Trade Shocks and Human Capital: Evidence from Brazil's Trade Liberalization *

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Abstract

This paper studies the medium and long-run effects of Brazil's 1990s trade liberalization reform on child labor, schooling, and human capital accumulation. Our analysis leverages extensive census and administrative data spanning nearly three decades to examine the effects of two distinct components of the shock that differentially affected the labor market opportunities for adults and children. We find that regions more exposed to child-specific tariff reductions experienced larger declines in child labor, accompanied by increases in schooling, with opposite results obtained for adult-specific tariff reductions. The effects of the shocks are persistent and always larger in the long run. Specifically, we show that tariff reductions impacted the educational attainment of the cohorts more exposed to trade liberalization during their formative years. Our results highlight the potential role of human capital investments in amplifying the impacts of economic shocks.

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1 Introduction

Child labor remains a major problem in many parts of the developing world. In 2020, approximately 160 million children were engaged in labor activities, constituting nearly 10 percent of the global child population (ILO, 2021). The issue of child labor is of particular concern due to its impact on children's development, not only hindering their capacity to accumulate human capital, but also perpetuating social inequalities and poverty (Heckman, 2006; Chetty et al., 2016). At the heart of this issue lies the crucial decision faced by households − especially those from disadvantaged backgrounds − of whether to invest in their children's education or make them work. These decisions made during childhood have significant long-term consequences, due to their influence on the returns to subsequent human capital investments (Cunha and Heckman, 2007, 2008; Cunha et al., 2010).

A comprehensive understanding of the factors that influence households' decisions concerning the allocation of their children's time is, therefore, crucial for the design of policies aimed at combating inequality and poverty. Indeed, a large body of literature has examined the effects of economic shocks on human capital (Currie and Almond, 2011; Almond et al., 2018; Frankenberg and Thomas, 2017), and specifically on child labor and schooling (Edmonds, 2007; Edmonds and Theoharides, 2020). The empirical challenge lies in the fact that there are multiple channels through which a shock might affect families' decisions. For instance, a trade liberalization reform may impact households' incomes as well as the opportunity costs of schooling. Thus, it is not surprising that the literature finds contrasting results depending on the study-context.[1] We believe that a more systematic understanding of these issues is still needed.

This paper studies the medium and long-term effects of Brazil's trade liberalization reform of the early 1990s on child labor, schooling and human capital accumulation. The Brazilian trade reform entailed a significant reduction in protection across industries, with the average nominal tariff abruptly declining from 30.5% in 1990 to 12.8% in 1995. Brazil offers a compelling context for studying the impact of a trade-induced labor market shock on households' human capital investment decisions for several reasons. First, child labor remains a prevalent issue, especially in the poorer and less developed regions of the country. Second, Brazil is a large developing country composed of local labor markets that are highly heterogeneous in terms of their industry composition and child employment.

[1]For instance, while some papers find that positive (negative) income shocks lead to an increase in schooling (child labor) (Edmonds and Pavcnik, 2005; Beegle et al., 2006; Edmonds et al., 2010; Kis-Katos and Sparrow, 2011), other studies, especially those focused on Latin American countries, find the opposite (Duryea and Arends-Kuenning, 2003; Kruger, 2007; Carrillo, 2020).

Third, the Brazilian Census contains unique information about labor market participation, school attendance and various other socioeconomic characteristics of children, and has the key advantage of being representative at fine geographic levels. Importantly, it features precise information about the sector in which children are employed.

Following Topalova (2010), Kovak (2013) and Dix-Carneiro and Kovak (2017), our analysis exploits cross-industry variation in tariff changes between 1990 and 1995, combined with cross-regional variation in the industry composition of local employment to estimate the causal effects of the trade liberalization reform on children's activities and human capital investments. Our study leverages three waves of Census data for the years of 1991, 2000 and 2010, as well as over 25 years of administrative data from the School Census to provide a comprehensive investigation of the evolution of the effects following the reform. Moreover, since shocks to different industries affect the labor market opportunities for adults and children differently (Soares et al., 2012; Bai and Wang, 2020), our analysis also exploits cross-regional variation in the employment shares of adults and children in each sector to decompose the overall measure of local exposure to trade liberalization into two additive components that differentially affect the returns to adult and child labor.[2] By doing so, we are able to partially disentangle the relative magnitudes of the income and substitution effects that are so crucial for understanding how economic shocks affect households' decisions.

We begin our analysis by examining the effects of the trade liberalization reform on child labor and schooling, focusing on changes in outcomes between 1991-2000 (medium-run) and 1991-2010 (long-run), and controlling for state fixed effects, lag of the dependent variable, and various local characteristics of Brazilian regions. Our results show that an increase in the overall exposure to trade liberalization leads to smaller relative increases in school attendance, accompanied by larger relative increases in child labor. These general results conceal an important nuance, however. By splitting the overall measure of tariff reduction into two components that distinctly affect local labor market conditions for adults and children, we obtain estimates in opposite directions, consistent with income and substitution effects.[3] Specifically, we find that regions more exposed to child-specific tariff reductions experienced larger relative increases in schooling, while regions more exposed to adult-specific tariff reductions experienced larger relative increases (smaller

[2]Our approach is similar to that employed by Autor et al. (2019) to study the effects of gender-specific components of a large-scale demand shock ("China shock") on marriage and fertility decisions in the United States.

[3]In Section 2, we propose a theoretical framework illustrating that a negative shock to the demand for adult labor leads to an increase in the share of children who work (i.e. income effect), while a negative shock to the demand for child labor leads to an increase in the share of children attending school (i.e. substitution effect).

declines) in child labor.

Furthermore, by comparing the medium and long-term impacts of the trade liberalization, we find that the effects are persistent and always larger in the long run. Specifically, we show that school attendance never recovers in regions harder hit by adult-specific tariff shocks, while it remains persistently higher in regions harder hit by child-specific tariff shocks, even almost two decades later. The magnitudes of the effects are substantial. According to our preferred specification, a 0.003 log point reduction in child-specific tariff protection − which is equivalent to moving a region from the 10th to the 90th percentile of the distribution − leads to a 3.3 percentage point (pp) larger relative increase in the share of children who exclusively attend school ("study only") in the long run, which corresponds to a growth 16.5% above the national trend between 1991 and 2010.[4] Our results are robust to controlling for differences in trends across regions, which are allowed to vary based on a number of demographic and socioeconomic characteristics. Interestingly, we show that the estimated effects are significantly more pronounced among children from socially disadvantaged backgrounds, particularly those from low-income and less-educated households.

We complement these results by leveraging annual administrative data from the Brazilian School Census, available for an extended period (1995-2020), to examine in more detail the dynamic effects of the trade liberalization on school enrollment and other educational outcomes, such as age-grade distortion and approval rates. Our results are consistent with previous findings, reinforcing the idea that the effects are persistent and that the adjustment process occurs gradually over time. Specifically, our estimates suggest that during the period between 1995 and 2020 a decrease of 0.003 log points in child-specific tariff protection led to a larger relative increase in school enrollment of about 2.3 pp, which corresponds to a growth 41.8% above the national trend.[5] Furthermore, we document that tariff shocks did not impact age-grade distortion and approval rates among elementary school students, suggesting that children induced to enroll as a result of the shocks were able to successfully progress within the school system. Finally, we show that our results cannot be explained by supply-side changes in the provision of education, since we find no systematic effects of the shocks on local school infrastructure.

Having established that the trade liberalization affected children's activities, we next

[4]Conversely, a 0.104 log point reduction in adult-specific tariff protection − which is equivalent to moving a region from the 10th to the 90th percentile of the distribution − leads to a 6.7 pp smaller relative increase in the share of children who "study only" in the long-run, which corresponds to a growth 33.7% below the national trend between 1991 and 2010.

[5]Conversely, a 0.104 log point reduction in adult-specific tariff protection led to a 3.2 pp smaller relative increase in school enrollment, which corresponds to a growth 58.1% below the national trend between 1995 and 2020.

turn to examining its long-term consequences in terms of human capital accumulation. To do so, we exploit the fact that different birth cohorts within the same region experienced varying degrees of exposure to the tariff shocks. Intuitively, we expect individuals who were in their formative years during the early 1990s to have been more impacted by the reform. Using data from the 2010 Census and the share of individuals in a given cohort who completed elementary school, high school and have some college education as proxies for the stock of human capital, we find that the trade liberalization affected only the educational attainment of the cohorts born after the mid-1980s, with no significant impact on older cohorts. Importantly, the directions of the effects of both adult and child-specific tariff reductions are in line with our previous results. Moreover, we find that the magnitude of the estimated effects becomes increasingly more pronounced among younger cohorts.

Next, to better understand the effects of the shock, as well as of the mechanisms driving their persistent impact on educational outcomes and human capital accumulation, we investigate how both adult and child-specific tariff reductions impacted the structure of local economies. Previous research by Dix-Carneiro and Kovak (2017, 2019) and Ponczek and Ulyssea (2021) showed that regions facing larger overall tariff reductions experienced a steady decline in formal sector employment and earnings, as the stock of capital gradually reallocated away from the local manufacturing sector. Consistent with their findings, we also show that adult-specific tariff reductions led to smaller relative increases in both overall earnings and the share of formal employment in the long run. Strikingly, we find that child-specific tariff reductions led to opposite results, with harder-hit regions experiencing larger relative increases in earnings and share of formal employment. Interestingly, our findings suggest that the destruction of informal sector jobs associated with tariff reductions in child-intensive industries also had persistent effects, triggering a process of gradual reallocation of resources towards the more formal sectors of the local economy.

Finally, to put our results into perspective and to examine whether they apply more generally, we investigate the effects of the import competition shock associated with the rise of Chinese manufacturing ("China shock") on child labor and schooling in Brazil during the early 2000s. Following Autor et al. (2013) and Costa et al. (2016), we exploit cross-industry variation in Chinese imports and pre-existing differences in employment shares in specific industries across regions to create a local measure of adult and child-specific exposure to foreign imports. Consistent with our previous results, we find that regions more exposed to child-specific import competition experienced larger relative increases in schooling, while regions more exposed to adult-specific import shocks experienced larger relative increases in child labor. These findings further reinforce the robustness of our results, also lending some external validity to our conclusions.

Our paper contributes to an extensive literature examining the effects of economic shocks on human capital, with particular emphasis on child labor and schooling (Edmonds and Theoharides, 2020). Most of the previous research has focused on transitory shocks affecting specific commodities and sectors (Edmonds and Pavcnik, 2005; Kruger, 2007; Bai and Wang, 2020; Carrillo, 2020). Our study adds to this literature by providing a comprehensive examination of the impacts of a country-wide shock that affected all sectors of the economy. In this respect, our paper is closely related to Edmonds et al. (2010) and Kis-Katos and Sparrow (2011), who investigated the short and medium-term effects of tariff reforms in India and Indonesia. We contribute to these papers by leveraging data spanning almost three decades to characterize the long-term impacts of Brazil's trade liberalization reform, as well as the dynamics of adjustment over time. Strikingly, we find that the effects of the shocks are persistent and always larger in the long run. Moreover, the richness of our data allows us to uncover heterogeneous effects that vary by households' socioeconomic characteristics and individuals' birth cohorts. In doing so, we provide further evidence supporting the importance of early childhood environment for human capital formation (Currie and Almond, 2011; Almond et al., 2018).

Our paper also contributes to a related strand of the literature which has examined the effects of direct shocks to household income on human capital investment decisions (Thomas et al., 2004; Beegle et al., 2006; Edmonds, 2006; Duryea et al., 2007). The insights provided by these studies have led researchers to recognize that such shocks may influence families' decisions through a variety of channels, particularly via a combination of income and substitution effects (Soares et al., 2012). Our paper adds to this literature by extending the standard shift-share approach to empirically decompose a trade shock into two components that differentially affect the labor market opportunities for adults and children. In this respect, we complement the work by Bai and Wang (2020) who examined, in the context of India's trade liberalization reform, the effects of tariff reductions in crops which they categorize as intensive in either adult or child labor. Our paper, in turn, takes advantage of census data containing detailed information about the sector in which children are employed to implement a more precise decomposition of the tariff shock. We also conduct a systematic examination of the effects of both adult and child-specific tariff reductions on various distinct outcomes, showing that these shocks have persistent impacts on human capital accumulation.

This paper also relates to a large literature examining the dynamics of labor market adjustments to trade shocks (Gonzaga et al., 2006; Acemoglu et al., 2016; Dix-Carneiro and Kovak, 2017; Autor et al., 2019). Specifically, Dix-Carneiro and Kovak (2017) document that formal sector employment and wages in Brazil continued to decline well after the country's trade liberalization reform was implemented (see also Kovak (2013); Dix-Carneiro and Kovak (2019); Ponczek and Ulyssea (2021)). In an environment with imperfect labor mobility and agglomeration economies, Dix-Carneiro and Kovak (2017) argue that the destruction of formal employment led to a reduction in regional productivity, triggering a self-reinforcing process whereby capital stocks slowly reallocated away from negatively affected regions. Our paper contributes to this literature by providing novel evidence that human capital investments followed a pattern of adjustment similar to that observed in local labor markets. Interestingly, we show that tariff shocks that destroyed jobs in the more informal, child-intensive sectors caused local economies to gradually become more formal over time. This process was accompanied by larger relative increases in schooling and human capital accumulation.[6] In this respect, our analysis highlights the potential role of human capital in amplifying the impacts of trade shocks.[7]

2 Theoretical Framework

In this section, we propose a simple theoretical framework to study the general effects of an economic (trade) shock on children's activities. We consider an economy composed of N households, each endowed with one unit of adult labor, which is supplied inelastically, and one unit of child labor. We suppose that each children may either work (W), study (S) or remain idle (I). For simplicity, we consider the case where children are unable to divide their time among different activities, so that the household's problem can be modeled as a discrete choice problem with three alternatives.

In particular, our analysis is based on multinomial logit model where the utility of household i under choice $j \in \{W, S, I\}$ is given by:

$$U_{ij} = V_j + \epsilon_{ij},$$

where ϵ_{ij} is an iid random utility shock with Type I Extreme Value distribution. The term V_j can be interpreted as the household's generalized consumption when alternative j is chosen. We assume that:

$$V_S = w_A + \gamma_S$$

[6]These results are consistent with evidence suggesting that returns to education are lower in the informal sector (De Paula and Scheinkman, 2011).

[7]Finally, while other papers in the literature have investigated the impacts of Brazil's trade liberalization reform on crime (Dix-Carneiro et al., 2018), elections (Ogeda et al., 2024) and health (Charris et al., 2024), our analysis makes a novel contribution by providing a comprehensive examination of the effects of the trade reform on child labor, schooling and human capital formation.

$$V_W = w_A + w_C$$

and

$$V_I = w_A,$$

where w_A and w_C denote adult and child wages, respectively, and the parameter γ_S capture the overall net benefit of sending the child to school. For simplicity, and without loss of generality, we assume that the benefit of keeping the child idle is normalized to zero. Following the spirit of Basu and Van (1998)'s luxury axiom, we suppose that a household can afford to send their children to school only when their income from non-child labor sources is sufficiently large. In particular, we assume that children can attend school if, and only if:

$$w_A \geq \varphi_i,$$

where the term $\varphi_\imath$ represents a household-specific subsistence level, which we assume to be uniformly distributed in the interval $[0, \overline{\varphi}]$. Note that this formulation captures the potential heterogeneity in subsistence levels, which may vary according to geographic location and the availability of other sources of household income, including rents, transfers and returns on other assets. Our analysis focuses on the more interesting case where $w_A < \overline{\varphi}$, so that the probability of the subsistence condition being satisfied is always interior and given by $\Pr(w_A \geq \varphi_i) = w_A/\overline{\varphi}$.

Households take wages w_A and w_C as given, observe their idiosyncratic shocks ϵ_{ij} and φ_i and choose the alternative $j \in \{W, S, I\}$ which maximizes their utility subject to the subsistence condition. Under a multinomial logit model, the shares of households choosing to send their children to school, have them work or keep them idle can be expressed as follows:

$$\varkappa_S(w_A, w_C) = \frac{w_A}{\overline{\varphi}} \frac{\exp(\gamma_S)}{\exp(\gamma_S) + \exp(w_C) + 1} \tag{1}$$

$$\varkappa_W(w_A, w_C) = \frac{w_A}{\overline{\varphi}} \frac{\exp(w_C)}{\exp(\gamma_S) + \exp(w_C) + 1} + \left(1 - \frac{w_A}{\overline{\varphi}}\right) \frac{\exp(w_C)}{\exp(w_C) + 1} \tag{2}$$

and

$$\varkappa_I(w_A, w_C) = \frac{w_A}{\overline{\varphi}} \frac{1}{\exp(\gamma_S) + \exp(w_C) + 1} + \left(1 - \frac{w_A}{\overline{\varphi}}\right) \frac{1}{\exp(w_C) + 1} \tag{3}$$

Note that whenever the subsistence condition is binding, which occurs with probability $1 - w_A/\overline{\varphi}$, households are limited to choosing between having their children work or keeping them idle, which intuitively explains the second term of the sum on the right-hand side of equations (2) and (3) above.

We investigate the effects of an economic shock on intra-household decision-making by decomposing it into two components that differentially affect labor market opportunities for adults and children and, consequently, their respective wages. Intuitively, a trade liberalization shock that negatively impacts a sector such as the automotive industry − which typically employs very few children − should induce significant changes in adult wages, but have little to no effect on children's labor market opportunities and wages. Conversely, an economic shock that negatively impacts a sector such as apparel or textiles − which typically employs a larger fraction of children − should result in significant changes in the labor market opportunities and wages for both adults and children.

Formally, our analysis provides a characterization of how children's activities are influenced by changes in adult and child wages, holding all other variables constant. The next proposition summarizes our main results.

Proposition 1. *Households respond to changes in adult and child wages in the following manner:*

i. ***Income Effect.*** *An increase in adult wages,* w_A*, leads to an increase in the share of children who attend school and to a reduction in the shares of children who work or remain idle.*

ii. ***Substitution Effect.*** *An increase in child wages,* w_C*, leads to an increase in the share of children who work and to a reduction in the shares of children who attend school or remain idle.*

Thus, we find that an increase in adult wages is associated with a positive *income effect* which allows more families to send their children to school, while an increase in child wages is associated with a negative *substitution effect*, which raises the returns to child labor (i.e. the opportunity cost of education), thereby reducing the share of children who attend school. Additionally, we find a decrease in idleness in both cases. In practice, an economic shock typically affects the labor markets for adults and children simultaneously, and in different ways, resulting in changes in both w_A and w_C. Our framework implies that, holding all other factors constant, school attendance should increase less (or decrease more) when a shock is accompanied by a rise in child wages, $\Delta w_C > 0$.

Our analysis thus far has assumed that households are homogeneous in the sense that they all receive identical wages and are subject to the same identically distributed shocks. We now introduce some degree of heterogeneity by assuming the existence of two types of households, rich (R) and poor (P). Specifically, rich households are defined as those for whom the subsistence condition is always satisfied, i.e. $w_A > \overline{\varphi}^R$, whereas poor households are those for whom this condition is binding with a strictly positive probability, i.e. $w_A < \overline{\varphi}^P$. Our goal is to understand how the magnitudes of the effects of the shocks differ between these two income groups. The next proposition summarizes our results.

Proposition 2. *In a model with rich and poor households, with* $\overline{\varphi}^R < w_A < \overline{\varphi}^P$*, the following results hold:*

i. The magnitude of the effect of a change in adult wages on the share of children who work is always larger for poor households relative to rich households, $|\frac{\partial \varkappa_W^P}{\partial w_A}| > |\frac{\partial \varkappa_W^R}{\partial w_A}|$.

ii. The magnitude of the effect of a change in child wages on the share of children who work is larger for poor households relative to rich households, $|\frac{\partial \varkappa_W^P}{\partial w_C}| > |\frac{\partial \varkappa_W^R}{\partial w_C}|$*, provided that* $w_C < \frac{1}{2}\log(1 + e^{\gamma_S})$.

Therefore, we find that the impact of an economic shock on child labor is more pronounced among children from socially disadvantaged backgrounds. Specifically, we show that the magnitude of the income effect is always larger for poor households. Moreover, the substitution effect will also be larger for poor households, provided that child wages are sufficiently small relative to the returns to schooling γ_s, a condition which is typically satisfied in most real-world settings. Overall, our theoretical framework provides general predictions about the effects of economic shocks on children's activities, which we can use to guide our investigation of Brazil's trade liberalization reform.

3 Institutional Background

3.1 Brazilian Trade Reform of the 1990s

For over five decades since the 1930s, Brazil pursued a state-led industrialization policy based on an import substitution strategy and a complex system of protection against foreign competition. In addition to the high nominal tariffs, a protective structure consisting of non-tariff barriers and special regimes was in place, which included lists of banned products, quantity controls, and government procurement restrictions (Kume et al., 2003). By the mid-1970s, Brazil's industrialization policy began showing signs of financial unsustainability and, throughout the 1980s, the country experienced a succession of financial and economic crises, accompanied by mounting social problems. In this context, the election of Fernando Collor de Mello in 1990 marked a significant shift towards a more liberal approach to economic policy-making.

In a move towards greater transparency, the Collor administration unexpectedly implemented a reform in 1990 that eliminated all non-tariff barriers, replacing them with higher import tariffs chosen to maintain the overall level of protection unchanged. Importantly, from that moment on, tariffs began to reflect the actual degree of protection received by each industry, thereby becoming the main instrument of trade policy.[8] Between 1990 and 1995, the trade liberalization process gained momentum, with average nominal tariffs declining from 30.5% to 12.8%, and then remaining relatively constant thereafter.[9] In Figure 1 we plot the percentage tariff change by industry, aggregated at the *Nível 50* classification level, from 1990 to 1995, as measured by the variation in $\log(1 + \textit{tariff})$. Note that there is substantial heterogeneity in the magnitude of tariff reductions across sectors, with tariffs declining by about 0.25 log points in Rubber and Apparel, but by only 0.03 log points in Petroleum, Gas, and Coal − and in Agriculture tariffs actually experienced a slight increase.

Another important goal of Brazil's trade liberalization reform was to reduce the cross-industry variation in tariffs in an attempt to minimize economic distortions (Kume et al., 2003). Consistent with this objective, the dispersion of protection across industries decreased substantially between 1990 and 1995, with the standard deviation of tariffs dropping from 14.9 percentage points (pp) to 7.4 pp. Moreover, crucial to our empirical strategy, the industries that were most protected before the reform experienced the largest tariff cuts (Kovak, 2013). As shown in Figure 2, there is a strong negative correlation (−0.90) between changes in tariffs and the pre-liberalization tariff levels imposed decades earlier (Kume et al., 2003). This pattern mitigates potential concerns that tariff cuts may have been influenced by industry-specific characteristics. As discussed in detail below, our analysis will be particularly careful in controlling for potential factors that could be correlated with realized tariff cuts.

3.2 Child Labor in Brazil

Child labor is still a major challenge in Brazil, a concern that is particularly alarming given that basic education and human capital have been repeatedly shown to be key determinants of economic development, as well as social and inter-generational mobility. As we report in Panel A of Table 1, while the percentage of children who work has been steadily declining since the 1980s, approximately 5.1% of the children aged between 10 and 14 were still engaged in paid or unpaid jobs in 2010. This amounts to more than 930,000 children participating in the labor market during a period of their lives considered crucial for the development of essential cognitive and social skills. Moreover,

[8]For a detailed description of the trade liberalization reform in Brazil, see Kume et al. (2003), Kovak (2013) and Dix-Carneiro and Kovak (2017).

[9]Figure A1 depicts the dynamics of nominal tariffs from 1987 to 1998 across the ten largest industries.

of the children working in 2010, approximately 46% held paid jobs, suggesting that a significant fraction of these children work to supplement their household's income.

In Panel B of Table 1, we show that the proportion of working children is considerably higher in the poorer and more rural regions of the country, defined as the microregions where per capita income is below the median and rural population is above the median. Furthermore, not only is the share of child labor consistently higher in these regions, but the rate of its reduction has also been slower over time. Indeed, from 1980 to 2010, the proportion of children who work decreased by about 67% in urban areas, but by only 47% in rural areas. A similar pattern is observed when comparing large and small microregions, defined respectively as those above and below the median population.

Also, from Panel B of Table 1, we observe that the share of child labor tends to be smaller in the wealthier states of the South, while it is more evenly distributed across the other regions of the country. Moreover, conditional on working, child labor is significantly more prevalent in the agricultural and extractive sectors than in the manufacturing and non-tradable sectors. Specifically, within the subsample of working children in 2010, approximately 55.3% were employed in the agriculture and extractive sectors, whereas 37% and 7.7% were employed in the non-tradable and manufacturing sectors, respectively.

In Figure A2, we take a closer look at the intensity of child labor across sectors by reporting the ratio of child labor to total labor in each industry, using Census data from 1991, the baseline period for our empirical analysis. The figure reveals substantial heterogeneity across industries, with agriculture standing out as the most child-intensive sector. In the manufacturing sector, industries such as non-metallic mineral manufacturing, footwear, wood and furniture, food processing, textiles, and apparel are particularly intensive in child labor. Finally, in Figure A3, we show a substantial negative correlation between the shares of child labor and formal employment (i.e. the proportion of workers with formal labor contracts), further reinforcing the notion that children are more likely to work in industries with lower skill requirements.

4 Data

4.1 Child Labor and Schooling Data

Our main source of data on child labor and schooling comes from the Brazilian Demographic Censuses for the years 1980, 1991, 2000, and 2010. These datasets contain detailed information about the labor market participation, school attendance, and various socioeconomic characteristics of children, and have the key advantage of being representative at fine geographic levels. Specifically, our analysis exploits information on whether children attend school, work, or remain idle (i.e. neither work nor study). Moreover, for the subsample of employed children, we also observe whether their work is paid or unpaid. Importantly, the dataset contains information about the sector in which each child is employed, as defined by the 5-digit CNAE Domiciliar classification.[10]

Our analysis focuses on children aged between 10 and 14 years old, given that information on schooling and labor market participation is unavailable for children under 10, and considering that the Brazilian legislation permits work as an "apprentice" for those above 14. Moreover, in line with the literature on local labor markets, our analysis is conducted at the microregion level − a level of aggregation defined by the Brazilian Institute of Geography and Statistics (IBGE) comprising neighboring municipalities that share similar geographic and productive characteristics. Similar to Costa et al. (2016) and Dix-Carneiro et al. (2018), our final sample consists of 411 microregions whose boundaries remained constant between 1980 and 2010 based on the definition of "minimally comparable areas" provided by Reis et al. (2008).[11]

Our analysis focuses on changes in child labor, schooling, and other educational and labor market outcomes between 1991 and 2000 ("medium run") and between 1991 and 2010 ("long run"). Furthermore, we use information from the 1980 Census to account for pre-existing trends potentially related to future tariff reductions, and census data to construct demographic control variables at the microregion level for the baseline year of 1991. We also exploit annual information from Brazil's School Censuses between 1995 and 2020 to assess the effects of the trade liberalization reform on the dynamics of school enrollment, age-grade distortion, and other educational measures. Finally, we use detailed administrative data from Relação Anual de Informações Sociais (RAIS) to examine the evolution of the effects of tariff reductions on formal labor markets.

4.2 Local Exposure to Trade Liberalization

Following the empirical literature on the regional effects of foreign competition, we construct a measure of local exposure to trade liberalization, leveraging two main sources of variation in a shift-share design. Specifically, we take advantage of the cross-industry variation in protection arising from distinct changes in nominal tariffs between 1990 and 1995, combined with cross-regional variation in the industry mix across the country. Intuitively, although tariff cuts were uniform across all regions for a given industry, exposure

[10]The CNAE Domiciliar classification system provides a categorization of economic activities and is used in demographic censuses and other household surveys in Brazil.

[11]As in other studies, we do not consider the microregion containing the Free Trade Area of Manaus, as it was not impacted by the trade liberalization reform of the 1990s. Moreover, we also exclude the archipelago of Fernando de Noronha for which no information is available prior to the 1991 census.

to the reform varied among microregions, depending on their prior sectoral specialization.

In particular, we follow Kovak (2013) and Dix-Carneiro and Kovak (2017), who proposed a measure of regional tariff change based on the average tariff reduction across industries, weighted by each industry's participation in the local labor market. Formally, the level of exposure of microregion m to the trade liberalization reform is given by:

$$\Delta Tariff_m = -\sum_{j\in S} \omega_{mj} \times \Delta \log(1+\tau_j), \quad (4)$$

where τ_j represents the nominal tariff in industry j, $\Delta\log(1+\tau_j)$ is the log difference of tariff rates in industry j between 1990 and 1995, and S denotes the set of all tradable industries.[12] Tariff changes are calculated based on data provided by Kume et al. (2003) on industry-specific tariff rates from 1987 to 1998.[13] The term ω_{mj} captures the relative importance of industry j in microregion m's employment and is given by:

$$\omega_{mj} = \frac{\lambda_{mj}/\varphi_j}{\sum_{j'\in S} \lambda_{mj'}/\varphi_{j'}} \quad (5)$$

where $\lambda_{mj} = L_{mj}/L_m$ represents the share of microregion m's workers employed in industry j, measured at the baseline year of 1991, and φ_j is defined as one minus the wage bill share of industry j, calculated based on information from the Brazilian national accounts. To facilitate the interpretation of the results, we multiply the tariff exposure measure by minus one, so that microregions experiencing larger tariff cuts are assigned higher positive values for $\Delta Tariff_m$.

While the $\Delta Tariff_m$ index reflects each microregion's overall exposure to trade liberalization, it does not distinguish between tariff reductions that differentially affect the labor market opportunities of adults and children. To capture this specific dimension of tariff changes, we decompose the aggregate measure of local tariff exposure by exploiting the fact that distinct industries and microregions employ varying proportions of adults and children. Specifically, for each industry j and microregion m, we calculate the share of child labor in the baseline year of 1991, $Ch_{mj} = L^{Ch}_{mj}/L_{mj}$, and then split the aggregate

[12] Following Kovak (2013), we exclude the non-tradable sector from our analysis. Indeed, Kovak (2013) shows that because the non-tradable price moves together with the price of a locally produced tradable good, the magnitude of the local tariff shock depends exclusively on the local tradable sector.

[13] We apply the same methodology as Dix-Carneiro and Kovak (2017) to aggregate information at the *Nível 50* industry classification level into a system compatible with the sector coding available in Brazilian census data, resulting in 20 tradable sectors.

measure of tariff exposure into two additive components:[14]

$$\Delta Tariff_m^{Child} = -\sum_{j \in S} Ch_{mj} \times \omega_{mj} \times \Delta \log(1 + \tau_j) \quad (6)$$

and

$$\Delta Tariff_m^{Adult} = -\sum_{j \in S} (1 - Ch_{mj}) \times \omega_{mj} \times \Delta \log(1 + \tau_j) \quad (7)$$

Figure 3 presents the spatial distribution of our measures of adult and child-specific tariff exposures across Brazilian microregions, with darker shades indicating higher exposure to tariff cuts. Note that there is substantial variation in both measures, even within states. Importantly, Figure A4 shows that while the relationship between the overall measure of tariff exposure and the adult-specific measure is nearly perfect ($\rho = 0.99$), the correlation with the child-specific measure is substantially smaller ($\rho = 0.60$).[15] As we shall discuss below, our empirical analysis will exploit precisely these within-state variations in adult and child-specific tariff exposures.

4.3 Summary Statistics

Our main dataset consists of information at the microregion level on changes in child labor and schooling over the periods 1991-2000 ("medium-run") and 1991-2010 ("long-run"), as well as measures of local exposure to tariff reductions calculated based on tariff changes between 1990 and 1995. Table 2 provides summary statistics for the main variables employed in our analysis. Panel A reports descriptive statistics for our measures of local exposure to trade liberalization. Note that, as expected, given the greater participation of adults in the workforce, the average adult-specific tariff shock is significantly larger than the average child-specific tariff shock. Importantly, there is considerable variation in both indexes across microregions. For reference, the differences between microregions in the 90th and 10th percentiles of the distributions of both the overall and adult-specific tariff exposures are 0.107 and 0.104 log points, respectively, while the corresponding difference for the child-specific tariff exposure is 0.003 log points.

Next, in Panel B, we report descriptive statistics for changes in schooling and child labor between 1991 and 2000 ("medium-run"). Note that during this period the share of children who attend "school only" increased by 15.7 percentage points (pp), accompanied by a 13.3 pp decrease in the fraction of children who remain "idle" and a more modest 2.4 pp reduction in the share of children who "work". A similar pattern is observed in

[14] Autor et al. (2019) use a similar strategy to decompose labor demand shocks into gender-specific components.

[15] The correlation between the measures of adult and child-specific tariff exposures is 0.58.

Panel C, where we report summary statistics for the same variables between 1991 and 2010 ("long-run"). During this period, the fraction of children who attend "school only" increased even further by 19.9 pp, accompanied by a 15.6 pp reduction in the share of children who remain "idle" and a 4.3 pp decrease in the fraction of children who "work".

Finally, in Panel D, we present descriptive statistics for selected socioeconomic characteristics of microregions for the baseline year of 1991. Remarkably, the average poverty rate in these microregions − defined as the fraction of the population living with less than 1/2 minimum wage per month − was 71.9%. Moreover, the mean share of urban population was 61.2% and the average illiteracy rate was 30.3%. Overall, Brazil in 1991 was a country marked by significant poverty and inequality.[16]

5 Empirical Strategy

Our empirical analysis is composed of four parts focusing on the effects of the trade liberalization reform on: (*i*) child labor and schooling, (*ii*) school enrollment and age-grade distortion, (*iii*) human capital accumulation and (*iv*) structural transformation.

Child Labor and Schooling. We begin our analysis by examining the impact of the overall exposure to trade liberalization on child labor and schooling by estimating the following regression:

$$\Delta y_m^{\tau-1991} = \beta \Delta Tariff_m + \theta \Delta y_m^{1991-1980} + W_m \gamma + \delta_s + \epsilon_m \tag{8}$$

where $\Delta y_m^{\tau-1991}$ represents the first-difference of the variable $y_{m,t}$ for microregion m between $\tau \in \{2000, 2010\}$ and the baseline year of 1991, i.e. $\Delta y_m^{\tau-1991} \equiv y_{m,\tau} - y_{m,1991}$. We estimate the above equation separately for the short and long differences, i.e. using $\tau = 2000$ and 2010, in order to investigate the medium and long-run effects of tariff reductions. The main outcomes considered in our analysis are the shares of children who attend "school only", "work" and neither work nor study ("idle"). Moreover, we also examine the impact of trade liberalization on the share of children employed in paid jobs. Our parameter of interest here is β, which captures the effect of the overall tariff shock on children's activities.

Our identification strategy relies crucially on accounting for potential trends in outcome variables that might be correlated with regional exposure to trade liberalization. To do so, our basic specification includes state fixed effects δ_s to account for distinct

[16] In Table A1, we present additional summary statistics for our analyses on school enrollment, human capital accumulation, and structural transformation, which we discuss below.

state-specific trends, as well as a vector of microregion characteristics W_m measured at the baseline year. Specifically, using information from the 1991 Census, we control for the logarithm of population, share of the population aged between 10 and 14, share of urban population, poverty rate, illiteracy rate, and income inequality (Gini index). By including these variables, we account for potential differences in trends across microregions, which are allowed to vary depending on their initial demographic and socioeconomic characteristics. Moreover, we also include the lag of the dependent variable, $\Delta y_m^{1991-1980} \equiv y_{m,1991} - y_{m,1980}$, to control for preexisting trends. All regressions are weighted by population size in 1991 and standard errors are clustered at the mesoregion level to allow for spatial correlation across neighboring microregions.[17]

Next, we examine the separate effects of adult and child-specific tariff reductions by estimating the following regression:

$$\begin{aligned}\Delta y_m^{\tau-1991} = \beta^{Adult}\Delta Tariff_m^{Adult} + \beta^{Child}\Delta Tariff_m^{Child} \\ + \theta\Delta y_m^{1991-1980} + W_m\gamma + \delta_s + \epsilon_m,\end{aligned} \tag{9}$$

where, similarly as before, we control for state fixed effects, the lag of the dependent variable and a number of microregion-specific characteristics measured at the baseline year. All regressions are weighted by population size in 1991 and standard errors clustered at the mesoregion level. Our parameters of interest in this case are β^{Adult} and β^{Child}, which capture the effects of adult and child-specific tariff reductions. In line with theoretical predictions, we expect the estimates associated with these two parameters to have opposite signs.[18]

We perform a number of robustness checks by controlling for various factors, including longer pre-trends, higher-order polynomials in income per capita, characteristics of local labor markets, exposure to social programs such as *Bolsa Familia*, local educational infrastructure and public spending, as well as other regional shocks that might have contemporaneously affected Brazilian microregions during our study period.[19] We also conduct heterogeneous effects analyses by splitting our sample according to household income, educational level of the head of the household, and children's gender and race. In doing so, our aim is to investigate whether the estimated effects are more pronounced

[17] A mesoregion is a geographic unit defined by the IBGE, composed of neighboring microregions with similar socio-economic characteristics. Our sample includes 91 mesoregions.

[18] Specifically, adult-specific tariff reductions are expected to lead children to move out of school and into the labor market, due to their negative impact on household income. Conversely, child-specific tariff shocks are expected to lead children to move in the opposite direction (namely, towards schooling), by reducing the opportunity costs of education.

[19] Furthermore, in Section 7 we follow the approach suggested by Goldsmith-Pinkham et al. (2020) to provide additional support for our main identification strategy.

among socially disadvantaged children.

School Enrollment, Age-Grade Distortion and Other Educational Measures. Next, we exploit administrative data from the Brazilian School Census to examine in more detail the evolution of the effects of adult and child-specific tariff reductions on school enrollment, age-grade distortion and approval rates. Data from the School Census has the advantage of being reported directly by schools on an annual basis, and is available for a longer period, between 1995 and 2020. We begin our analysis by focusing on the share of children aged between 10 and 14 who are enrolled in school using 1995 as baseline, the first year of the School Census.[20,21] Specifically, we estimate a linear regression model similar to the one specified in Equation (9) separately for each year $\tau \in \{1996, ..., 2020\}$, controlling for state fixed effects and microregion-specific characteristics. Moreover, while we are unable to directly control for the lag of the dependent variable in this case, due to the absence of school enrollment data prior to 1995, we proxy it by including the difference in the share of children attending school between 1980 and 1991 using information from the Demographic Census.

Furthermore, to check whether the children who may be entering school as a result of the shocks are actually able to progress through the school system − or conversely whether the children who may be dropping out of school are precisely those who would not have been able to progress anyway − we complement our analysis by examining the effects of tariff reductions on age-grade distortion rates for elementary school students. This measure is defined as the share of children who are enrolled in a school grade two or more years below that which would be expected based on their current age. We then estimate a regression for each year $\tau \in \{1996, ..., 2020\}$ using the same specification described above for school enrollment. Moreover, in a complementary analysis, we examine the impact of trade shocks on approval rates in elementary school, defined as the share of students who are able to successfully progress to the next grade at the end of the school year.[22]

Finally, in order to check whether our main results are being driven simply by differ-

[20]While information on enrollment is obtained directly from the School Census, data on the population size of children aged between 10 and 14 is available only for the Census years of 1991, 2000, 2010, and 2022. Following a standard approach in the literature, we project the population of children of this age group for non-census years using a linear interpolation method.

[21]We note that information on school enrollment per age group was not reported in the School Census of 1997. Thus, for this particular year, we employ a simple interpolation to project the enrollment of children aged between 10 and 14 for each microregion. As we shall become clear below, none of our findings depend on the results obtained specifically for 1997.

[22]We note that due to methodological changes, data on approval rates was not reported in the School Census of 2006. Thus, for this particular year, we also employ a simple interpolation to project approval rates for each microregion.

ential changes in the supply of school infrastructure, we estimate the effect of both tariff reduction shocks on the number of schools and teachers in elementary schools per 1,000 inhabitants, using School Census data.

Human Capital Accumulation. Next, we turn to the investigation of how local exposure to trade liberalization affected human capital accumulation in the long-run. Since we expect the effects in this case to be concentrated on specific age groups, our analysis focuses on an alternative specification, conducted at the 'year-of-birth cohort'-'microregion' level, using the shares of individuals who completed elementary school, high school and have some college education as proxies for the stock of human capital. In line with the existing research on early childhood environment (Currie and Almond, 2011; Almond et al., 2018), we expect the cohorts of individuals who were in their formative years during the early 1990s to have been more impacted by the trade reform.

Specifically, using data from the 2010 Census, we estimate the following regression:

$$y_{cm}^{2010} = \sum_{\substack{j=1950 \\ j\neq 1973}}^{1992} \beta_j^{Adult}(\mathbb{1}\{c=j\} \times \Delta Tariff_m^{Adult}) + \sum_{\substack{j=1950 \\ j\neq 1973}}^{1992} \beta_j^{Child}(\mathbb{1}\{c=j\} \times \Delta Tariff_m^{Child}) + \sum_{\substack{j=1950 \\ j\neq 1973}}^{1992} \gamma_c(\mathbb{1}\{c=j\} \times W_m) + \sum_{\substack{j=1950 \\ j\neq 1973}}^{1992} \theta_c(\mathbb{1}\{c=j\} \times \tilde{y}_{cm}^{1991}) + \lambda_m + \mu_c + \delta_{cs} + \epsilon_{cm}, \tag{10}$$

where y_{cm}^{2010} is a measure of the human capital stock of cohort c in microregion m in 2010. Our specification controls for microregion fixed effects λ_m, cohort fixed effect μ_c, cohort-state fixed effects δ_{cs} and the interaction between cohort fixed effects and the same microregion-specific characteristics W_m considered in previous specifications, all measured at the baseline year of 1991. Moreover, we also include the lag of the dependent variable $\tilde{y}_{cm}^{1991}$, defined as stock of human capital of the cohort which, in 1991, was the same age as cohort c in 2010.[23] Our approach enables us to control for potential 'cohort'-'microregion'-specific confounders whose effects are allowed to vary flexibly across cohort. As before, all regressions are weighted by population size in 1991 and standard errors are clustered at the mesoregion level.

Our analysis focuses on cohorts born from 1950 to 1992, whose members were aged between 18 and 60 in 2010. We consider as the baseline (omitted) group the cohort born in 1973, whose members were 18 years old in 1991. Our parameters of interest are β_c^{Adult} and β_c^{Child}, which capture the effects of adult and child-specific tariff reductions

[23] For instance, for the cohort c born in 1992, which was 18 years old in 2010, we consider the human capital stock of the cohort born in 1973, which was 18 years old in 1991.

on the stock of human capital accumulated by members of cohort c by the Census year of 2010. Note that, since individuals born in 1973 and before were not exposed to the trade liberalization shock during the most important part of their formative years, we expect the estimates for β_c^{Adult} and β_c^{Child} to be close to zero and statistically insignificant for $c \leq 1973$. Conversely, given that individuals born after 1973 were progressively more exposed to the shock, we expect the estimated effects to increase in magnitude and start showing statistical significance for cohorts born at some point after 1973.

Structural Transformation. Finally, to better understand the mechanisms driving the effects of the shocks and to provide a context for our results, we investigate how exposure to trade liberalization affected the structure of local economies. In particular, we focus on the medium and long-run effects of trade shocks on changes in a several key characteristics of local labor markets, including share of formal employment (i.e. fraction of private sector workers with a formal labor contract), logarithm of average individual earnings, and distribution of the workforce across agriculture/mining, manufacturing and the non-tradable sector.[24] As before, our analysis is based on estimating linear regression models similar to that specified in Equation (9), controlling for state fixed effects, lag of the dependent variable and microregion-specific characteristics, with standard errors are clustered at the mesoregion level.[25] Finally, we complement our study by leveraging over 30 years of administrative data from the Relação Anual de Informações Sociais (RAIS) to examine the evolution of the effects of both adult and child-specific tariff reductions on formal sector employment and earnings in a manner similar to Dix-Carneiro and Kovak (2017).

[24]While other studies have examined the overall effect of Brazil's trade liberalization reform on some of these outcomes (Dix-Carneiro and Kovak, 2017, 2019; Ponczek and Ulyssea, 2021), our analysis adds to the literature by disentangling the effects of adult and child-specific tariff reductions.

[25]Our analysis employs a two-step approach similar to the one used by Dix-Carneiro and Kovak (2017) to net out social and demographic characteristics of the local workforce from the dependent variables prior to conducting our main analysis. Specifically, we regress individual labor market outcomes on individual demographic characteristics (age, age squared, and dummies for gender and years of schooling) and microregion fixed effects to obtain the average of the logarithm of earnings and formal employment rates net of workers composition. We then use the microregion fixed effects estimates to construct our dependent variables, taking differences between census years. The second-stage regressions are performed at the local labor market level, weighted by the inverse of the first-stage standard errors.

6 Main Results

6.1 Child Labor and Schooling

Main Estimates. We begin our discussion by reporting in Table 3 the effects of local exposure to trade liberalization on changes in child labor and schooling between 1991 and 2000 (columns 1, 3, 5 and 7) and 1991 and 2010 (columns 2, 4, 6 and 8). In Panel A, we report coefficient estimates for the specification in Equation (8) focusing on the impact of overall tariff reductions on children's activities. Our results indicate that an increase in exposure to trade liberalization leads to smaller increases in the share of children who "study only" over the medium and long-run relative to the national trend (columns 1 and 2). This effect is accompanied by larger relative increases (smaller declines) in the share of children who "work" (columns 2 and 4). Conversely, we find no significant effect on the share of children who remain "idle" (columns 5 and 6). Our results also suggest that the larger relative increases in child labor observed in microregions more heavily exposed to tariff reductions are primarily driven by larger increases (smaller declines) in the share of children engaged in paid employment (columns 7 and 8).

Interestingly, we find that the estimated effects are persistent and always more pronounced in the long-run (columns 2, 4 and 8). Specifically, our point estimates suggest that reducing the overall local tariff exposure by 0.107 log points − which is equivalent to moving a microregion from the 10th to the 90th percentile of the distribution of overall tariff reductions − leads to a smaller relative increase in the share of children who "study only" of about 1.4 percentage points (pp) (0.132×0.107) in the medium-run and 4.7 pp (0.442×0.107) in the long-run. This is accompanied by a larger relative increase (smaller decline) in the share of children who "work" of about 2.8 pp (0.258×0.107) in the medium-run and 5.9 pp (0.551×0.107) in the long-run. To put these figures into perspective, note that the fraction of children who "study only" in Brazil increased 19.9 pp between 1991 and 2010 (see Table 2, panel C). Thus, a microregion exposed to an overall tariff reduction of 0.107 log points is estimated to have experienced an increase in the share of "study only" approximately 23.6% ($4.7 \div 19.9$) below the national trend.

Next, we disentangle the effects of adult and child-specific tariff reductions on children's activities by estimating the specification in Equation (9) for both the medium and long-run. The results reported in Panel B of Table 3 show that the estimates for adult-specific tariff reductions are very similar to those obtained for the overall measure − with the same sign, but consistently larger in magnitude. Conversely, the estimates associated with child-specific tariff reductions have always the opposite sign, in a manner consistent with substitution effects. In particular, we find that local exposure to child-specific tariff reductions leads to larger relative increases in the share of children who "study only" over the medium and long-run (columns 1 and 2). This is accompanied by smaller relative increases (larger declines) in the proportion of children who "work" (columns 3 and 4) and who have a paid employment (columns 7 and 8) − with no significant effects on the share of children who remain "idle" (columns 5 and 6).

As before, we also find that the estimated effects of both adult and child-specific tariff shocks are persistent and always larger in the long-run. Specifically, focusing on child-specific tariff reductions, our point estimates suggest that a decrease in tariff exposure of 0.003 log points − which is equivalent to moving a microregion from the 10th to the 90th percentile of the distribution of child-specific tariff reductions − leads to a larger relative increase in the share of children who "study only" of about 2.2 pp (7.456×0.003) in the medium-run and 3.3 pp (11.058×0.003) in the long-run. This is accompanied by a smaller relative increase (larger decline) in the share of children who "work" of about 2.0 pp (6.676×0.003) in the medium-run and 2.6 pp (8.822×0.003) in the long-run.[26] To put these numbers into perspective, a microregion exposed to a local child-specific tariff reduction of 0.003 log points is estimated to have experienced an increase in the share of children who "study only" approximately 16.5% ($3.3 \div 19.9$) above the national trend between 1991 and 2010.[27] Interestingly, while child-specific tariff reductions are much smaller in magnitude than adult-specific tariff reductions, our results suggest that the impacts of both shocks are substantial and economically significant.

Robustness Checks. To check the robustness of our main findings, we estimate several alternative specifications for the model in Equation (9) controlling for additional socioeconomic variables that could potentially be correlated with adult and child-specific tariff reductions. Tables 4 and 5 report the results of these robustness checks focusing on the two main outcomes of our analysis, namely share of children who "study only" and share of children who "work", respectively.

We begin by discussing our results for the share of children who "study only", as reported in Table 4, for both the medium (panel A) and the long-run (panel B). To facilitate comparison, we present in column 1 the estimates from our baseline specification

[26] For adult-specific tariff reductions, a decrease in exposure of 0.104 log points − which approximately corresponds to moving a microregion from the 10th to the 90th percentile of the distribution of adult-specific tariff reductions − leads to a smaller relative increase in the share of children who "study only" of about 2.8 pp (0.267×0.104) in the medium-run and 6.7 pp (0.647×0.104) in the long-run, accompanied by a larger relative increase (smaller decline) in the share of children who "work" of about 3.7 pp (0.361×0.104) and 7.2 pp (0.691×0.104), respectively.

[27] Similarly, a microregion exposed to a local adult-specific tariff reduction of 0.104 log points is estimated to have experienced an increase in the share of children who "study only" approximately 33.6% ($6.7 \div 19.9$) below the national trend.

(Table 3, panel B, columns 1 and 2), and in column 2 we report estimates from a specification with state fixed effects but without any other controls. We then report coefficient estimates for a number of different specifications where, in addition to the variables already included in the baseline regression, we control for other specific characteristics of microregions. Specifically, in column 3 we account for longer pre-liberalization trends by including the change in the dependent variable between 1970 and 1980, $\Delta y_m^{1980-1970}$, while in column 4 we add a cubic polynomial in the logarithm of per capita income for 1991. Additionally, in column 5 we control for several characteristics of the local labor markets, including share of unskilled workers (fraction of workers who did not complete high school), share of informal employment, and the shares of the workforce in agriculture/mining and manufacturing, all measured in the baseline year of 1991.

Next, in column 6 we account for the local exposure to key social programs by including the share of the microregion's population in 2000 impacted by PETI (a program for the eradication of child labor) and the share of the population receiving benefits from the conditional cash transfer program *Bolsa Família* as of December 2004, following Almeida and Carneiro (2012). Moreover, in column 7 we control for the local supply of public goods and educational infra-structure, adding the logarithm of the microregions' total per capita spending in 1991, number of teachers in primary schools per 1,000 inhabitants in 1995, and number of schools per 1,000 inhabitants in 1995. Finally, in column 8 we account for macroeconomic shocks that occurred during the post-liberalization period by including, similarly to Dix-Carneiro and Kovak (2017), microregion-specific changes in import tariffs during 1995-2000 (medium-run analysis, panel A) and 1995-2010 (long-run analysis, panel B), microregion-specific changes in real exchange rates (both import and export-weighted) during 1991-2000 (panel A) and 1991-2010 (panel B), and microregion-specific changes in commodity prices during 1991-2000 (panel A) and 1991-2010 (panel B), using a measure proposed by Adão (2016).[28]

Note that the point estimates reported in Table 4 remain quite stable across the various specifications. The long-run effects (panel B) are particularly large in magnitude and always statistically significant, with the point estimates associated with adult-specific tariff shocks ranging from -0.479 to -1.344, and those associated with child-specific tariff shocks ranging from 9.246 to 15.422. Next, in Table 5 we report the results of the same

[28]The changes in post-liberalization tariffs were computed based on the UNCTAD TRAINS tariff database. To calculate microregion-specific changes in real exchange rates, we first computed industry-specific real exchange rates. This was done by averaging the real exchange rates between Brazil and its trade partners, using as weights the shares of exports to (or imports from) each country in a specific industry based on trade data from 1989. We then calculate the microregion-specific changes in real exchange rates by taking the differences in the logarithm of industry-specific real exchange rates during 1991-2000 and 1991-2010, weighting each industry by its labor market share as in Equation (4).

robustness checks for the share of children who "work". As before, we show that our main results are robust to the inclusion of these various additional controls. In particular, we find that in the long-run (panel B) the point estimates associated with adult-specific tariff shocks range from 0.354 to 0.723, while those associated with child-specific tariff shocks vary between −7.956 and −11.808, with all estimates being statistically significant at conventional levels. Additionally, in Tables A2 and A3 we report the results of the same exercises for the shares of children who remain "idle" and have a "paid employment" respectively, showing that our main findings are robust across all specifications.

Heterogeneous Effects. We complement our analysis by examining whether the estimated effects vary according to the characteristics of children and households. Intuitively, we expect the mechanisms underlying our main results to be more pronounced among children from less-advantaged backgrounds, particularly those belonging to low-income and less-educated families. In Table 6 we report separate estimates based on our main specification for subsamples of children from "poor" (columns 1, 3, 5 and 7) and "non-poor" households (columns 2, 4, 6 and 8). A household is defined as "poor" if its income per household member falls below the 75th percentile of the income distribution in that particular microregion.[29] Note that, as expected, the estimated effects are much larger for the subsample of children from "poor" households. Specifically, focusing on child-specific tariff reductions, we find that the long-run impact of a decrease in tariff exposure of 0.003 log points leads to a larger relative increase in the share of children who "study only" of about 4.1 pp (13.745×0.003) among "poor" households, compared to just 0.7 pp (2.555×0.003) among "non-poor" households (panel B, columns 1 and 2). This effect is accompanied by a smaller relative increase (larger decline) in the share of children who "work" of about 2.9 pp (9.636×0.003) among "poor" households, compared to 1.4 pp (4.623×0.003) among "non-poor" households (panel B, columns 3 and 4).[30] Consistent with these findings, we obtain similar results for the share of children who have a "paid employment" (columns 7 and 8). Overall, our results indicate that children from "poor"

[29]The decision to divide the sample at the 75th percentile of the income distribution was made considering the widespread poverty and marked income inequality prevalent in many regions across Brazil. For instance, in 2010, the 75th percentile of the income per household member distribution was R$ 652.50, corresponding to just about 25% more than the minimum wage at that time. In any case, our results are robust to using the median income as the cutoff to classify "poor" and "non-poor" households, although the differences become slightly less pronounced in this case.

[30]Interestingly, the long-run impact of a reduction in the adult-specific tariff exposure on the share of children who "study only" is negative and statistically significant only among "poor" children. Specifically, a reduction of 0.104 log points is estimated to lead to a smaller relative increase in the fraction of "study only" of about 9.2 pp (0.888×0.104) (panel B, column 1). This is accompanied by a larger relative increase (smaller decline) in the share of children who "work" of about 8.9 pp (0.854×0.104) (panel B, column 3).

households are much more sensitive to trade shocks.

Next, in Table 7 we report the results of another heterogeneous effects analysis where we estimate our basic specification separately for households with different educational levels. Specifically, we define a household as "low education" if the highest level of schooling attained by the head of the household, or his or her spouse, is elementary or less. Conversely, a household is considered "medium/high education" if the highest level of schooling is above elementary. Similarly as before, we find that the estimated effects are always more pronounced among "low education" households. In particular, the long-run effect of a decrease of 0.003 log points in the child-specific tariff protection is estimated to lead to a larger relative increase in the share of children who "study only" of about 4.0 pp (13.356×0.003) among "low education" households, compared to just 1.0 pp (3.478×0.003) among "medium/high education" households (panel B, columns 1 and 2).[31] Consistent with these findings, we observe effects in the opposite direction for the share of children who "work" (columns 3 and 4) and who have a "paid employment" (columns 7 and 8).

We further report in Table A4 the results of a similar exercise where we compare the effects of tariff shocks on "black" and "non-black" children.[32] Consistent with previous findings, we observe that the impact on "black" children is larger − although the estimated differences are not as pronounced as those obtained before. Finally, we also perform a heterogeneity analysis by gender. The results reported in Table A5 show that the estimated effects are slightly more pronounced for boys, particularly regarding the share of children who attend "school only". Overall, our results are consistent with the idea that individuals from disadvantaged backgrounds are much more sensitive to economic shocks, particularly poor and black children with less-educated parents.

6.2 School Enrollment, Age-Grade Distortion and Other Educational Measures

Next, we proceed to examine the dynamic effects of adult and child-specific tariff reductions on school enrollment, age-grade distortion and approval rates across Brazilian microregions. As discussed before, school enrollment data have the advantage of being reported annually by the School Census and of being available for a longer period, provid-

[31]Note that the long-run impact of a reduction in the adult-specific tariff exposure on the share of children who "study only" is negative and statistically significant only for "low education" households, in which case a reduction of 0.104 log points is estimated to lead to a smaller relative increase in "study only" of about 7.96 pp (0.766×0.104) (panel B, column 3). This effect is accompanied by a larger relative increase in the share of children who "work" of a similar magnitude (panel B, column 4)

[32]We consider as "black" children those classified as "*preto*" or "*pardo*" in the Brazilian Census.

ing an alternative way of measuring the impact of tariff shocks on educational outcomes. In Figure 4 we plot the point estimates of the effects of both adult and child-specific tariff reductions obtained from estimating separate regressions based on the specification in Equation (9), with the dependent variable corresponding to changes in school enrollment between year $\tau \in \{1996, ..., 2020\}$ and the baseline year of 1995. The estimates connected by the solid-line represent the evolution of the effects of child-specific tariff shocks over time, while those connected by the dashed-line represent the dynamic effects of adult-specific tariff shocks.[33] The shaded areas in Figure 4 show the 90% confidence intervals computed based on standard errors clustered at the mesoregion level.

Consistent with our previous results, we find that an increase in local exposure to child-specific tariff reductions leads to larger relative increases in school enrollment. Conversely, an increase in exposure to adult-specific tariff reductions leads to results in the opposite direction. Interestingly, our findings indicate that the impact of both shocks gradually increase over time, with enrollment rates taking about a decade to fully adjust to the trade liberalization reform. Specifically, our point estimates imply that during the period between 1995 and 2020 a decrease of 0.003 log points in the child-specific tariff exposure led to a larger relative increase in school enrollment of approximately 2.3 pp (7.674×0.003), while a decrease of 0.104 log points in the adult-specific tariff exposure was associated with a smaller relative increase in school enrollment of about 3.2 pp (0.305×0.104).[34] Overall, the impact of the trade liberalization reform on enrollment is consistent with our previous findings for child labor and schooling, providing additional robustness to our main results. Interestingly, our findings also provide novel insights into the dynamics of human capital investment adjustments.

A potential concern related to the evidence which we have obtained so far is that, while we have shown that school enrollment and attendance increased more rapidly in microregions harder-hit by child-specific tariff reductions, there is no guarantee that the children induced to enroll as a result of these shocks were actually able to successfully advance within the school system. Similarly, the children induced to drop out as a result of adult-specific tariff reductions could be precisely those who would not have been able to advance anyway. These questions are of significant importance from a policy perspective, given our ultimate interest in understanding how these shocks impact human capital accumulation.

To assess the relevance of these potential concerns, we examine the impact of tariff

[33] To facilitate the visualization of the effects, we scale down the estimates associated with child-specific tariff reductions by dividing them by 10.

[34] These effects are substantial considering that proportion of children between 10 and 14 enrolled in school increased 5.5 pp between 1995 and 2020 (see Table A1, panel A).

reductions on age-grade distortion rates among children enrolled in elementary school. Figure 5a reports the effects of adult and child-specific tariff shocks obtained from estimating the specification in Equation (9) separately for each year between 1996 and 2020. Interestingly, both adult and child-specific tariff shocks do not seem to have any effect on children's progression through the school system, with the point estimates being always small and statistically insignificant. Moreover, in Figure 5b, we plot the results of an additional analysis for approval rates among elementary school students. As before, the point estimates are small and generally statistically insignificant, suggesting that tariff shocks did not have any effect on the school progression of children in Brazil.

Finally, we examine whether our main findings could be simply attributed to differential changes in the supply of school infrastructure across regions more or less affected by the trade liberalization reform, i.e. we investigate whether increases in school enrollment could be simply due to more schools opening in certain regions.[35] To do so, we report in Figure A5 the evolution of the effects of adult and child-specific tariff reductions on changes in the number of schools per 1,000 inhabitants and number of elementary school teachers per 1,000 inhabitants. The results suggest that both tariff shocks exerted no systematic impact on changes in school infrastructure over time. If anything, regions more severely exposed to adult-specific tariff reductions seem to have experienced slightly faster increases in the number of schools and teachers.

6.3 Human Capital Accumulation

In previous subsections we have shown that adult and child-specific tariff reductions affected significantly − and in opposite ways − the allocation of time of children, particularly their choices between work and study. We now proceed to investigate whether these changes impacted their educational attainment in the long run, focusing specifically on the human capital stock accumulated by individuals from different year-of-birth cohorts. To do so, we estimate the specification in Equation (10) using data from the 2010 Census, with the shares of individuals in each cohort who completed elementary school, high school and have some college education used as proxies for their stock of human capital. Intuitively, our analysis compares different year-of-birth cohorts within the same microregion to examine whether the trade liberalization reform had a more pronounced effect on the human capital of individuals who were more exposed to it during their early childhood.

In Figure 6, we report the point estimates associated with the effects of both adult and

[35]Indeed, this is a relevant concern given that Brazil has made substantial progress in expanding access to public education over the past few decades.

child-specific tariff reductions for each year-of-birth cohort, with the coefficients for the cohort born in 1973 normalized to zero (omitted group) − members from this group were exactly 18 years old in 1991. Our results show that the trade liberalization reform did not have any impact on the educational outcomes of individuals born around 1980 or before, which is consistent with expectation given that these individuals were already adolescents or young adults when the reform took place. However, starting with the cohorts born in the mid to late-1980s, the estimates for both shocks begin to show statistical significance, with the magnitude of the effects progressively increasing over time. Thus, in line with the literature on early childhood environment, our results suggest that the effects of the shocks are always more pronounced for individuals exposed to the consequences of the trade reform earlier in their childhood.

Moreover, consistent with our previous results, we find that child-specific tariff reductions lead to relative increases in the stock of human capital accumulated (as indicated by the solid-lines in Figure 6), while adult-specific tariff reductions lead to an effect in the opposite direction (as indicated by the dashed-lines). Specifically, our point estimates suggest that, for the cohort born in 1992, a decrease of 0.104 log points in the adult-specific tariff exposure is associated with a 6.9 pp relative decrease in the share of individuals who were able to complete elementary school by 2010. This effect is accompanied by a reduction in the proportion of individuals who completed high school of about 9.1 pp and in the share of those who had some college education by 2010 of approximately 6.5 pp.

Conversely, we find that a decrease of 0.003 log points in the child-specific tariff exposure leads to a 2.7 pp relative increase in the share of the individuals born in 1992 who were able to complete elementary school by 2010. This is accompanied by an increase in the proportion of individuals who completed high school of about 3.9 pp and in the share of those who had some college education by 2010 of approximately 2.3 pp. Note that these effects are quite substantial, considering that, for the cohort born in 1992, the sample mean for the share of individuals who completed elementary school is 69.0 pp (see Table A1, panel B), while the sample means for the proportions of those who completed high school and had some college education are 28.7 pp and 9.3 pp, respectively.

Finally, we check the robustness of our findings by reporting in Figure A6 the results of a placebo exercise where we estimate a similar specification, but now focusing on the stock of human capital accumulated by the cohorts born between 1931 and 1973 as of the census year of 1991.[36] Intuitively, we expect to find no impact of tariff shocks on

[36]To make the analysis completely symmetric, we focus on the cohorts born in the period 1931-1973, since their members were exactly between 18 and 60 years old in 1991. Moreover, we control for the lag of the dependent variable and microregion-specific characteristics measured in the year of 1980.

educational outcomes determined entirely prior to their occurrence. Indeed, our estimates show that there is no relationship between both adult and child-specific tariff reductions in the early 1990s and the shares of individuals in all cohorts who completed elementary school, high school and had some college education by 1991, with the point estimates being generally small and very imprecisely estimated.

6.4 Structural Transformation

Our analysis thus far has shown that the trade liberalization reform had a lasting impact on educational outcomes and human capital accumulation, with the effects being always larger in the long-run. To better understand the mechanisms underlying the persistent impact of these shocks, we now proceed to investigate how adult and child-specific tariff reductions affected the structure of local economies. In doing so, we aim to establish a connection between our findings and those documented in the literature on dynamics of labor market adjustments.

Consistent with previous findings in the literature (Dix-Carneiro and Kovak, 2017, 2019; Ponczek and Ulyssea, 2021), the results reported in Table 8 show that larger adult-specific tariff reductions lead to smaller relative increases in both the share of formal sector employment and logarithm of average earnings. Furthermore, we find that these shocks are associated with changes in the structure of local economic activity, with harder-hit regions experiencing a transition of their workforce from manufacturing to agriculture. As before, the estimated effects are persistent and always more pronounced in the long-run. Specifically, our point estimates suggest that in the long-run (panel B), a reduction of 0.104 log points in adult-specific tariff exposure leads to a smaller relative increase in formality rate of approximately 15.7 pp (1.505×0.104) and log earnings of about 0.087 log points (0.833×0.104).[37] Moreover, we find that harder-hit regions experience a smaller increase (larger decline) in the share of the workforce in manufacturing of about 6.2 pp (1.063×0.104), accompanied by a larger increase (smaller decline) in the share of the workforce in agriculture of 4.4 pp (0.972×0.104).

Conversely, we find that child-specific tariff reductions are associated with results in the opposite direction, leading to larger relative increases in the share of formal sector employment and logarithm of average earnings. Moreover, we observe a reallocation of adult labor away from the non-tradable sector and into manufacturing. Specifically, our point estimates suggest that in the long-run (panel B) a reduction of 0.003 log points in the child-specific tariff exposure leads to a larger relative increase in formality rate of

[37] These effects are quite substantial, considering that during the period of our analysis formality rate and log earnings increased by 8.6 pp and 0.81 log points, respectively (see Table A1, panel C).

approximately 4.5 pp (15.054 × 0.003) and log earnings of about 0.037 log points (12.578 × 0.003). Moreover, we find that harder-hit regions experience a larger relative increase in the share of the workforce in manufacturing of 2.0 pp (6.864 × 0.003), accompanied by a smaller relative increase (larger decline) in the share of the workforce in the non-tradable sector of 2.2 pp (7,486 × 0.003).

The reallocation of workers towards formal employment in regions with greater exposure to child-specific tariff reductions stands out in Table 8. In Figure 7a, we explore this pattern in more detail by using census data on formal employment to report the point estimates for adult and child-specific tariff reductions obtained from estimating the specification in Equation (9) separately for each year between 1985 and 2018.[38] Consistent with our previous results, we find a persistent shift of workers into the formal sector in regions adversely impacted by child-specific tariff reductions but relative declines (or smaller increases) in formal employment transitions in regions harder hit by adult-specific tariff reductions. Similarly, Figure 7b examines the dynamic effects on regional log formal earnings premiums, revealing a divergence in earnings trends between regions affected by each shock. Notably, regions facing higher child-specific tariff reductions experienced significantly faster formal earnings growth in the long run, with opposite effects on regions exposed to shocks in adult-intensive industries.

7 Additional Robustness Checks

In this section, we probe the robustness of our main findings by conducting a detailed investigation of the assumptions underlying our identification strategy. As discussed in Section 5, the validity of our research design relies crucially on the assumption that the shares of adult and child workers in each industry are not systematically correlated with other factors that could potentially influence the evolution of child labor and schooling over time. To better understand the sources of identification behind our strategy, we start by computing the Rotemberg weights associated with our estimates, as proposed by Goldsmith-Pinkham et al. (2020). Intuitively, the Rotemberg weights measure each industry's contribution to identification, providing a sensitivity-to-misspecification index which indicates how sensitive the estimates are to potential endogeneity in each share.[39]

[38]This analysis uses administrative data from the Relação Anual de Informações Sociais (RAIS), a yearly census of the Brazilian formal labor market compiled by the Ministry of Labor. The dataset includes job records with worker and establishment identifiers, enabling us to track workforce dynamics over time.

[39]While Goldsmith-Pinkham et al. (2020) focus primarily on the case where an instrumental variable approach is used, their results also apply to situations, such as ours, where the Bartik instruments are employed in a reduced form fashion. Thus, following their insights, we estimate the Rotemberg weights

In Figure A7, we present the estimated Rotemberg weights for both measures of adult and child-specific tariff exposure for the 20 industries considered in our analysis (see Table A6 for additional details).[40] Note that nearly all industries display a positive weight, with the exception of footware and leather in the case of the adult-specific tariff exposure measure. Importantly, no single sector dominates the others as a source of variation, with no industry accounting for more than 40% of positive weights. Moreover, we find that the top five industries associated with the adult-specific tariff exposure are: (*i*) apparels, (*ii*) metals, (*iii*) textiles, (*iv*) auto, transport and vehicles, and (*v*) agriculture. On the other hand, the top five industries associated with the child-specific tariff exposure are: (*i*) apparels, (*ii*) footwear and leather, (*iii*) non-metallic mineral manufacturing, (*iv*) wood, furniture and peat, and (*v*) textiles.

These findings suggest that our main source of identification comes from comparing microregions with high and low employment shares in the industries listed above, particularly apparels, which stands out as having the highest Rotemberg weight for both measures. Indeed, the apparel sector experienced one of the largest tariff cuts among all industries (see Figures 1 and A1). Moreover, it is a sector distinctive for being highly labor-intensive, characterized by a substantial fraction of informal employment and child labor (see Figure A3). According to Gorini (2000), shielded from foreign competition, the apparel industry in the early 1990s was marked by very low productivity, reliance on outdated technology, and geographically dispersed production.[41]

Since our identification strategy relies on the distribution of employment shares in each industry being exogenous across regions, we probe the robustness of our findings by re-estimating our main specification, exploiting only variation in adult and child labor in particular industries, one at a time, focusing on the top five sectors for each measure. Specifically, we re-estimate the model in Equation (9) including, instead of our main measures, the shift-share terms $Ch_{mj} \times \omega_{mj} \times \Delta log(1 + \tau_j)$ and $(1 - Ch_{mj}) \times \omega_{mj} \times \Delta log(1 + \tau_j)$ for a particular industry j. Note that these two expressions appear in the summand of the adult and child-specific tariff exposure measures in Equations (6) and (7) and, intuitively, capture the variation in the magnitude of local exposure to trade liberalization specific to industry j.

separately for both of our measures of adult and child-specific tariff exposure using, in each case, the corresponding shares of adult and child labor in each industry as instruments.

[40] We note that the Rotemberg weights are not influenced by the dependent variable, but vary only according to the controls being considered in the regressions. In our analysis, we include state fixed effects and the microregion-specific characteristics considered in our main specification (Equation 9), along with the variation in the share of children who "study only" between 1980 and 1991.

[41] The apparel sector was significantly impacted by the trade liberalization reform, particularly due to competition from cheaper and higher-quality imports from Asia (Gorini, 2000).

In Figure A8, we plot the point estimates associated with the effects of these industry-specific tariff exposure measures on changes in the shares of children who attend "school only" and "work" over the period between 1991 and 2010. In line with our previous results, we find that an increase in adult-specific tariff exposure in each of the top five industries consistently leads to smaller relative increases in the share of children who "study only" (panel a), accompanied by larger relative increases (smaller declines) in the share of children who "work" (panel b). Note that, in both cases, the point estimates for each industry have always the same sign and similar magnitude − with the possible exception of the estimates for agriculture, which in spite of having the correct sign, tend to be larger in absolute terms and less precisely estimated.

Moreover, we also find that an increase in child-specific tariff exposure in each of the corresponding top five industries leads to larger relative increases in the share of children who "study only" (panel c), accompanied by smaller relative increases (larger declines) in the share of children who "work" (panel d). Note that, in this case, the point estimates tend to be more variable in magnitude and less precisely estimated − which is expected since the geographic variation in child labor within specific industries is generally much smaller. Importantly, however, the estimated coefficients always have the same sign, pointing to a consistent effect in the expected direction. Thus, our main results hold even when we limit the analysis to exploiting variation within specific sectors only.

Next, we further complement our analysis by assessing the sensitivity of our findings to the influence of each specific industry. To do so, we estimate a version of the specification in Equation (9) where, in addition to all other controls, we include, one at a time, the shares of adults and children working in each industry in the baseline year of 1991. In Figure A9, we report the point estimates obtained from each separate regression focusing on the changes in the shares of children who attend "school only" and "work" during the period between 1991 and 2010, alongside our baseline estimates. Note that the point estimates are remarkably stable across all specifications, suggesting that our results are not driven by any single sector in particular.[42] Finally, as an additional robustness check, we construct alternative measures of adult and child-specific tariff exposures, as defined in Equations (6) and (7), using employment shares from the 1980 Census. By doing so, we exploit differences in the location of production that existed a decade before the trade liberalization reform was implemented. The results reported in Table A7 show that our main findings are largely robust to the use of these alternative measures, although the estimates for child-specific tariff exposure become slightly smaller in magnitude.

[42]In a complementary analysis (available upon request), we show that our results are robust to an alternative exercise where we exclude each industry, one at a time, from our measures of adult and child-specific tariff exposures.

8 The China Shock: Effects on Child Labor and Schooling

Our analysis thus far has shown that Brazil's trade liberalization reform had a significant and persistent impact on children's allocation of time, particularly their choices between work and study. In this section, we provide additional support for our main findings by exploiting the import competition shock associated with the rise of Chinese manufacturing sector during the early 2000s, commonly referred to as the "China shock". Between 2000 and 2010, China's share of the world's manufacturing exports more than tripled from 4.8% to 15.1%. This remarkable growth was driven by the country's rapid economic expansion and active involvement in international trade, especially following its accession to the World Trade Organization in 2001.[43]

In order to examine the impact of increased exposure to Chinese import competition on child labor and schooling, we employ a shift-share methodology similar to that used in our main analysis. Specifically, following Autor et al. (2014) and Costa et al. (2016), we exploit pre-existing differences in employment shares in each industry across Brazilian microregions to create a local measure of adult and child-specific exposure to Chinese imports. Similarly to Equations (6) and (7), our main measures are defined as follows:

$$\Delta IS_m^{Child} = \sum_{j \in S} Ch_{mj} \times \lambda_{mj} \times \frac{\Delta I_j}{L_j} \tag{11}$$

and

$$\Delta IS_m^{Adult} = \sum_{j \in S} (1 - Ch_{mj}) \times \lambda_{mj} \times \frac{\Delta I_j}{L_j}, \tag{12}$$

where the term $\Delta I_j / L_j$ represents the change in the value of Brazilian imports from China in industry j between 2000 and 2010, denominated in thousands of 2010 US dollars, and normalized by the total workforce in sector j.[44] As before, the term $\lambda_{mj} = L_{mj}/L_m$ captures the relative importance of industry j in microregion m's employment, while Ch_{mj} represents the share of child labor in microregion m and industry j. Note that, in this case, the employment shares used in the construction of these measures refer to the

[43] The rise in Chinese competition has been shown to have significantly impacted several countries. For instance, Autor et al. (2014), Acemoglu et al. (2016), Pierce and Schott (2016), Autor et al. (2019) and Autor et al. (2020) show that the China shock is associated with larger unemployment, lower wages, and increased political polarization in the United States. Similarly, Costa et al. (2016) show that Brazilian manufacturing wages experienced slower growth due to Chinese competition.

[44] Our analysis uses trade data from CEPII BACI, covering over 200 countries, with detailed product information (6-digit Harmonized System codes). To categorize each product in the trade database into a specific Brazilian industry, we follow the approach proposed by Costa et al. (2016), mapping products to Brazilian census categories (CNAE Domiciliar). This procedure resulted in 82 distinct traded merchandise industries.

baseline year of 2000.

We investigate the effects of adult and child-specific exposure to Chinese import competition by estimating a regression similar to that specified in Equation (9), using the measures ΔIS_m^{Child} and ΔIS_m^{Adult} defined above, and controlling for the same microregion-specific characteristics as before using information from the 2000 Census.[45] Our main outcomes are differences in the shares of children who attend "school only", "work", neither work nor study ("idle"), and have a paid employment between 2000 and 2010. All regressions are weighted by population size in 2000 and standard errors are clustered at the mesoregion level. Moreover, given that changes in realized Brazilian imports from China could potentially reflect Brazil-specific shocks (such as sector-specific productivity shocks) not directly related to China's rising comparative advantage, we follow Autor et al. (2013) by also running an additional specification where we instrument our measures of adult and child-specific exposure to Chinese imports with similar measures constructed using, for each industry, the imports from China to all other countries except Brazil, ΔI_j^{world}.

In Table 9, we present the estimates obtained from both OLS (columns 1, 3, 5, and 7) and 2SLS (columns 2, 4, 6, and 8) regressions. Note that these results are in line with previous findings discussed in Subsection 6.1. Specifically, we find that an increase in exposure to adult-specific Chinese import competition leads to smaller relative increases in the share of children who "study only" (columns 1 and 2), accompanied by larger increases (smaller declines) in the share of children who "work" (columns 3 and 4). Conversely, the estimates associated with child-specific Chinese import competition always have the opposite sign, with an increase in local exposure leading to larger relative increases in the share of children who "study only" (columns 1 and 2), accompanied by smaller increases (larger declines) in the share of children who "work" (columns 3 and 4).

Observe that the point estimates obtained from both OLS and 2SLS are quite similar, with the first-stage being strong in all IV specifications (columns 2, 4, 6, and 8). In particular, the 2SLS estimates suggest that an increase of US$ 465.3 per worker in adult-specific exposure to Chinese import competition − which corresponds to moving a microregion from the 10th to the 90th percentile of the distribution of the adult-specific import shock − leads to a smaller relative increase in the share of children who "study only" of about 0.28 pp (0.006×0.465), accompanied by a larger relative increase (smaller decline) in the

[45] We also control for a measure of overall exposure to Chinese exports, defined as $XS_m = \sum_{j \in S} \lambda_{mj} \times \Delta X_j / L_j$, where ΔX_j represents the change in the value of Brazilian exports to China in industry j between 2000 and 2010. We do so because some Brazilian regions experienced a positive shock resulting from the increased Chinese demand for commodities during this period. We observe that all our results remain unchanged regardless of whether we control for this variable or not.

share of children who "work" of approximately 0.42 pp (0.009×0.465). Conversely, we find that an increase of US$ 5.70 per worker in child-specific exposure to Chinese imports − which corresponds to moving a microregion from the 10th to the 90th percentile of the distribution of the child-specific import shock − leads to a larger relative increase in the share of children who "study only" of about 0.52 pp (0.86×0.006), accompanied by a smaller relative increase (larger decline) in child labor of 0.51 pp (0.859×0.006).[46]

In Figure A10, we present the Rotemberg weights associated with both of our measures of import competition from China for the top 20 industries in each case. Note that the top three sectors associated with the adult-specific measure are electronics (36.4%), basic metals (14.3%) and machinery (8.6%), while the top three sectors associated with the child-specific measure are other textile products (55.6%), electronics (14.1%) and computing (5.4%). Contrarily to the trade liberalization reform, the effects of the China shock seem to be more concentrated in specific industries, which is unsurprising considering that electronics, machinery, and electrical equipment accounted for approximately 40% of Brazil's total import growth from China between 2000 and 2010 (Costa et al., 2016). Specifically regarding the child-specific measure, we find that other textile products emerge as the dominant industry − a sector specialized in the production of fabrics and textile products for domestic use, such as bedding, tablecloths, and kitchen linens.

We check the robustness of the results by re-estimating our main specification sequentially, including the shares of adults and children working in each industry at the baseline year of 2000. We specifically focus on the 27 sectors that rank among the top 20 industries according to the Rotemberg weights for each of our measures. In Figure A11, we plot the 2SLS estimates derived from these regressions, alongside the point estimates from our baseline regression. We find that the estimates remain quite stable across all specifications, suggesting that our results do not depend on any sector in particular. Finally, we further probe the robustness of our findings by using the employment shares from the 1991 Census to construct the import competition shocks in Equations (11) and (12), and corresponding instruments. The results reported in Table A8 show that our estimates are robust to employing these alternative measures. Indeed, if anything, the effects associated with exposure to adult-specific import competition become larger in magnitude and more precisely estimated.

[46] While the magnitude of these effects may seem small at face value, they are, in fact, quite substantial considering the fact that the fraction of children who "study only" increased by just 4.1 pp between 2000 and 2010, while the fraction of children who "work" decreased by 1.8 pp during the same period.

9 Conclusion

This paper examines the long-term effects of Brazil's 1990s trade liberalization reform on child labor and human capital accumulation. Using comprehensive census and administrative data covering nearly three decades, we analyze how age-specific components of the trade shock influenced labor market opportunities for adults and children. Our findings reveal that regions more exposed to child-specific tariff reductions experienced relative decreases in child labor rates and higher relative increases in schooling. Notably, younger cohorts born after the mid-1980s adapted to the reform by increasing their educational attainment. We also observe faster increases in earnings, formal employment, and a shift from agriculture to manufacturing in heavily affected regions. Conversely, regions with larger tariff reductions in adult-intensive industries experienced diminished growth in school attendance, higher child labor rates, and lower educational attainment. All the effects persisted and strengthened over time.

While trade liberalization often raises concerns about job losses in protected industries, our findings suggest that shocks affecting adults and children trigger a distinct resource reallocation process across industries and between formal and informal sectors, leading to persistent impacts on earnings. Interestingly, this process coincides with shifts in educational investments and human capital accumulation, potentially amplifying the initial effects of the shocks. From a policy perspective, these findings suggest that policymakers promoting investments in education, particularly in elementary school enrollment for children at early ages, could alleviate some unintended consequences associated with the loss of protection on employment.

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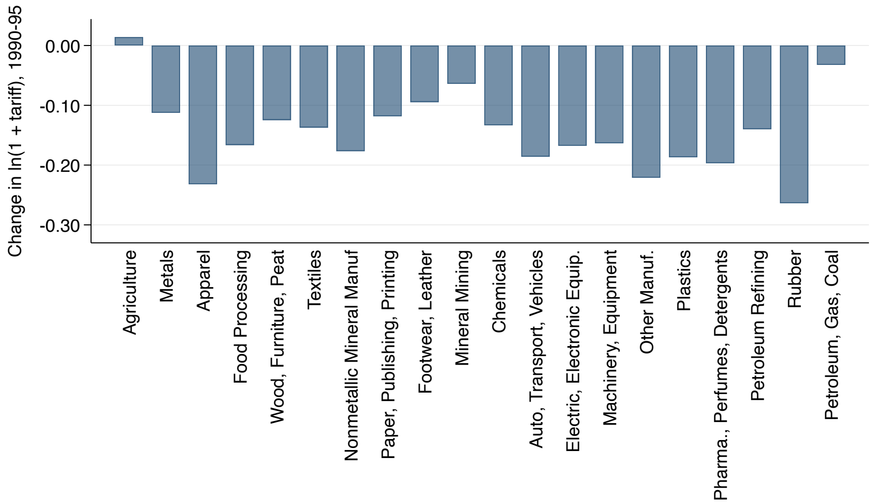
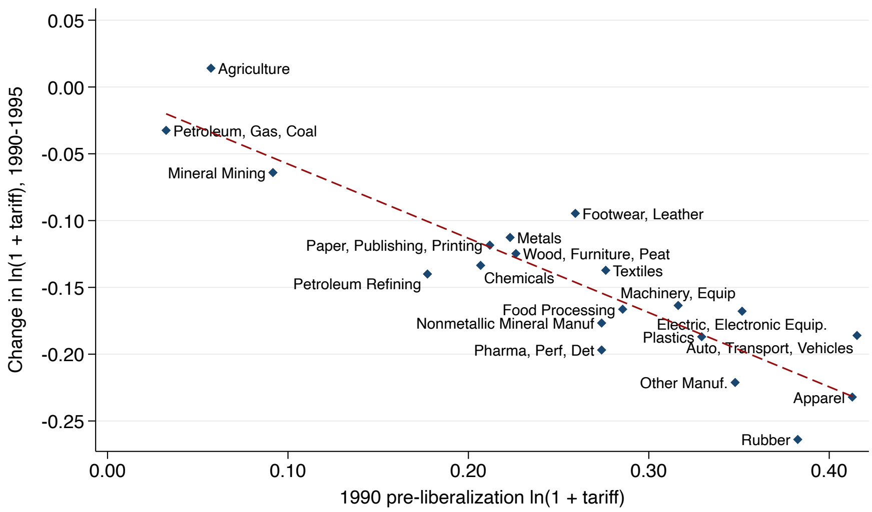
Figures

Figure 1: Tariffs Changes by Industry, 1990-1995



Notes: This figure plots percentage tariff changes by industry from 1990 to 1995, measured by the variation in $\log(1 + tariff)$. Tariff data come from Kume et al. (2003) and are aggregated at the *Nível 50* industry classification level into a system compatible with the sector coding available in the Brazilian census data resulting in 20 tradable sectors.

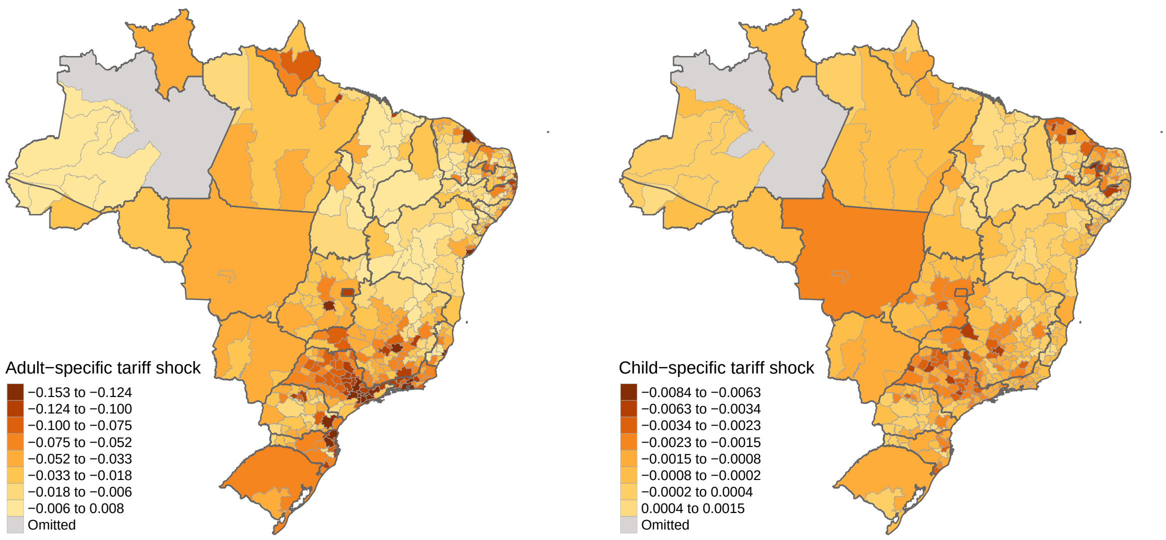
Figure 2: Tariff Changes vs Pre-Liberalization Tariff Levels



Notes: This figure plots the relationship across industries between tariff changes from 1990 to 1995 and pre-liberalization tariff levels in 1990. The correlation between the two variables is -0.90.

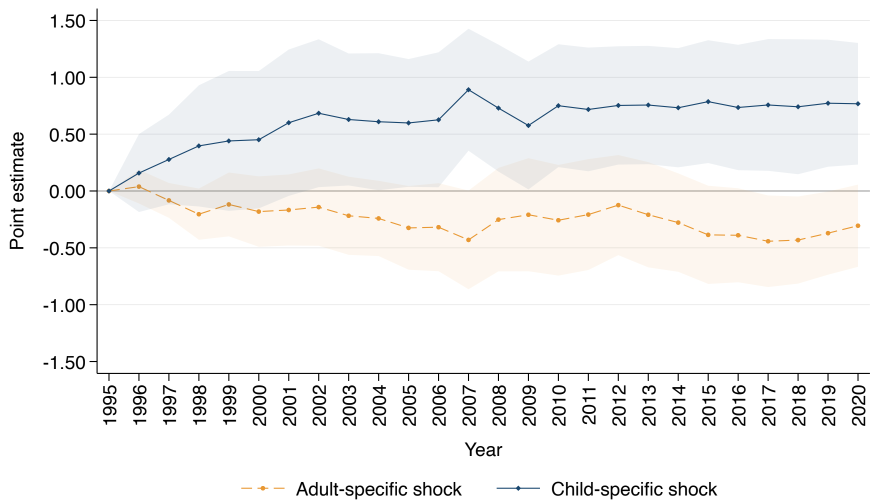
Figure 3: Spatial Distribution of Tariff Shocks

(a) $\Delta Tariff_m^{Adult}$ (b) $\Delta Tariff_m^{Child}$



Notes: These maps depict the spatial distribution of adult and child-specific tariff exposures across Brazilian microregions, as calculated using Equations (6) and (7). Darker shades indicate higher exposure to tariff cuts; the gray area is excluded from the analysis since it includes the Free Trade Area of Manaus.

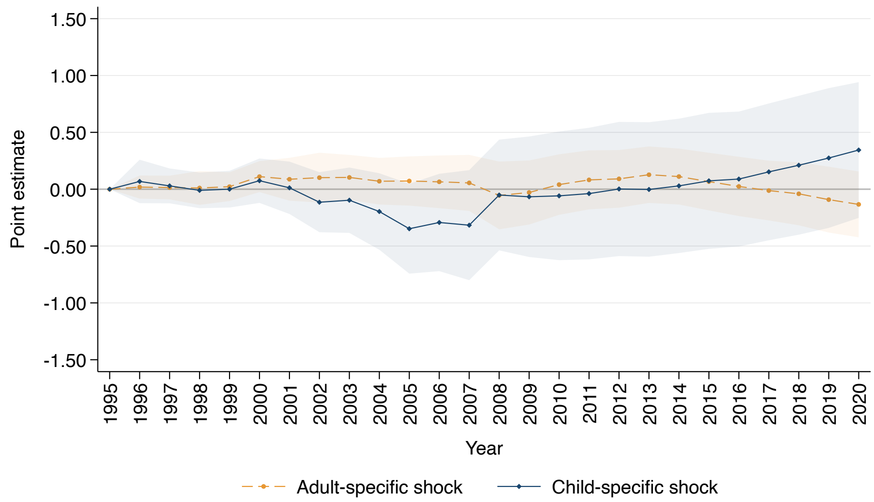
Figure 4: Dynamic Effects on School Enrollment



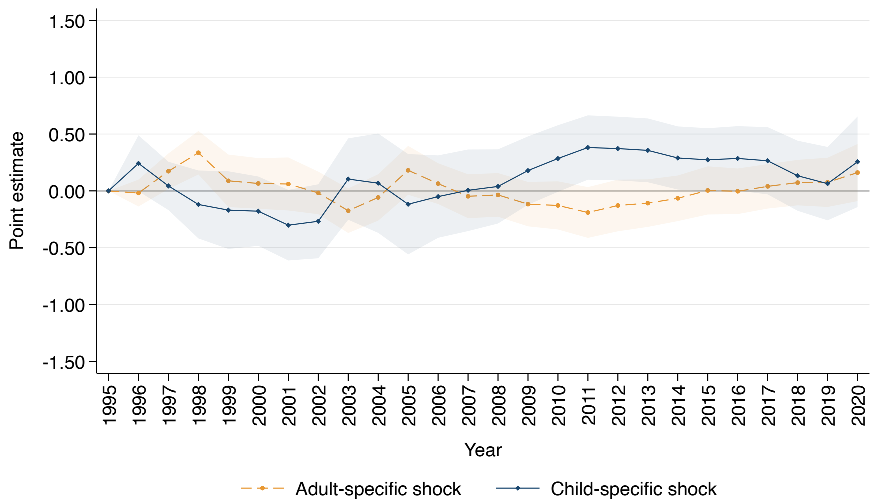
Notes: This figure plots the dynamic effects of adult and child-specific tariff reductions on school enrollment. Each point estimate is obtained from a separate regression based on Equation (9). The dependent variable represents changes in school enrollment rates between year $\tau \in \{1996, ..., 2020\}$ and the baseline year of 1995. The estimates connected by the solid line represent the dynamic effects of child-specific tariff shocks, while those connected by the dashed line represent the dynamic effects of adult-specific tariff shocks. Shaded areas depict the 90% confidence intervals computed based on standard errors clustered at the mesoregion level. The point estimates associated with child-specific tariff reductions are divided by 10 to facilitate visualization.

Figure 5: Dynamic Effects on School Performance

(a) Age-Grade Distortion Rates



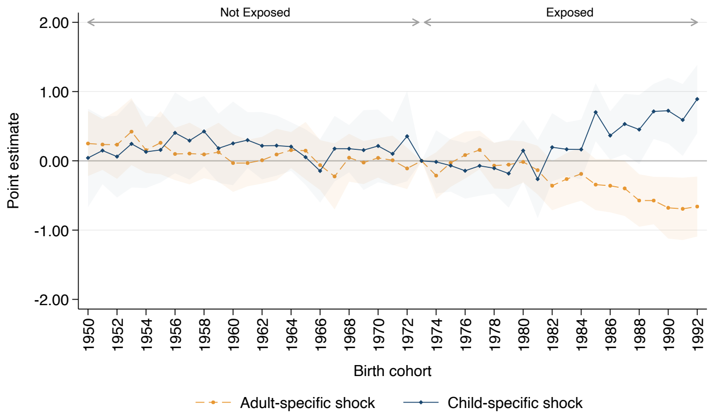
(b) Approval Rates



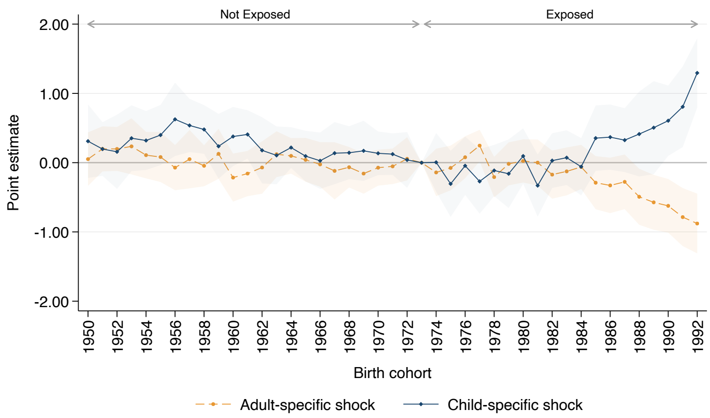
Notes: These figures plot the dynamic effects of adult and child-specific tariff reductions on two measures of school performance. Each point estimate is obtained from a separate regression based on Equation (9). The dependent variables represent changes in age-grade distortion rates (panel a) and approval rates (panel b), among elementary school students, between year $\tau \in \{1996, ..., 2020\}$ and the baseline year of 1995. The estimates connected by the solid line represent the dynamic effects of child-specific tariff shocks, while those connected by the dashed line represent the dynamic effects of adult-specific tariff shocks. Shaded areas depict the 90% confidence intervals computed based on standard errors clustered at the mesoregion level. The point estimates associated with child-specific tariff reductions are divided by 10 to facilitate visualization.

Figure 6: Effects on Human Capital Accumulation

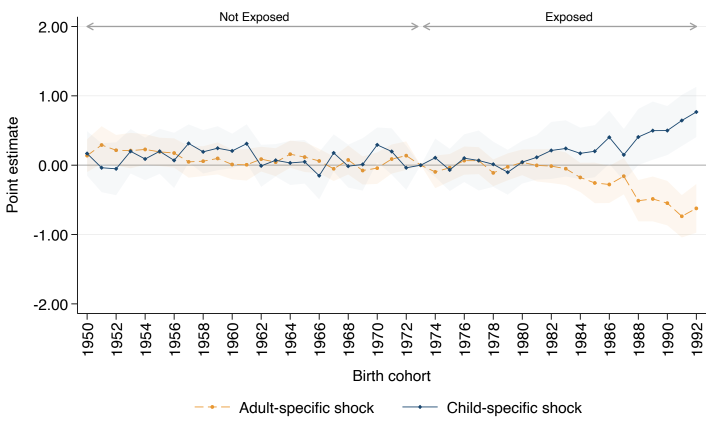
(a) Elementary School



(b) High School



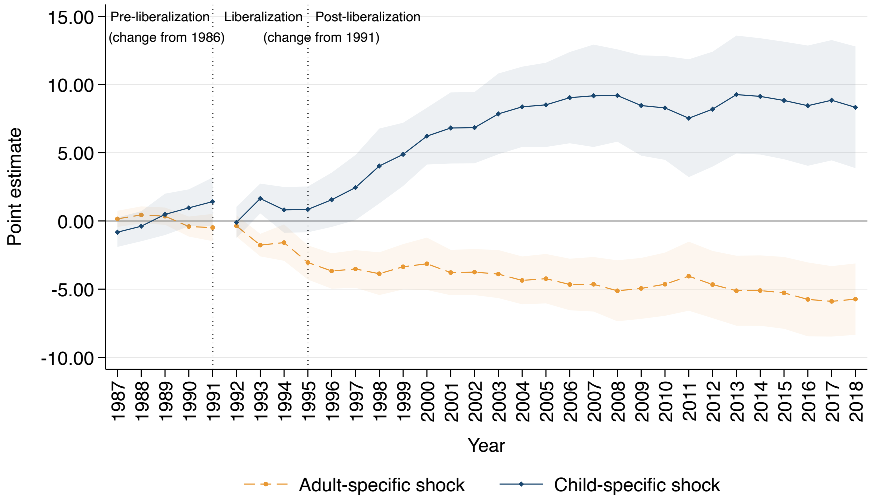
(c) Some College



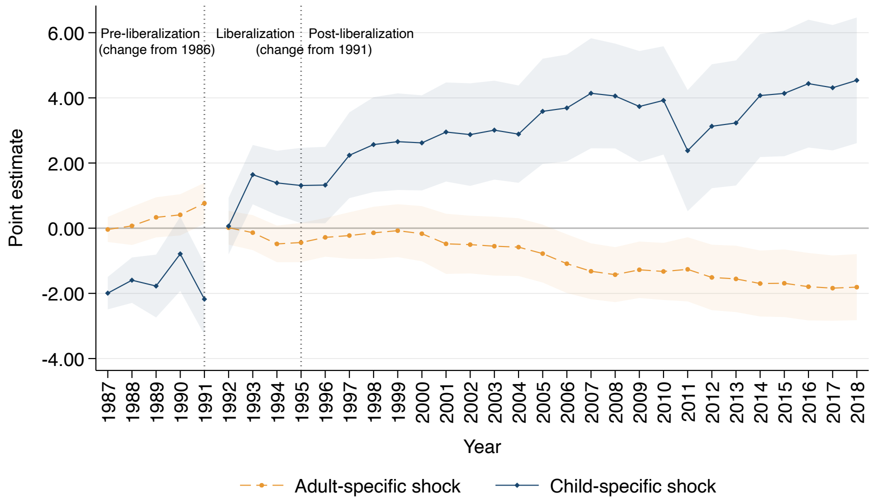
Notes: These figures plot the effects, by cohort, of adult and child-specific tariff reductions on human capital accumulation, using data from the 2010 Census. The point estimates in each figure are obtained from estimating the specification in Equation (10). The dependent variables represent the shares of individuals in each birth cohort who completed elementary school (panel a), high school (panel b) and have some college education (panel c). The analysis focuses on cohorts born from 1950 to 1992. The omitted group is the cohort born in 1973, whose members were 18 years old in 1991.

Figure 7: Effects on Formal Labor Market

(a) Log Formal Employment



(b) Log Formal Earnings Premium



Notes: These figures present the dynamic effects of adult and child-specific tariff reductions on formal labor market. Each point estimate comes from separate regressions based on Equation (9). The dependent variables are the change in regional log formal employment and regional log formal earnings premium between year $\tau \in \{1996, ..., 2020\}$ and the baseline year (1995). The solid line connects estimates from child-specific tariff shocks, and the dashed line represents estimates for adult-specific tariff shocks. Shaded areas indicate 90% confidence intervals, calculated using clustered standard errors at the mesoregion level. Estimates related to child-specific tariff reductions are scaled down by 10 for clarity.

Tables

Table 1: Child Labor in Brazil

	1980	1991	2000	2010
Panel A. Children's activities				
% School only	0.652	0.765	0.893	0.919
% Work	0.128	0.084	0.064	0.051
% Idle	0.220	0.151	0.044	0.029
% Paid employment	0.079	0.057	0.029	0.023
Panel B. Child labor (% Work)				
By per capita income				
Low	0.163	0.109	0.103	0.084
High	0.111	0.072	0.045	0.037
By rural population				
Urban	0.107	0.070	0.043	0.035
Rural	0.174	0.113	0.113	0.092
By population size				
Small	0.158	0.117	0.100	0.078
Large	0.123	0.079	0.058	0.048
By region				
Center-West	0.118	0.091	0.062	0.059
North	0.105	0.068	0.089	0.085
Northeast	0.143	0.103	0.098	0.078
Southeast	0.155	0.123	0.091	0.085
South	0.104	0.078	0.045	0.037
By sector (conditional on working)				
Agriculture/Extractive	0.602	0.506	0.540	0.553
Manufacturing	0.106	0.106	0.084	0.077
Non-tradable	0.292	0.388	0.376	0.370

Notes: This table reports descriptive statistics for child labor in Brazil, using data from the 1980, 1991, 2000, and 2010 Censuses. Panel A provides information on the time allocation of children aged between 10 and 14. Panel B reports the percentage of children who work, broken down by microregions based on whether they fall below or above the median in terms of per capita income, rural population, and population size, as well as by region of the country and sector of activity.

Table 2: Summary Statistics

	Mean	Std. Dev.	Min	Max	10th	90th
Panel A. Tariff changes (Δ 1991-1995)						
$\Delta Tariff_m$	0.044	0.040	-0.010	0.154	0.001	0.108
$\Delta Tariff_m^{Adult}$	0.043	0.039	-0.008	0.153	0.002	0.106
$\Delta Tariff_m^{Child}$	0.001	0.001	-0.002	0.008	-0.001	0.002
Panel B. Children's activities (Δ 1991-2000)						
% School only	0.157	0.062	0.001	0.397	0.088	0.244
% Work	-0.024	0.041	-0.151	0.119	-0.077	0.027
% Idle	-0.133	0.071	-0.401	-0.033	-0.237	-0.059
% Paid employment	-0.035	0.028	-0.126	0.029	-0.073	-0.004
Panel C. Children's activities (Δ 1991-2010)						
% School only	0.199	0.076	0.037	0.447	0.106	0.296
% Work	-0.043	0.044	-0.207	0.130	-0.097	0.008
% Idle	-0.156	0.085	-0.492	-0.031	-0.277	-0.064
% Paid employment	-0.044	0.033	-0.135	0.085	-0.089	-0.008
Panel D. Demographic controls (1991 Census)						
Log population	12.064	0.995	9.452	16.275	10.921	13.298
Share children 10-14	0.123	0.014	0.094	0.164	0.105	0.141
Share urban pop.	0.612	0.198	0.160	0.997	0.352	0.887
Illiteracy rate	0.303	0.166	0.051	0.696	0.116	0.538
Poverty rate	0.719	0.191	0.204	0.968	0.434	0.927
Gini index	0.552	0.040	0.438	0.720	0.499	0.601

Notes: This table reports summary statistics at the microregion level for the main variables considered in our analysis. Panel A presents descriptive statistics for the measures of local exposure to trade liberalization, as calculated using Equations (4), (6), and (7). Panels B and C provide descriptive statistics for the differences in the shares of children aged 10-14 engaged in various activities during the periods 1991-2000 and 1991-2010. Panel D reports summary statistics for various socioeconomic characteristics of microregions based on data from the 1991 Census. The sample consists of 411 microregions whose boundaries remained constant from 1980 to 2010.

Table 3: Effects on Child Labor and Schooling

	School only		Work		Idle		Paid work	
	1991-2000	1991-2010	1991-2000	1991-2010	1991-2000	1991-2010	1991-2000	1991-2010
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Overall tariff reduction								
$\Delta Tariff_m$	-0.132	-0.442^{**}	0.258^{**}	0.551^{***}	-0.101	-0.103	0.278^{***}	0.339^{***}
	(0.169)	(0.182)	(0.102)	(0.098)	(0.111)	(0.133)	(0.081)	(0.100)
R-squared	0.80	0.86	0.56	0.59	0.91	0.92	0.65	0.64
Panel B. Adult and child-specific tariff reductions								
$\Delta Tariff_m^{Adult}$	-0.267	-0.647^{***}	0.361^{***}	0.691^{***}	-0.084	-0.069	0.391^{***}	0.495^{***}
	(0.184)	(0.199)	(0.108)	(0.100)	(0.129)	(0.158)	(0.082)	(0.092)
$\Delta Tariff_m^{Child}$	7.456^{*}	11.058^{***}	-6.676^{***}	-8.822^{***}	-1.141	-2.131	-7.369^{***}	-10.213^{***}
	(3.975)	(3.740)	(2.182)	(2.273)	(2.411)	(2.550)	(1.722)	(1.821)
R-squared	0.81	0.87	0.59	0.63	0.91	0.92	0.70	0.71
Observations	411	411	411	411	411	411	411	411
Mean dep. var.	0.157	0.199	-0.024	-0.043	-0.133	-0.156	-0.035	-0.044

Notes: This table reports estimates of the effects of local exposure to trade liberalization on changes in child labor and schooling during the periods 1991-2000 ("medium-run"), and 1991-2010 ("long-run"). Panel A presents the effects of the overall tariff reduction estimated based on the specification in Equation (8), while Panel B presents the effects of adult and child-specific tariff reductions estimated based on the specification in Equation (9). The regressions include state fixed effects and control for microregion-specific characteristics measured at the baseline year, including logarithm of population, share of population aged 10-14, share of urban population, poverty rate, illiteracy rate, Gini index, and lag of the dependent variable. All regressions are weighted by population size in 1991, and standard errors are clustered at the mesoregion level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effects on Child Labor and Schooling: Robustness Checks ("Study Only")

	Baseline	No controls	Longer pre-trends	Income per capita	Labor market	Social programs	Educ./Pub. spending	Macro shocks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	-0.267	-0.964^{***}	-0.239	-0.294^{*}	-0.277	-0.241	-0.323^{*}	-0.182
	(0.184)	(0.072)	(0.172)	(0.169)	(0.201)	(0.159)	(0.169)	(0.154)
$\Delta Tariff_m^{Child}$	7.456^{*}	9.805^{***}	6.686^{*}	5.503	10.900^{***}	6.357^{*}	6.159^{*}	6.862^{**}
	(3.975)	(2.543)	(4.003)	(3.714)	(3.711)	(3.217)	(3.338)	(3.160)
R-squared	0.81	0.73	0.81	0.83	0.83	0.82	0.84	0.83
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	-0.647^{***}	-1.344^{***}	-0.599^{***}	-0.675^{***}	-0.539^{**}	-0.607^{***}	-0.690^{***}	-0.479^{***}
	(0.199)	(0.069)	(0.166)	(0.191)	(0.229)	(0.159)	(0.189)	(0.148)
$\Delta Tariff_m^{Child}$	11.058^{***}	12.817^{***}	9.763^{***}	9.246^{**}	15.422^{***}	9.570^{***}	9.814^{***}	10.103^{***}
	(3.740)	(2.392)	(3.697)	(3.537)	(3.513)	(2.698)	(3.065)	(3.762)
R-squared	0.87	0.82	0.88	0.88	0.89	0.89	0.90	0.89
Observations	411	411	411	411	411	396	409	411

Notes: This table reports robustness checks for the effects of local exposure to trade liberalization on the share of children who attend "school only". Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For a description of the controls included in each specification, see discussion in Section 6.1; for additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effects on Child Labor and Schooling: Robustness Checks ("Work")

	Baseline	No controls	Longer pre-trends	Income per capita	Labor market	Social programs	Educ./Pub. spending	Macro shocks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	0.361^{***}	0.171^{***}	0.358^{***}	0.377^{***}	0.454^{***}	0.360^{***}	0.393^{***}	0.266^{**}
	(0.108)	(0.063)	(0.101)	(0.106)	(0.119)	(0.100)	(0.104)	(0.102)
$\Delta Tariff_m^{Child}$	-6.676^{***}	-9.663^{***}	-6.496^{***}	-5.262^{**}	-8.361^{***}	-6.215^{***}	-6.044^{***}	-5.847^{***}
	(2.182)	(3.010)	(2.122)	(2.304)	(1.967)	(1.845)	(2.176)	(2.091)
R-squared	0.59	0.48	0.59	0.63	0.61	0.59	0.61	0.62
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	0.691^{***}	0.354^{***}	0.686^{***}	0.723^{***}	0.670^{***}	0.691^{***}	0.697^{***}	0.623^{***}
	(0.100)	(0.071)	(0.091)	(0.108)	(0.118)	(0.095)	(0.100)	(0.106)
$\Delta Tariff_m^{Child}$	-8.822^{***}	-11.808^{***}	-8.512^{***}	-7.956^{***}	-11.398^{***}	-8.282^{***}	-8.287^{***}	-7.994^{***}
	(2.273)	(2.960)	(2.204)	(2.517)	(2.003)	(1.938)	(2.334)	(2.887)
R-squared	0.63	0.51	0.65	0.66	0.66	0.64	0.64	0.67
Observations	411	411	411	411	411	396	409	411

Notes: This table reports robustness checks for the effects of local exposure to trade liberalization on the share of children who "work". Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For a description of the controls included in each specification, see discussion in Section 6.1; for additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Effects on Child Labor and Schooling: Heterogeneity by Income

	School only		Work		Idle		Paid work	
	Poor (1)	Non-poor (2)	Poor (3)	Non-poor (4)	Poor (5)	Non-poor (6)	Poor (7)	Non-poor (8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	-0.424^{**}	0.323^{**}	0.456^{***}	-0.008	-0.027	-0.325^{***}	0.464^{***}	0.118
	(0.211)	(0.161)	(0.121)	(0.103)	(0.149)	(0.091)	(0.094)	(0.077)
$\Delta Tariff_m^{Child}$	9.191^{**}	1.600	-6.856^{***}	-4.252^{**}	-2.473	2.670^{**}	-7.740^{***}	-4.562^{***}
	(4.556)	(2.830)	(2.423)	(1.930)	(2.774)	(1.320)	(2.047)	(1.633)
R-squared	0.79	0.76	0.64	0.31	0.91	0.85	0.72	0.40
Mean dep. var.	0.173	0.078	-0.021	-0.016	-0.152	-0.062	-0.035	-0.030
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	-0.888^{***}	0.274^{*}	0.854^{***}	0.046	-0.002	-0.364^{***}	0.598^{***}	0.095
	(0.231)	(0.144)	(0.112)	(0.108)	(0.180)	(0.095)	(0.102)	(0.092)
$\Delta Tariff_m^{Child}$	13.745^{***}	2.555	-9.636^{***}	-4.623^{**}	-3.757	2.365^{*}	-10.748^{***}	-6.898^{***}
	(4.316)	(2.753)	(2.558)	(2.109)	(2.884)	(1.233)	(2.174)	(1.724)
R-squared	0.86	0.82	0.66	0.44	0.92	0.88	0.72	0.47
Observations	411	411	411	411	411	411	411	411
Mean dep. var.	0.223	0.084	-0.043	-0.014	-0.179	-0.069	-0.048	-0.027

Notes: This table reports estimates of the effects of local exposure to trade liberalization on child labor and schooling for subsamples of children from "poor" and "non-poor" households. A household is defined as "poor" if its income per household member falls below the 75th percentile of the income distribution in that particular microregion. Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Effects on Child Labor and Schooling: Heterogeneity by Education

	School only		Work		Idle		Paid work	
	Low educ.	Medium/ High educ.	Low educ.	Medium/ High educ.	Low educ.	Medium/ High educ.	Low educ.	Medium/ High educ.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	-0.348^{*}	0.143	0.414^{***}	-0.049	-0.043	-0.097^{*}	0.460^{***}	0.025
	(0.198)	(0.102)	(0.124)	(0.076)	(0.136)	(0.049)	(0.096)	(0.073)
$\Delta Tariff_m^{Child}$	9.229^{**}	1.174	-7.735^{***}	-2.493^{**}	-2.058	1.223	-8.634^{***}	-2.338^{**}
	(4.496)	(1.718)	(2.548)	(1.221)	(2.573)	(0.859)	(2.151)	(0.974)
R-squared	0.77	0.38	0.61	0.25	0.90	0.47	0.71	0.35
Mean dep. var.	0.166	0.030	-0.025	-0.007	-0.141	-0.023	-0.037	-0.016
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	-0.766^{***}	0.085	0.770^{***}	-0.043	-0.016	-0.046	0.577^{***}	-0.004
	(0.220)	(0.108)	(0.119)	(0.073)	(0.170)	(0.056)	(0.111)	(0.073)
$\Delta Tariff_m^{Child}$	13.356^{***}	3.478^{**}	-10.137^{***}	-3.725^{***}	-3.309	0.201	-11.453^{***}	-3.828^{***}
	(4.464)	(1.604)	(2.764)	(1.110)	(2.750)	(0.858)	(2.305)	(0.940)
R-squared	0.84	0.39	0.65	0.30	0.91	0.54	0.71	0.46
Observations	411	410	411	410	411	410	411	410
Mean dep. var.	0.208	0.029	-0.043	-0.006	-0.165	-0.023	-0.046	-0.019

Notes: This table reports estimates of the effects of local exposure to trade liberalization on child labor and schooling for subsamples of children from “low education” and “medium/high education” households. A household is defined as “low education” if the highest level of schooling attained by the head of the household, or his or her spouse, is elementary or less. Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Effects on Structural Transformation

			Conditional on work		
	Formal Emp.	Log Earnings	Agro./mining	Manuf.	Non-tradable
	(1)	(2)	(3)	(4)	(5)
Panel A. Medium-run (1991-2000)					
$\Delta Tariff_m^{Adult}$	-1.081^{***}	-0.290	0.426^{***}	-0.597^{***}	0.237^{**}
	(0.165)	(0.248)	(0.117)	(0.070)	(0.115)
$\Delta Tariff_m^{Child}$	11.754^{***}	5.964	-1.718	5.327^{**}	-6.186^{**}
	(2.005)	(3.840)	(2.266)	(2.077)	(2.426)
R-squared	0.67	0.72	0.52	0.60	0.28
Mean dep. var.	-0.019	0.006	-0.087	0.037	0.043
Panel B. Long-run (1991-2010)					
$\Delta Tariff_m^{Adult}$	-1.505^{***}	-0.833^{**}	1.063^{***}	-0.972^{***}	-0.016
	(0.216)	(0.319)	(0.173)	(0.097)	(0.160)
$\Delta Tariff_m^{Child}$	15.054^{***}	12.578^{**}	-2.908	6.864^{**}	-7.486^{**}
	(2.377)	(5.483)	(3.575)	(2.694)	(3.509)
R-squared	0.68	0.79	0.62	0.62	0.49
Observations	411	411	411	411	411
Mean dep. var.	0.086	0.810	-0.223	0.066	0.070

Notes: This table reports estimates of the effects of local exposure to trade liberalization on the structure of local economies accounting for compositional effects. To net out social and demographic characteristics of the local workforce, we implement the two-step approach described in Section 5 ("Structural Transformation"). Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

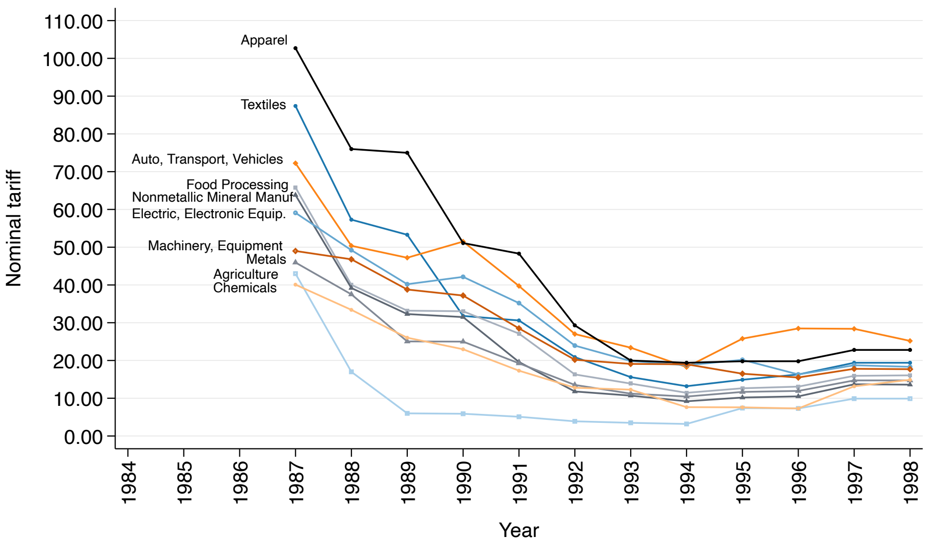
Table 9: Effects of the China Shock on Child Labor and Schooling

	School only		Work		Idle		Paid work	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔIS_m^{Adult}	-0.007^{*}	-0.006	0.010^{**}	0.009^{**}	-0.001	-0.001	-0.001	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)
ΔIS_m^{Child}	0.650^{*}	0.860^{**}	-0.788^{**}	-0.859^{**}	0.087	-0.075	-0.472^{**}	-0.559^{***}
	(0.388)	(0.408)	(0.341)	(0.357)	(0.249)	(0.229)	(0.192)	(0.191)
KP-F		179.598		177.380		176.728		174.181
R-squared	0.689	0.689	0.451	0.451	0.768	0.767	0.492	0.491
Observations	411	411	411	411	411	411	411	411
Mean dep. var.	0.041	0.041	-0.018	-0.018	-0.023	-0.023	-0.009	-0.009

Notes: This table reports OLS and 2SLS estimates of the effects of local exposure to Chinese import competition on changes in child labor and schooling between 2000 and 2010. The regressions include state fixed effects and control for microregion-specific characteristics measured at the baseline year of 2000, including logarithm of population, share of population aged 10-14, share of urban population, poverty rate, illiteracy rate, Gini index, lag of the dependent variable, and a measure of overall exposure to Chinese exports. In columns 2, 4, 6 and 8, we report 2SLS estimates using as instruments two measures of adult and child-specific tariff exposure to China constructed using, for each industry, the imports to China to all other countries except Brazil. All regressions are weighted by population size in 2000, and standard errors are clustered at the mesoregion level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

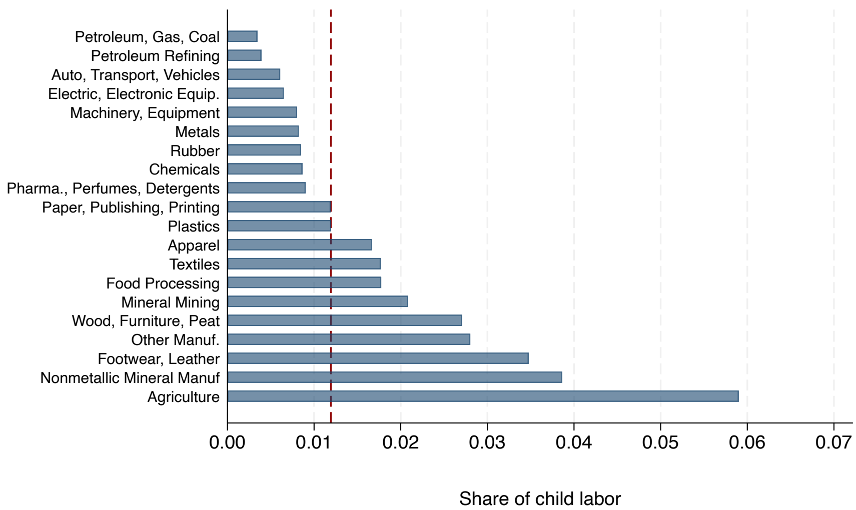
Appendix A

Figure A1: Dynamics of Nominal Tariffs (1987-1998)



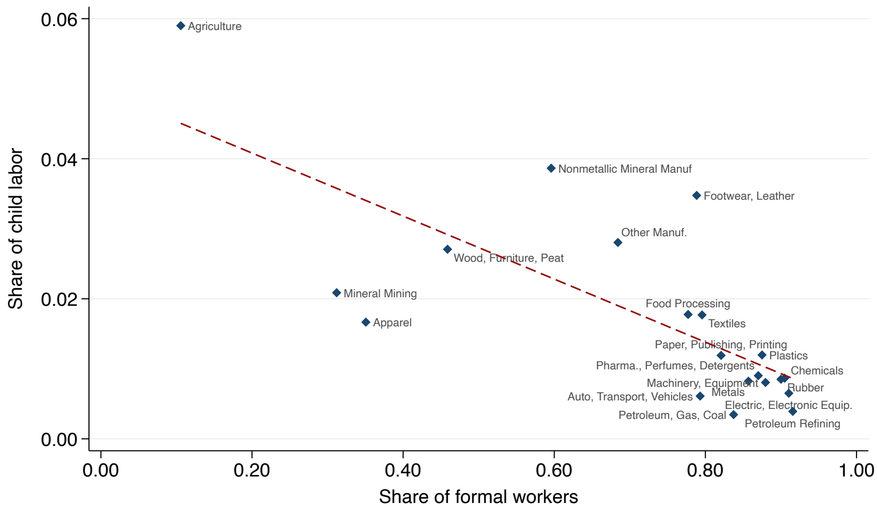
Notes: This figure plots the evolution of nominal tariffs from 1987 to 1998 for the ten largest industries ranked by value added in 1990. Tariff data come from Kume et al. (2003). Source: Dix-Carneiro and Kovak (2017).

Figure A2: Child Labor by Industry



Notes: This figure presents the share of child labor by industry, measured as the ratio of child labor to total labor within each industry, using data from the 1991 Census.

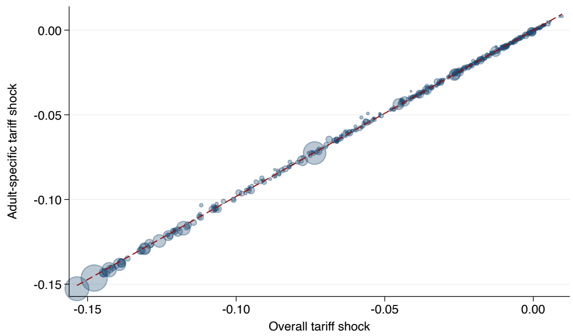
Figure A3: Child Labor vs Formal Employment



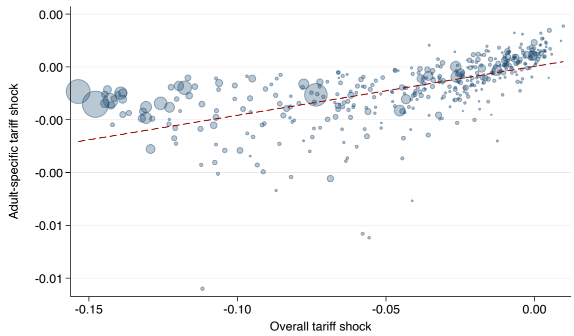
Notes: This figure plots the relationship across industries between the share of child labor and the percentage of formal employment, using data from the 1991 Census. An employee is considered a formal worker if they hold a formal labor contract, with a signed booklet.

Figure A4: Regional Tariff Shocks

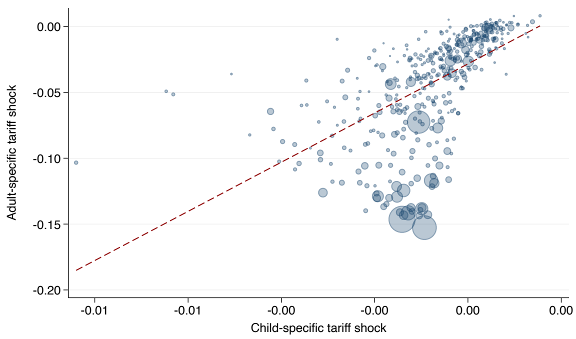
(a) $\Delta Tariff_m^{Adult}$ vs $\Delta Tariff_m$



(b) $\Delta Tariff_m^{Child}$ vs $\Delta Tariff_m$



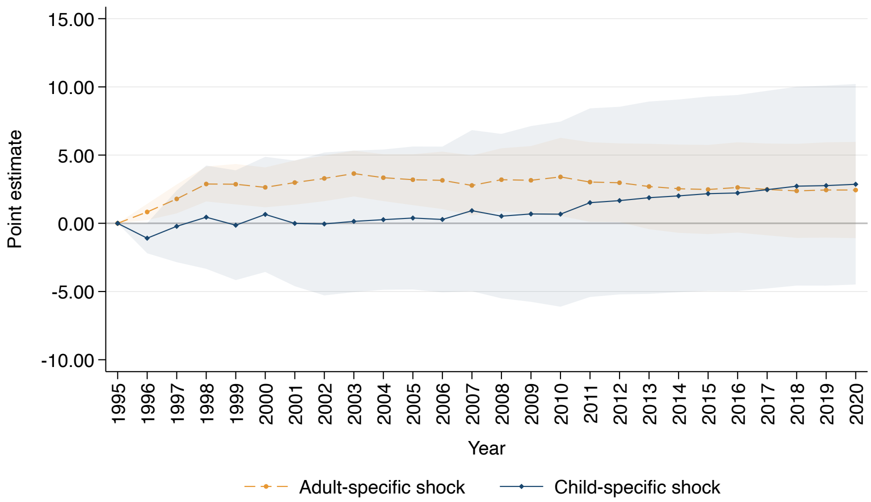
(c) $\Delta Tariff_m^{Adult}$ vs $\Delta Tariff_m^{Child}$



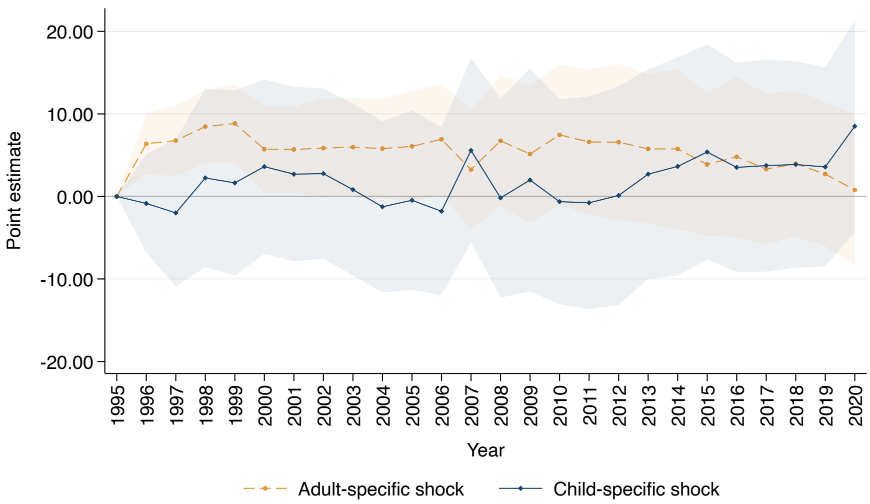
Notes: These figures present the correlation among the overall tariff shock, adult-specific and child-specific tariff shocks calculated using Equations (4), (6), and (7). Each dot represents a microregion, with weights given by the local population in 1991.

Figure A5: Effects on School Infrastructure

(a) Number of Schools per 1,000



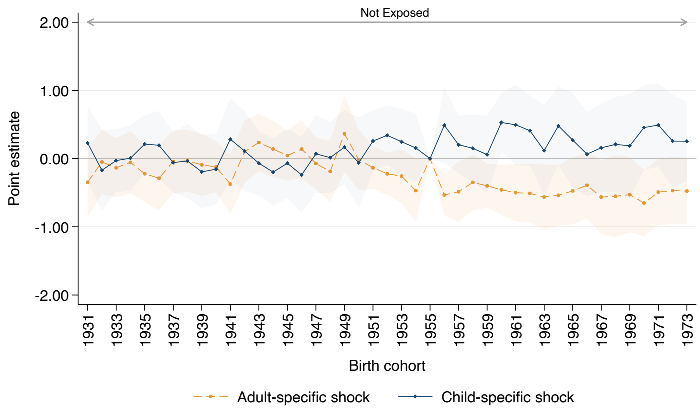
(b) Number of Elementary Schools Teachers per 1,000



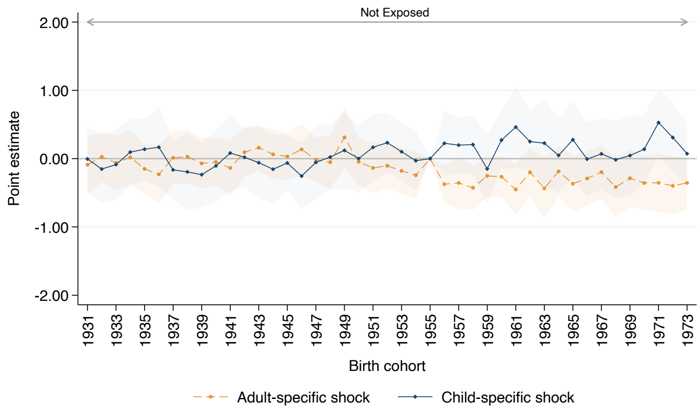
Notes: These figures plot the dynamic effects of adult and child-specific tariff reductions on school infrastructure. Each point estimate is obtained from a separate regression based on Equation (9). The dependent variables represent changes in number of schools per 1,000 inhabitants (panel a) and number of elementary schools teachers per 1,000 inhabitants (panel b) between year $\tau \in \{1996, ..., 2020\}$ and the baseline year (1995). The estimates connected by the solid line represent the dynamic effects of child-specific tariff shocks, while those connected by the dashed line represent the dynamic effects of adult-specific tariff shocks. Shaded areas depict 90% confidence intervals computed based on standard errors clustered at the mesoregion level. The point estimates associated with child-specific tariff reductions are divided by 10 to facilitate visualization.

Figure A6: Effects on Human Capital Accumulation: Placebo Exercise

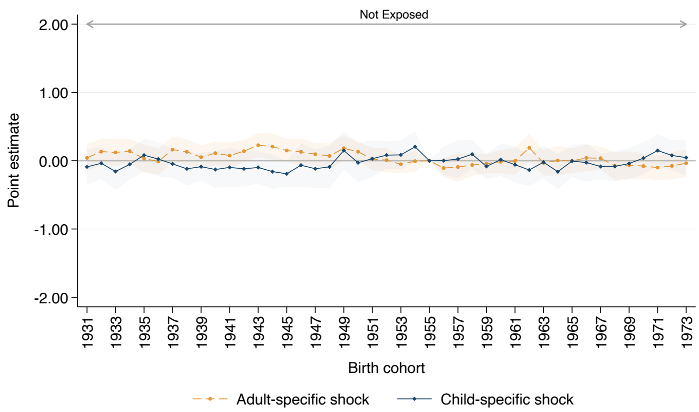
(a) Elementary School



(b) High School



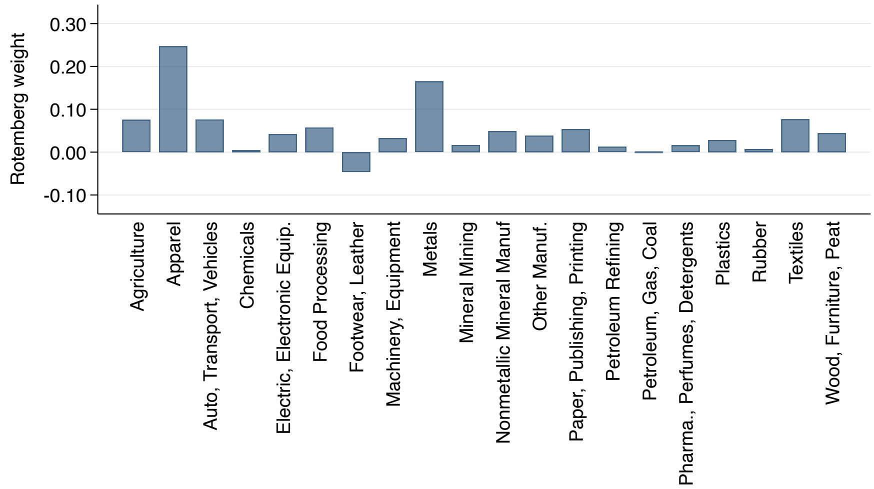
(c) Some College



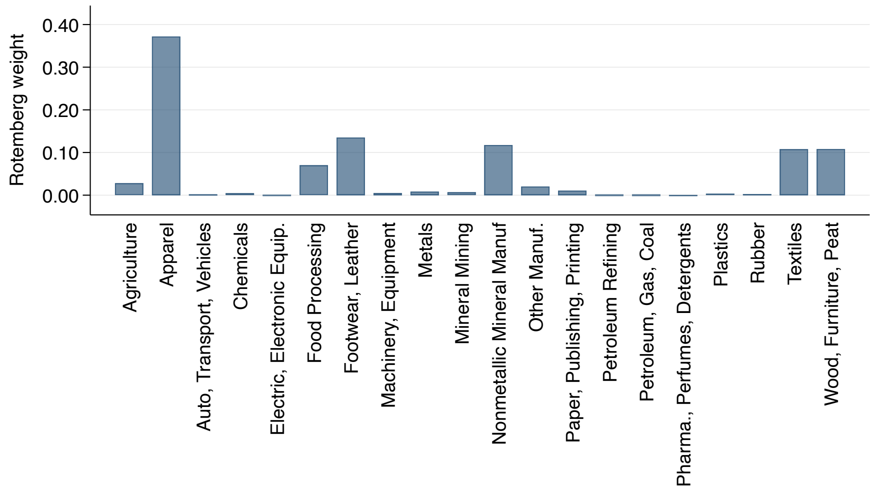
Notes: These figures present results of a placebo exercise where the stock of human capital is measured before the implementation of the trade liberalization reform, using data from the 1991 Census. Each point estimate is obtained from a separate regression based on Equation (10). The dependent variables represent the shares of individuals in each birth cohort who completed elementary school (panel a), high school (panel b) and have some college education (panel c). The analysis focuses on cohorts born from 1931 to 1973. The omitted group is the cohort born in 1955, whose members were 18 years old in 1973. For additional details, see footnote to Figure 4.

Figure A7: Rotemberg Weights

(a) Adult-Specific Tariff Reduction



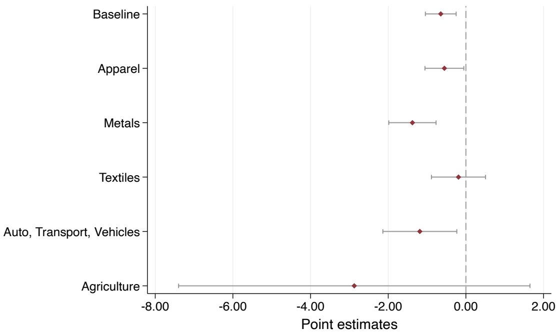
(b) Child-Specific Tariff Reduction



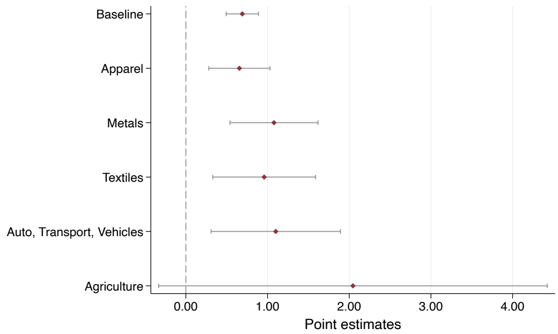
Notes: These figures report estimated Rotemberg weights for both measures of adult-specific (panel a) and child-specific (panel b) tariff reductions for the 20 industries considered in our analysis. The top five industries associated with the adult-specific tariff exposure are: apparel (23.6%), metals (15.5%), textiles (7.3%), auto, transport and vehicles (7.3%), and agriculture (7.2%). The top five industries associated with the child-specific tariff exposure are: apparel (37.1%), footwear and leather (13.5%), nonmetallic mineral manufacturing (11.8%), wood, furniture and peat (10.8%), and textiles (10.8%). For additional details, see Table A6.

Figure A8: Industry-Specific (“Just-Identified”) Effects

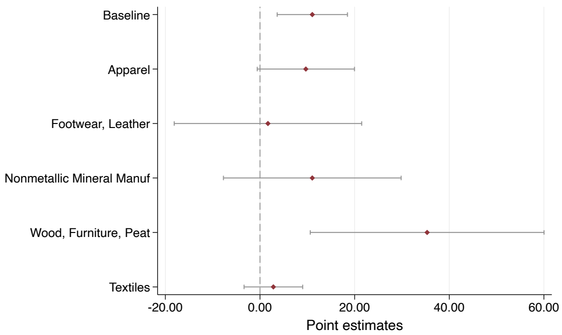
(a) Adult-Specific Shock (“School Only”)



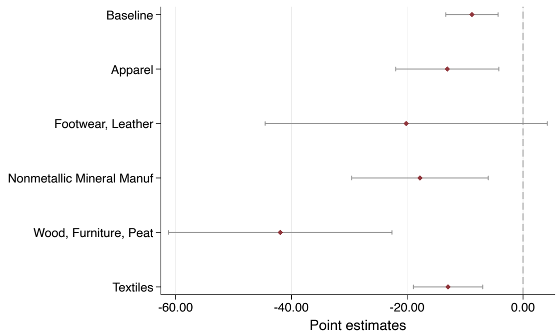
(b) Adult-Specific Shock (“Work”)



(c) Child-Specific Shock (“School Only”)



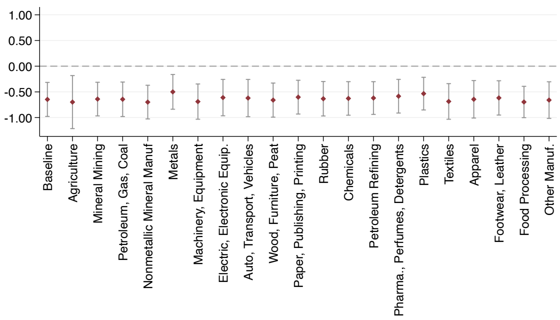
(d) Child-Specific Shock (“Work”)



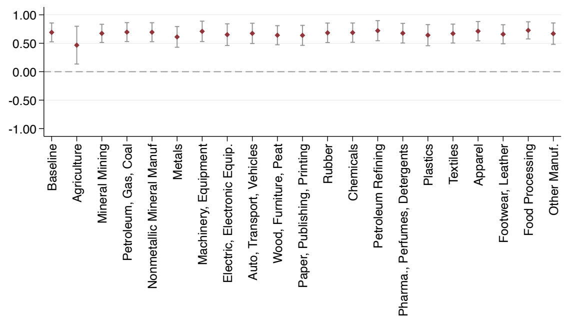
Notes: These figures plot the effects of industry-specific tariff reductions (“just-identified effects”) on changes in the shares of children who attend “school only” and “work” during the period 1991-2010 (“long-run”). The analysis focuses on the five sectors with the largest Rotemberg weights for each measure. Each point estimate is obtained from a separate regression based on Equation (9), including the shift-share terms $Ch_{mj} \times \omega_{mj} \times \Delta log(1 + \tau_j)$ and $(1 - Ch_{mj}) \times \omega_{mj} \times \Delta log(1 + \tau_j)$ for a specific industry j. The estimates for the effects of adult-specific tariff shocks on “school only” and “work” are reported in panels a and b, while the estimates for the effects of child-specific tariff shocks are reported in panels c and d. All figures report 90% confidence intervals computed based on standard errors clustered at the mesoregion level.

Figure A9: Additional Robustness Checks: Controlling for Industry Shares

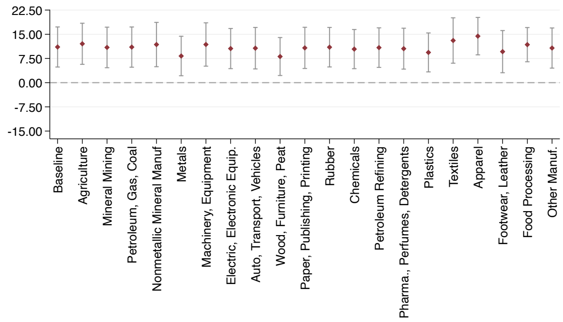
(a) $\Delta Tariff_m^{Adult}$ (“School Only”)



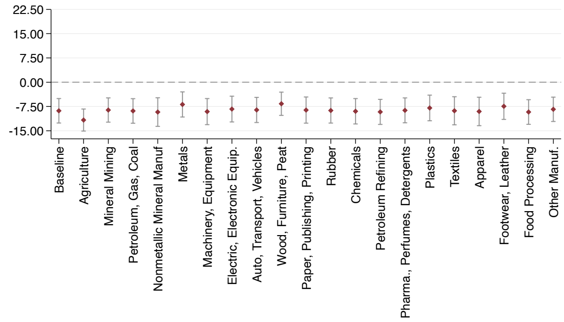
(b) $\Delta Tariff_m^{Adult}$ (“Work”)



(c) $\Delta Tariff_m^{Child}$ (“School Only”)



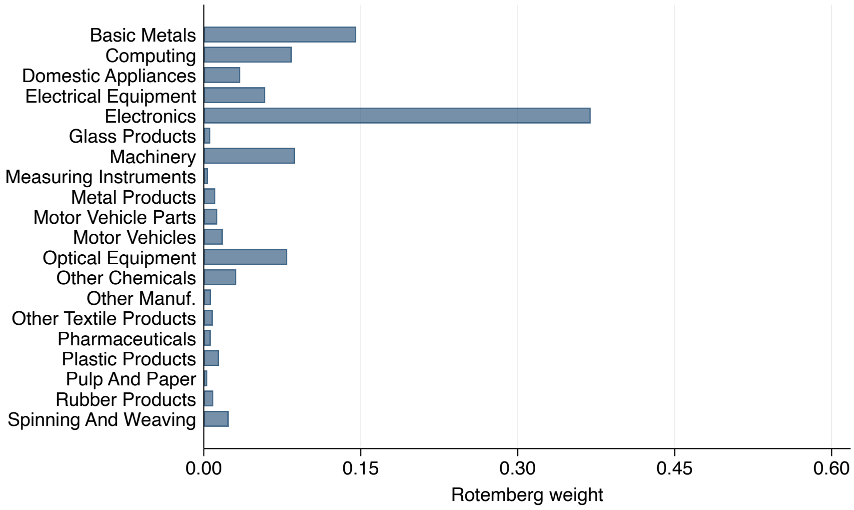
(d) $\Delta Tariff_m^{Child}$ (“Work”)



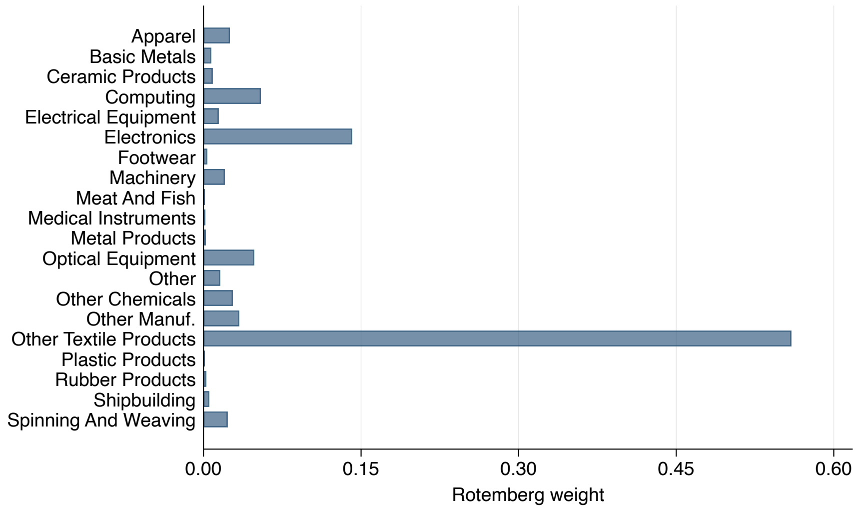
Notes: These figures plot the effects of adult and child-specific tariff reductions on changes in the shares of children who attend “school only” and “work” during the period 1991-2010 (“long-run”). Each point estimate is obtained from a separate regression based on Equation (9), including, one at a time, the shares of adult and children working in each industry in the baseline year of 1991. The estimates for the baseline specification (first estimate on the left-hand side of each figure) are the same as those reported in Table 3. All figures report 90% confidence intervals computed based on standard errors clustered at the mesoregion level. For additional details, see Table A6.

Figure A10: China Shock: Rotemberg Weights

(a) Adult-Specific Exposure to Chinese Imports



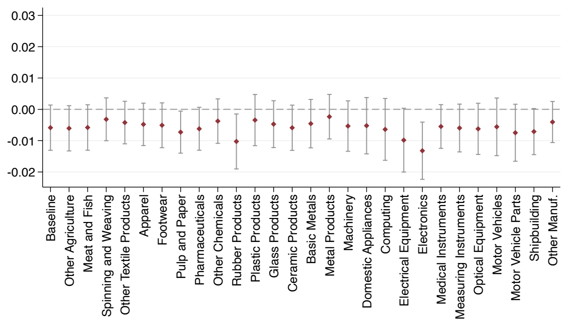
(b) Child-Specific Exposure to Chinese Imports



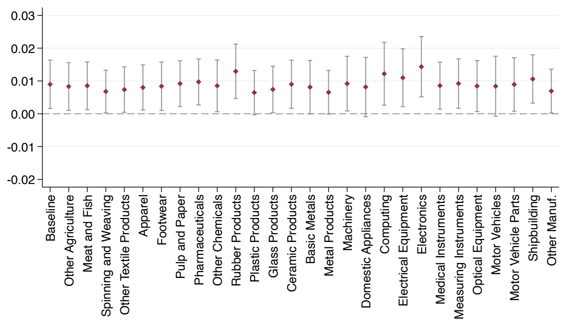
Notes: These figures report estimated Rotemberg weights for both measures of adult-specific (panel a) and child-specific (panel b) exposure to Chinese import competition, considering the 20 industries with the largest weights in each case. The top five industries associated with the adult-specific shock are: electronics (36.4%), basic metals (14.3%), machinery (8.6%), computing (8.3%), and optical equipment (7.8%). The top five industries associated with the child-specific shock are: other textile products (55.6%), electronics (14.1%), computing (5.4%), optical equipment (4.8%), and other manufacturing (3.4%).

Figure A11: China Shock: Controlling For Industry Shares (2SLS Estimates)

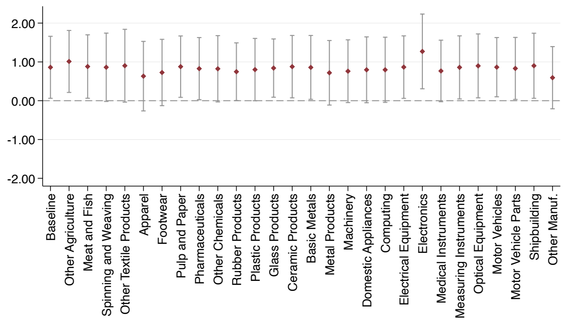
(a) ΔIS_m^{Adult} ("School Only")



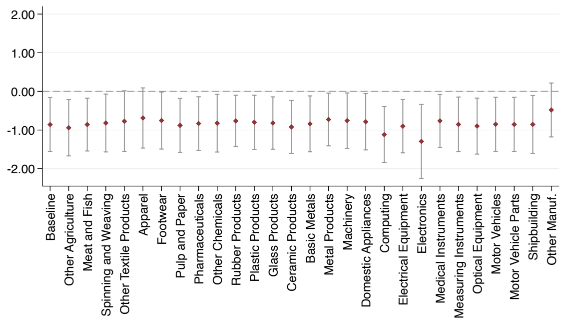
(b) ΔIS_m^{Adult} ("Work")



(c) ΔIS_m^{Child} ("School Only")



(d) ΔIS_m^{Child} ("Work")



Notes: These figures plot the effects of adult and child-specific exposure to Chinese import competition on changes in the shares of children who attend "school only" and "work" during the period 2000-2010. Each point estimate is obtained from a separate 2SLS regression, including, one at a time, the shares of adult and children working in each industry in the baseline year of 2000. The analysis considers the 27 sectors that rank among the top 20 industries according to the Rotemberg weights for each measure. The estimates for the baseline specification (first estimate on the left-hand side of each figure) are the same as those reported in Table 9. All figures report 90% confidence intervals computed based on standard errors clustered at the mesoregion level.

Table A1: Additional Summary Statistics

	Mean	Std. Dev.	Min	Max	10th	90th
Panel A. School census						
Δ *1995-2010*						
School enrollment	0.053	0.091	-0.190	0.373	-0.054	0.175
Age-grade distortion rate	-0.156	0.109	-0.485	0.066	-0.306	-0.025
Approval rate	0.160	0.053	0.019	0.302	0.096	0.233
Δ *1995-2020*						
School enrollment	0.055	0.088	-0.174	0.384	-0.039	0.168
Age-grade distortion rate	-0.243	0.147	-0.673	0.027	-0.433	-0.066
Approval rate	0.277	0.096	-0.018	0.525	0.166	0.418
Panel B. Human capital accumulation						
Cohort born in 1992 (2010 Census)						
Share elementary education	0.691	0.118	0.324	0.957	0.521	0.830
Share high school	0.287	0.118	0.030	0.617	0.132	0.443
Share college degree	0.096	0.061	0.000	0.339	0.023	0.176
Cohort born in 1973 (1991 Census)						
Share elementary education	0.238	0.118	0.021	0.551	0.097	0.406
Share high school	0.058	0.044	0.000	0.214	0.012	0.125
Share college degree	0.004	0.005	0.000	0.026	0.000	0.012
Panel C. Structural transformation (net of composition)						
Δ *1991-2000*						
Formal employment	-0.019	0.048	-0.183	0.139	-0.081	0.039
Log-earnings	0.006	0.123	-0.517	0.371	-0.143	0.165
Share agriculture/mining	-0.087	0.044	-0.303	0.015	-0.144	-0.036
Share manufacturing	0.037	0.032	-0.082	0.123	0.003	0.072
Share non-tradable	0.043	0.036	-0.060	0.218	0.002	0.084
Δ *1991-2010*						
Formal employment	0.086	0.074	-0.103	0.354	0.000	0.189
Log-earnings	0.810	0.170	0.140	1.270	0.587	1.006
Share agriculture/mining	-0.223	0.063	-0.439	-0.050	-0.300	-0.146
Share manufacturing	0.066	0.048	-0.099	0.233	0.020	0.131
Share non-tradable	0.070	0.050	-0.065	0.237	0.009	0.136

Notes: This table reports additional summary statistics at the microregion level for the variables considered in our analysis. Panel A presents descriptive statistics for the differences in school enrollment among children aged 10-14, as well as for age-grade distortion and approval rates in elementary schools, during the periods 1995-2010 and 1995-2020, based on data from the School Census. Panel B provides descriptive statistics for the educational attainment of the cohort born in 1992, based on data from the 2010 Census, and for the cohort born in 1973, based on data from the 1991 Census. Panel C reports summary statistics for the differences in the share of formal employment, logarithm of average earnings, and the distribution of the workforce across agriculture/mining, manufacturing, and the non-tradable sector, during the periods 1991-2000 and 1991-2010. In all cases, the sample consists of 411 microregions whose boundaries remained constant from 1980 to 2010.

Table A2: Effects on Child Labor and Schooling: Robustness Check ("Idle")

	Baseline	No controls	Longer pre-trends	Income per capita	Labor market	Social programs	Educ./Pub. spending	Macro shocks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	−0.084	0.793***	−0.052	−0.091	−0.209	−0.119	−0.074	−0.097
	(0.129)	(0.102)	(0.118)	(0.122)	(0.141)	(0.115)	(0.132)	(0.114)
$\Delta Tariff_m^{Child}$	−1.141	−0.142	−1.084	−0.590	−2.116	−0.396	−0.343	−1.264
	(2.411)	(2.525)	(2.703)	(2.107)	(2.236)	(2.099)	(1.920)	(1.998)
R-squared	0.91	0.79	0.92	0.91	0.92	0.91	0.93	0.91
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	−0.069	0.990***	−0.029	−0.093	−0.202	−0.116	−0.046	−0.192
	(0.158)	(0.115)	(0.141)	(0.151)	(0.186)	(0.136)	(0.164)	(0.120)
$\Delta Tariff_m^{Child}$	−2.131	−1.009	−2.062	−1.081	−3.274	−1.088	−1.166	−2.450
	(2.550)	(2.888)	(2.845)	(2.253)	(2.295)	(2.110)	(1.195)	(2.612)
R-squared	0.92	0.81	0.93	0.92	0.93	0.92	0.93	0.92
Observations	411	411	411	411	411	396	409	411

Notes: This table reports robustness checks for the effects of local exposure to trade liberalization on the share of children who remain "idle" (i.e. neither work nor study). Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For a description of the controls included in each specification, see discussion in Section 6.1; for additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Effects on Child Labor and Schooling: Robustness Check ("Paid Work")

	Baseline	No controls	Longer pre-trends	Income per capita	Labor market	Social programs	Educ./Pub. spending	Macro shocks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	0.391***	0.236***	0.313***	0.398***	0.475***	0.406***	0.427***	0.374***
	(0.082)	(0.048)	(0.066)	(0.081)	(0.097)	(0.079)	(0.081)	(0.073)
$\Delta Tariff_m^{Child}$	−7.369***	−10.537***	−5.072***	−6.336***	−8.036***	−6.951***	−6.859***	−6.812***
	(1.722)	(2.903)	(1.787)	(1.738)	(1.685)	(1.372)	(1.673)	(1.456)
R-squared	0.70	0.55	0.75	0.74	0.71	0.72	0.73	0.73
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	0.495***	0.306***	0.401***	0.495***	0.720***	0.512***	0.551***	0.491***
	(0.092)	(0.057)	(0.080)	(0.093)	(0.108)	(0.090)	(0.087)	(0.084)
$\Delta Tariff_m^{Child}$	−10.213***	−14.220***	−7.455***	−8.844***	−9.875***	−9.755***	−9.529***	−9.321***
	(1.821)	(3.174)	(1.993)	(1.904)	(1.697)	(1.476)	(1.783)	(1.973)
R-squared	0.71	0.56	0.76	0.74	0.73	0.72	0.74	0.72
Observations	411	411	411	411	411	396	409	411

Notes: This table reports robustness checks for the effects of local exposure to trade liberalization on the share of children who have a paid work. Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For a description of the controls included in each specification, see discussion in Section 6.1; for additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Effects on Child Labor and Schooling: Heterogeneity by Race

	School only		Work		Idle		Paid work	
	Black	Non-black	Black	Non-black	Black	Non-black	Black	Non-black
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	-0.642^{***}	-0.167	0.618^{***}	0.277^{**}	0.058	-0.115	0.575^{***}	0.346^{***}
	(0.217)	(0.192)	(0.133)	(0.112)	(0.152)	(0.130)	(0.109)	(0.081)
$\Delta Tariff_m^{Child}$	10.953^{**}	8.640^{**}	-8.385^{***}	-6.662^{***}	-2.991	-2.341	-9.098^{***}	-7.074^{***}
	(5.070)	(3.455)	(2.643)	(2.228)	(2.931)	(2.177)	(2.628)	(1.711)
R-squared	0.72	0.72	0.64	0.55	0.87	0.84	0.69	0.63
Mean dep. var.	0.183	0.128	-0.035	-0.015	-0.148	-0.113	-0.045	-0.026
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	-1.147^{***}	-0.452^{**}	1.007^{***}	0.571^{***}	0.148	-0.128	0.755^{***}	0.427^{***}
	(0.255)	(0.172)	(0.134)	(0.104)	(0.187)	(0.130)	(0.123)	(0.097)
$\Delta Tariff_m^{Child}$	16.649^{***}	10.866^{***}	-11.455^{***}	-8.501^{***}	-5.368^{*}	-2.541	-12.512^{***}	-9.915^{***}
	(4.987)	(2.879)	(2.789)	(2.199)	(3.048)	(2.169)	(2.760)	(1.760)
R-squared	0.81	0.81	0.68	0.62	0.88	0.87	0.71	0.66
Observations	411	411	411	411	411	411	411	411
Mean dep. var.	0.235	0.160	-0.059	-0.029	-0.176	-0.132	-0.058	-0.033

Notes: This table reports estimates of the effects of local exposure to trade liberalization on child labor and schooling for subsamples of "black" and "non-black" children. A child is defined as "black" if they are classified as "*preto*" or "*pardo*" in the Brazilian Census. Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Effects on Child Labor and Schooling: Heterogeneity by Gender

	School only		Work		Idle		Paid work	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Medium-run (1991-2000)								
$\Delta Tariff_m^{Adult}$	-0.399^{*}	-0.191	0.429^{***}	0.324^{***}	-0.069	-0.089	0.473^{***}	0.336^{***}
	(0.204)	(0.172)	(0.146)	(0.081)	(0.136)	(0.132)	(0.115)	(0.062)
$\Delta Tariff_m^{Child}$	9.427^{*}	6.090^{*}	-7.100^{**}	-6.396^{***}	-2.425	0.022	-8.122^{***}	-6.647^{***}
	(4.920)	(3.180)	(3.321)	(1.457)	(2.768)	(2.225)	(2.997)	(1.142)
R-squared	0.79	0.79	0.51	0.64	0.90	0.89	0.64	0.67
Mean dep. var.	0.163	0.152	-0.040	-0.008	-0.123	-0.144	-0.050	-0.019
Panel B. Long-run (1991-2010)								
$\Delta Tariff_m^{Adult}$	-0.930^{***}	-0.398^{**}	0.885^{***}	0.509^{***}	-0.033	-0.104	0.580^{***}	0.433^{***}
	(0.208)	(0.193)	(0.141)	(0.080)	(0.165)	(0.161)	(0.129)	(0.068)
$\Delta Tariff_m^{Child}$	13.368^{***}	9.208^{***}	-9.265^{***}	-8.489^{***}	-3.666	-0.693	-11.786^{***}	-8.640^{***}
	(4.259)	(3.277)	(3.171)	(1.674)	(2.883)	(2.342)	(3.027)	(1.228)
R-squared	0.90	0.81	0.62	0.67	0.92	0.90	0.67	0.68
Observations	411	411	411	411	411	411	411	411
Mean dep. var.	0.218	0.179	-0.074	-0.011	-0.144	-0.168	-0.061	-0.026

Notes: This table reports estimates of the effects of local exposure to trade liberalization on child labor and schooling for subsamples of boys and girls. Panels A and B report the effects of adult and child-specific tariff reductions for the medium-run (1991-2000) and long-run (1991-2010), respectively. For additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Additional Robustness Checks: Controlling For Industry Shares

Industry	Rotemberg weights		Estimate of β controlling for industry shares							
			School only				Work			
			1991-2000		1991-2010		1991-2000		1991-2010	
	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child
Baseline	.	.	-0.267	7.456	-0.647	11.058	0.361	-6.676	0.691	-8.822
Apparel	0.247	0.372	-0.328	12.360	-0.644	14.418	0.421	-8.982	0.712	-9.030
Metals	0.165	0.009	-0.118	4.852	-0.500	8.266	0.261	-4.774	0.611	-6.867
Textiles	0.077	0.108	-0.328	9.575	-0.686	13.068	0.366	-7.048	0.670	-8.819
Auto, Transport, Vehicles	0.076	0.001	-0.220	6.789	-0.620	10.686	0.325	-6.162	0.674	-8.565
Agriculture	0.075	0.028	-0.389	7.386	-0.699	12.050	0.199	-8.083	0.467	-11.684
Food Processing	0.058	0.070	-0.350	9.026	-0.697	11.785	0.418	-7.566	0.727	-9.200
Paper, Publishing, Printing	0.054	0.011	-0.193	6.976	-0.603	10.780	0.306	-6.357	0.639	-8.603
Nonmetallic Mineral Manuf	0.049	0.118	-0.297	7.783	-0.699	11.816	0.371	-6.749	0.695	-9.213
Wood, Furniture, Peat	0.044	0.108	-0.305	5.131	-0.660	8.106	0.347	-4.948	0.641	-6.654
Electric, Electronic Equip.	0.042	-0.001	-0.175	6.271	-0.611	10.571	0.293	-5.782	0.651	-8.292
Other Manuf.	0.039	0.020	-0.242	7.104	-0.660	10.731	0.309	-6.184	0.669	-8.366
Machinery, Equipment	0.033	0.005	-0.263	7.433	-0.689	11.831	0.352	-6.455	0.709	-9.074
Plastics	0.028	0.003	-0.133	5.702	-0.534	9.372	0.288	-5.572	0.642	-7.949
Mineral Mining	0.017	0.007	-0.266	7.448	-0.640	10.920	0.349	-6.511	0.674	-8.589
Pharma., Perfumes, Detergents	0.016	-0.002	-0.173	6.677	-0.584	10.540	0.314	-6.274	0.677	-8.693
Petroleum Refining	0.013	-0.000	-0.229	7.146	-0.620	10.866	0.360	-6.693	0.721	-9.166
Rubber	0.007	0.003	-0.234	7.015	-0.634	10.995	0.338	-6.286	0.684	-8.735
Chemicals	0.005	0.005	-0.249	6.938	-0.628	10.405	0.356	-6.786	0.687	-8.972
Petroleum, Gas, Coal	-0.000	-0.000	-0.268	7.450	-0.644	11.027	0.367	-6.720	0.696	-8.870
Footwear, Leather	-0.047	0.135	-0.236	5.986	-0.617	9.618	0.334	-5.487	0.658	-7.438

Notes: This table reports Rotemberg weights for each industry, as well as the effects of adult and child-specific tariff reductions on changes in the shares of children who attend "school only" and "work" during the periods 1991-2000 ("medium-run") and 1991-2010 ("long-run"). Each point estimate is obtained from a separate regression based on Equation (9), including, one at a time, the shares of adult and children working in each industry in the baseline year of 1991. The estimates for changes in "school only" and "work" for the period 1991-2010 are the same as those reported in Figure A9.

Table A7: Additional Robustness Checks: Effects on Child Labor and Schooling

	School only		Work		Idle		Paid work	
	1991-2000	1991-2010	1991-2000	1991-2010	1991-2000	1991-2010	1991-2000	1991-2010
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Overall tariff shock								
$\Delta Tariff_m$	-0.330^{***}	-0.544^{***}	0.351^{***}	0.562^{***}	-0.049	-0.062	0.372^{***}	0.444^{***}
	(0.125)	(0.136)	(0.076)	(0.075)	(0.085)	(0.104)	(0.059)	(0.068)
R-squared	0.81	0.87	0.58	0.62	0.91	0.92	0.69	0.68
Panel B. Adult-specific vs child-specific tariff shocks								
$\Delta Tariff_m^{Adult}$	-0.417^{***}	-0.626^{***}	0.385^{***}	0.583^{***}	-0.022	-0.027	0.411^{***}	0.507^{***}
	(0.129)	(0.138)	(0.081)	(0.081)	(0.089)	(0.110)	(0.063)	(0.070)
$\Delta Tariff_m^{Child}$	6.830^{***}	6.207^{***}	-3.319^{***}	-1.675	-3.107^{*}	-4.075^{**}	-3.289^{***}	-5.412^{***}
	(1.782)	(1.756)	(1.235)	(1.572)	(1.687)	(1.859)	(0.879)	(0.974)
R-squared	0.81	0.87	0.59	0.62	0.91	0.92	0.71	0.72
Observations	411	411	411	411	411	411	411	411

Notes: This table reports robustness checks for the effects of local exposure to trade liberalization on changes in child labor and schooling during the periods 1991-2000 ("medium run"), and 1991-2010 ("long run"), using employment shares from the 1980 Census to construct the measures of adult and child-specific tariff reductions. For additional details, see footnote to Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: Effects of China Shock on Child Labor and Schooling: Robustness Check

	School only		Work		Idle		Paid work	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔIS_m^{Adult}	-0.028^{***}	-0.026^{***}	0.031^{***}	0.031^{***}	0.003	0.002	0.002	0.000
	(0.008)	(0.007)	(0.008)	(0.007)	(0.004)	(0.003)	(0.006)	(0.006)
ΔIS_m^{Child}	0.422^{***}	0.496^{***}	-0.418^{***}	-0.493^{***}	-0.131	-0.142^{*}	-0.131	-0.129
	(0.149)	(0.137)	(0.136)	(0.127)	(0.085)	(0.083)	(0.085)	(0.084)
KP-F		249.324		235.352		252.125		232.695
R-squared	0.697	0.697	0.466	0.466	0.769	0.769	0.489	0.488
Observations	411	411	411	411	411	411	411	411
Mean dep. var.	0.041	0.041	-0.018	-0.018	-0.023	-0.023	-0.009	-0.009

Notes: This table reports robustness checks for the effects of local exposure to Chinese import competition on changes in child labor and schooling between 2000 and 2010, using employment shares from the 1991 Census to construct the adult and child-specific import competition measures and corresponding instruments. For additional details, see footnote to Table 9. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.