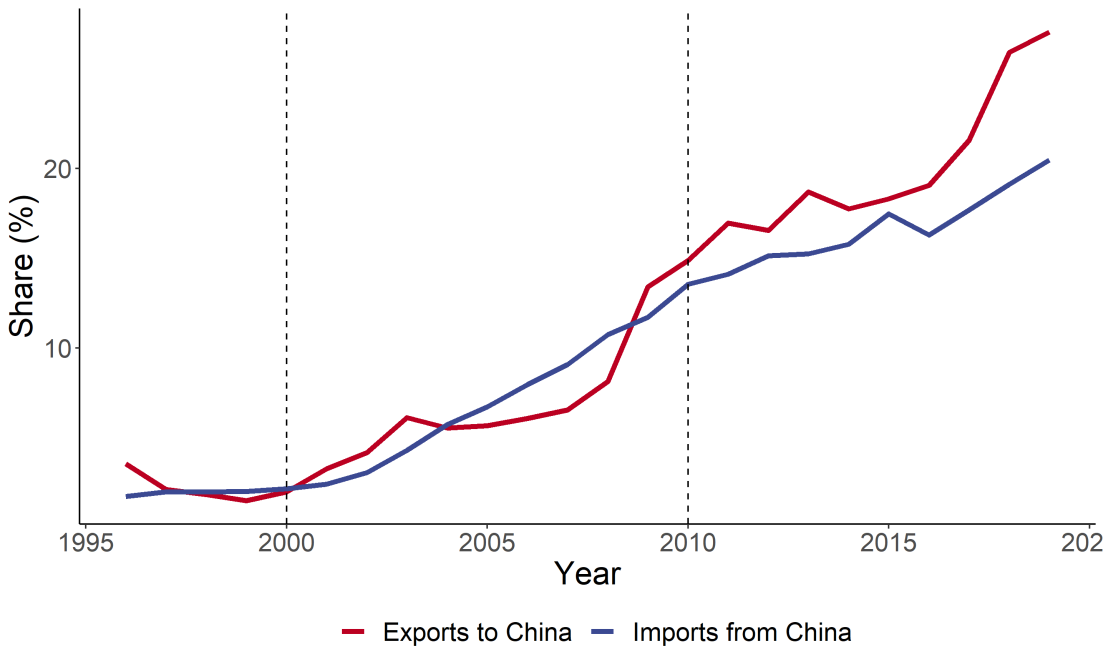
Figures and Tables

Figure 1: Evolution of China's participation in Brazilian total export and import flows



Note: This figure shows the share of exports and imports between Brazil and China as a share of total Brazilian exports and exports, between 1996 and 2019.

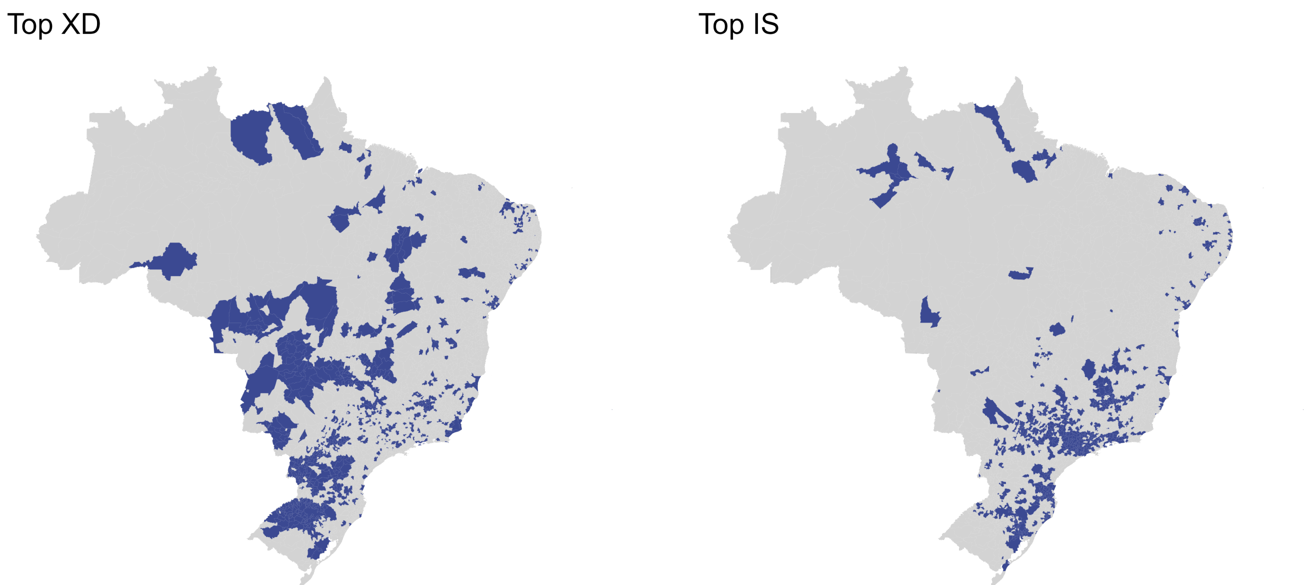


Figure 2: Municipalities in the top quintiles of the trade shocks. This figure shows the distribution of the municipalities in the top 20% of exposure to the export shock XD_m (left) and the import shock IS_m (right). Municipalities are aggregated in minimum comparable areas (N = 4,267).

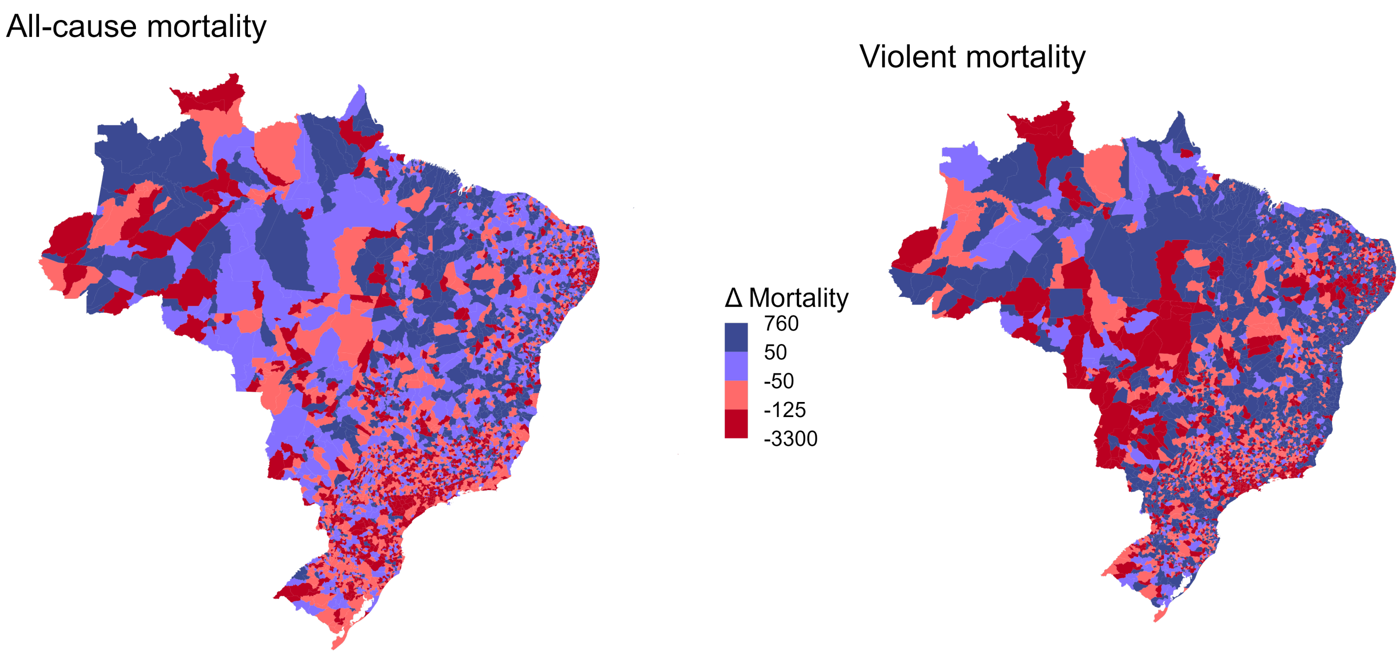


Figure 3: Distribution of changes in mortality rates between 2000 and 2010. This figure shows the distribution of changes in all-cause mortality rates and mortality rates due to violence between 2000 and 2010. Mortality is calculated as the age-adjusted rate per 100k people across all ages. Municipalities are aggregated in minimum comparable areas (N = 4,267).

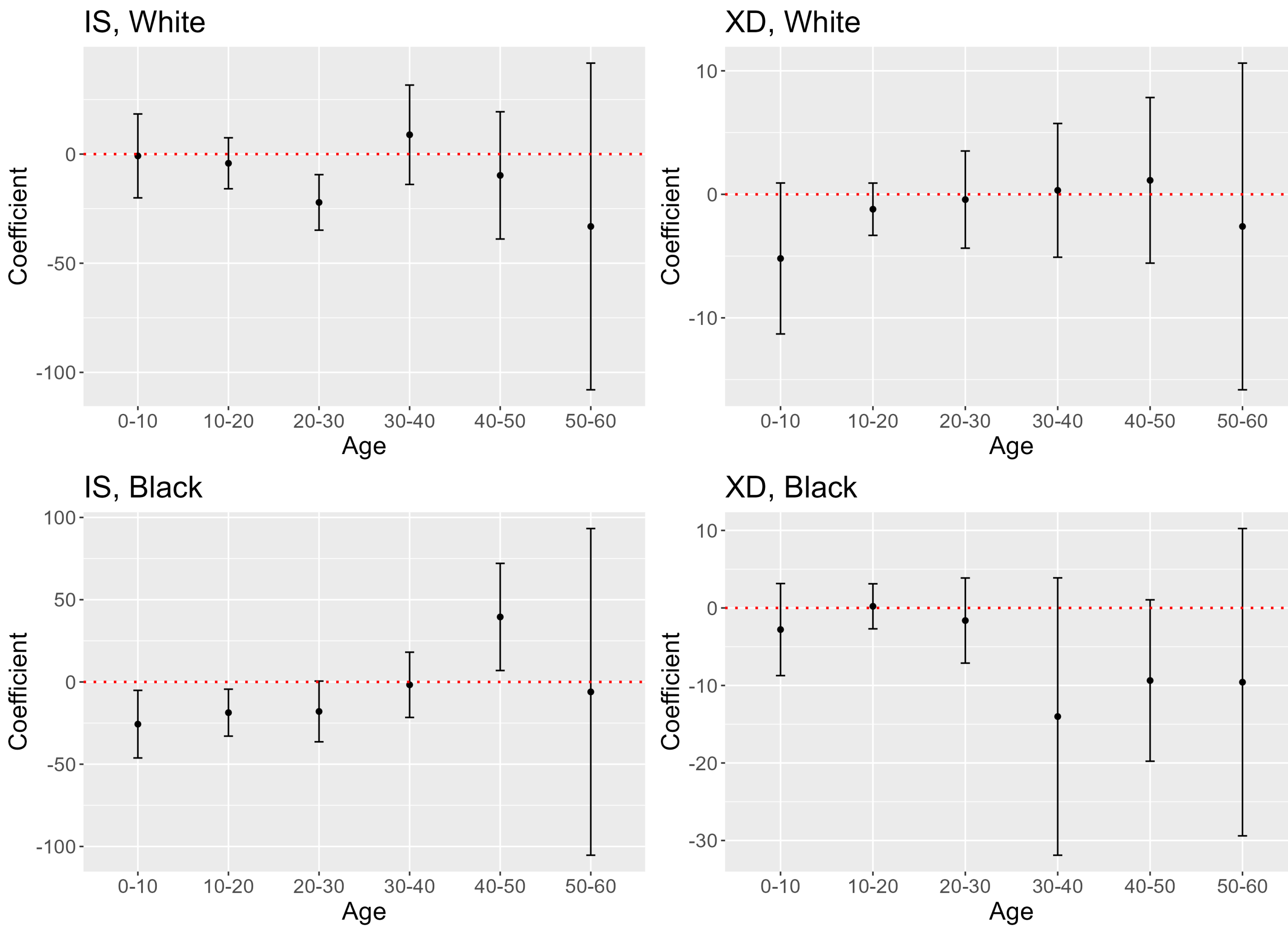


Figure 4: China Shock effects on mortality by race. This figure shows coefficients from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by age and race between 2000 and 2010. Mortality is calculated as the number of total deaths per 100k people in each age group. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. 95% confidence intervals are plotted based on standard errors clustered at the micro-region level. Regressions are weighted by municipality population.

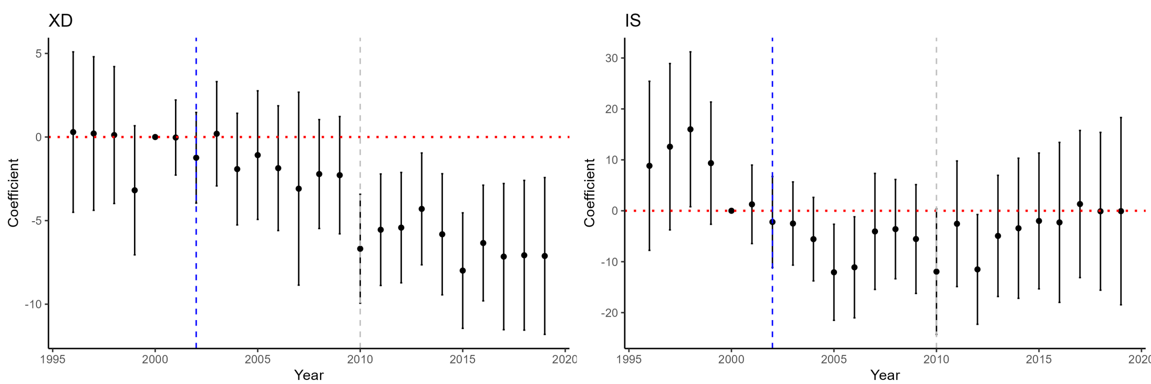


Figure 5: Dynamic China Shock effects on mortality. This figure shows coefficients from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality between 2000 and different years. Mortality is calculated as the number of total deaths per 100k people in each municipality and year. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. 95% confidence intervals are plotted based on standard errors clustered at the micro-region level. Regressions are weighted by municipality population.

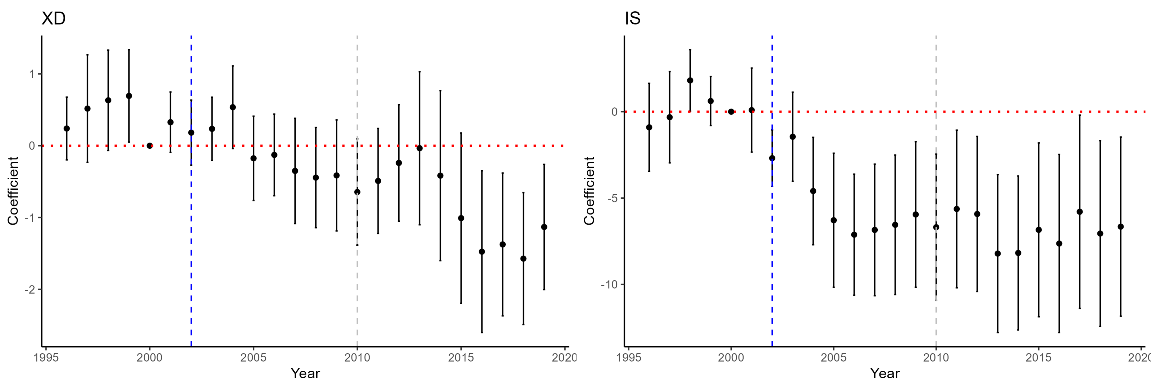


Figure 6: Dynamic China Shock effects on violent mortality. This figure shows coefficients from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in violent mortality between 2000 and different years. Mortality is calculated as the number of deaths due to violence per 100k people in each municipality and year. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. 95% confidence intervals are plotted based on standard errors clustered at the micro-region level. Regressions are weighted by municipality population.

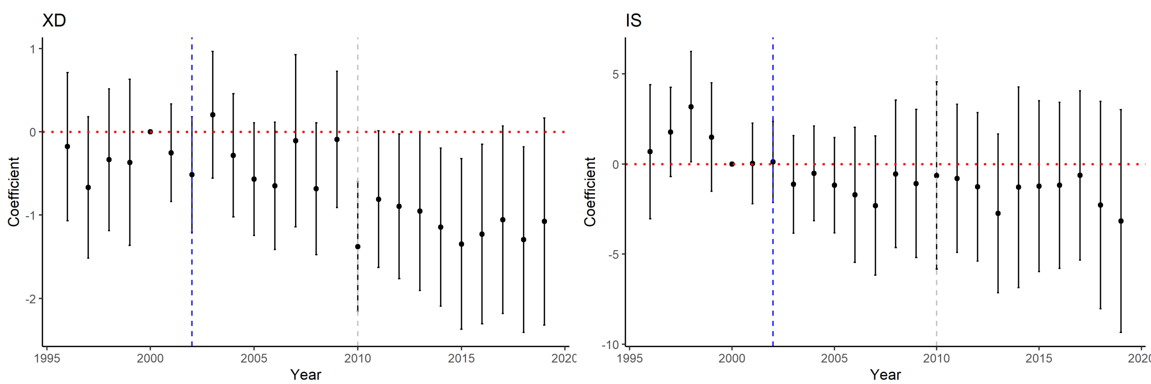


Figure 7: Dynamic China Shock effects on poverty-related mortality. This figure shows coefficients from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in poverty-related mortality between 2000 and different years. Mortality is calculated as the number of deaths due to poverty-related causes, which we define as nutritional deficiencies and infectious and parasitic diseases, per 100k people in each municipality and year. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. 95% confidence intervals are plotted based on standard errors clustered at the micro-region level. Regressions are weighted by municipality population.

Table 1: Descriptive statistics

	2000	2010
Panel A: All municipalities		
Mortality	563.0	490.8
Violent mortality	25.7	26.3
Unemployment	0.15	0.08
White	0.54	0.47
Age	34.81	36.10
Wage	6.10	7.95
Workforce	717,043	799,806
N	4267	4267
Panel B: Top IS_m		
Mortality	611.8	507.6
Violent mortality	32.9	25.8
Unemployment	0.16	0.08
White	0.62	0.55
Age	35.09	36.50
Wage	7.91	9.75
Workforce	1,302,486	1,426,553
N	854	854
Panel C: Top XD_m		
Mortality	578.5	501.3
Violent mortality	20.7	30.3
Unemployment	0.15	0.08
White	0.55	0.47
Age	34.80	36.19
Wage	5.79	7.73
Workforce	282,089	325,490
N	854	854

Note: This table shows the mean values for selected variables in the sample, averaged at the municipality level with weights according to population size. Panels B and C show values for the municipalities in the top quintiles of exposure to the China Shock. Variables are shown as follows: mortality is calculated as the all-cause age-adjusted rate per 100k people across all ages; violent mortality is the age-adjusted rate of violent deaths per 100k people across all ages; unemployment is the unemployment rate; white is the share of white workers in the workforce; wage is the hourly wage in 2010 BRL; age is the mean age in the workforce.

Table 2: Results — Mortality (Total)

	OLS	2SLS
	(1)	(2)
XD_m	-5.112^{***}	-6.916^{***}
	(1.528)	(1.774)
IS_m	-16.365^{***}	-17.947^{***}
	(5.602)	(6.697)
First stage		
$ivXD_m$		2.101^{***}
		(0.044)
$ivIS_m$		2.796^{***}
		(0.113)
Kleibergen-Paap F-Stat.		311.148^{***}
Controls	Y	Y
FE (state)	Y	Y
N	4,267	4,267
R^2	0.349	0.349

Note: This table shows results from Ordinary Least Squares (OLS) and Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on the change in mortality between 2000 and 2010. Mortality is calculated as the all-cause age-adjusted rate per 100k people across all ages. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 3: Results — Robustness Tests

	Main	Pre-trend	ADH	Controls	Log	Unweighted	Meso FE	Restricted Sample	Microregion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
XD_m	-6.916^{***}	-6.749^{***}	-4.557^{*}	-6.115^{***}	-0.019^{***}	-3.325^{*}	-3.586^{**}	-6.452^{***}	-7.920^{***}
	(1.774)	(1.807)	(2.764)	(1.594)	(0.005)	(1.998)	(1.536)	(2.095)	(2.597)
IS_m	-17.947^{***}	-14.733^{**}	-18.510^{***}	-15.217^{**}	-0.031^{**}	-13.941	-10.336	-16.881^{**}	-21.242^{**}
	(6.697)	(6.364)	(6.544)	(6.515)	(0.014)	(12.235)	(8.376)	(7.550)	(8.570)
N	4,267	4,267	4,267	4,267	4,267	4,267	4,267	1,485	554
R^2	0.349	0.246	0.349	0.358	0.309	0.118	0.415	0.412	0.690

Note: This table shows results from different specifications of Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on the change in mortality between 2000 and 2010. Mortality is calculated as the all-cause age-adjusted rate per 100k people across all ages. Column (1) shows the preferred specification following Table 2. Column (2) controls for previous trends in mortality by including the change in mortality between 1996 and 2000, instrumented by the level in 1996 to avoid auto-correlation of residuals. Column (3) uses the alternative instrument proposed by Autor et al. (2013). Column (4) controls for the change between 2000 and 2010 of several socioeconomic variables. Column (5) uses $Log(Mortality + 1)$ as the dependent variable. All regressions include controls for the sectoral composition in 2000 as well as fixed effects. Columns(1)-(6) and (8) include state fixed effects. Column (7) includes mesoregion fixed effects. Column (8) restricts the sample to municipalities that had 100 or more registered deaths in 2000. Regressions are at the municipality level, except for column (9), at the microregion level. Standard errors shown in parentheses are clustered at the micro-region level (except for column (9), clustered at the mesoregion level), and regressions are weighted by municipality population (except for column (6)). *p<0.1; **p<0.05; ***p<0.01

Table 4: Results — Standard Error Comparison

	$\hat{\beta}_{2SLS}$	Microregion	Mesoregion	AKM	AKM0
	(1)	(2)	(3)	(4)	(5)
XD_m	−7.360	[−10.800, −3.960]	[−10.900, −3.860]	[−9.345 , −5.375]	[−11.753, −5.637]
IS_m	−17.600	[−30.700, −4.500]	[−32.200, −3.030]	[−26.425 , −8.809]	[−26.735 , 9.589]
N	4,267	4,267	4,267	4,267	4,267

Note: This table shows 95% confidence intervals for our main specification of Two-Stage Least Squares (2SLS) regressions that estimates effects of Chinese import and export shocks on the change in mortality between 2000 and 2010. Mortality is calculated as the all-cause age-adjusted rate per 100k people across all ages. To allow comparability between estimates, in this table the instruments are separately added (i.e we run one regression for each instrument, controlling for the other). Column (1) shows the coefficients based in our main specification (Column (1) of Table 3 — with the exception that, here, instruments are separately added such that each row represents a different model). Columns (2) to (5) compare confidence intervals built based on different standard errors. Column (2) is our main specification approach, in which we cluster standard errors by microregion. Column (3) clusters standard errors by mesoregion, following Costa et al. (2016). Columns (4) and (5) use the AKM and AKM0 procedures developed by Adão et al. (2019). For these columns, we group our 4-digit sectors derived from the CNAE categorization into 48 larger 3-digit sectors.

Table 5: Results — Mortality by cause

	Cancer	Cardiovascular	Blood and Endocrine	Nutritional	Infectious	Respiratory
XD_m	-0.631^{*}	-1.255	0.036	-0.196^{**}	-0.939^{***}	-0.736^{**}
	(0.376)	(1.184)	(0.327)	(0.093)	(0.358)	(0.347)
IS_m	-0.237	-1.113	-1.390	0.042	0.078	0.350
	(1.678)	(4.120)	(1.238)	(0.291)	(2.170)	(1.027)
N	4,267	4,267	4,267	4,267	4,267	4,267

	Transport accidents	Violence	Drug overdose	Self-harm	Other	Indeterminate
XD_m	-0.423^{*}	-0.752^{**}	0.027	0.077	-0.879^{*}	-1.243
	(0.248)	(0.364)	(0.182)	(0.130)	(0.513)	(1.414)
IS_m	-1.139	-6.665^{***}	-0.078	-0.204	-0.948	-6.643
	(1.025)	(2.072)	(0.413)	(0.280)	(2.232)	(7.032)
N	4,267	4,267	4,267	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by cause between 2000 and 2010. Mortality is calculated as the age-adjusted rate per 100k people across all ages for each cause. Categories are mutually exclusive and exhaustive (including indeterminate deaths) and ICD-10 codes are detailed in Table A12. "Drug overdose" includes alcohol induced liver diseases. All regressions include controls for the sectoral composition in 2000, as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{\dagger}p<0.1$; $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.01$

Table 6: Results — Mortality by Age (per 100k): Selected causes

	Children (0-14) 2SLS	Young Adults (15-29) 2SLS	Adults (30-59) 2SLS	Elderly (60+) 2SLS
	(1)	(2)	(3)	(4)
Panel A: Violence				
XD_m	-0.008	-0.955	-1.265^{**}	-0.749^{*}
	(0.087)	(0.833)	(0.547)	(0.451)
IS_m	-0.768^{***}	-15.983^{***}	-4.634^{**}	-3.443^{***}
	(0.297)	(4.999)	(2.184)	(1.166)
Panel B: Poverty-related				
XD_m	-0.745	-0.076	-0.896^{**}	-8.023^{***}
	(0.707)	(0.232)	(0.456)	(2.956)
IS_m	-3.621	-0.057	1.777	-5.270
	(2.616)	(1.360)	(1.956)	(17.266)
Controls	Y	Y	Y	Y
FE (state)	Y	Y	Y	Y
N	4,267	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by age group between 2000 and 2010 for violent deaths and for deaths due to poverty-related causes, which we define as nutritional deficiencies and infectious and parasitic diseases. Mortality is calculated as the number of total deaths per 100k people in each age group. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table 7: Descriptive statistics: Mortality by age and race (in 2000)

	Children (0-14)	Young Adults (15-29)	Adults (30-59)	Elderly (60+)
Panel A: Black				
All-cause mortality	111.68	153.56	394.77	2528.27
Violent mortality	2.05	66.57	32.54	9.22
Poverty-related mortality	26.8	11.7	41.2	179.8
Panel B: White				
All-cause mortality	142.18	111.17	354.1	3242.61
Violent mortality	1.21	32.76	21.29	8.66
Poverty-related mortality	31.93	9.26	32.38	231.9

Note: This table shows the mean values for selected mortality variables in the sample, averaged at the municipality level with weights according to total population size. Mortality is calculated as the total number of deaths per 100k people in each age group. Poverty-related mortality is defined as nutritional deficiencies and infectious and parasitic diseases. Note that only observations that had race information disclosed are included (about 84% of the total 946 thousand observations).

Table 8: Results — Economic Variables

	Unemployment 2SLS	Employment 2SLS	Log wages 2SLS	Log income 2SLS	Informality 2SLS	Extreme Poverty 2SLS	Poverty 2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
XD_m	-0.003^{***}	0.002^{**}	0.011^{**}	0.014^{***}	-0.005^{***}	-0.018^{**}	-0.084^{***}
	(0.001)	(0.001)	(0.004)	(0.003)	(0.001)	(0.008)	(0.018)
IS_m	-0.012^{***}	0.003	0.028^{**}	-0.003	-0.010	0.023	-0.098^{**}
	(0.002)	(0.002)	(0.014)	(0.008)	(0.006)	(0.028)	(0.047)
Controls	Y	Y	Y	Y	Y	Y	Y
FE (state)	Y	Y	Y	Y	Y	Y	Y
N	4,267	4,267	4,267	4,267	4,267	4,267	4,267
R^2	0.670	0.753	0.529	0.682	0.213	0.288	0.380

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes between 2000 and 2010 of different economic variables. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table 9: Results — Employment and wages by sector

	Manuacturing 2SLS	Primary 2SLS	Non-Traded 2SLS
	(1)	(2)	(3)
Panel A: Sector shares			
XD_m	0.001	0.002*	−0.003***
	(0.001)	(0.001)	(0.001)
IS_m	−0.014**	0.008**	−0.004
	(0.006)	(0.003)	(0.009)
Panel B: Log wages			
XD_m	0.010*	0.002	0.010**
	(0.005)	(0.009)	(0.004)
IS_m	−0.014	0.071	0.036***
	(0.018)	(0.056)	(0.013)
N	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in sectoral employment and wages between 2000 and 2010. In panel A, the dependent variable is the difference between 2000 and 2010 of the percentage of workers employed in each sector. In panel B, it is the difference in log wages in each sector. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table 10: Educational distribution across sectors (in 2000)

Sector	Educational level No School	 Elementary	 High-school	 College
Panel A: Younger (18-29)				
Manufacturing	0.02	0.51	0.39	0.08
Non-traded	0.02	0.45	0.40	0.13
Primary	0.15	0.74	0.10	0.01
Panel B: Older (30-59)				
Manufacturing	0.27	0.41	0.23	0.09
Non-traded	0.27	0.34	0.24	0.15
Primary	0.65	0.30	0.04	0.01

Note: This table shows the distribution of workers by age and educational level across sectors in 2000. The table show values in terms of percentage of workers by sector and age group (values add to close to 1 for each age group in each row).

Table 11: Racial distribution across sectors (in 2000)

Sector	Younger (18-29) Black	Younger (18-29) White	Older (30-59) Black	Older (30-59) White
Panel A: Whole economy (by age)				
Manufacturing	0.39	0.60	0.36	0.63
Non-traded	0.43	0.56	0.40	0.59
Primary	0.57	0.41	0.52	0.46
Panel B: Whole economy (total)				
Manufacturing	0.02	0.04	0.03	0.05
Non-traded	0.11	0.14	0.16	0.24
Primary	0.04	0.03	0.06	0.05
Panel C: Top XD				
Agriculture - Bovine animals	0.53	0.45	0.44	0.54
Agriculture - Maize	0.54	0.45	0.49	0.50
Agriculture - Other	0.60	0.38	0.57	0.41
Panel D: Top IS				
Manuacturing - Apparel	0.37	0.62	0.35	0.63
Manufacturing - Metal Products	0.39	0.60	0.36	0.63
Manufacturing - Other Food	0.47	0.52	0.43	0.55

Note: This table shows the distribution of workers by age and race across sectors in 2000. Panels A and B consider our whole sample (N = 4,267), while panels C and D consider the municipalities that are in the top quintile of exposure to each of the trade shocks XD and IS. Panels A, C, and D show values in terms of percentage of workers by age group (values add to close to 1 for each age group). Panel B shows values as shares of the total workforce (the 12 cells add to close to 1). Values do not add exactly to 1 because of workers who are neither black (or mixed-race) nor white. We omit those because they represent a small fraction of the workforce.

Table 12: Results — Employment by Educational Level

	No School 2SLS (1)	Elementary 2SLS (2)	High-school 2SLS (3)	College 2SLS (4)
XD_m	0.0002	0.001	0.0002	0.002
	(0.002)	(0.001)	(0.001)	(0.002)
IS_m	0.032***	0.006**	−0.006*	−0.017***
	(0.004)	(0.003)	(0.004)	(0.004)
Observations	4,267	4,267	4,267	4,244
R^2	0.812	0.636	0.296	0.111

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in employment by educational group (highest degree achieved) between 2000 and 2010. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table 13: Results — Employment by Age and Race

	Younger (18-29) 2SLS	Middle-aged (30-49) 2SLS	Older (50-59) 2SLS
	(1)	(2)	(3)
Panel A: Black workers			
XD_m	0.004***	0.004***	0.003*
	(0.001)	(0.001)	(0.002)
IS_m	0.017***	−0.001	0.002
	(0.004)	(0.004)	(0.006)
N	4,257	4,262	4,232
Panel B: White workers			
XD_m	0.003**	0.001	0.001
	(0.001)	(0.001)	(0.001)
IS_m	−0.00000	−0.004	−0.006
	(0.004)	(0.004)	(0.005)
N	4,267	4,267	4,264

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in employment by age and race between 2000 and 2010. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 14: Results — Racial Employment Gap by Age

	Overall	Younger (18-29)	Middle-aged (30-49)	Older (50-59)
	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
XD_m	-0.002^{**}	-0.002	-0.003^{**}	-0.002
	(0.001)	(0.001)	(0.001)	(0.002)
IS_m	-0.010^{***}	-0.017^{***}	-0.003	-0.009^{*}
	(0.003)	(0.006)	(0.004)	(0.005)
Observations	4,263	4,257	4,262	4,229
R^2	0.233	0.167	0.127	0.063

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in the employment gap by age between 2000 and 2010. The employment gap is defined as the difference between the employment-to-population rate among whites and blacks. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix

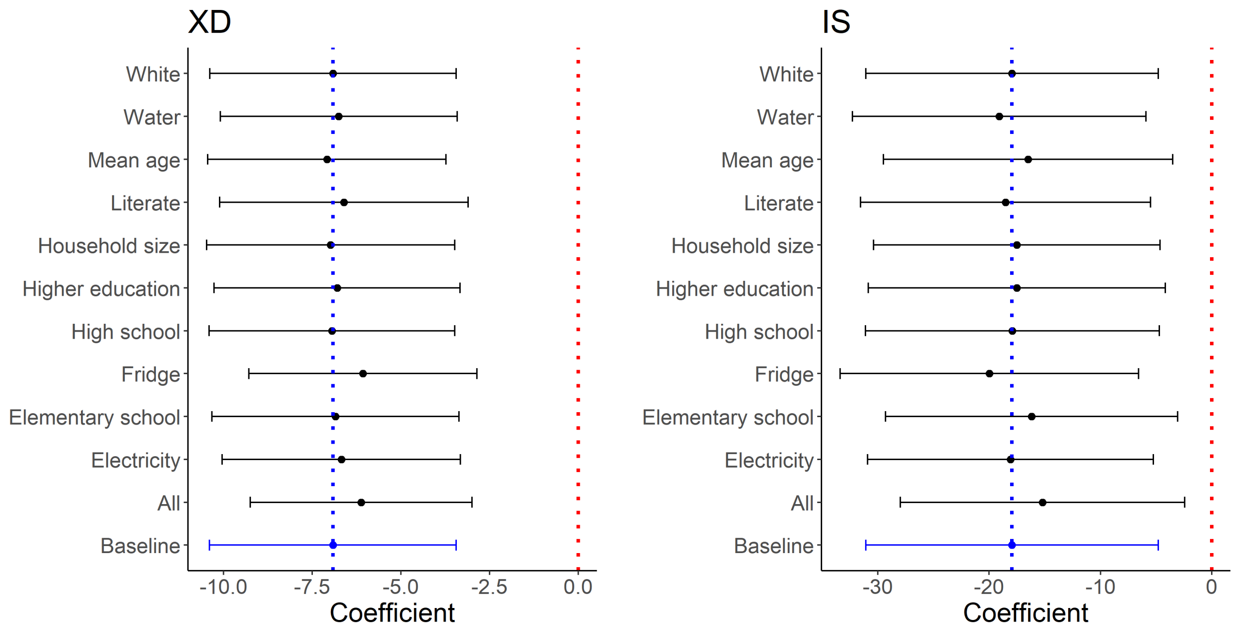


Figure A1: Robustness tests: socioeconomic outcomes. This figure shows coefficients from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality between 2000 and different years. Mortality is calculated as the all-cause age-adjusted rate per 100k people across all ages. Each row (except for the last, which is the baseline specification from Table 2) separately includes a different control, calculated as the change between 2000 and 2010 of different socioeconomic variables. The second-to-last row adds all controls at once (it is equivalent to column (4) of Table 3). Variables are: the variation between 2000 and 2010 of the share of white workers in the workforce, share of households with access to plumbing and electricity, mean age of workers, ownership of a refrigerator, number of residents per household, and educational distribution (percentage of workers in each of the following categories: literate only, elementary school, high school and higher education).All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. 95% confidence intervals are plotted based on standard errors clustered at the micro-region level. Regressions are weighted by municipality population.

Table A1: Descriptive statistics by sector

Sector	Workforce % (2000)	Share of Imports % (2000)	Share of Imports % (2010)	$\Delta ln(Imports)$ $\Delta_{2000,2010}$	Share of Exports % (2000)	Share of Exports % (2010)	$\Delta ln(Exports)$ $\Delta_{2000,2010}$
Agriculture - other	3.51	0.76	1.10	2.98	0.91	0.53	13.67
Agriculture - bovine animals	2.51	0.04	0.01	0.00	0.00	0.33	0.00
Agriculture - maize	2.35	0.30	0.04	0.00	0.07	1.12	9.07
Manuf. - apparel	2.13	0.39	0.67	2.14	0.52	0.11	11.78
Agriculture - coffee	1.96	0.00	0.00	0.00	2.75	2.54	13.52
Agriculture - manioc	1.47	0.00	0.00	0.00	0.00	0.00	0.00
Manuf. - metal products	1.43	1.41	2.01	2.99	1.22	1.25	17.54
Manuf. - other food	1.40	1.05	0.98	3.04	1.27	0.81	17.03
Agriculture - rice	1.07	0.04	0.01	0.00	0.00	0.00	0.00
Manuf. - furniture	0.99	0.24	0.23	3.86	0.86	0.38	9.61
Forestry	0.70	0.08	0.06	2.14	0.12	0.04	15.37
Manuf. - wood products	0.68	0.16	0.08	2.02	2.61	0.95	21.87
Manuf. - printing and recording	0.58	0.59	0.27	3.02	0.11	0.05	7.96
Manuf. - footwear	0.57	0.09	0.23	1.61	2.85	0.81	14.58
Agriculture - sugar cane	0.57	0.00	0.00	0.00	0.00	0.00	0.00
Fishing and Aquaculture	0.55	0.05	0.10	0.00	0.05	0.01	6.90
Agriculture - other cereals	0.50	1.61	0.73	4.22	0.00	0.12	0.00
Manuf. - machinery	0.50	10.58	12.26	3.51	5.23	4.45	22.82
Manuf. - other textile products	0.50	0.67	0.80	3.66	0.83	0.37	13.74
Manuf. - ceramic products	0.48	0.16	0.23	3.75	0.54	0.22	11.13
Agriculture - tobacco	0.47	0.03	0.03	-4.61	1.38	1.31	23.78
Manuf. - spinning and weaving	0.46	0.73	0.98	3.40	0.69	0.18	16.04
Agriculture - soya	0.37	0.22	0.02	0.00	3.83	5.40	28.72
Manuf. - other chemicals	0.35	13.06	13.10	2.29	5.78	4.27	23.85
Agriculture - birds	0.35	0.03	0.01	-0.73	0.02	0.07	0.00
Manuf. - plastic products	0.34	1.26	1.42	2.77	0.55	0.53	17.85
Manuf. - meat and fish	0.34	0.77	0.61	5.56	4.11	6.65	22.25
Manuf. - motor vehicle bodies and parts	0.33	3.82	4.00	4.16	3.84	2.64	20.57
Manuf. - other nonmetallic mineral products	0.31	0.22	0.29	3.22	0.66	0.54	18.14
Manuf. - basic metals	0.29	3.37	5.69	3.94	12.59	8.24	24.69

Note: This table shows descriptive statistics by sector. The first column shows the share of the national workforce in 2000 that worked in each sector. The next columns show the shares of total imports and exports that each sector represented in 2000 and 2010, and the log change in the total traded value between Brazil and China (in 2010 USD) of products in each sector.

Table A1: Descriptive statistics by sector (continued)

Sector	Workforce % (2000)	Share of Imports % (2000)	Share of Imports % (2010)	$\Delta ln(Imports)$ $\Delta_{2000,2010}$	Share of Exports % (2000)	Share of Exports % (2010)	$\Delta ln(Exports)$ $\Delta_{2000,2010}$
Agriculture - citrus fruits	0.27	0.00	0.01	0.00	0.05	0.04	5.20
Manuf - other	0.27	0.66	0.71	1.90	0.47	0.22	16.29
Manuf - motor vehicles	0.26	4.11	6.54	8.72	5.67	4.34	13.81
Manuf - sugar	0.25	0.00	0.02	2.50	2.18	6.43	13.15
Manuf - dairy products	0.22	0.66	0.23	6.51	0.03	0.08	4.97
Agriculture - bananas	0.22	0.00	0.00	0.00	0.02	0.04	0.00
Agriculture - cocoa	0.19	0.09	0.07	0.00	0.01	0.00	0.00
Manuf - electrical equipment	0.19	4.48	4.13	2.62	1.69	1.57	18.78
Manuf - pharmaceuticals	0.19	3.81	4.22	2.13	0.74	0.97	19.11
Mining - nonmetals for construction	0.18	0.04	0.04	1.28	0.44	0.19	19.75
Manuf - beverages	0.16	0.28	0.29	3.62	0.20	0.62	9.61
Manuf - pulp and paper	0.15	1.45	0.95	6.29	4.09	3.62	25.38
Manuf - cleaning and hygiene products	0.14	0.50	0.50	5.15	0.31	0.41	14.44
Manuf - rubber products	0.11	1.05	1.35	2.94	1.16	0.88	16.28
Manuf - paper products	0.11	0.19	0.12	3.72	0.67	0.10	11.85
Agriculture - cotton	0.11	0.48	0.04	-7.81	0.06	0.40	11.85
Manuf - electronics	0.11	10.57	6.52	2.86	3.51	0.88	20.30
Agriculture - flowers and ornamentals	0.11	0.01	0.01	0.03	0.03	0.02	5.29
Agriculture - other animals	0.11	0.01	0.01	-3.46	0.01	0.00	7.16
Agriculture - pigs	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture - grapes	0.10	0.02	0.02	0.00	0.03	0.07	0.00
Manuf - leather products	0.09	0.03	0.03	2.48	0.07	0.03	7.57
Manuf - domestic appliances	0.09	0.25	0.40	3.03	0.48	0.20	12.79
Manuf - medical instruments	0.08	1.02	1.26	3.22	0.17	0.17	13.74
Manuf - glass products	0.06	0.44	0.38	2.49	0.37	0.17	16.30
Manuf - refined petroleum	0.06	5.47	6.94	5.69	1.31	1.57	9.43
Mining - oil and gas	0.06	6.98	6.80	0.00	0.34	7.99	25.92
Manuf - leather processing	0.05	0.32	0.04	0.22	1.38	0.85	23.10
Manuf - paints and varnishes	0.05	0.38	0.23	2.61	0.14	0.12	13.51
Mining - precious metals	0.04	0.00	0.00	0.00	0.04	0.01	0.00

Note: This table shows descriptive statistics by sector. The first column shows the share of the national workforce in 2000 that worked in each sector. The next columns show the shares of total imports and exports that each sector represented in 2000 and 2010, and the log change in the total traded value between Brazil and China (in 2010 USD) of products in each sector.

Table A1: Descriptive statistics by sector (continued)

Sector	Workforce % (2000)	Share of Imports % (2000)	Share of Imports % (2010)	$\Delta ln(Imports)$ $\Delta_{2000,2010}$	Share of Exports % (2000)	Share of Exports % (2010)	$\Delta ln(Exports)$ $\Delta_{2000,2010}$
Manuf - tobacco	0.04	0.02	0.01	-1.77	0.06	0.03	0.25
Mining - other metals	0.04	0.62	0.72	-0.02	5.75	15.51	29.17
Manuf - fruits and vegetables	0.04	0.40	0.36	2.90	2.35	1.18	19.67
Manuf - shipbuilding	0.04	0.04	0.81	7.52	0.02	0.09	0.00
Mining - precious stones	0.04	0.01	0.00	-0.73	0.07	0.02	16.61
Manuf - computing	0.04	4.19	2.14	2.38	0.87	0.12	15.07
Manuf - coffee	0.03	0.00	0.02	2.65	0.44	0.33	13.32
Manuf - optical equipment	0.03	0.74	1.05	2.90	0.10	0.03	17.60
Manuf - aircraft	0.03	4.49	2.05	6.38	6.50	2.80	23.58
Manuf - other transport	0.03	0.30	0.41	2.84	0.14	0.08	6.04
Mining - other nonmetals	0.02	0.27	0.25	2.28	0.15	0.10	14.73
Manuf - measuring instruments	0.02	1.81	1.45	2.97	0.39	0.24	16.01
Agriculture - beekeeping	0.02	0.00	0.00	2.51	0.02	0.03	10.20
Manuf - oils and fats	0.02	0.38	0.42	2.57	3.90	3.19	24.27
Agriculture - sheep	0.01	0.01	0.00	0.00	0.00	0.01	0.00
Agriculture - silk	0.01	0.00	0.00	6.62	0.05	0.01	0.00
Mining - coal	0.01	1.13	1.56	-0.92	0.00	0.01	1.01
Manuf - railway products	0.01	0.18	0.34	3.95	0.07	0.28	5.38
Manuf - watches and clocks	0.01	0.19	0.10	1.43	0.01	0.00	3.74
Manuf - coke	0.00	0.19	0.38	1.06	0.01	0.00	0.00
Manuf - nuclear fuel	0.00	0.03	0.09	0.00	0.00	0.00	0.00
Mining - radioactive metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: This table shows descriptive statistics by sector. The first column shows the share of the national workforce in 2000 that worked in each sector. The next columns show the shares of total imports and exports that each sector represented in 2000 and 2010, and the log change in the total traded value between Brazil and China (in 2010 USD) of products in each sector.

Table A2: Results — Mortality by Age

	Children (0-14) 2SLS	Young Adults (15-29) 2SLS	Adults (30-59) 2SLS	Elderly (60+) 2SLS
	(1)	(2)	(3)	(4)
XD_m	-1.769	-2.305^{**}	-6.392^{***}	-45.389^{***}
	(1.586)	(1.091)	(1.726)	(13.976)
IS_m	-16.599^{**}	-21.866^{***}	-5.370	-111.793^{**}
	(6.613)	(6.201)	(6.154)	(49.693)
Controls	Y	Y	Y	Y
FE (state)	Y	Y	Y	Y
N	4,267	4,267	4,267	4,267
R^2	0.065	0.468	0.253	0.222

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by age group between 2000 and 2010. Mortality is calculated as the number of total deaths per 100k people in each age group. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table A3: Results — Mortality by Gender and Race

	Male 2SLS	Female 2SLS	White 2SLS	Black 2SLS
	(1)	(2)	(3)	(4)
XD_m	-12.212^{***}	-3.698^{**}	-2.882	-9.519^{*}
	(2.908)	(1.700)	(3.129)	(5.544)
IS_m	-19.246^{**}	-14.431^{**}	-6.912	-15.146
	(8.738)	(7.075)	(13.275)	(17.636)
Controls	Y	Y	Y	Y
FE (state)	Y	Y	Y	Y
N	4,267	4,267	4,267	4,267
R^2	0.371	0.139	0.141	0.297

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by gender and race between 2000 and 2010. Mortality is calculated as the all-cause age-adjusted rate per 100k people across all ages for each group. All regressions include controls for the sectoral composition in 2000, as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.01$

Table A4: Results — Mortality by cause - Youth (15-29 years old)

	Cancer	Cardiovascular	Blood and Endocrine	Nutritional	Infectious	Respiratory
XD_m	-0.390^{**}	-0.005	-0.073	-0.072	-0.004	0.009
	(0.197)	(0.206)	(0.136)	(0.060)	(0.233)	(0.115)
IS_m	0.883	0.031	0.201	0.023	-0.079	-0.276
	(0.539)	(0.797)	(0.506)	(0.136)	(1.304)	(0.402)
N	4,267	4,267	4,267	4,267	4,267	4,267

	Transport accidents	Violence	Drug overdose	Self-harm	Other	Indeterminate
XD_m	-0.482	-0.955	-0.136	-0.026	-0.088	-0.084
	(0.453)	(0.833)	(0.107)	(0.259)	(0.505)	(0.332)
IS_m	-1.371	-15.983^{***}	0.510^{*}	-0.785	-4.832^{*}	-0.187
	(1.682)	(4.999)	(0.306)	(0.577)	(2.491)	(0.716)
N	4,267	4,267	4,267	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by cause between 2000 and 2010. Mortality is calculated as the number of total deaths per 100k people across people between 15-29 years old for each cause. Categories are mutually exclusive and exhaustive (including indeterminate deaths) and ICD-10 codes are detailed in Table A12. "Drug overdose" includes alcohol induced liver diseases. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table A5: Results — Mortality by cause - Adults (30-59 years old)

	Cancer	Cardiovascular	Blood and Endocrine	Nutritional	Infectious	Respiratory
XD_m	-0.710	-0.979	-0.126	-0.191^{***}	-0.705	-0.590^{**}
	(0.563)	(1.118)	(0.319)	(0.060)	(0.443)	(0.271)
IS_m	-1.359	-1.087	-0.609	0.336	1.441	-0.287
	(2.474)	(3.998)	(0.983)	(0.256)	(1.894)	(0.778)
N	4,267	4,267	4,267	4,267	4,267	4,267

	Transport accidents	Violence	Drug overdose	Self-harm	Other	Indeterminate
XD_m	-0.793^{**}	-1.265^{**}	-0.004	0.215	-0.673	-0.571
	(0.377)	(0.547)	(0.397)	(0.201)	(0.650)	(1.142)
IS_m	-1.591	-4.634^{**}	0.088	-0.020	3.759^{*}	-1.407
	(1.244)	(2.184)	(0.865)	(0.527)	(2.011)	(5.477)
N	4,267	4,267	4,267	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality by cause between 2000 and 2010. Mortality is calculated as the total number of deaths per 100k people across people between 15-29 years old for each cause. Categories are mutually exclusive and exhaustive (including indeterminate deaths) and ICD-10 codes are detailed in Table A12. ”Drug overdose” includes alcohol induced liver diseases. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table A6: Results — Mortality by Age (per 100k): Selected causes - Black

	Children (0-14) 2SLS	Young Adults (15-29) 2SLS	Adults (30-59) 2SLS	Elderly (60+) 2SLS
	(1)	(2)	(3)	(4)
Panel A: Violence				
XD_m	-0.034	0.292	-0.900	-0.723
	(0.145)	(1.183)	(0.789)	(0.580)
IS_m	-0.752	-14.479^{*}	-4.364	-4.755^{**}
	(0.628)	(7.403)	(3.011)	(2.405)
Panel B: Poverty-related				
XD_m	-0.385	-0.172	-2.289^{**}	-11.642^{***}
	(0.689)	(0.494)	(0.953)	(4.378)
IS_m	-4.762^{**}	-2.871	5.292	6.727
	(1.915)	(3.163)	(4.262)	(18.866)
Controls	Y	Y	Y	Y
FE (state)	Y	Y	Y	Y
N	4,267	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality among black people by age group between 2000 and 2010 for violent deaths and for deaths due to poverty-related causes, which we define as nutritional deficiencies and infectious and parasitic diseases. Mortality is calculated as the number of total deaths per 100k people in each age group. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table A7: Results — Mortality by Age (per 100k): Selected causes - White

	Children (0-14) 2SLS (1)	Young Adults (15-29) 2SLS (2)	Adults (30-59) 2SLS (3)	Elderly (60+) 2SLS (4)
Panel A: Violence				
XD_m	-0.018	-0.481	-0.393	-0.614
	(0.107)	(0.909)	(0.516)	(0.673)
IS_m	-0.421	-14.662^{***}	-4.130^{*}	-4.562^{***}
	(0.293)	(4.219)	(2.242)	(1.450)
Panel B: Poverty-related				
XD_m	-1.624^{**}	0.192	-0.210	-7.662
	(0.791)	(0.335)	(0.653)	(4.676)
IS_m	2.253	2.145	2.220	-6.757
	(2.853)	(2.036)	(2.131)	(19.903)
Controls	Y	Y	Y	Y
FE (state)	Y	Y	Y	Y
N	4,267	4,267	4,267	4,267

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in mortality among white people by age group between 2000 and 2010 for violent deaths and for deaths due to poverty-related causes, which we define as nutritional deficiencies and infectious and parasitic diseases. Mortality is calculated as the number of total deaths per 100k people in each age group. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table A8: Results — Robustness Tests: Selected Causes

	Main	Pre-trend	ADH	Controls	Log	Unweighted	Meso FE	Restricted Sample	Microregion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Violence									
XD_m	−0.752**	−0.620	0.926	−0.707*	−0.018	0.215	−0.168	−0.973**	−0.819
	(0.364)	(0.437)	(1.165)	(0.390)	(0.021)	(0.281)	(0.251)	(0.453)	(0.816)
IS_m	−6.665***	−7.034***	−7.391***	−5.409***	−0.276***	−4.922***	−5.209**	−6.880***	−7.323***
	(2.072)	(2.712)	(1.932)	(1.804)	(0.070)	(1.902)	(2.291)	(2.231)	(2.361)
R^2	0.627	0.387	0.625	0.641	0.423	0.109	0.761	0.701	0.789
Panel B: Poverty-related									
XD_m	−1.135***	−1.168***	−0.086	−1.020***	−0.040***	−2.075***	−0.583	−0.728	−0.316
	(0.375)	(0.432)	(0.708)	(0.389)	(0.010)	(0.439)	(0.460)	(0.476)	(0.464)
IS_m	0.121	0.505	0.041	0.827	0.013	−1.319	−0.825	−0.105	0.935
	(2.204)	(2.316)	(2.117)	(2.234)	(0.041)	(2.909)	(2.415)	(2.698)	(2.271)
R^2	0.138	−0.054	0.137	0.145	0.100	0.027	0.237	0.218	0.405
N	4,267	4,267	4,267	4,267	4,267	4,267	4,267	1,485	554

Note: This table shows results from different specifications of Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on the change in mortality due to violence and poverty-related diseases between 2000 and 2010. Mortality is calculated as the age-adjusted rate per 100k people across all ages for each cause. Deaths due to poverty-related causes are defined as nutritional deficiencies and infectious and parasitic diseases. Column (1) shows the preferred specification following Table 2. Column (2) controls for previous trends in mortality by including the change in mortality between 1996 and 2000, instrumented by the level in 1996 to avoid auto-correlation of residuals. Column (3) uses the alternative instrument proposed by Autor et al. (2013). Column (4) controls for the change between 2000 and 2010 of several socioeconomic variables. Column (5) uses $Log(Mortality + 1)$ as the dependent variable. All regressions include controls for the sectoral composition in 2000 as well as fixed effects. Columns(1)-(6) and (8) include state fixed effects. Column (7) includes mesoregion fixed effects. Column (8) restricts the sample to municipalities that had 100 or more registered deaths in 2000. Regressions are at the municipality level, except for column (9), at the microregion level. Standard errors shown in parentheses are clustered at the micro-region level (except for column (9), clustered at the mesoregion level), and regressions are weighted by municipality population (except for column (6)). *p<0.1; **p<0.05; ***p<0.01

Table A9: Results — Unemployment by Age and Race

	Younger (18-29) 2SLS	Middle-aged (30-49) 2SLS	Older (50-59) 2SLS
	(1)	(2)	(3)
Panel A: Black workers			
XD_m	-0.005^{***}	-0.003^{***}	-0.003^{**}
	(0.001)	(0.001)	(0.001)
IS_m	-0.019^{***}	-0.011^{***}	-0.013^{***}
	(0.004)	(0.003)	(0.004)
N	4,253	4,258	4,222
Panel B: White workers			
XD_m	-0.004^{***}	-0.001^{***}	-0.002^{***}
	(0.001)	(0.001)	(0.001)
IS_m	-0.010^{***}	-0.009^{***}	-0.010^{***}
	(0.004)	(0.002)	(0.003)
N	4,265	4,267	4,259

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in unemployment by age and race between 2000 and 2010. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table A10: Results — Income by Educational Level

	No School 2SLS (1)	Elementary 2SLS (2)	High-school 2SLS (3)	College 2SLS (4)
Panel A: Log wages				
XD_m	0.014*	0.010**	0.012***	0.013
	(0.007)	(0.005)	(0.005)	(0.010)
IS_m	0.069***	0.019	0.029*	0.013
	(0.022)	(0.019)	(0.015)	(0.019)
Observations	4,267	4,267	4,267	4,149
Panel B: Log income				
XD_m	0.024***	0.017***	0.014***	0.023***
	(0.006)	(0.004)	(0.004)	(0.008)
IS_m	0.028*	−0.024**	0.009	0.009
	(0.017)	(0.012)	(0.012)	(0.015)
Observations	4,267	4,267	4,267	4,149

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in wages and total net income by educational group (highest degree achieved) between 2000 and 2010. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population. *p<0.1; **p<0.05; ***p<0.01

Table A11: Results — Income by Age and Race

	Younger (18-29)		Middle-aged (30-49)		Older (50-59)	
	Black	White	Black	White	Black	White
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Log wages						
XD	0.012**	0.007	0.008*	0.014**	0.025***	0.020**
	(0.005)	(0.006)	(0.005)	(0.007)	(0.007)	(0.009)
IS	0.007	−0.011	−0.003	0.058***	−0.011	0.009
	(0.021)	(0.017)	(0.014)	(0.022)	(0.030)	(0.027)
Observations	4,247	4,265	4,255	4,267	4,215	4,251
Panel B: Log income						
XD	0.017***	0.016***	0.017***	0.018***	0.028***	0.024***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.007)	(0.007)
IS	−0.031**	−0.016	−0.029***	0.041**	−0.038	−0.053***
	(0.014)	(0.013)	(0.011)	(0.020)	(0.026)	(0.020)
Observations	4,247	4,265	4,255	4,267	4,215	4,251

Note: This table shows results from Two-Stage Least Squares (2SLS) regressions that estimate effects of Chinese import and export shocks on changes in wages and total net income by educational group (highest degree achieved) between 2000 and 2010. All regressions include controls for the sectoral composition in 2000 as well as state fixed effects. Standard errors shown in parentheses are clustered at the micro-region level and regressions are weighted by municipality population.
*p<0.1; **p<0.05; ***p<0.01

Table A12: ICD codes by category

Category	ICD codes
Cancer	C00-C99, D00-D48
Cardiovascular	I00-I99
Blood and endocrine disorders	D55-D89, E03-E07, E10-E14, E15-E34, E65-E88
Drug overdose	X40-X44, K70-K77,Y10-Y14
Self Harm	X60-X84, Y87
Indeterminate	R98-R99
Infectious and parasitic diseases	A00-A99, B00-B99, G00-G04, H65-H66, J00-J22, N70-N73, P35-P37
Nutritional deficiencies	D50-D53, E00-E02, E40-E46, E50-E64
Respiratory	J30-J98
Transport accidents	V00-V99
Violence	X85-X99, Y00-Y09

Note: This table shows the ICD-10 codes included in each category for the mortality by cause analysis in Table 5. Classifications are obtained from http://tabnet.datasus.gov.br/cgi/sih/mxcid10lm.htm and https://icd.who.int/browse10/2019/en, then grouped according to categories based on Pierce and Schott (2020) and Hone et al. (2019).