Tariffs and Growth: Heterogeneous Effects by Economic Structure*

Mateo Hoyos†

October 20, 2022
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Abstract

This article presents evidence that the impact of tariffs on GDP per capita is mediated by economic structure. I use a panel of 161 countries from 1960 to 2019 to study the impact of changes in average tariff rates on GDP per capita. Using a local projections difference-in-differences (LP-DiD) approach allows me to flexibly control for the surge in GDP that precedes tariff reductions, which if ignored could bias the estimates, and to estimate medium-term dynamic effects. The results, consistent with a specific strand of the trade theory literature, establish that the tariff-growth nexus is contingent on economic structure: tariff reductions led to lower GDP per capita for nonmanufacturer countries, but higher GDP per capita for manufacturers. Additionally, the effects are persistent even twenty years after tariff reductions. The validity of the baseline estimates is confirmed by several robustness checks, especially the control for relevant confounders in the tariffs-growth nexus and a clean controls analysis aimed to address biases from heterogeneity as highlighted by recent difference-in-differences literature. The results seem to be driven by heterogeneous effects in productivity and capital accumulation, in turn related to changes in the manufacturing share of GDP.

JEL codes: F14, F63, O24, O47.

Keywords: tariffs, trade liberalization, trade policy, economic growth, economic structure.

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*I am especially grateful to Arslan Razmi, Daniele Girardi, and Matt Woerman for careful guidance and support. I also thank Peter Skott, Francesco Bogliacino, Leonardo Bonilla-Mejía and the participants of the Analytical Political Economy Workshop at UMass Amherst and the seminar of the Economics department at Universidad Nacional de Colombia. The usual disclaimer applies.

†Department of Economics, UMass Amherst. Email: mhoyoslopez@umass.edu.

1 Introduction

The relationship between trade policy and economic growth is one of the most debated issues in the history of economics. The dominant view in economics is that countries with lower barriers to trade tend to grow faster than countries with protectionist policies. Some even argue that support for free trade is the idea on which economists disagree least (Krugman, 1993; Furceri, Hannan, Ostry, & Rose, 2020, 2022). However, the theoretical literature does not provide unambiguous predictions on the nature of the tariffs-growth relationship. On the one hand, free trade may bring a scale effect in the sense that a larger market, associated with greater benefits for innovation, will boost growth for all countries involved. Trade may also enhance international technology diffusion. On the other hand, competition effects may lead backward countries to specialize in activities with lower innovation potential and therefore to experience lower growth rates (Grossman & Helpman, 2015; Melitz & Redding, 2021). The sign of the relationship is therefore an empirical question.

The empirical literature has addressed this question, but the results remain inconclusive. The seminal paper by Rodríguez and Rodrik (2001) revealed that most of the literature in the 1990s used independent variables capturing phenomena other than trade policy[1]. More importantly, the authors showed that when considering only the effect of trade policy on growth, separated from other phenomena, the relationship ceases to be positive and becomes insignificant. The authors end by suggesting that the literature should study heterogeneous effects of trade policy on growth, instead of focusing exclusively on general unambiguous relationships. Although there have been new contributions since then, recently reviewed by Irwin (2019), the results on a general relationship are contradictory and thus inconclusive, and contributions studying heterogeneous effects, which could shed light on these discrepancies, have been rare.

In this article, I demonstrate that the relationship between trade policy and growth at the country level is characterized by sharp heterogeneous effects by economic structure. I do this by investigating the effects of tariffs on GDP per capita using a panel of 161 countries from 1960 to 2019[2]. I provide evidence that tariff reductions led to lower GDP per capita for nonmanufacturer countries, but higher for manufacturers. The estimates suggest that a one-standard-deviation reduction in tariffs (i.e., 3.65 percentage points) leads to a fall (increase) of more than 2 percent in GDP per capita fifteen years later for nonmanufacturer (manufacturer) countries. The effects persist even after twenty years. These results may explain the apparent

[1]For example, in the case of Dollar (1992), the variables used were exchange rate distortion and variability; in Sachs and Warner (1995), the Sachs–Warner (SW) dichotomous measure of liberalization used included trade policy information but also exchange rate distortions and state ownership of important sectors, among others; and the paper by Frankel and Romer (1999) used trade openness, which is an outcome variable but not a trade policy measure.

[2]Trade policy is also composed by nontariff barriers, export taxes, among others. Although my focus is on the effects of tariffs, I nonetheless control for nontariff barriers changes as a robustness check.

nonexistence of a general unambiguous relationship. I further show that the results appear to be driven by heterogeneous effects on productivity and capital accumulation, in turn linked to changes on the manufacturing share of GDP.

To establish the baseline results, I show that tariff reductions are preceded by a surge in GDP, for which it is then necessary to control to avoid biased effect estimates. As shown in Figure 1, countries reducing tariffs (the treatment group) are on a different trajectory ex ante as compared to countries not changing tariffs (the control group): GDP of the former is increasing in relative terms before the decrease in tariffs (that is, the treatment date). To avoid biases, I then use the local projections difference-in-differences (LP-DiD) estimator, that allows a flexible semiparametric approach to control for pre-treatment values, as in conditional parallel trends (Dube, Girardi, Jordà, & Taylor, 2022). Additionally, this approach allows me to estimate medium-term dynamic effects, contrary to most of the previous empirical literature in the tariffs-growth nexus. The underlying identification assumption of the baseline results is that, conditional on lags of growth rates, which successfully capture pretrends, changes in tariffs are as good as random.

I then demonstrate the validity of the baseline results to several robustness exercises, thus relaxing the previous identification assumption. First, I check the validity of the estimates after accounting for important confounding variables that are related to both tariff changes and growth, as well as for some common trends for different groups of countries. Second, cognizant of the problems highlighted in the recent difference-in-differences literature with estimates of average treatment effects due to effect heterogeneity and variation in treatment timing (de Chaisemartin & d'Haultfoeuille, 2020; Sun & Abraham, 2021; Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021)—more concerning in the case of a continuous treatment variable (Callaway, Goodman-Bacon, & Sant'Anna, 2021)—I provide a robustness exercise aimed to address these problems. I apply the idea of comparing movers, here countries experiencing *relevant* tariff changes, and quasi-stayers, here countries experiencing changes in tariffs virtually equal to zero, as recently proposed by de Chaisemartin, D'Haultfœuille, Pasquier, and Vazquez-Bare (2022) and also suggested as an application of LP-DiD by Dube et al. (2022). Reassuringly, the direction of the effect heterogeneity of tariffs on growth is preserved, although statistical significance is reduced due to losses in statistical power.

I also provide evidence of potential mechanisms underpinning this heterogeneity in the effects of tariffs on growth. I show that for nonmanufacturer countries, tariff reductions lead to lower productivity levels, also accompanied by lower capital accumulation. For manufacturer countries, on the other hand, both productivity and capital accumulation increases after tariff reductions. These results seem to be driven in turn by changes in the manufacturing share of GDP: for nonmanufacturer (manufacturer) countries, tariff reductions lead to lower (higher) manufacturing shares of GDP. In the case of nonmanufacturer countries, this can also be interpreted as empirical evidence in support of the premature deindustrialization story by Rodrik (2016), according to which developing countries have deindustrialized due to globalization.

The results in this paper are novel in three aspects. First, in the empirical literature on the effects of trade policy (tariffs) on GDP (growth), this paper is the first, to the best of my knowledge, to test for heterogeneous effects related to the economic structure. Previous works have evaluated effect heterogeneity related to income or to protected sectors, but none have studied the differential impact of the aggregate sectoral composition of economies. Second, although I am not the first to use local projections for this question, I use this method for the first time in the trade policy literature to address potential selection biases coming from pretrends. I address this problem by modeling pretrends on observables, following the application first made by Acemoglu, Naidu, Restrepo, and Robinson (2019) studying the effects of democratization on GDP and as formalized recently by Dube et al. (2022). And finally, I also provide evidence of the mechanisms that might explain this heterogeneity.

Although this is not the first paper to address heterogeneous effects of tariffs on growth, it is the first to do so studying the effect of tariff *changes* instead of *levels*. First, Yanikkaya (2003) studied the relationship between growth and several different trade policies, among them tariffs, export taxes, and total taxes on international trade. His results showed that trade restrictions, particularly tariffs, encourage growth, especially in developing countries. Later, DeJong and Ripoll (2006) explicitly studied the heterogeneous effects of trade policy in relation to income per capita. They found that trade restrictions may encourage growth in developing countries but negatively impact growth in developed countries. Finally, Nunn and Trefler (2010) revealed that what matters for the positive correlation for tariffs and growth is the skill bias of tariffs: higher tariffs in skill-intensive sectors are robustly associated with higher growth. According to Irwin (2019), these examples rely on regressions that amount to comparing growth performance between high-tariff countries and low-tariff countries instead of examining how changes in tariffs within countries affect growth, which is arguably the relevant question to identify the impact of trade liberalization (or protectionist policies).

Although there are papers studying the effects of tariff *changes* on growth, my contribution also differs in important aspects to that literature. First, my contribution uses tariffs rates as the independent variable of interest, directly capturing the effect of key component of trade policy, contrary to some important previous contributions. The studies by Wacziarg and Welch (2008) and Billmeier and Nannicini (2013) used a dichotomous measure taking value 1 for liberal countries and 0 for protectionist ones as independent variable. This dichotomous measure of liberalization is based on criteria including trade policy but also other phenomena related to market reforms, so it ends up identifying more than a change in trade policy. Therefore, this exercise is once again subject to the criticism made by Rodríguez and Rodrik (2001). In fact, Rodríguez (2007) has argued that the results in Wacziarg and Welch (2008) are fundamentally driven by exchange rate black market premia, and not by trade policy. Apart from that, using a dummy variable as the independent variable of interest also has the problem of assuming that the trade regime is defined by certain threshold in average tariff rates. For example, there is no reason to think that a country has a liberal trade regime if its average tariff rate is lower than 40 percent and a protectionist one otherwise[3].

Second, this paper provides an explanation for some recent results pointing again to a lack of a general unambiguous relationship from tariffs to growth. The study by Estevadeordal and Taylor (2013) revisited the question on the tariffs–growth nexus, focusing on the great liberalization of the 1990s and using continuous changes in tariff rates as the independent variable of interest[4]. The analysis is carried out through a difference regression with acceleration in average growth as the dependent variable and the change in tariffs as the independent variable of interest. The difference regression only consider averages of two periods, the pre- and post-1990. The regressions therefore had only one observation per country with available data (averaging between 31 to 47 observations). The authors found that tariff reductions in capital and intermediate goods increased growth. However, as shown by Hoyos (2022), the results in that paper are not robust and again a general unambiguous relationship between tariffs and growth seems not to exist.

And finally, my contribution here provides medium-term dynamic effects estimates and controls for pretrends. The recent studies by Furceri et al. (2020, 2022) study yearly changes in average tariffs rates from 1960 to 2014 on growth and other macroeconomic variables[5]. Importantly, the authors make use of a new tariff dataset with the longest coverage to date, including general tariff rates for 161 countries. The authors use the local projections method (Jordà, 2005) to estimate for the first time the dynamic effects of a one-percentage-point change in tariffs. Nevertheless, the authors restricted the analysis to 5 years after changes in tariffs, while my analysis considers a longer analysis window. Moreover, those papers did not test for pretrends, which is important to avoid selection biases. As shown later, countries that reduce their tariffs do so after experiencing higher GDP growth as compared to countries that do not change them.

The paper has seven sections in addition to this introduction. In section 2, I provide a theoretical discussion to motivate the empirical investigation of heterogeneous effects of tariffs conditional on the economic structure and explain why I use the manufacturing share of exports as a proxy for the economic structure. In section 3, I present the data used and some descriptive statistics. In section 4, I present the baseline results, demonstrating heterogeneous effects of tariffs on growth depending

[3]Rodríguez (2007) has also argued that the results in Wacziarg and Welch (2008) are not robust to changes in these thresholds.

[4]According to Irwin (2019), this is the only contribution (before his review) to use tariff rates directly.

[5]Their estimates used GDP, not GDP per capita, as the dependent variable.

on the initial economic structure. In section 5, I present robustness checks to account for the endogeneity of tariff changes, the influence of other policies, relevant covariates and trends, and other possibly relevant heterogeneous effects in the impact of tariffs on growth. In section 6, I perform additional robustness checks and particularly address some of the problems highlighted by the recent difference-in-differences literature. In section 7, I show the analysis on potential mechanisms underpinning the heterogeneous effects. Finally, in section 8, I conclude the paper.

2 Theory: Economic structure matters

Traditional trade theory emphasizes the gains from trade in a static framework. As countries specialize in sectors in which they are relatively more productive due either to natural/technological or endowment differences, following their comparative advantage, production expands, and through trade, countries can secure welfare gains. This strand of the literature deals in a sense with interindustry trade. New trade theory, which emerged to explain patterns of trade between developed economies or intraindustry trade, emphasizes scale economies as the source of gains from trade. As countries specialize in some varieties, increasing production in certain lines while allowing production of other lines to disappear within their borders, welfare ends up increasing due to the greater number of varieties that consumers can access and to improvements in productivity. Thus, there are good theoretical reasons to expect positive static gains from trade (Feenstra, 2015).

Although informative on the role of trade in production, the previous theories do not deliver insights about growth. These traditional theories are static in nature, and after specialization from trade has occurred, economies do not grow in equilibrium. In a sense, the theories point to positive growth in the transition to the trade equilibrium, assumed normally to be instantaneous, whereupon, growth becomes zero. Thus, these theories abstract from long-run growth and are not informative about the engines of growth, which is a crucial question for the inquiry.

Analyzing trade (policy) and its impact on growth therefore implies dealing with conceptualizations of growth and its engines. The literature on trade and growth has dealt fundamentally with two types (or causes) of growth: learning-by-doing and innovation. Learning-by-doing refers to increases in productivity due to higher output such that as time progresses, producers become more productive simply due to being engaged in production. Analyses of trade and learning-by-doing go back to important contributions in the 1980s like those by Krugman (1981, 1987) and A. K. Dutt (1986), among others. Later contributions in this tradition are those from Young (1991), Skott and Larudee (1998) and the more recent paper by Greenwald and Stiglitz (2006). With the emergence of endogenous growth theory, the analysis of trade and its impact on growth (innovation) gained new traction, especially due to the seminal work by Grossman and Helpman (1991)[6]. In endogenous growth theory, innovation emerges from R&D fueled by private profitability. In other words, private producers invest in producing new varieties of intermediate goods, better quality inputs or better production methods, with the aim of capturing higher profits.

Although the specifics of theory in the two traditions may differ, the general message that the effects of trade policy vary with the economic structure emerges from both strands. When sectors differ qualitatively in terms of technological progress, the trade and comparative advantage literature tends toward the same conclusion. The main message is that economies that end up specialized in less (more) dynamic economic activities due to trade liberalization will experience a reduction (increase) in growth rates[7]. In other words, countries that end up specialized in high-tech or manufacturing sectors will see improvements to their growth rates, while others will see a fall in growth. According to Young (1991), "examining the interaction of an LDC [less developed country] and a DC [developed country], the latter distinguished by a higher initial level of knowledge, I find that under free trade the LDC (DC) experiences rates of technical progress and GDP growth less than or equal (greater than or equal) to those enjoyed under autarky" (p. 369). By affecting, or in a sense obstructing, the comparative advantage specialization pattern, trade policy changes therefore can affect growth outcomes, as argued by Greenwald and Stiglitz (2006).

There is a crucial assumption in this strand of the theoretical literature that drives the results, and differs to those of contributions delivering different conclusions. The models surveyed share the idea that the economy is characterized by qualitatively different economic sectors (i.e., less vs. more dynamic). Modern general equilibrium analyses of comparative advantage and growth, based mostly on the trade theory emanating from the seminal works of Melitz (2003) and Eaton and Kortum (2002), show that if sectors are qualitatively equal, trade liberalization might lead to higher economic growth for all countries engaged. However, the empirical evidence seems to back up the idea that economic sectors are different. Important work by Rodrik (2013) showed that manufacturing, unlike other sectors, experiences unconditional convergence such that manufacturing sectors starting at lower productivity levels experience higher growth than others starting at higher levels. The author interpreted this evidence as suggesting that technological diffusion might be a property of particular relevance for the manufacturing sector, in contrast to other sectors[8].

A recent article by Atkin, Costinot, and Fukui (2021) provides both theory and

[6]The authors provided an in-depth theoretical analysis of the interactions between growth coming from innovation and trade in several different settings. Readers are encouraged to review this important work.

[7]Highly dynamic activities, in comparison to less dynamic, refer to sectors characterized by greater learning-by-doing or innovative potential than other sectors.

[8]This can be interpreted as evidence supporting the models by Stiglitz (2015) and Hoyos (2021) where international knowledge spillovers exist, but they only materialize through the more dynamic sector, so that comparative advantage specialization patterns lead once again to uneven growth.

evidence to support the idea that qualitative sectoral differences do exist and that trade can therefore lead to widespread dynamic welfare losses. The authors construct a model of trade and development where sectors differ in their economic complexity and that complexity exerts positive effects on the growth of the countries producing them. The authors demonstrate theoretically that if international competition is tougher in less (more) complex goods, then trade leads to dynamic welfare gains (losses). They first provide causal evidence that growth (and thus welfare) of a country is indeed positively affected by the average level of complexity of the goods the country is specialized in. Then, they show evidence that suggests competition is tougher in more complex goods. "Through the lens of our model, rather than pushing countries up the development ladder, opening up to international trade tends to hold many of them back" (Atkin et al., 2021, p. 42).

In synthesis, the initial economic structure, as reflecting initial comparative advantage in more or less dynamic sectors, determines the direction of the impact tariffs have on growth. Countries with a comparative advantage in less (more) dynamic sectors that open to trade may experience GDP and welfare losses (gains).

How to account empirically for initial economic structures? For simplicity and ease of interpretation, I use the initial share of manufacturing exports as the variable capturing initial economic structure. In other words, I assume that countries with high manufacturing exports have a comparative advantage in more dynamic or complex goods and those with low exports have a comparative advantage in less dynamic sectors. This implies that manufacturing is understood to be in broad terms the relatively more complex sector and that the share of manufacturing exports expresses well the comparative advantage of countries in that sector. The first condition seems to be backed by the evidence provided by (Rodrik, 2013), as already mentioned, and the second is supported by the data used here[9].

3 Data and descriptive statistics

I put together a panel of 161 countries covering 1960 to 2019. For the outcome variable in the growth regressions, I use the data of GDP per capita in constant national prices in 2011 dollars taken from the Penn World Table (PWT) 10.0. The tariffs data are taken from Furceri et al. (2022) and represent the average tariff rate applied to imports in each country on a given year, covering from 1960 to 2014. The coverage of tariffs data is lower than that of the GDP data, so I end up using approximately 4,500 observations in each regression.

[9]The correlation between the share of manufacturing exports and revealed comparative advantage in manufacturing is 0.98. The results obtained by using revealed comparative advantage in manufacturing, Figure A6, are virtually the same as the baseline results using the shares of exports.

Table 1: Summary statistics

Variables	Observ.	Mean	St.Dev.	Observ.	Mean	St.Dev.
	1960-1989			1990-2019		
GDP per capita	4,274	11,089.6	18,480.13	5,460	17,517.09	19,344.82
Tariff	1,675	17.73	20.27	3,367	8.01	7.06
Manufacturing share of exports	4,522	33.72	28.89	6,122	52.35	30.32
Trade share of GDP	2,999	62.68	46.19	5,173	86.69	56.36
Nontariff barriers	3,048	12.97	4.50	4,587	9.46	4.82
Polity score (institutional quality)	3,811	-1.58	7.41	4,504	3.25	6.57
Chinn–Ito Index (capital account openness)	2,465	0.35	0.32	4,945	0.50	0.36
Human capital index	3,644	1.76	0.60	4,350	2.40	0.69
Investment as a share of GDP	2,901	22.34	9.54	4,921	23.55	8.54
Gini index	1,553	34.31	10.47	2,826	38.29	9.18
Terms of trade (net export price index)	4,065	111.75	74.24	5,267	74.61	26.43
Real effective exchange rate	2,910	151.04	133.60	3,754	100.99	37.34
Growth forecast	0	-	-	5,353	3.25	5.96

Note: See the main text for a description of the variables. I present the descriptive statistics for two equal-sized periods of time for simplicity, one capturing years 1960-1989 and the second capturing 1990-2019.

Finally, importantly for the discussion of heterogeneous effects, I gather information on shares of manufacturing exports from COMTRADE data, as cleaned and made more reliable by the Growth Lab at Harvard University. I calculate the share as follows. First, I exclude services exports and exports not elsewhere classified, ending up with a measure of total goods exports. And then, I get the shares by excluding the following three broad categories of goods from the Standard International Trade Classification (SITC): (i) food and live animals chiefly for food; (ii) crude materials, inedible, except fuels; and (iii) mineral fuels, lubricants and related materials[10]. The data cover most countries in the sample and run from 1962 to 2019.

I also gather information on important covariates to control for in the regressions. The data has country–year information on the trade share on GDP, so-called trade openness, and investment as a share of GDP, taken from World Development Indicators (WDI) from the World Bank; the economic growth forecast, the net exports terms of trade, and the real effective exchange rate, all taken from the IMF; the Gini index, taken from the Standardized World Income Inequality Database of Solt (2020); institutional quality, as measured by the Polity score; the Chinn–Ito index for capital account openness (Chinn & Ito, 2006); the human capital index in PWT, which improves on the traditional measure of years of schooling from Barro and Lee (2013) and has greater coverage; and a count variable that measures nontariff barriers, recently published by Estefania-Flores, Furceri, Hannan, Ostry, and Rose (2022). In a robustness exercise, I control for regional trends based on the World Bank classification: Africa, East Asia and the Pacific, Eastern Europe and Central Asia, Western Europe and other developed countries, Latin America and the Caribbean, the Middle East and the North of Africa, and South Asia.

Table 1 presents descriptive statistics of the variables that I use in the analysis. I present the summary dividing the data in two periods, 1960-1989 and 1990-2019, each capturing the same number of years but reflecting two different periods in terms of tariff levels. In the first period, tariffs are higher and more dispersed, with a mean of 18.43 percent and a standard deviation of 20.92, while in the second, the mean is 8.24 percent and the standard deviation 7.56. This grouping in two periods is made only to illustrate that the world has been moving towards a more liberal trade regime, as can also be confirmed with the fall in the measure of nontariff barriers. The periods also reveal that the information on tariffs in the first period is scarcer than in the more recent one. Moreover, consistent with a more liberal regime, trade as a share of GDP has increased on average. Likewise, as trade has liberalized, capital accounts have also moved towards liberalization, as captured by the Chinn–Ito index.

[10]The United Nations follows a different classification system for goods, so the share of manufacturing exports might be slightly different. They follow the classification proposed by Lall (2000). This classification identifies the nature of goods at the three-digit level of aggregation in the SITC instead of using broad categories. Nonetheless, the results are robust to this different classification, as shown in Appendix A, Figure A5.

GDP per capita, institutional quality, and human capital improved from the first to the second period. Inequality, as documented extensively elsewhere, increased. The growth forecast is available only from 1990 onward.

4 Baseline results

In this section, I establish the baseline results based on local projections difference-in-differences (LP-DiD). I develop this section in three parts. First, I explain LP-DiD and its advantages and limitations. Second, I use LP-DiD to observe and then model pretrends to avoid clear violations of the parallel trends assumption. To this end, I abstract from heterogeneity and focus only on tariff changes in general. Third, I present the baseline results, according to which decreases in tariffs lead to reductions (increases) in GDP for nonmanufacturer (manufacturer) countries.

Local projections difference-in-differences (LP-DiD)

The LP method, originally proposed by Jordà (2005), has become a well-known and widely used approach in macroeconometrics. Recent work by Dube et al. (2022) has advanced an estimator based on the seminal LP contribution but also going beyond by including a discussion of recent challenges of difference-in-differences literature, the LP-DiD estimator. LP-DiD is specifically useful for the question on the tariffs–growth nexus as it allows to estimate dynamic effects of tariffs and also capture pretrends by flexibly controlling on observables to avoid potential biases coming from violations of the parallel trends assumption. I explain these advantages in more detail below.

First, LP-DiD, although this applies for LP in general, provides a simpler form of estimating dynamic effects that arguably performs better in terms of biases as compared to VARs. LP capture the effect of a shock or a treatment on the outcome variable by estimating a regression for each horizon studied, while VARs estimate only one regression with the lags of the outcome variable as regressors, so that their coefficients capture a parametric dynamic relation. According to Ramey (2016) and Nakamura and Steinsson (2018), the advantage of LP over VARs is precisely that the former does not assume any structure for the data-generating process (semiparametric estimates), particularly regarding the dynamic relation between the treatment and the outcome. In the words of D. Li, Plagborg-Møller, and Wolf (2021), "empirically relevant DGPs are unlikely to admit finite-order VAR representations, so mis-specification of VAR estimators is a valid concern" (p. 31). These authors demonstrate that LP leads to lower biases but higher variance than VARs[11].

[11]This feature is actually reassuring with respect to the validity of the results in the paper, as they are significant even under this problem of inefficiency of LP.

This ability to model and capture dynamic effects delivers advantages with respect to previous estimates in the empirical literature on the tariffs–growth nexus. The literature has usually captured only instantaneous effects (as in Wacziarg and Welch (2008)) or tried to capture dynamic effects by doing single-regression analysis on averages of GDP measures for long periods of time (i.e., between 12 to 28 years, in the case of Nunn and Trefler (2010), 15 years in the case of Estevadeordal and Taylor (2013), 10 years in the case of Yanikkaya (2003), and 5 years in DeJong and Ripoll (2006)). In the first case, capturing only instantaneous effects does not actually reflect the mechanisms derived from the reviewed theory on trade and growth, which points to a relocation of factors of production, innovation and diffusion, mechanisms that take time to emerge. The second operationalization, although supposedly capturing medium-term effects, does not in fact reflect dynamic relations and leads to regressions with small samples, ranging from 47 observations (Estevadeordal & Taylor, 2013) to a maximum of 260 (DeJong & Ripoll, 2006).

Second, LP-DiD allows to model pretrends and avoid biases coming from clear violations of the parallel trends assumption, as investigated and formalized by (Dube et al., 2022). Simple LP estimates allow to observe the trajectory of the outcome variable both after and before the treatment. In this setting, I observe GDP trends in countries that reduced tariffs in comparison to those of countries that did not. This pattern can be observed in Figure 1. The surge in GDP before tariff reductions constitutes a clear violation of the parallel trends assumption on which the difference-in-differences analysis is predicated. One of the main ideas behind LP-DiD is to use the flexible LP framework to model pretrends on observables, similar to what was done recently by Acemoglu et al. (2019). Particularly, the LP-DiD specification proposed by Dube et al. (2022) is modelling those pretrends through the inclusion of lags of first differences of the outcome variable (i.e., which in the case here refers to lags of growth rates). By doing this, they show that biases coming from pretrends can be effectively eliminated, so that in the case here I might be able to model the surge and eliminate the potential selection bias arising from it[12].

Pretrends to tariff changes

Are countries reducing tariffs on a different trajectory of GDP per capita than those not changing them? For now, I abstract from the heterogeneity in the tariffs–growth nexus linked to the economic structure and observe the trajectory of tariff changes in general. A LP equation to observe the evolution of (log) GDP per capita before and

[12] Another crucial component of the LP-DiD estimator is to use clean controls to address the challenges identified by recent difference-in-differences literature. I discuss and develop this further in section 6.

after a change in tariffs, based in Jordà (2005), is given by:

$$y_{c,t+h} - y_{c,t-1} = \beta_h \Delta TA_{c,t} + \alpha_t + \epsilon_{c,t} \tag{1}$$

where $y_{c,t+h}$ stands for (log) GDP per capita in country c in year $t+h$ and $\Delta TA_{c,t}$ refers to the change in the tariff level in year t with respect to year $t-1$, the variable of interest. In other words, this local projection equation basically regresses the cumulative change in (log) GDP per capita in year $t+h$ against the change in tariffs at time t. as Following Dube et al. (2022), I include only time fixed effects, as the equation is already in differences[13]. To observe both the trajectory of GDP per capita before and after the treatment, I estimate this regression equation separately for each $h = -15, -14, ..., -1, 0, 1, ..., 19, 20$. The cumulative change in GDP per capita in $t+h$ related to a one-percentage-point increase in tariffs is captured by β_h.

A couple of comments regarding the presentation of results are in order, as they will apply for all results presented in the paper unless otherwise specified. Instead of presenting results associated to an increase in one percentage point in tariffs, I present the results associated with a decrease in one-standard-deviation of the change in tariffs, $SD(\Delta TA)$, a decrease in 3.65 percentage points. For example, in terms of equation 1, instead of plotting β_h I show $(-1) * SD(\Delta TA) * \beta_h$. And I also do the same for the heterogeneous results later shown. I do this for two reasons. First, most of the changes in tariffs in the data are decreases, consistent with the general trend towards liberal trade regimes in the last thirty years. Second, as shown in the Appendix A, by separating the effects of both increases and decreases I only find significant effects for decreases of tariffs and not for increases. This means that the average effect of tariffs presented in the paper are driven mainly by decreases in tariffs. And finally, I present the results scaled to one-standard-deviation, so they have an order of magnitude related to the changes in tariffs observed in the data. The other important aspect of the results presented across the text is that I use two-way cluster robust standard errors, in the country and year dimensions, making the inference even more robust (Thompson, 2011; Cameron, Gelbach, & Miller, 2011).

The results associated to equation 1 are presented in Figure 1. As can be observed, countries reducing their tariffs are on different pretrends from those not changing them. In particular, the former countries display a surge in GDP before tariff reductions, unlike the latter. In other words, tariff changes are endogenous to the evolution of GDP, such that countries that decide to decrease tariffs do so after GDP has been on a relative increase. Failure to control for this surge constitutes a clear violation of the parallel trends assumption and may lead to biases in the treatment effect estimates. How to deal with this violation of the parallel trends assumption? As mentioned before, following the approach by Dube et al. (2022) I end up modelling pretrends through lags of growth rates (first differences) of GDP per capita (the

[13] I include country fixed effects later as a robustness check, and the heterogeneity holds.

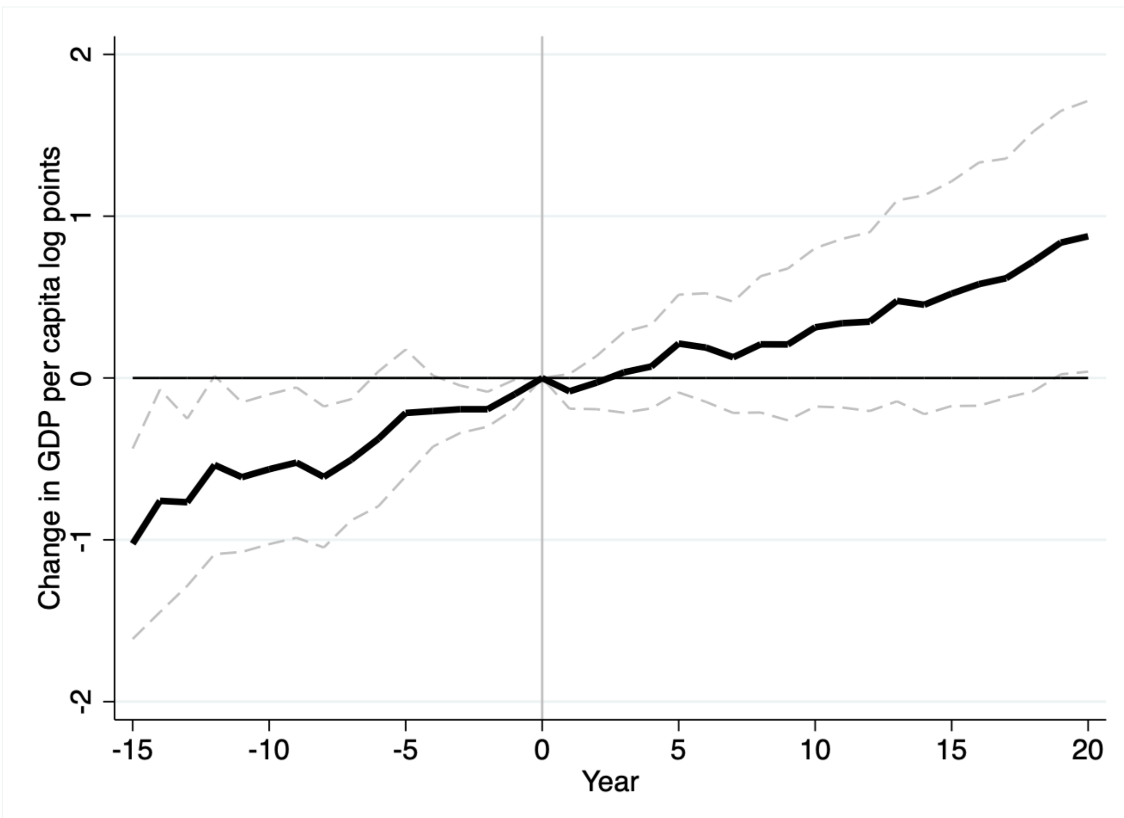
outcome variable).

Formally, the LP-DiD equation to control for pretrends is:

$$y_{c,t+h} - y_{c,t-1} = \beta_h \Delta TA_{c,t} + \sum_{j=1}^{1,2,4,8} \sigma_h^j g_{c,t-j} + \alpha_t + \epsilon_{c,t} \tag{2}$$

where, unlike in equation 1, I also include lags of the growth rate of GDP per capita to capture the surge in GDP preceding tariff reductions. The growth rate, $g_{c,t}$, is calculated simply as $y_{c,t} - y_{c,t-1}$, given that y already represents (log) GDP per capita. I use 1, 2, 4 or 8 lags of the growth of GDP per capita to test various alternatives for the elimination of the surge in GDP.

Figure 1: GDP per capita before and after a one-standard-deviation tariff reductions

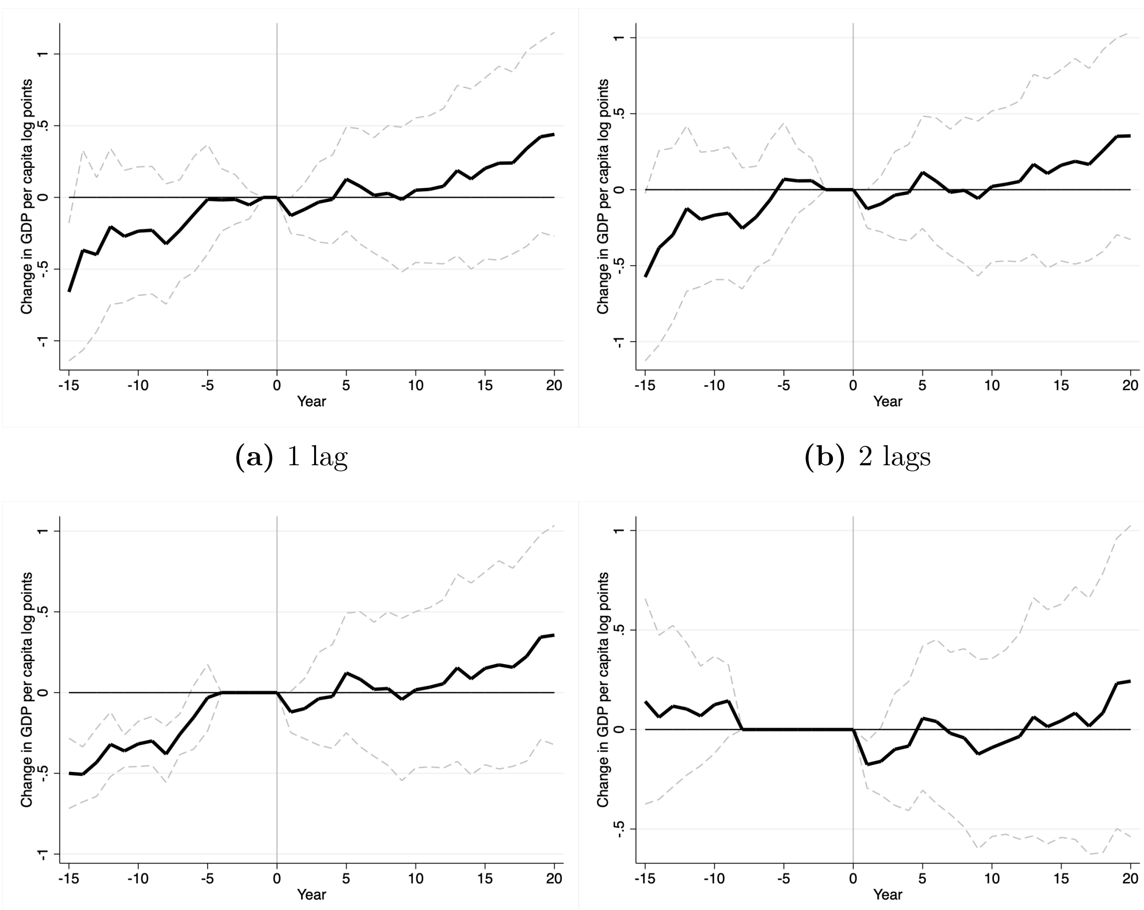


Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

The results of the estimates of equation 2 are presented in Figure 2. As can be seen, including lags as covariates helps dealing with the surge in GDP that precedes the decreases in tariffs. Only in the case with 8 lags am I able to obtain equal trajectories for countries reducing tariffs and countries not changing them. Therefore, from here onward, I add 8 lags of growth rates so that I can control effectively for the existence of pretrends that might bias the coefficients.

By comparing Figures 1 and 2, it can be seen that while under the former, with bias-prone estimates, GDP significantly increases 20 years after tariff reductions, in the latter, the effect is no longer significant. Controlling for lags is therefore crucial to avoid inference from biased coefficients. If the researcher were to stop at this point, tariff changes and growth would appear to be uncorrelated, very much in the spirit of Rodríguez and Rodrik (2001), but that result would mask important heterogeneity, as I show below.

Figure 2: Modeling the surge in GDP per capita through lags in growth rates



(a) 1 lag

(b) 2 lags

(c) 4 lags

(d) 8 lags

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Results

I now return to the main question of interest: do tariff changes have different effects on countries in relation to their economic structure? More precisely, is there evidence that trade liberalization may differently affect manufacturer and nonmanufacturer countries? In this subsection, I demonstrate that trade liberalization leads to lower (higher) growth for nonmanufacturer (manufacturer) countries.

To capture the heterogeneous effects of tariffs in relation to economic structures, I have to change the regression equation. The new LP-DiD equation is as follows:

$$y_{c,t+h} - y_{c,t-1} = \beta_h \Delta TA_{c,t} + \theta_h int_{c,t} + \phi_h m_{c,t} + \sum_{j=1}^{8} \sigma_h^j g_{c,t-j} + \alpha_t + \epsilon_{c,t} \tag{3}$$

where $m_{c,t}$ represents the initial share of manufacturing exports and $int_{c,t}$ represents the interaction (multiplication) between changes in tariffs $\Delta TA_{c,t}$ and the initial share of manufacturing exports $m_{c,t}$. The initial share of manufacturing exports, $m_{c,t}$, is calculated as the average of this variable in the five years before the shock, to avoid contemporaneous endogeneity that may run from GDP to manufacturing exports. With this specification, the impact of tariff changes on growth varies with the initial level of the manufacturing share of exports. For example, if I want to calculate the cumulative change in GDP per capita at time $t + h$ in relation to a one-standard-deviation tariff reduction for a country with an initial manufacturing share of exports of 29 percent, I estimate it by calculating $(-1) * SD(\Delta TA) * (\beta_h + 29 * \theta_h)$.

To show the significance of the heterogeneous effects of tariffs on growth, I calculate the estimates for the 10th and the 90th percentiles of the share of manufacturing exports. In other words, I present the estimated impact on GDP per capita of a one-standard-deviation decrease in tariffs for a country with an initial share of manufacturing exports of 3.96 percent and a country with an initial share of 88.26 percent[14]. From now on, I refer to the former estimates as those of nonmanufacturer countries and to the latter as the estimates of manufacturer countries[15].

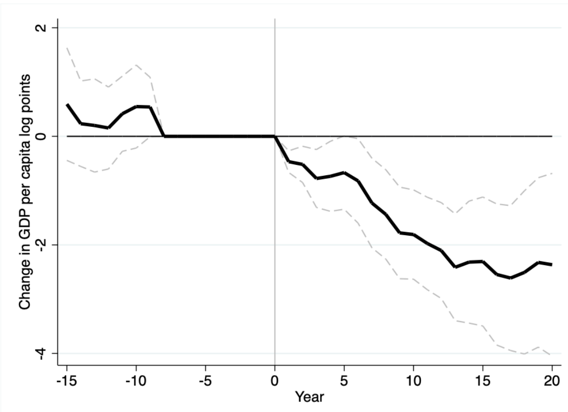
Figure 3 reveals the results associated to equation 3, capturing Average effects of tariff reductions for manufacturer and nonmanufacturer countries. The crucial result is that there is a significant heterogeneous effect of tariffs on GDP per capita associated with the initial share of manufacturing exports. For nonmanufacturer countries, the effect is negative, meaning that the liberalization of trade policy has affected them negatively. For manufacturer countries, on the other hand, liberalizing

[14] The reader may recall that Appendix A reveals separate results for tariff increases and tariff reductions, only the latter being significant.

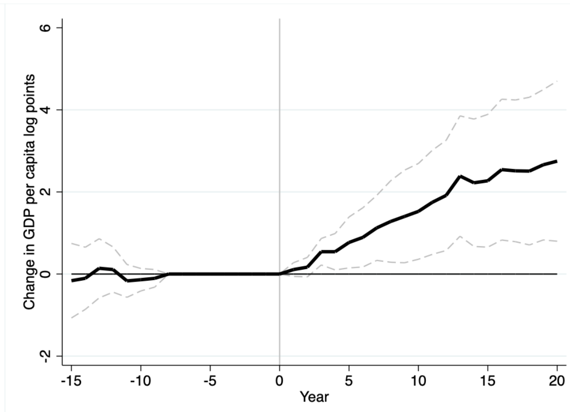
[15] In Appendix A, I show that for only two deciles—the 50th and 60th—I obtain results with no significant effect. The effect is thus stronger for nonmanufacturer countries.

their trade regimes have affected them positively. Both subfigures in 3 also reveal that the pretrends are not different, which is reassuring on the appropriateness of using the LP-DiD estimator with 8 lags of growth rates to avoid potential selection biases.

Figure 3: Average heterogeneous effects of tariff reductions on GDP per capita



(a) For nonmanufacturer countries



(b) For manufacturer countries

Note: The estimates presented are the predicted values for the 10th and 90th percentiles of the distribution of the share of manufacturing exports. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

The heterogeneity of the tariffs–growth nexus by economic structure is both statistically and economically meaningful. For nonmanufacturer countries, a one-standard-deviation reduction in tariffs leads to an average decrease of 2.31 percent in GDP per capita after 15 years. For manufacturer countries, on the other, a one-standard-deviation decrease in tariffs leads to an average increase in GDP after 15 years of approximately 2.32 percent. The effects are also persistent even twenty years after tariff reductions. According to Estevadeordal and Taylor (2013), the median reduction in tariffs following the Washington Consensus of the 1990s was by 25 percentage points. Assuming a constant marginal effect of tariffs, a 25-percentage-point reduction in tariffs would imply a fall in GDP per capita after 20 years of about 15.8 percent for nonmanufacturer countries. To illustrate how important these magnitudes are, the Norwegian economy, grew by 15.9 percent between 2000 and 2019, virtually the same magnitude than the 20-year impact that I obtain for nonmanufacturer countries.

Throughout the rest of the paper, I use the specification of heterogeneous effects of tariffs on growth from equation 3. However, this specification is premised on two important assumptions that need to be examined. First, the baseline specification assumes that the impact of tariffs is a linear function of the share of manufacturing exports, but this is not guaranteed a priori. To test for a nonlinear relationship, I change the regression equation specified in 3 by introducing dummies for six quantiles of observations according to their initial share of manufacturing exports and the interactions between these dummies and the change in tariffs. In other words, I end up estimating the impact for six different subsamples of observations, without assuming that the impact of tariffs is linear with respect to the share of manufacturing exports. The new equation is as follows:

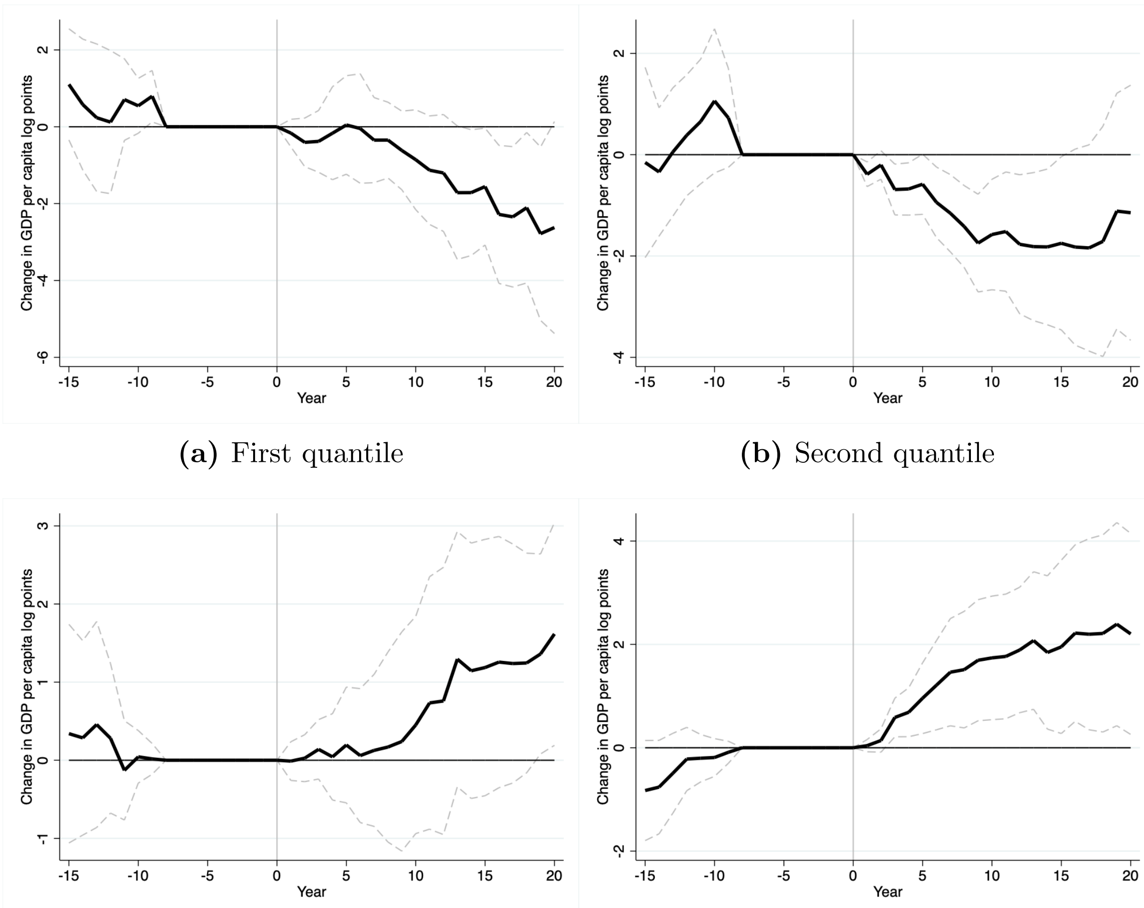
$$y_{c,t+h} - y_{c,t-1} = \beta_h \Delta TA_{c,t} + \sum_{k=1}^{6} \theta_h^k intd_{c,t}^k + \sum_{k=1}^{6} \phi_h^k md_{c,t}^k + \sum_{j=1}^{8} \sigma_h^j g_{c,t-j} + \alpha_t + \epsilon_{c,t} \quad (4)$$

where k now refers to quantiles of manufacturing exports, so that $k = 1$ refers to observations in the bottom 16.6 percent of that variable. Also, $md_{c,t}^k$ refers to the manufacturing dummy taking value 1 if the observation belongs to the quantile k or zero otherwise. Finally, $intd_{c,t}^k$ represents the interaction between $\Delta TA_{c,t}$ and the dummy just explained, $md_{c,t}^k$. Thus, to calculate the one-standard-deviation decrease impact for each of the six quantiles of the distribution of manufacturing exports, I estimate $(-1) * SD\,(\Delta TA) * \left(\beta_h + \theta_h^k\right)$.

The results associated to the bottom ($k = 1, 2$) and top ($k = 5, 6$) two quantiles of estimating equation 4 are shown in Figure 4. The estimates are more erratic and less precise than those of the preferred linear specification, as using subsamples reduce the statistical power of the estimates. For the first quantile of manufacturing exports, the impact on GDP per capita of reducing tariffs is negative in all the 20 years but one following a tariff reduction, although only statistically significant after 15 years. For the second quintile, tariff reductions lead to lower GDP per capita, with the impact being significant all 15 years after the decrease. For the fifth quantile, the relationship becomes positive and is significant only after 19 years of the decrease. For quantile number six, the estimates are positive and significant for all the period analyzed. Overall, the results with this specification are reassuring that there are indeed heterogeneous effects of tariffs on GDP per capita conditional on the initial share of manufacturing exports and that this relationship is not the outcome of the linearity assumption in the baseline results[16].

[16] I do not show the results for the third and fourth quantiles, to keep the presentation simple, but they are both close to zero, consistent with the heterogeneity story.

Figure 4: Average effects of tariff reductions on GDP per capita for quintiles of manufacturing exports



(a) First quantile

(b) Second quantile

(c) Fifth quantile

(d) Sixth quantile

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Second, in the baseline specification, I define the initial economic structure in a very specific way, namely, as the share of manufacturing exports in the five years before the decrease in tariffs, and following the broad export classification categories. Reassuringly, Appendix A reveals that the effect heterogeneity is robust to several alternative specifications of the initial economic structure of countries, including Lall's classification of exports, revealed comparative advantage on manufacturing and a few changes to the lagged five-year average.

I further show that the data used for growth figures do not affect the results. Throughout the paper, I focus on GDP per capita in national constant prices, taken from PWT. This is the series best suited for growth regressions according to Feenstra, Inklaar, and Timmer (2015). Nevertheless, in Appendix A, I also provide robustness checks showing that the heterogeneity is also significant when using GDP per capita in constant national prices from other sources (either the World Development Indicators or the Maddison Project), and GDP per capita in constant PPP terms (from PWT).

Finally, the results are also robust to consideration of outliers and leverage points. In Appendix A, I show that the results are robust to the use of Huber (1964) weights, G. Li (1985)'s robust regression improvement on Huber weights and also hold with regressions without leverage points, following the methods proposed by Belsley, Kuh, and Welsch (1980). The heterogeneity identified in the results is even stronger in most of these exercises.

5 Robustness

So far, I have shown that tariffs have different effects on GDP per capita for manufacturer and nonmanufacturer countries. I have also shown that the identifying assumption of parallel trends cannot be rejected, so the estimates may not have selection biases. However, the validity of these baseline results still depends critically on the nonexistence of time-varying economic and/or political factors that might drive both changes in tariffs and changes in GDP (i.e., omitted variable biases). In this subsection, I investigate the validity of the baseline results to consideration of important time-varying covariates and trends.

I perform this robustness investigation in five steps. First, I show robustness checks related to variables identified as important determinants of changes in tariffs in the endogenous trade policy literature. Second, I show robustness checks with respect to other policy changes that might be associated to changes in tariffs. Third, I show the robustness of the results to consideration of economic phenomena that have been found to be important for explaining growth. For these first three steps of the robustness exercises, I simply add four lags of changes in the covariates as done by (Acemoglu et al., 2019)[17]. These specifications have to be interpreted with caution, since changes in these covariates may be endogenous to tariff changes, although using lags may relax this concern[18]. Fourth, I investigate the robustness of the effect heterogeneity to other possible heterogeneous effects between tariffs and growth. Finally, I show the results of robustness checks considering different trends in GDP among groups of countries that might drive the results. In synthesis, this section confirms the validity of the baseline results after considering important covariates and thus confirms the existence of heterogeneity in the effects of tariffs on GDP arising from differences in initial economic structures. Instead of showing LP-DiD graphs for each robustness exercise, I summarize the results with Figure 5, which shows the average

[17] I use a different specification only for the growth forecast variable, as explained below.

[18] I also run the regressions with contemporaneous changes in covariates instead of lags. The results, summarized in Figure B18, are qualitatively the same: heterogeneity still holds.

effect for both manufacturer and nonmanufacturer countries between 13 and 17 years after tariff reductions. Individual LP-DiD graphs for each robustness exercise can nonetheless be found in Appendix B.

Endogenous tariffs

Early in the 1980s, Findlay and Wellisz (1982) argued that trade policy in general and tariffs in particular are in practice set in response to political economy factors, particularly the active efforts or lobbying of interest groups. Important theoretical work by Mayer (1984) and Grossman and Helpman (1994) have provided the base for endogenous trade policy to become a research area. These theoretical works also triggered empirical work . The first factor identified to explain trade policy is GDP growth. Bohara and Kaempfer (1991) present evidence from the US that GDP growth leads to changes in tariffs—particularly, that high-growth export industries may lobby for lower tariffs to avoid future retaliatory trade policies abroad. The second factor identified is distribution itself. P. Dutt and Mitra (2002) provide evidence that higher inequality leads to higher trade protection in capital-abundant countries (arguably manufacturer countries) while lower protection in capital-scarce countries (arguably nonmanufacturer countries). And finally, Trefler (1993) shows that tariffs are particularly explained by import penetration. With data from US industries, the author provided empirical evidence that import penetration leads to lobbying and higher protection.

Given the determination of tariffs by growth, distribution itself and import penetration, the estimates might be biased if they fail to account for these potential channels of endogeneity. I explain below how I deal with these three factors.

Although the baseline framework already incorporates lags in growth rates, it might be that expectations on contemporaneous growth are what really drives tariff changes. To control for this possibility, I use growth forecast data from the World Economic Outlook of the IMF. Specifically, I calculate the change in the growth forecast for year t made in $t-1$ with respect to the growth forecast made in $t-2$. This change in the forecast captures the change in expected contemporaneous growth and thus may reflect precisely what might drive changes in tariffs from the GDP side, as suggested by the endogenous trade policy literature. Robustness exercise number 1 in Figure 5 summarizes the results of including the change in growth forecasts in the baseline specification. As can be seen, the effect heterogeneity survives this first exercise, with the average impact on GDP 13-17 years after a tariff reduction still negative for nonmanufacturer countries but positive for manufacturer countries.

An important thing to note here is that the information on growth forecasts is available only from 1990. In other words, results controlling for changes in the growth forecast only use data from 1990 onward. This is also reassuring of the validity of the results, as the availability of data by country becomes less biased towards developed countries. In short, the effect of tariff reductions that I estimate is fundamentally explained by the liberalization period of the 1990s, the so-called Great Liberalization (Estevadeordal & Taylor, 2013), associated with the Washington Consensus. In other words, the trade liberalization of the 1990s was beneficial for manufacturer countries but detrimental for nonmanufacturer countries.

To control for the potential endogeneity of tariff changes arising from distribution itself, I use the Gini coefficient from the Standardized World Income Inequality Database (Solt, 2020). In the regressions, I introduce four lags of the first difference in the Gini coefficient as covariates to the framework specified in equation 3. The results are presented in robustness exercise number 2 in Figure 5. The average effects 13-17 years after the decrease in tariffs are still significant and of different signs for manufacturer and nonmanufacturer countries.

Finally, to control for endogeneity that may arise from import penetration, I include four lags of the change in the share of imports in GDP from the World Bank. The results are presented in robustness exercise number 3 in Figure 5. The identified heterogeneity remains, with the effect of tariffs on nonmanufacturer countries still different from that on manufacturer countries. A very interesting result, not shown in the figure, is that the coefficients of the changes in the share of imports in GDP are positive and significant across the whole period considered. Importing more is associated with higher growth, but this does not mean that lower tariffs are good, as reductions are still associated with lower GDP for nonmanufacturer countries. This result is actually in line with the finding by Yanikkaya (2003) where both (higher) tariffs and trade as a share of GDP are positively correlated with growth.

Other policies

Tariff changes are usually decided in settings where countries are also changing other types of policies. The trade liberalization of the 1990s, for instance, was part of a broad set of market reforms aimed at liberalizing economies generally—an agenda known as the Washington Consensus (Williamson, 1990). Thus, the baseline estimates can potentially be driven by other policy changes, and checking the robustness to those changes is necessary.

First, I consider nontariff barriers, another important component of the trade policy regime. Estefania-Flores et al. (2022) recently provided the literature with a new measure of trade restrictions in government policy, which specifically accounts for nontariff barriers[19]. The authors showed that this new measure is correlated with

[19]The measure is a count variable made up of dummies for subcategories of trade policy, and although it does not capture how restrictive policies are in themselves (e.g., import tariffs are captured with a dummy, ignoring the tariff level), it does provide a novel measure of how many restrictive trade

the tariff level, so it becomes necessary to check that the results are not driven by it. I do this by adding four lags of the change in the count of nontariff barriers to the baseline regression. The results are presented in robustness exercise number 4 in Figure 5. The heterogeneity identified in the results remains similar to that in the baseline. Changes in nontariff barriers have no significant effect on GDP in the whole period studied[20].

The second policy change that I test robustness for is capital account openness. Usually, trade liberalization occurs alongside capital account liberalization. Therefore, the first robustness check here is the inclusion of four lags of the change in the Chinn–Ito capital account openness indicator as covariates (Chinn & Ito, 2006). The results are presented in robustness exercise number 5 in Figure 5. Reassuringly, the results again point to heterogeneous effects of tariffs for manufacturer and nonmanufacturer countries, with a negative and significant effect of increasing tariffs on the former and a positive and significant effect on the latter.

Third, I test the robustness of the results to changes in institutional quality. As shown by Acemoglu et al. (2019), democratization leads to higher GDP. Thus, as changes in institutions might drive GDP and I cannot a priori discard that such changes might also be linked to changes in the tariffs regime, it is necessary to control for them. To this end, I use the Polity V index for institutional quality to test for this possibility. Specifically, I include as covariates four lags of the first difference in the Polity V index in the baseline regression as specified in equation 3. The results are presented in robustness exercise number 6 in Figure 5. Again, the heterogeneity in the results still holds.

Relevant variables that explain growth

Another threat to the validity of the baseline results comes from relevant covariates shown to affect GDP that might also be correlated with tariff changes. I include each of these covariates in turn to provide reassurance on the validity of the baseline results.

First, I test for the possibility that the results might be affected by changes in human capital. For this, I use the human capital index available in PWT. I include as covariates four lags of the first difference of this index. The results are presented in robustness exercise number 7 in Figure 5. Changes in human capital do not drive

policies a country has in each year. For the exercise, I use the variable that counts only nontariff barriers, excluding the dummy on tariffs, as they are already captured in the regressions.

[20]This result contrasts with that presented by Estefania-Flores et al. (2022), where changes in trade restrictions in general (including the dummy on tariffs) were found to relate to a fall in GDP. I do replicate that result when controlling for the contemporaneous change in nontariff barriers instead of the four lags that I originally use. The heterogeneous effects identified in the results still hold in this alternative specification, as shown in exercise 4 in B18.

the results, such that the heterogeneity of the effect of tariffs in relation to the initial economic structure remains significant.

Second, I test the robustness of the results to changes in population size. To do so, I include four lags of the first difference in population as covariates in the baseline regression. The results are presented in robustness exercise number 8 in Figure 5. The heterogeneous effects of tariffs on GDP conditional on the initial economic structure remain similar to those found in the baseline.

Third, I test the robustness of the results to changes in trade as a share of GDP, so-called trade openness. To do so, I include four lags of the change in trade openness from the WDI as covariates in the baseline regression. Results are presented in robustness exercise number 9 in Figure 5. The heterogeneous effects of tariffs on GDP conditional on the initial economic structure once again remain significant.

Additionally, changes in trade as a share of GDP are positively associated with GDP across the whole period studied, consistent with the finding regarding imports. Although not shown here, this result implies that trading is important for GDP growth even though the impact of tariffs remains heterogeneous and significant. In other words, both lower trading and lower tariffs lead to lower GDP growth for non-manufacturer countries. Lower tariffs may lead to higher imports and arguably higher trade. This might mean that the negative impact of reducing tariffs for nonmanufacturer countries might derive from a mechanism other than trade volume.

Fourth, I consider changes in capital accumulation, usually the short-run driver of growth. According to standard trade theory, countries with less abundant capital might choose to protect capital-intensive sectors such that changes in investment levels might provide reasons to change tariffs, thus biasing the estimates. To control for this possibility, I add four lags of the first difference of the investment share of GDP to the baseline specification in equation 3. The results are presented in robustness exercise number 10 in Figure 5. The heterogeneous effects remain significant.

Fifth, I test the results to changes in the real exchange rate. It has been shown that exchange rate undervaluation leads to higher growth (Rodrik, 2008). Changes in tariffs might be related to changes in real exchange rates such that the baseline estimates might be biased if I fail to control for such changes. Thus, I use four lags of the first difference of real exchange rates, taken from the Information Notice System of the IMF. The results are presented in robustness exercise number 11 in Figure 5. The identified heterogeneity is still significant.

Finally, I test the robustness of the results to changes in the terms of trade. It can bee thought that the relation between tariffs and terms of trade runs only from the former to the latter, but I cannot discard a priori that changes in the terms of trade lead to changes in tariffs, biasing the baseline results. Thus, I include four lags of the first difference in terms of trade as covariates in the baseline specification. The results are presented in robustness exercise number 12 in Figure 5. The heterogeneity is still significant, the effect of reducing tariffs still being negative (positive) for nonmanufacturer (manufacturer) countries.

Other heterogeneous effects

The main point of this paper is that there are heterogeneous effects of tariffs on GDP in relation to the initial economic structure. Nevertheless, there might be other relevant heterogeneities at play in the effects of tariffs that might drive the results, making the estimates invalid. Two heterogeneous effects might be important. First, although I interpret the theoretical literature mainly pointing to deeper economic determinants as the source of effect heterogeneity —namely, countries' comparative advantage at the moment of trade opening— some works talk in general terms about distance to the frontier (see Acemoglu, Aghion, and Zilibotti (2006) for an example). Thus, the idea that this effect heterogeneity is more precisely given by different development statuses cannot a priori be rejected. Second, according to one of the models developed by Lucas (1988), uneven development might be the outcome of free trade if economic sectors differ in terms of their potential for human capital accumulation. In other words, human capital, rather than the economic structure, might be an important source of heterogeneous effects of tariffs.

I first test the robustness of the results to the inclusion of an interaction between the change in tariffs and initial GDP per capita. To do so, I include in the regression the average GDP per capita for the five years before the change in tariffs and the multiplication of this term with the change in tariffs as covariates. The results are presented in robustness exercise number 13 in Figure 5, where I assume the median level of income to calculate the predicted values. The heterogeneity in relation to the initial economic structure still holds.

As mentioned, I also test the robustness of the results to a possible heterogeneous effect based on human capital accumulation. I introduce this possible source of heterogeneity in the same way that I did with the one coming from income. I include the average value of human capital in the five years prior to the change in tariffs and its multiplication with the change in tariffs in the regression. The results are presented in robustness exercise number 14 in Figure 5, where I assume the median level of human capital to calculate the predicted values. The effect heterogeneity still holds.

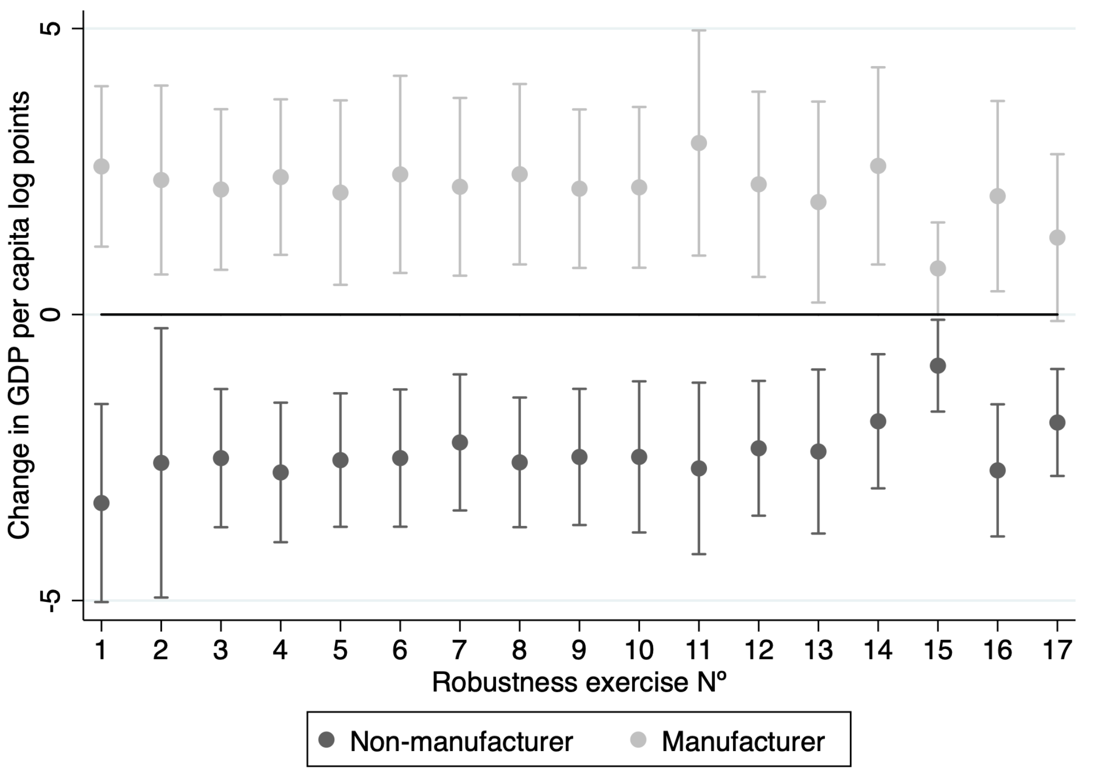
Interestingly, although not shown here, I also find that the interactions between human capital and changes in tariffs are negative and significant for most of the years studied. In other words, for countries with low levels of human capital, tariff reductions may lead to lower growth, while countries with high levels of human capital will gain in GDP terms from an tariff reductions. Although not the focus of the paper, Lucas (1988)'s hypothesis receives support from the evidence found here.

Different trends

Up to this point, the most important threats to the validity of the finding of heterogeneous effects could come from countries (and specific groups of them) with either different time-invariant average growth rates or different trends in GDP. First, I test the robustness of the results to the inclusion of country fixed effects. Second, I add specific time trends for countries in different income groups. Third, I control for trends of different regions of countries. Reassuringly, the effect heterogeneity is robust to all of these checks.

Although the LP-DiD specification is already in differences, I include country fixed effects as a robustness check. This robustness exercise is demanding, as it might capture part of the effect of interest. The results are presented in robustness exercise number 15 in Figure 5. The effects are smaller but still significant 13-17 years after tariff changes.

Figure 5: Robustness checks: average effect between 13-17 years after tariff reductions



Note: The estimates presented are the predicted values for the 10th and 90th percentiles of the distribution of initial manufacturing exports. The coefficients display the average of the average effect for each year between 13 and 17 years after tariff reductions. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Exercise 1 is the outcome of estimating equation 3 with the change in the growth forecast as a covariate. Exercise 2 is the outcome of estimating equation 3 with four lags of the change in the Gini coefficient. Exercise 3 is the outcome of estimating equation 3 with four lags of the change in import penetration. Exercise 4 is the outcome of estimating equation 3 with four lags of the change in nontariff barriers. Exercise 5 is the outcome of estimating equation 3 with four lags of the change in capital account openness. Exercise 6 is the outcome of estimating equation 3 with four lags of the change in Polity. Exercise 7 is the outcome of estimating equation 3 with four lags of the change in human capital. Exercise 8 is the outcome of estimating equation 3 with four lags of the change in the population size. Exercise 9 is the outcome of estimating equation 3 with four lags of the change in trade openness. Exercise 10 is the outcome of estimating equation 3 with four lags of the change in investment. Exercise 11 is the outcome of estimating equation 3 with four lags of the change in the real exchange rate. Exercise 12 is the outcome of estimating equation 3 with four lags of the change in the terms of trade. Exercise 13 is the outcome of estimating equation 3 with heterogeneous effects from income. Exercise 14 is the outcome of estimating equation 3 with heterogeneous effects from human capital. Exercise 15 is the outcome of estimating equation 3 with country fixed effects. Exercise 16 is the outcome of estimating equation 3 with different trends for country groups by income. Exercise 17 is the outcome of estimating equation 3 with different trends for country regions.

I also control for specific time trends for countries in different income groups. Using GDP per capita in 1960 from the Maddison Project, to maximize the number of countries, I include time trends for each income quintile. The results are presented in robustness exercise number 16 in Figure 5. The effect heterogeneity holds.

Another possible driver of the results could be specific patterns in certain regions that lead to a correlation between tariff changes and GDP, which would bias the baseline results. Using the 7 regions from the World Bank, as specified by Acemoglu et al. (2019), I introduce time trends for each region. The results are presented in robustness exercise number 17 in Figure 5. As in the previous case, the heterogeneity in the results holds, but the impact is significant only for nonmanufacturer countries.

Overall, the results in Figure 5 are reassuring that there is significant heterogeneity in the effect of tariffs on GDP per capita depending on the initial economic structure. Reducing tariffs has been bad for growth in nonmanufacturer countries but good in manufacturer countries. Although claiming causality is always difficult, I think these estimates are suggestive of a causal relationship. It is important to clearly establish the assumption that allows me to suggest a causal effect. Conditional on the inclusion of lags of growth rates and consideration of important covariates, changes in tariffs are assumed as good as random. Although there might be other phenomena that could drive both tariff changes and GDP per capita changes, the robustness exercises that further relax this assumption suggest that this is not likely the case[21].

[21] In Appendix B, I also show results of the estimates including all control variables at the same time. Although this exercise is extremely demanding, and I lose statistical power, the direction of the heterogeneous effects still holds and with statistical significance around 13 years after tariff changes. Overall, this reassures that the heterogeneity is not being driven by correlations between covariates, which were not captured when controlling for each covariate in turn.

6 Additional robustness

The empirical analysis so far may still be subject to criticism with respect to four issues. First, it could be the case that the correlations between past and future growth depend on whether a country is a manufacturer and that global shocks (captured by year fixed effects) might be also different depending on manufacturing status. Second, when regressing the cumulative change in GDP at time $t + h$ on the tariff change observed at time t, I ignore tariff changes occurring between $t + 1$ and $t + h$, which may lead to biases, as highlighted by Teulings and Zubanov (2014). Third, so far, I have exploited all tariff changes from 1960 to 2014, even those virtually equal to zero, which may not necessarily point to liberalization or protectionist episodes but may still drive the results. Finally, the recent difference-in-differences literature has highlighted that in the absence of clean control groups (in the setting here, countries never "treated" by "relevant" tariff changes or treated only after the time horizon of analysis), estimates might be problematic and may capture terms beyond the causal estimate of interest (de Chaisemartin & d'Haultfoeuille, 2020; Sun & Abraham, 2021; Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021; Callaway et al., 2021). In this section, I address these four possible criticisms.

Inclusion of interactions of initial economic structure with i) previous growth rates and ii) year fixed effects

As mentioned, the relationship between past and future growth could depend on whether a country is a manufacturer. If so, then by estimating a single set of lagged growth controls for all countries, any heterogeneity in these correlations is effectively relegated to the error term. In other words, the interaction variable could be endogenous, because it would be correlated with this heterogeneity that ends up in the error term. By the same token, it could be the case that the experience of global shocks, as captured by year fixed effects, might differ based on whether the country is a manufacturer. If this is the case, then there is a possibility that the interaction term, capturing heterogeneity, is actually correlated with and explained by heterogeneity in global shocks. Thus, controlling for interactions between the initial economic structure and year fixed effects might serve as another useful robustness check. The results are presented in Figures C1 and C2 and confirm the baseline findings.

Inclusion of other tariff changes

What if the impact of tariff changes that I estimate for the period $t + 9$ is really the outcome of tariff changes happening not at t, the treatment year, but five years later? Although Teulings and Zubanov (2014) show that this effect might not be entirely ignored in the baseline specification, they show that ignoring all tariff changes can lead to biases. Thus, the first additional robustness exercise is to include in the baseline framework, equation 3, all tariff changes occurring before $t + h$, not only that in time t, following their proposed solution. That is, I include tariff changes at $t + 1, t + 2, ..., t + h$ as covariates in the baseline regression.

The results of this exercise are presented in Appendix C, Figure C3. Although the estimates are less precise, as statistical power is lost, the identified heterogeneity persists: the effects of reducing tariffs are still negative for nonmanufacturers and positive for manufacturers.

Analysis of relevant tariff changes only

The tariff dataset that I use provides the longest country–year coverage to date (Furceri et al., 2020, 2020). As I use it to analyze tariff changes, I end up using observations where changes are not necessarily very different from zero. In other words, in most years, countries do not really change their average tariffs, but slight variation still appears in the data, perhaps in some cases due to errors in the collection process. More precisely, the 25th percentile of tariff changes is -0.76 percentage points, and the 75th percentile is 0.35 percentage points, meaning that more than 50 percent of the tariff changes observed are approximately smaller than half percentage point in absolute value and thus may not indicate intended changes in the tariffs regime. Are the results robust to considering *relevant* tariff changes only?

I answer this question by identifying and defining *relevant* changes in tariffs in the following manner. Following the LP application by Girardi, Paternesi Meloni, and Stirati (2020), I consider a tariff change *relevant* when it is one standard deviation from the mean change. That is, a tariff change is *relevant* if it is lower than the mean tariff change minus one standard deviation or larger than the mean change plus one standard deviation. For the sake of robustness, I also show results based on using two standard deviations. Although I do not use irrelevant tariff changes as part of the treatment group, they end up being used as part of the control group, assuming that small changes are not actually intentional changes to trade policy (i.e., I treat these observations as having zeros in the treatment variable).

The results of this exercise are shown in Appendix C, particularly Figures C4 and C5. The effect heterogeneity remains virtually the same as in the baseline results. Thus, the results are not driven by almost negligible tariff changes, which in turn may not reflect intended changes in tariffs.

Clean controls analysis

Recent contributions on difference-in-differences have shown that standard estimates based on simple two-way fixed effects regressions under the parallel trends assumption are not entirely reliable. This literature has shown that under treatment heterogeneity and differential treatment timing, estimates might be contaminated and thus biased. The literature has also shown that those biases arise from the use of control groups that were already treated before the time of the treatment under analysis. The solutions devised so far thus require the existence of clean controls, that is, observations (i.e., countries in specific years) never treated or not treated before the time horizon at which the effect is estimated (Callaway & Sant'Anna, 2021; Sun & Abraham, 2021; de Chaisemartin & d'Haultfoeuille, 2020; Goodman-Bacon, 2021). These problems are even more binding in the case of a continuous treatment variable, where treatment heterogeneity regarding dose changes imposes additional challenges (Callaway et al., 2021).

What does this mean in terms of the estimates so far? The baseline analysis has considered all country–year observations where tariffs changed. In this setting, the treatment group comprised the observations with the largest changes in tariffs, in absolute value, while the control group was composed of countries with lower changes, in absolute value. Inference is thus made by exploiting variation in tariff changes. In the previous subsection, I have assumed that *irrelevant* changes in tariffs are really not changes at all in the tariffs regime and thus classed them officially in the control group, with the treatment group being those observations of *relevant* tariff changes. Nevertheless, the observations used as controls there are still not necessarily clean controls, as they might be under the effect of a treatment applied years before the one being analyzed. In other words, a country–year observation where tariffs do not change is still not a good control if a *relevant* tariff change happened two years before, for example.

I follow the recent idea by de Chaisemartin et al. (2022) to use quasi-stayers as control observations, deployed with the LP-DiD estimator as suggested by Dube et al. (2022). Although there is no straightforward way to define these quasi-stayers in terms of tariffs, I approach this problem in the following way. First, I preserve the distinction of *relevant* tariff changes drawn in the previous subsection. Thus, I maintain the assumption that a country–year observation where tariffs change by a magnitude that is less than one standard deviation from the mean (or two standard deviations) does not have a change in tariffs. Second, I define a country as previously treated if it had a *relevant* tariff change during the period of analysis (1960-2014). Two subgroups are therefore used as part of the control group: i) countries that never experienced a *relevant* tariff change between 1960-2014 and ii) countries that experienced a *relevant* tariff change only after the horizon of analysis. An example of a country in the first subgroup in the sample would be Japan, for which tariffs are observed only from 1988 to 2014, with a mean tariff of 3.78, a minimum value of 1.18 and a maximum value of 5.75, and changes always below the threshold of one standard deviation. An example of a country in the second subgroup would be Belgium, which experienced a *relevant* tariff change in 1974, such that from 1961 to 1973, it provides observations that can be used as controls. This definition of a clean controls group still has the drawback of ignoring tariff changes before 1960 or before the internal data became available (in 1988 for Japan) and thus is far from perfect. Nevertheless, it allows me to circumvent the use of observations that are clearly not good controls, at least as defined based on the tariff changes observed in the sample. In a nutshell, I use the LP-DiD specification from equation 3 but now only including *relevant* tariff changes and quasi-stayer countries that didn't experience a *relevant* tariff change before the horizon of analysis.

The results of this clean controls regression analysis are shown in Appendix C, Figures C6 and C7. They are much noisier than those in the two previous robustness checks, as I lose not only variation in tariffs (*relevant* tariff changes happening a couple years after another one are not included) but also observations to compare them with (control group observations are also reduced as some of them might be "contaminated" by the effect of a previous treatment). For nonmanufacturer countries, the effect of reducing tariffs is negative in the whole period based on both definitions of *relevant* tariff changes and significant between 10-15 years after the change. For manufacturer countries, the effect is not clearly different from zero in either magnitude or significance under the first definition but is positive for the almost all the period studied and significant between 15-17 years after the change under the second definition.

7 Mechanisms

In this section, I explore the mechanisms by which tariff reductions may lead to lower growth for nonmanufacturer countries and higher growth for manufacturer countries. The evidence presented suggests that the mechanisms in the trade theory revised have empirical support, although this investigation can not rule other things might be also at work.

I particularly explore the impact of tariff reductions on four variables: i) productivity, ii) capital accumulation, iii) manufacturing share of GDP, and iv) share of imports in GDP. I use the following specification to analyze these potential channels:

$$y_{c,t+h} - y_{c,t-1} = \beta_h \Delta TA_{c,t} + \theta_h int_{c,t} + \phi_h m_{c,t} + \sum_{j=1}^{8} \sigma_h^j g_{c,t-j} + \sum_{j=1}^{8} \gamma_h^j \Delta y_{c,t-j} + \alpha_t + \epsilon_{c,t} \quad (5)$$

where, unlike in the baseline regression in equation 3, $y_{c,t}$ refers to one of the four variables explored and also includes eight lags of the first difference in each of these variables. The regression preserves the lags in GDP growth rates and time fixed effects from the baseline regression. I once again predict the impact of a one-standard-deviation decrease in tariffs for nonmanufacturer and manufacturer countries.

Tariff reductions lead to lower productivity in nonmanufacturer countries while higher for manufacturer ones, as shown in Figure 6[22]. According to the trade theory reviewed, that's precisely the effect heterogeneity we should expect in productivity terms. More deeply, reducing tariffs lead nonmanufacturer countries to specialize in the less dynamic sector, abandoning production in the more dynamic sector, so that productivity at the aggregate level ends up falling. In the same vein, reducing tariffs may increase productivity and growth in manufacturer countries, as it allows full specialization in the more dynamic sector and the associated productivity gains. The results in productivity are also statistically significant for all the horizon of analysis studied and economically meaningful (i.e., more than 2 percent reduction in productivity as the result of a one-standard-deviation decrease in tariffs).

As portrayed in Figure 7, the dynamics of capital accumulation after tariff reductions are also heterogeneous: falling stocks of capital for nonmanufacturer countries while increasing for manufacturers. Results are also statistically significant for all the horizon of analysis. In the same line as the previous results, by making nonmanufacturer (manufacturer) countries to reduce (increase) specialization in the more dynamic sector, tariff reductions might also reduce (increase) capital accumulation, given that the dynamic sector is more capital intensive than the average of the economy. One can also make sense of these results as they relate to the idea that capital accumulation moves in the same direction as productivity, as demonstrated extensively by the development accounting literature (Klenow & Rodriguez-Clare, 1997; Hsieh & Klenow, 2010)[23].

Theory ultimately points to a mechanism by which labor relocates to different sectors for each type of country in response to tariff reductions. Figure 8 presents evidence in support of this mechanism. tariff reductions lead to lower manufacturing shares of GDP for nonmanufacturer countries while higher for manufacturer countries. Although the results are not significant, the direction of the effects is consistent across the whole horizon of analysis, suggesting this mechanism might be at work. First, this result suggest that economies specialize following initial comparative advantage, as suggested by the theory. In other words, tariff reductions make nonmanufacturer countries to specialize more on non-manufacturing production, while

[22] In Figure D1, I also show estimates of total factor productivity (TFP) evolution after tariff reductions. Results point to the same heterogeneity. The results are in the correct direction for all horizon of analysis but only significant around 15 years after tariff changes.

[23] The effects on capital accumulation in this literature come from TFP changes, not labor productivity ones, which anyways is consistent with the results shown in Figure D1.

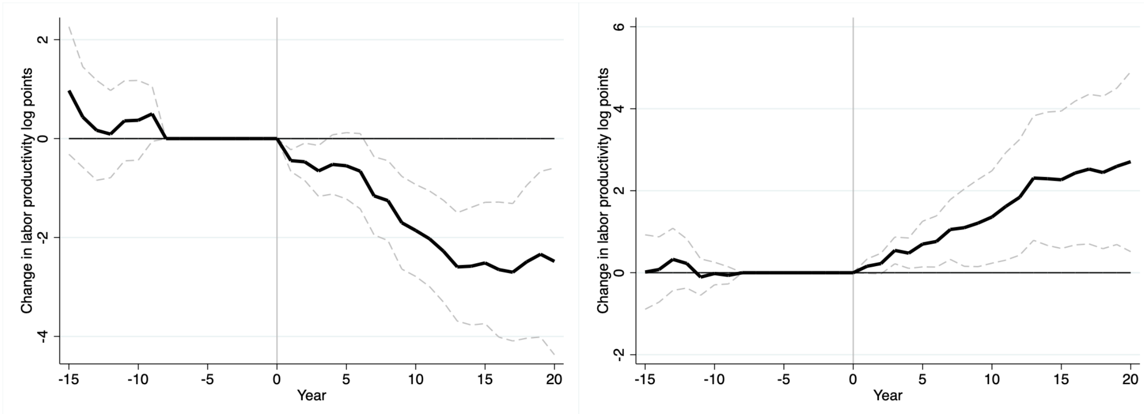
manufacturer countries to strengthen its manufacturing specialization[24]. This labor relocation mechanism is, according to theory, the one that also drives the heterogeneous effects in both productivity and capital accumulation.

The heterogeneous effects of tariff reductions on manufacturing shares of GDP also relate to other strands of the literature on macroeconomics of development. First, developing economies have experienced premature reductions in their manufacturing shares of GDP in the last thirty years, arguably driven by globalization as suggested by Rodrik (2016). The evidence here presented for nonmanufacturer countries, arguably a similar group to developing countries, might be understood as backing this argument. Second, the evidence suggests manufacturing is the more dynamic sector in the economy, as analytically considered in theory. In that sense, the evidence might also be in line with that presented by Rodrik (2013), according to which manufacturing is different to all other broad economic sectors in that it is characterized by unconditional convergence at the cross-country level.

Finally, I also explore the dynamics of the share of imports in GDP after tariff reductions, as revealed in Figure D2. Results reveal that the share of imports in GDP does not significantly change after tariff reductions, for both nonmanufacturer and manufacturer countries. A priori, we might expect an increase in the share of imports for both types of countries, given that imports are now relatively cheaper. The relocation mechanism discussed above might provide a way to understand why this is not the case. As nonmanufacturer countries deindustrialize, import demand for intermediate and capital goods might also fall, given the manufacturing sector is more reliant on them, so that even though imports of these type of goods are now cheaper the volume imported nonetheless falls. For manufacturer countries, on the other hand, the strengthening of the manufacturing sector might lead to a reduction of the import elasticity of demand, so that even though imports of manufacturing goods are now cheaper, the volume imported does not increase. In short, this dynamic associated with structural changes in the economy should finally be reflected in changes in the composition of imports. However, more work is needed to test and confirm the empirical validity of this explanation.

[24]Although manufacturing shares of GDP provide a good proxy, the ideal data to test the relocation mechanism are manufacturing shares of employment. Cross-country data on sectoral shares of employment is however scant.

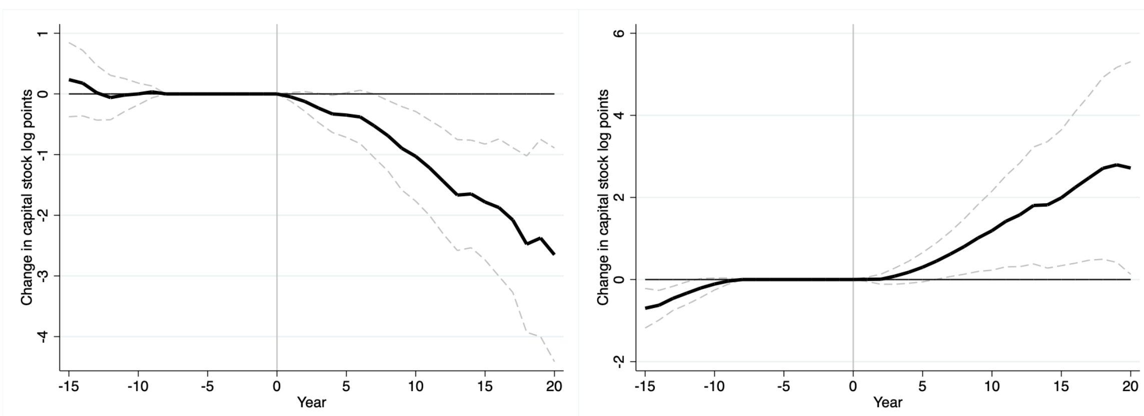
Figure 6: Average effects of tariff reductions on labor productivity



(a) Nonmanufacturer countries **(b)** Manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure 7: Average effects of tariff reductions on capital accumulation

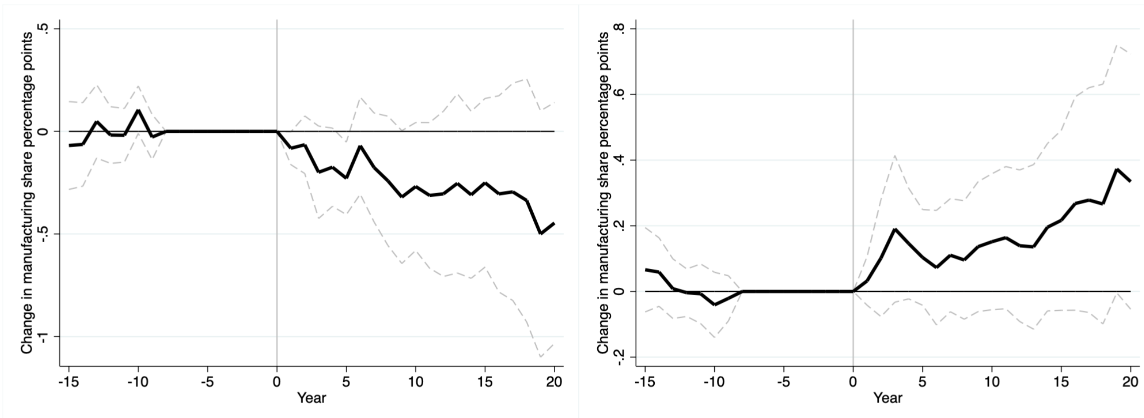


(a) Nonmanufacturer countries **(b)** Manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure 8: Average effects of tariff reductions on the manufacturing share of GDP

A. Manufacturing share of GDP



(a) Nonmanufacturer countries **(b)** Manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

8 Conclusion

Most economists hold that trade liberalization is a good policy for growth of all countries. However, theory does not provide a clear response to the question of the relation of tariffs with growth, as there are mechanisms that may lead to one or another direction. Empirical evidence, likewise, does not provide an unambiguous response, as there are both positive and negative answers. Moreover, there are good theoretical reasons that suggest the relationship is contingent in specific factors, and thus not having a general unambiguous direction.

In this paper, I establish that the relationship between tariffs and growth is characterized by sharp heterogeneous effects by economic structure. In other words, I unveil the existence of heterogeneous effects of tariffs on GDP per capita depending on the initial share of manufacturing exports. More precisely, I show that the widespread reduction in tariffs around the world since 1960, particularly strong in the last 30 years, has reduced GDP per capita for nonmanufacturer countries, but increased GDP per capita for manufacturers. I establish this result by making use of a local projections difference-in-differences (LP-DiD) estimator (Dube et al., 2022), by which I am able to calculate the dynamic effects of tariff reductions and also control for pretrends that may bias the estimates. Although establishing causality is always difficult, the multiple robustness checks that I perform point to a solid heterogeneous relation running from tariffs to economic growth. Moreover, I also address recent challenges to estimating average treatment effects as highlighted in the recent difference-in-differences literature, deploying the idea by de Chaisemartin et al. (2022) of comparing movers and quasi-stayers through the LP-DiD specification. Overall, the estimates suggest that a one-standard-deviation reduction in tariffs (i.e., 3.65 percentage points) leads to an average fall (increase) of more than 2 percent in GDP per capita fifteen years later for nonmanufacturer (manufacturer) countries. The effects are also persistent even after twenty years after tariff reductions.

I also show some evidence on the potential channels underpinning these heterogeneous effects of tariffs on growth. On the one hand, tariff reductions lead to lower productivity and capital accumulation for nonmanufacturer countries. On the other, tariff reductions lead to higher productivity and capital accumulation for manufacturer countries. I also show that both these changes and those on GDP might at the end be explained by changes in the manufacturing share of GDP, falling for nonmanufacturer countries and increasing for manufacturer ones, although these results are not statistically significant. In short, the evidence points to a story consistent with the theories surveyed on the effects of tariffs being contingent on economic structure.

The empirical evidence that I find in this paper calls for a more nuanced view on the effects of tariffs on growth. The common view in economics, according to which a liberal trade regime is the best policy option, is not warranted. The evidence suggests that for nonmanufacturer countries trade liberalization has had a negative impact on their incomes. Although the empirical evidence does not show any discernible effect of increasing tariffs, it is possible that some level of protection, along with other measures of so-called industrial policy, might encourage productivity growth in the more dynamic sectors for these countries and thus encourage general growth. More work, however, might be needed to clarify the precise conditions for this to be true.

Two words of caution are necessary regarding the results showed in this paper. First, the estimates take into account only the average tariff rate, thus ignoring the structure of tariffs in each country. As shown by Nunn and Trefler (2010), growth is specifically associated with tariffs in highly dynamic sectors. Therefore, the structure of tariffs also matters. The results shown here should not be interpreted to suggest that *any* kind of protection might be useful for developmental purposes, so further research is needed on this topic. Second, although this paper provides a first approximation to a solution to the problems related to estimating treatment effects with continuous treatment variables in the tariffs–growth nexus, I nevertheless think this issue deserves more attention. Determining a clean controls group in this cross-country setting or a definition of quasi-stayers is challenging, as tariffs existed before the first year of analysis and thus defining a nontreated country in a given year will always require subjective assumptions. Thus, another area of possibly fruitful future research would be a more "appropriate" difference-in-differences analysis of the tariffs–growth nexus.

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Appendix

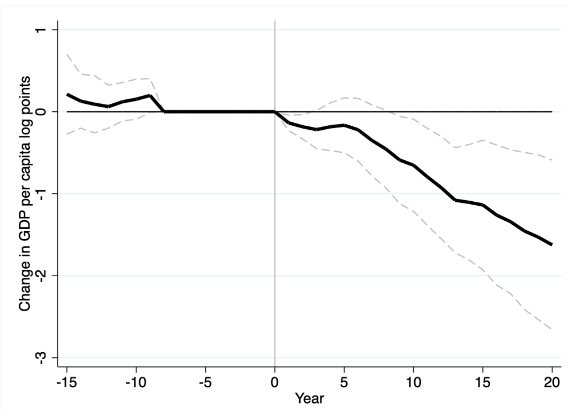
The Appendix is structured using the same section found in the main text, so that each one complements its corresponding one.

A Baseline results

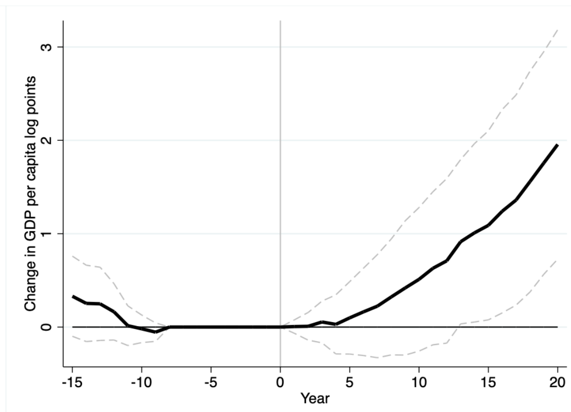
Effects of increases and decreases of tariffs

The following two graphs present the average results associated to decreases of tariffs, on the one hand, and increases, on the other.

Figure A1: Average effects of tariff reductions on GDP per capita



(a) For nonmanufacturer countries

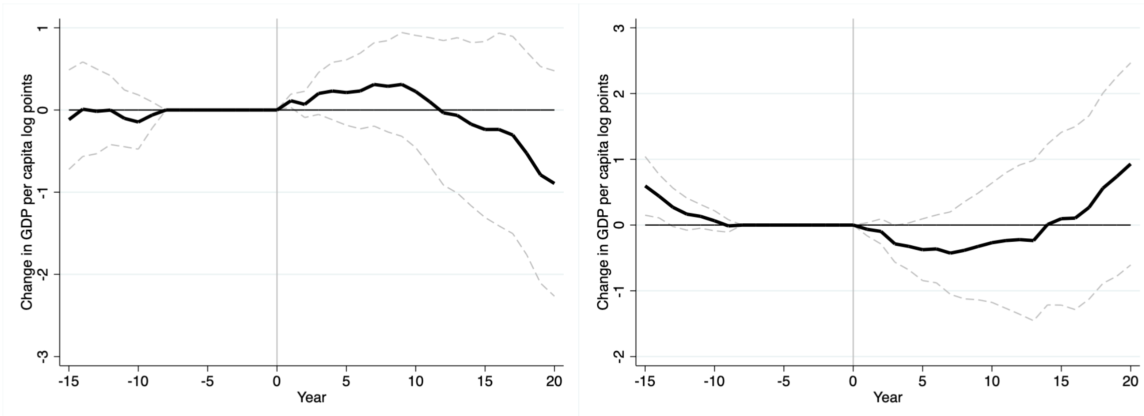


(b) For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

As it can be observed in Figure A1, tariff reductions are associated with GDP falls for nonmanufacturer countries and GDP increases for manufacturer countries. On the other hand, the effect of tariff increases, show in Figure A2, is not significant across the whole period for both type of countries.

Figure A2: Average effects of tariff increases on GDP per capita



(a) For nonmanufacturer countries

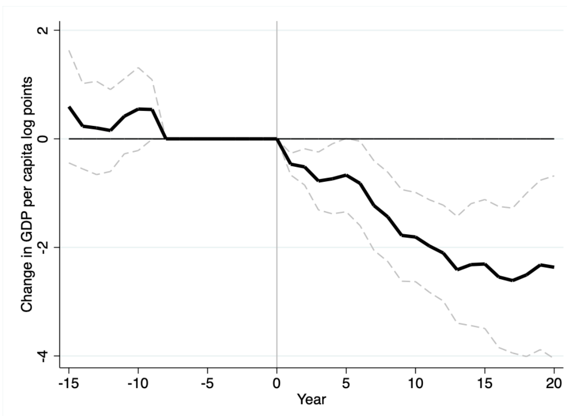
(b) For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

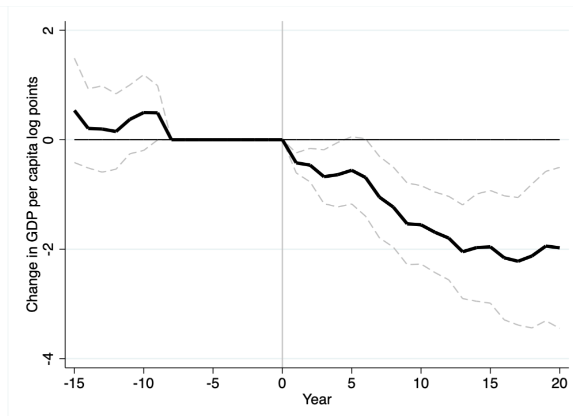
Effects at different level of initial shares of manufacturing exports

In the main text, I present the effects of a decrease in tariffs on growth for countries with two different levels of initial shares of manufacturing exports—what can be called manufacturer and nonmanufacturer countries. Here I show the impact for different levels of manufacturing exports, given the linear specification of the heterogeneous effects specified in equation 3.

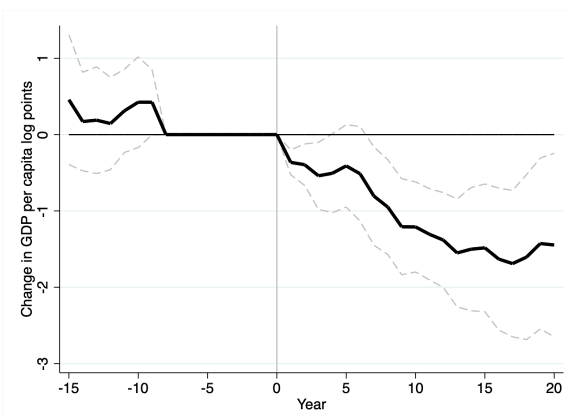
Figure A3: Average effects of decreases in tariffs on GDP per capita at different level of initial manufacturing exports, part 1



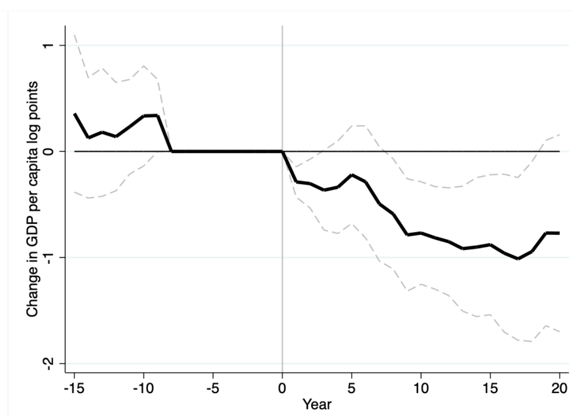
(a) 10th percentile



(b) 20th percentile



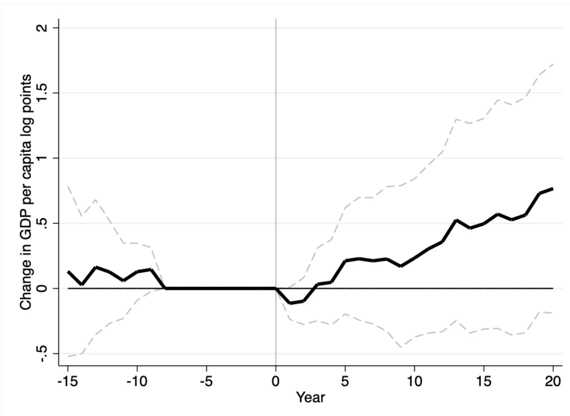
(c) 30th percentile



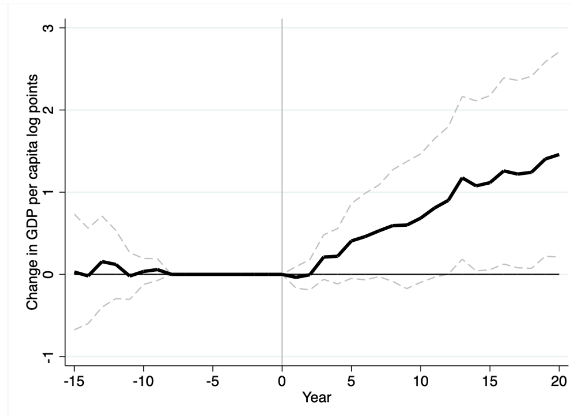
(d) 40th percentile

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

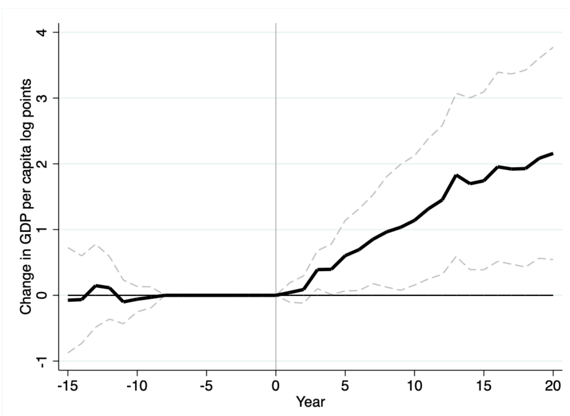
Figure A4: Average effects of tariffs on GDP per capita at different level of initial manufacturing exports, part 2



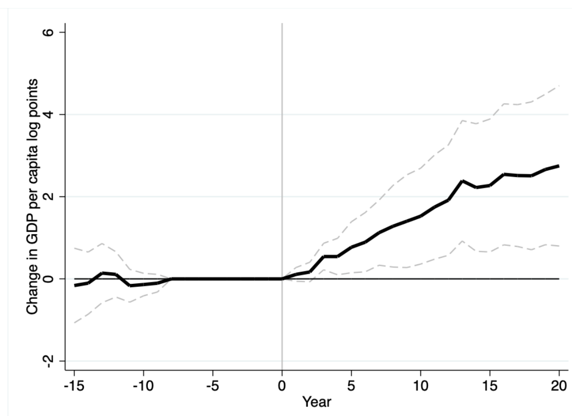
(a) 60th percentile



(b) 70th percentile



(c) 80th percentile



(d) 90th percentile

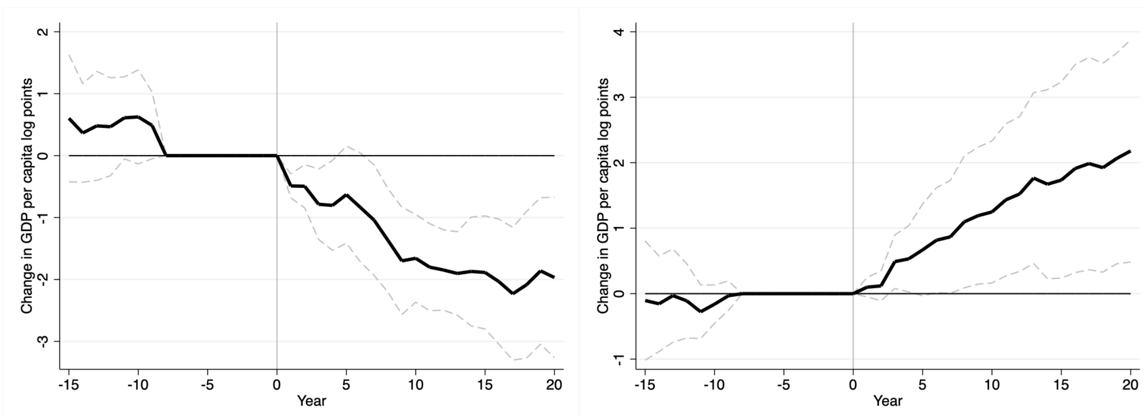
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figures A3 and A4 show that at least for the top 30 percent of the distribution of manufacturing exports, there is a positive effect on GDP of tariff reductions , while for the bottom 40 percent of the distribution, the impact is negative.

Alternative specifications of initial economic structure

I show here that the results are robust to different specifications of the initial economic structure. In the baseline specification, I define the initial economic structure as the average of the previous five years of the share of manufacturing exports, following the broad classification of goods in the SITC. Here, I replace this definition with six alternative ones. First, I use the average of the previous five years of the share of manufacturing exports, following Lall's (2000) classification. Second, I use the average of the previous five years of the revealed comparative advantage in manufacturing exports, using the broad category classification. Then, following the specifications proposed by Acemoglu et al. (2019) in a similar exercise, I define the initial economic structure as the first lag of the share of manufacturing exports, the value of manufacturing exports in 1962 (the first year for which trade data are available), the value of manufacturing exports in 1970, and, finally, the value in 1980.

Figure A5: Average effects of tariff reductions on GDP per capita, using Lall's (2000) classification

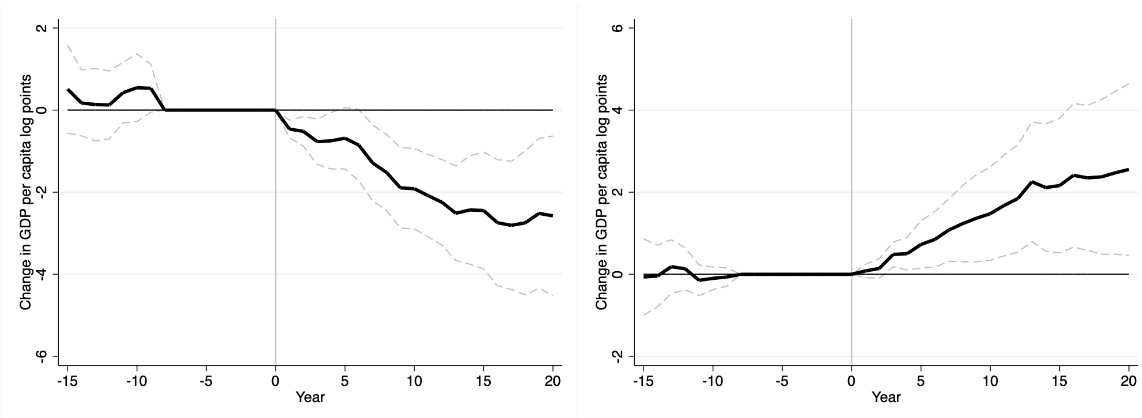


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: Initial economic structure is defined as the average of the previous five years of the share of manufacturing exports, using Lall's (2000) classification. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A5 reveals the result of using the initial economic structure defined using manufacturing exports with Lall's (2000) classification. The effect heterogeneity is still significant.

Figure A6: Average effects of tariff reductions on GDP per capita, using revealed comparative advantage

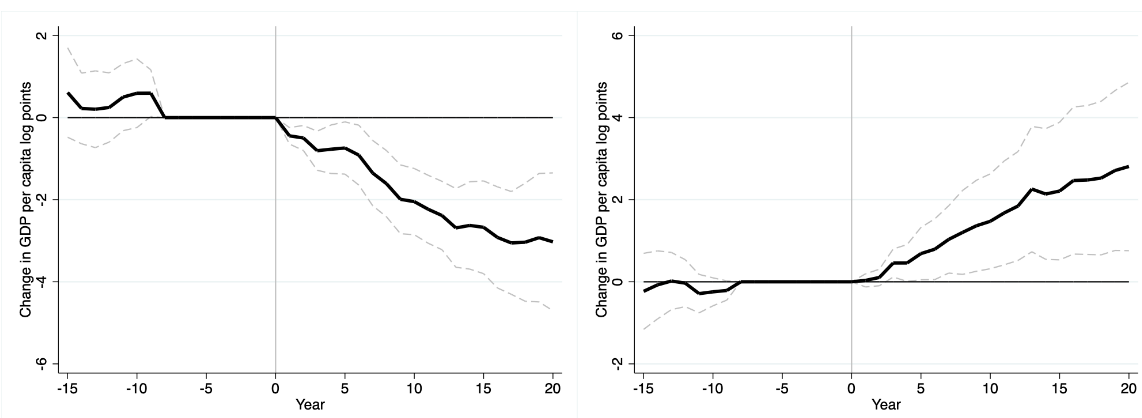


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: Initial economic structure is defined as the average of the previous five years of revealed comparative advantage in manufacturing exports. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A6 reveals the results when I use revealed comparative advantage instead of the share of manufacturing exports. The results are virtually the same as those in the baseline.

Figure A7: Average effects of tariff reductions on GDP per capita, 3rd alternative definition of initial economic structure

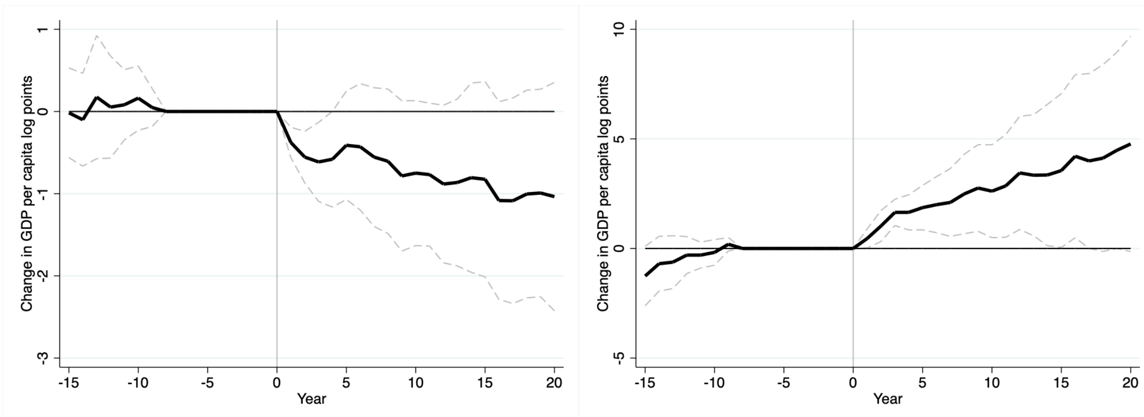


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: Initial economic structure is defined as the first lag of the share of manufacturing exports. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A7 reveals the results where the initial economic structure is defined by the first lag of the share of manufacturing exports. The heterogeneity in the results still holds.

Figure A8: Average effects of tariff reductions on GDP per capita, 4th alternative definition of initial economic structure

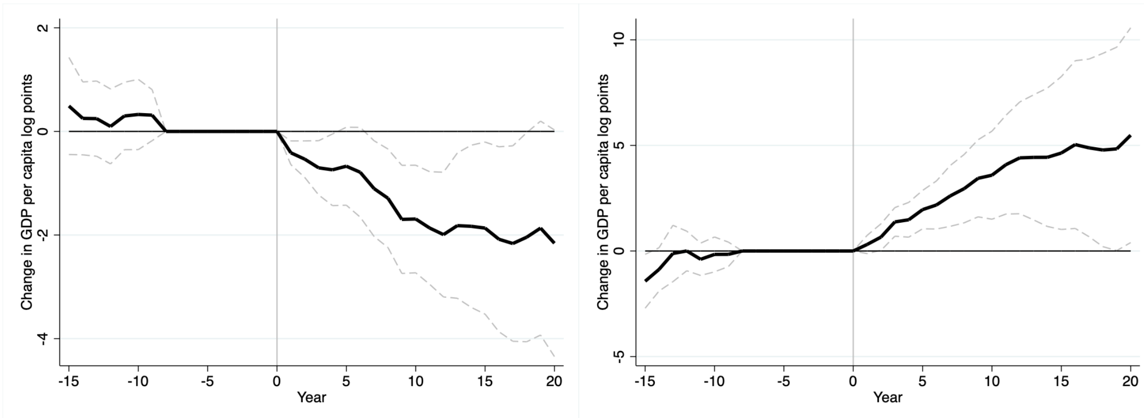


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: Initial economic structure is defined as the the share of manufacturing exports in 1962. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A8 reveals the results where the initial economic structure is the value of the share of manufacturing exports in 1962, the initial year of the trade data. The heterogeneity still holds, but the results are less precise, as the data for 1962 is scarcer.

Figure A9: Average effects of tariff reductions on GDP per capita, 5th alternative definition of initial economic structure

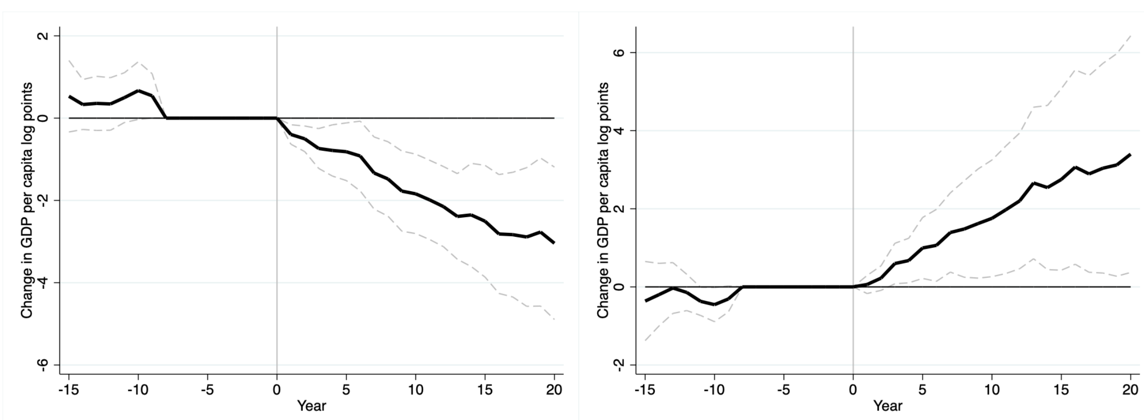


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: Initial economic structure is defined as the the share of manufacturing exports in 1970. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A9 reveals the results where the initial economic structure is the value of the share of manufacturing exports in 1970. The heterogeneity still holds.

Figure A10: Average effects of tariff reductions on GDP per capita, 6th alternative definition of initial economic structure



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: Initial economic structure is defined as the the share of manufacturing exports in 1980. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

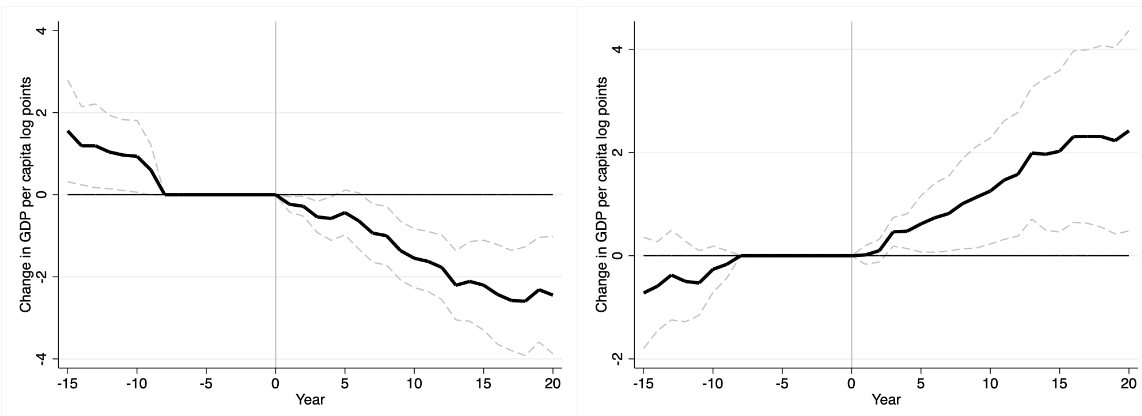
Figure A10 reveals the results where the initial economic structure is given by the value of the share of manufacturing exports in 1980. The heterogeneity in the results is still significant, and the magnitudes of the effects are even bigger.

Alternative GDP data for growth rates

I show here that the baseline results are robust to alternative GDP data and that the heterogeneous effects of tariffs do not rely on the specific data used in the baseline.

Figure A11 reveals the results when I use GDP per capita from the World Development Indicators (WDI) in constant national prices. The effect of reducing tariffs is negative and significant for nonmanufacturer countries and positive and significant for manufacturer countries.

Figure A11: Average effects of tariff reductions on GDP per capita, data from WDI

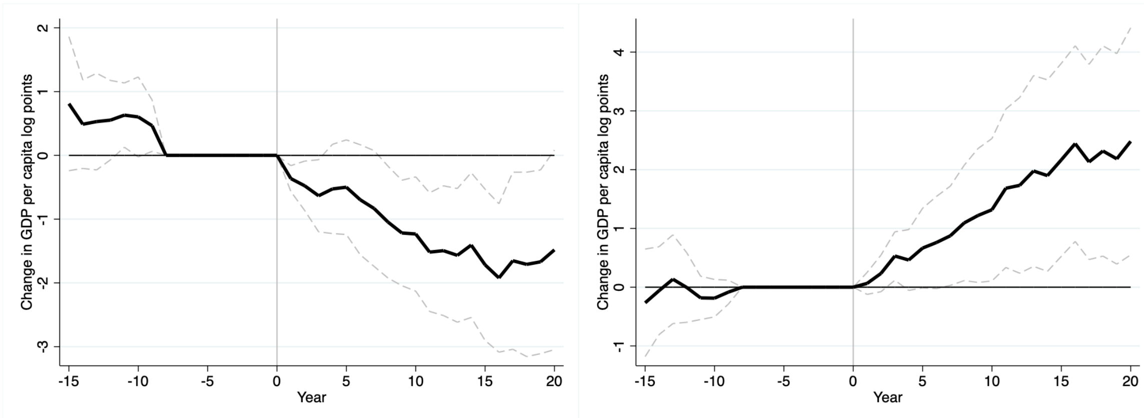


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The GDP per capita data used for this figure are in constant national prices from the WDI. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A12 reveals the results when I use data from the Maddison Project (Bolt & van Zanden, 2020). The estimates are more erratic but still point to significant heterogeneity in the effects of tariffs on growth depending on the initial economic structure.

Figure A12: Average effects of tariff reductions on GDP per capita, data from the Maddison Project

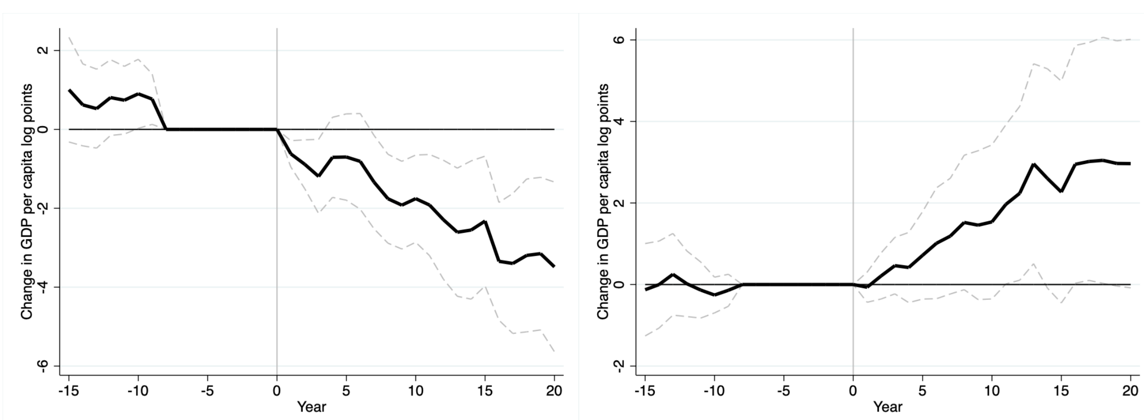


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The GDP per capita data used for this figure are in constant national prices from the Maddison Project. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Finally, in Figure A13 I present the results based on GDP per capita data in purchasing power parity (PPP) constant terms from Penn World Table (PWT) 10.0. The results are negative and significant for nonmanufacturer countries and positive but mostly insignificant for manufacturer countries.

Figure A13: Average effects of tariff reductions on GDP per capita, data in PPP from PWT



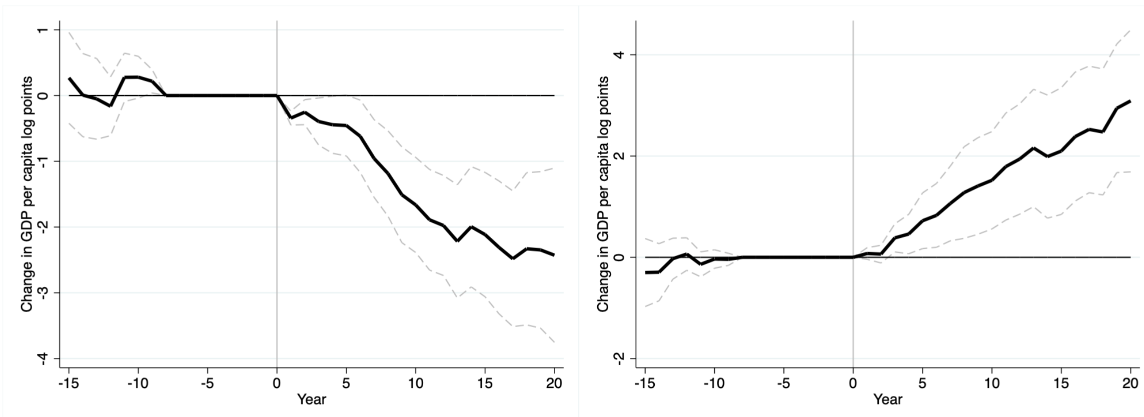
(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The GDP per capita data used for this figure are in PPP constant terms from PWT 10.0 The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Robustness to outliers and leverage points

I show here that the results are robust to the use of robust regression methods and consideration of the influence of leverage points.

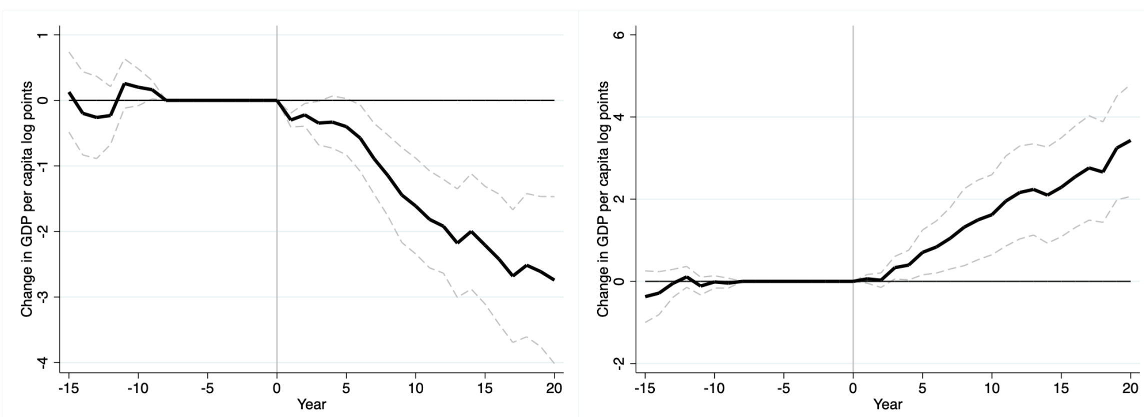
Figure A14: Average effects of tariff reductions on GDP per capita, regression with Huber weights



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A15: Average effects of tariff reductions on GDP per capita, Li's robust regression

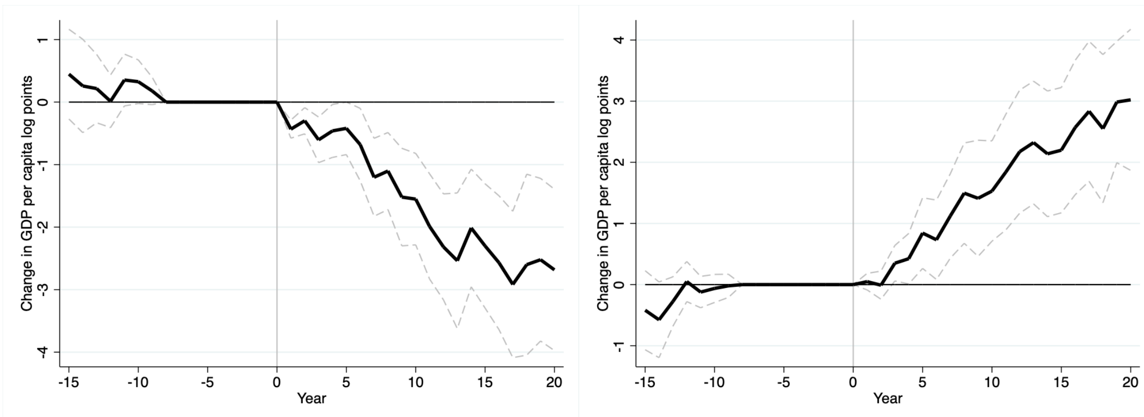


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A14 reveals the results of using Huber (1964) weights and Figure A15 shows the results of using G. Li (1985)'s robust regression, deemed an improvement on Huber weights. The heterogeneity in the results is still significant and the magnitude of effects is bigger.

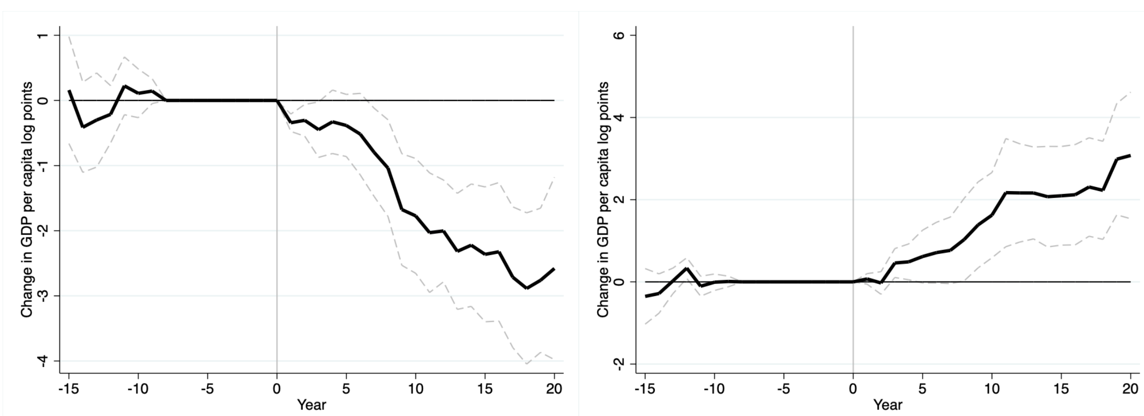
Figure A16: Average effects of tariff reductions on GDP per capita, removing Cook's distance leverage points



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A17: Average effects of tariff reductions on GDP per capita, removing R-standardized leverage points

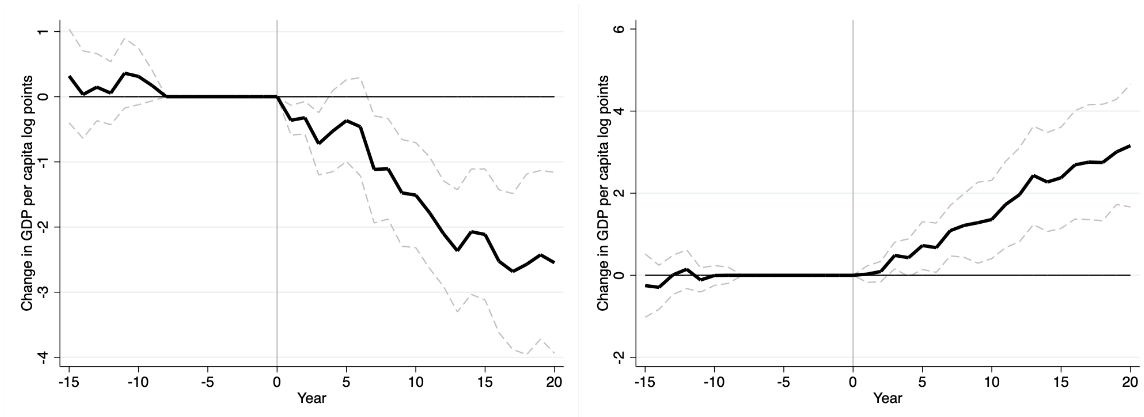


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

I also consider the influence of leverage points by following the methods of deletion proposed by Belsley et al. (1980). Figures A16, A17, A18, A19 and A20 reveal that the results are robust to deletion of Cook's, R-standardized, Dfits, Hat and Covratio outliers, respectively.

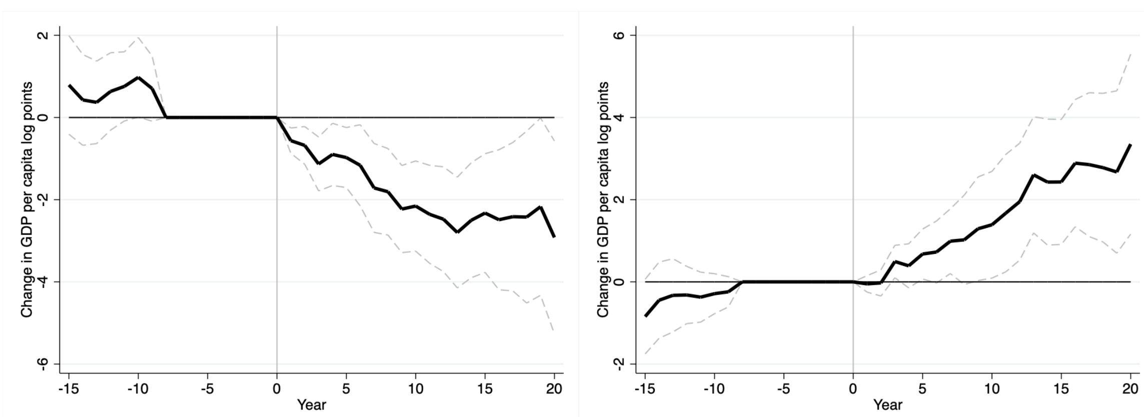
Figure A18: Average effects of tariff reductions on GDP per capita, removing Dfits leverage points



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

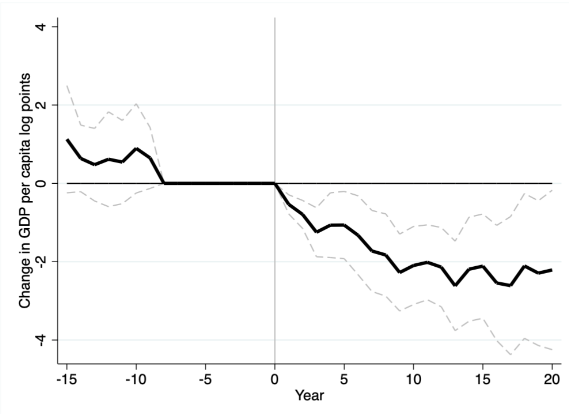
Figure A19: Average effects of tariff reductions on GDP per capita, removing Hat leverage points



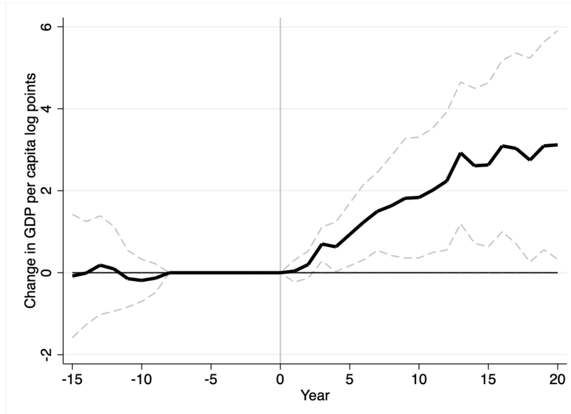
(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure A20: Average effects of tariff reductions on GDP per capita, removing Covratio leverage points



(a) For nonmanufacturer countries



(b) For manufacturer countries

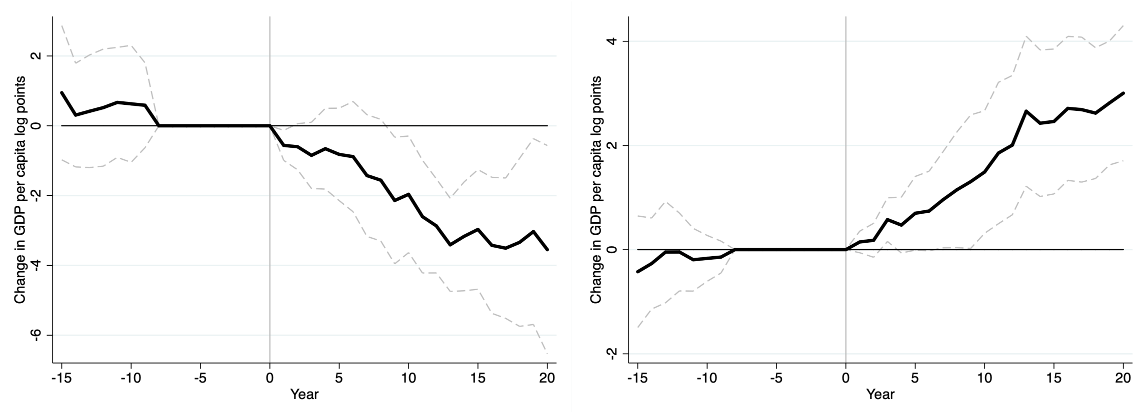
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

B Robustness

The following graphs show the average effects of tariff reductions, controlling once at a time for all relevant covariates discussed in the main text, and as summarized in Figure 5. Effect heterogeneity is preserved in all cases.

Endogenous tariffs

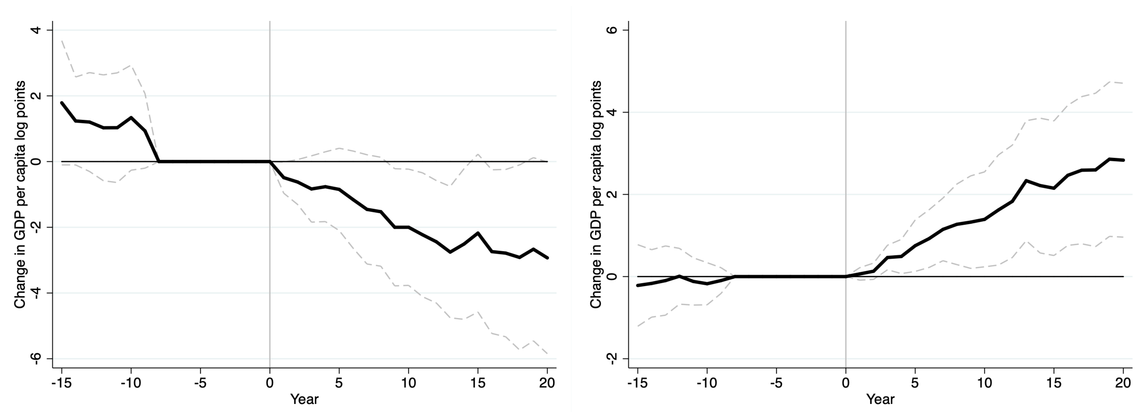
Figure B1: Average effects of tariff reductions on GDP per capita, controlling for the change in the growth forecast



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

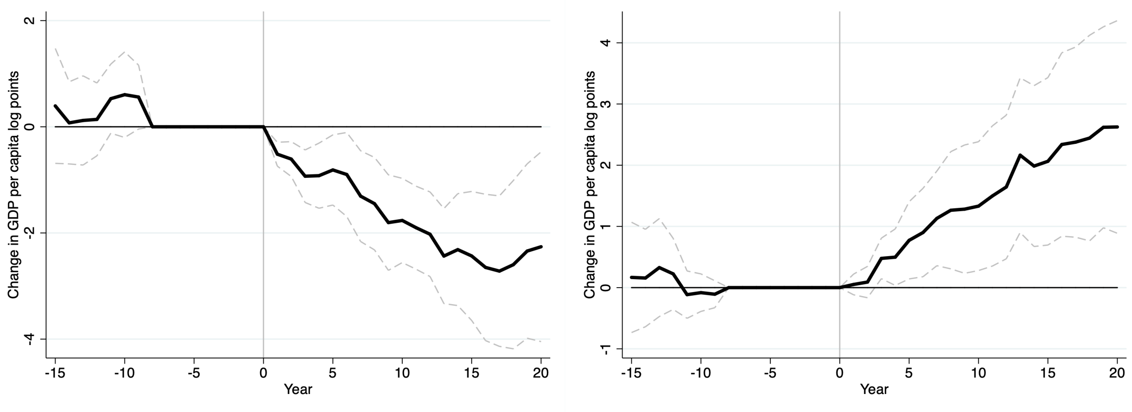
Figure B2: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in the Gini coefficient



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B3: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in import penetration

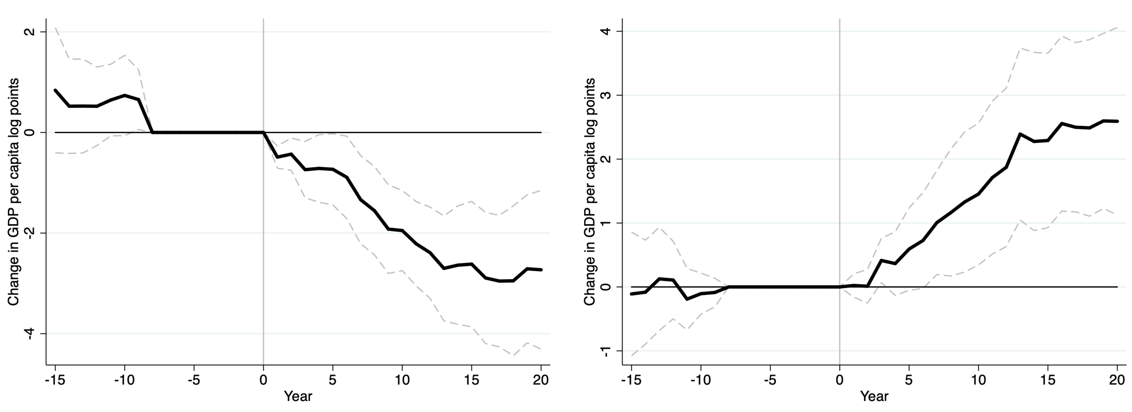


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Other policies

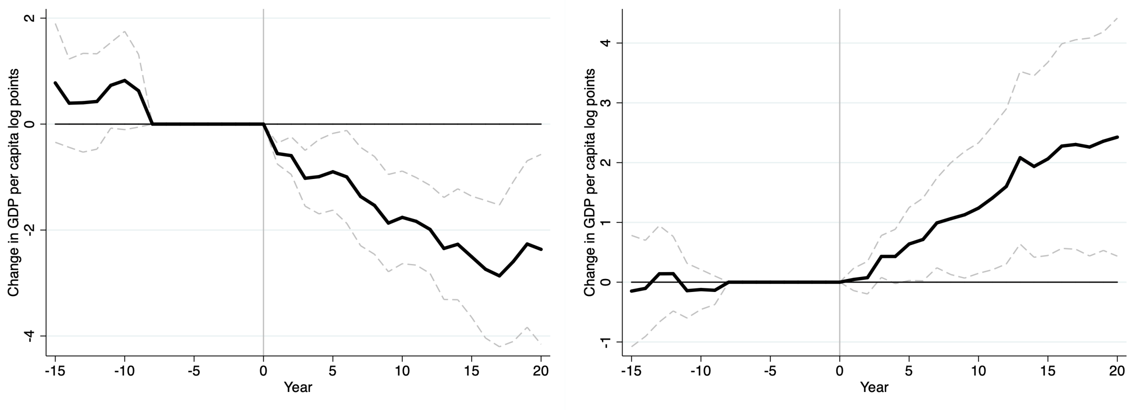
Figure B4: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in nontariff barriers



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

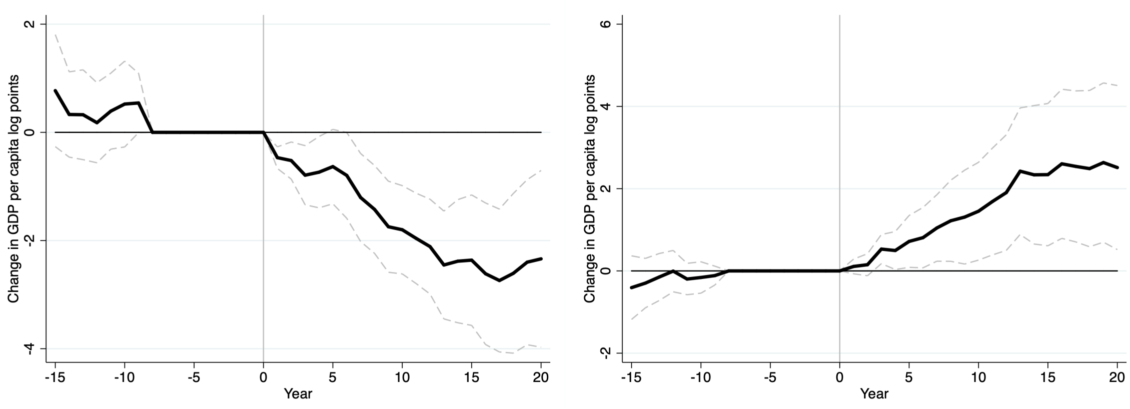
Figure B5: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in capital account openness



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B6: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in Polity

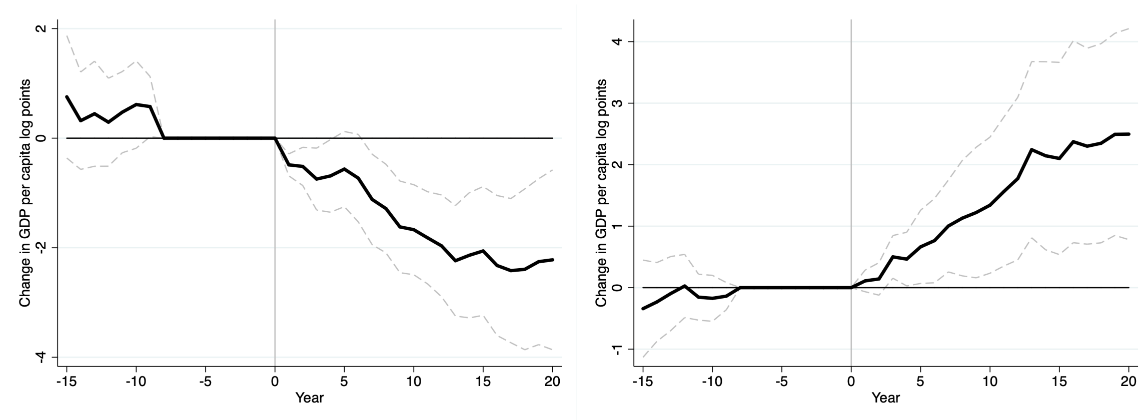


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Relevant covariates

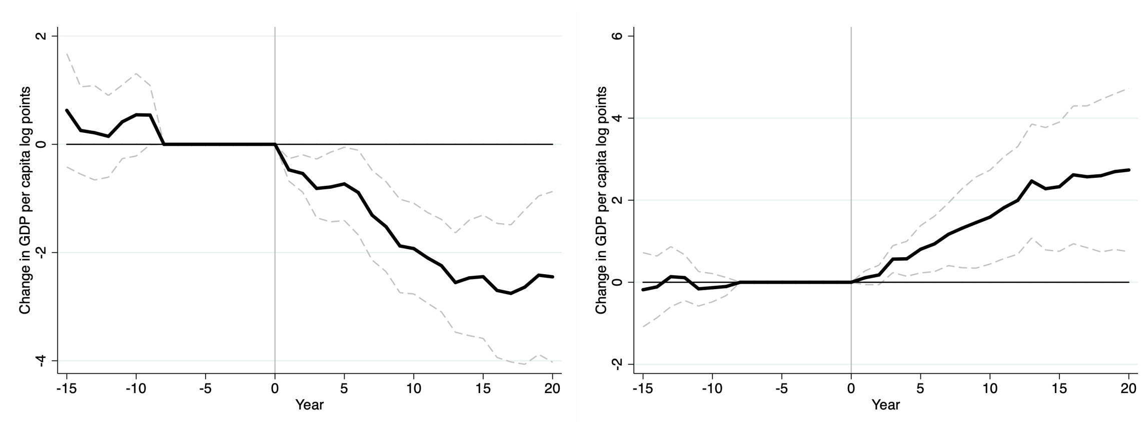
Figure B7: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in human capital



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

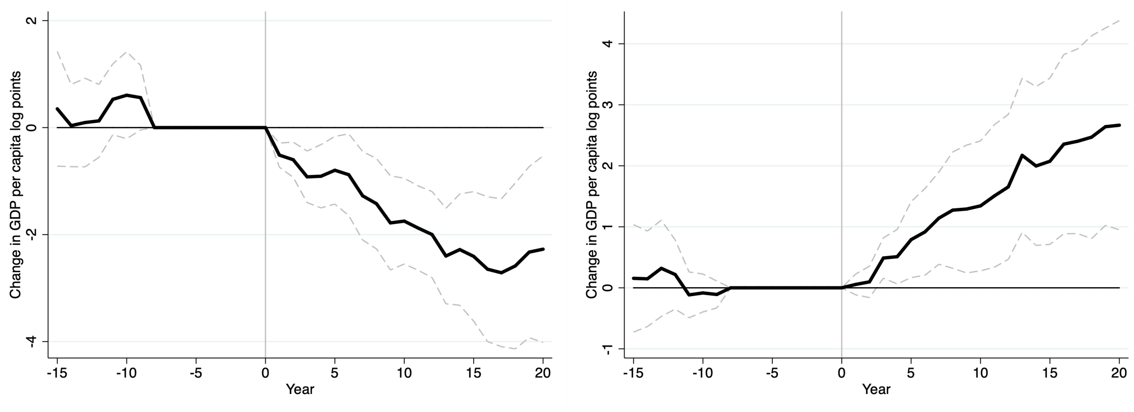
Figure B8: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in population size



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

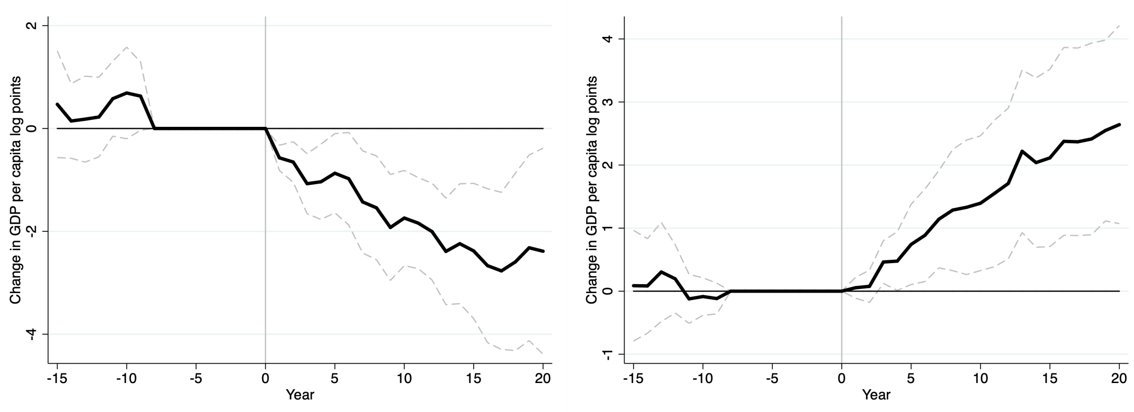
Figure B9: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in trade as share of GDP



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

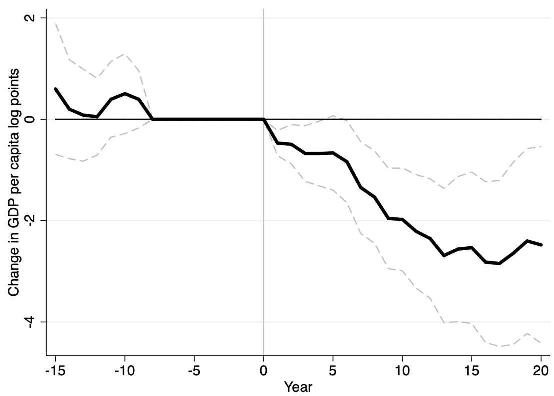
Figure B10: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in investment



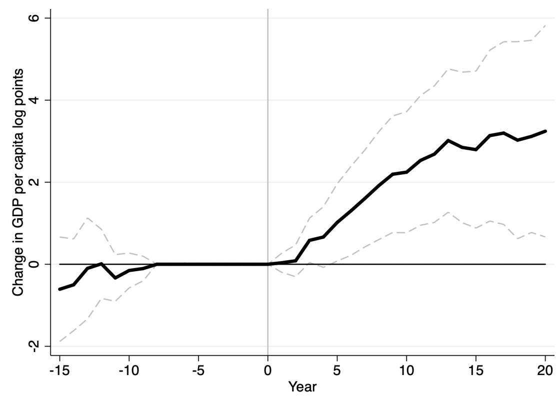
(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B11: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in real exchange rates



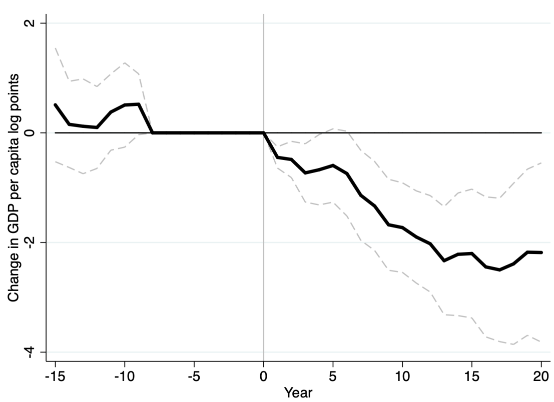
(a) For nonmanufacturer countries



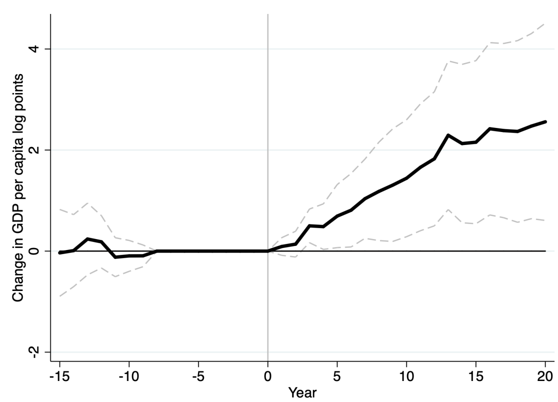
(b) For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B12: Average effects of tariff reductions on GDP per capita, controlling for four lags of the change in terms of trade



(a) For nonmanufacturer countries

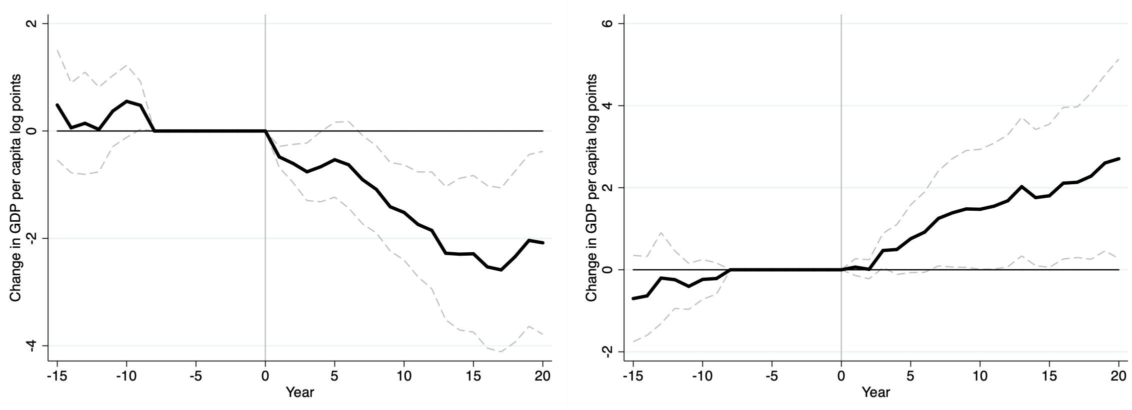


(b) For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Other heterogeneities in the effects

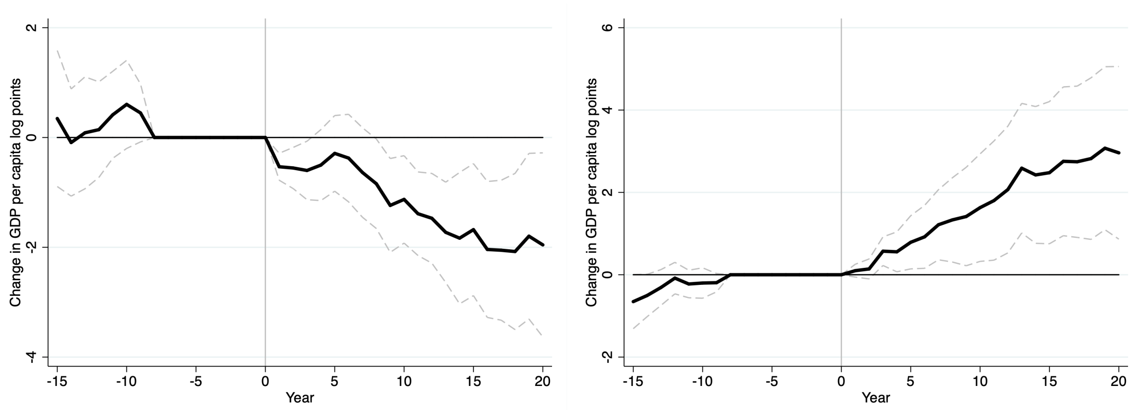
Figure B13: Average effects of tariff reductions on GDP per capita, controlling for heterogeneous effects from income



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B14: Average effects of tariff reductions on GDP per capita, controlling for heterogeneous effects from human capital

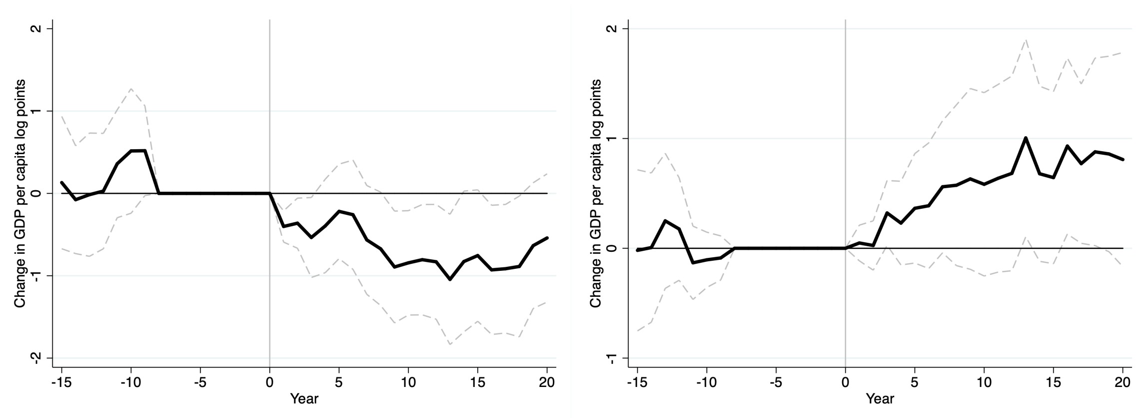


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Different trends

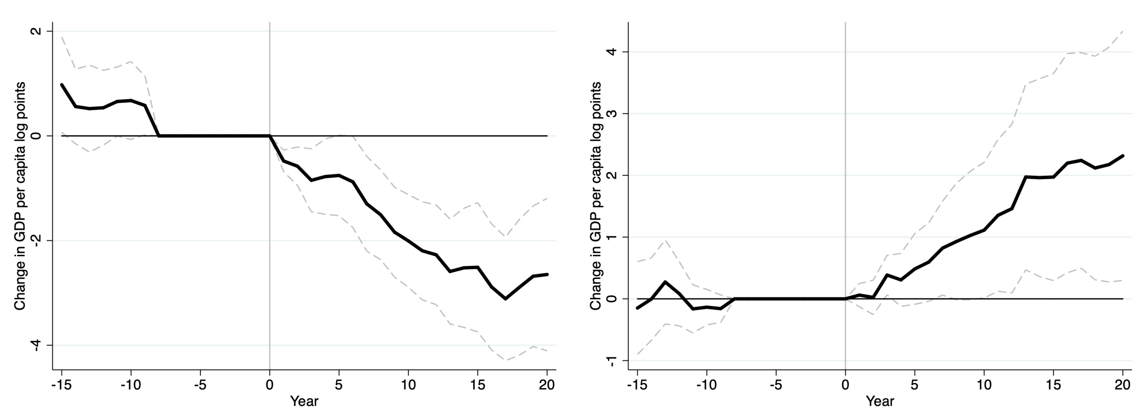
Figure B15: Average effects of tariff reductions on GDP per capita, with country fixed effects included



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

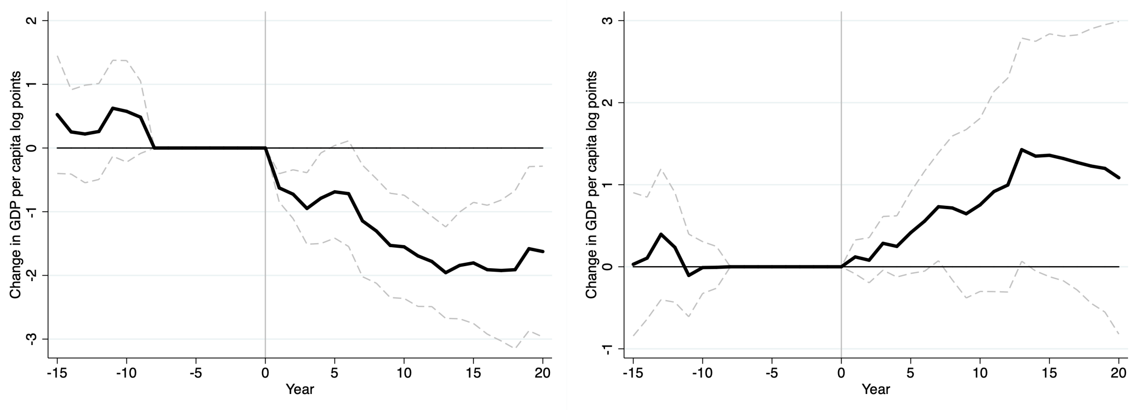
Figure B16: Average effects of tariff reductions on GDP per capita, controlling for trends in different country income groups



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B17: Average effects of tariff reductions on GDP per capita, controlling for trends in different regions of countries



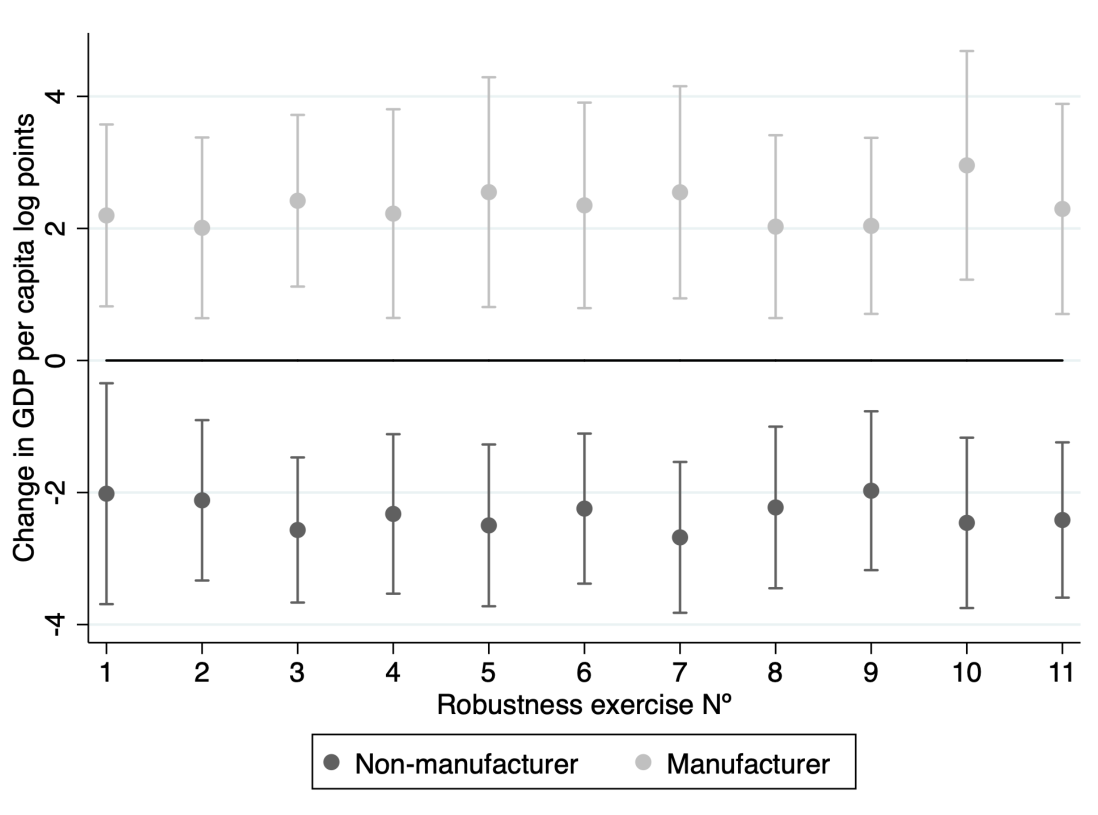
(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Robustness to contemporaneous changes in covariates

In the main text, I use a specification with four lags of the changes in covariates to account for potential confounding variables. Here, I simply summarize the results obtained if, instead, I include the contemporaneous change in each covariate. Figure B18 shows the results, confirming the effect heterogeneity of tariffs on growth.

Figure B18: Robustness of heterogeneous effects of tariff reductions on GDP per capita, average effect 13-17 years after, and based on contemporaneous changes in relevant covariates



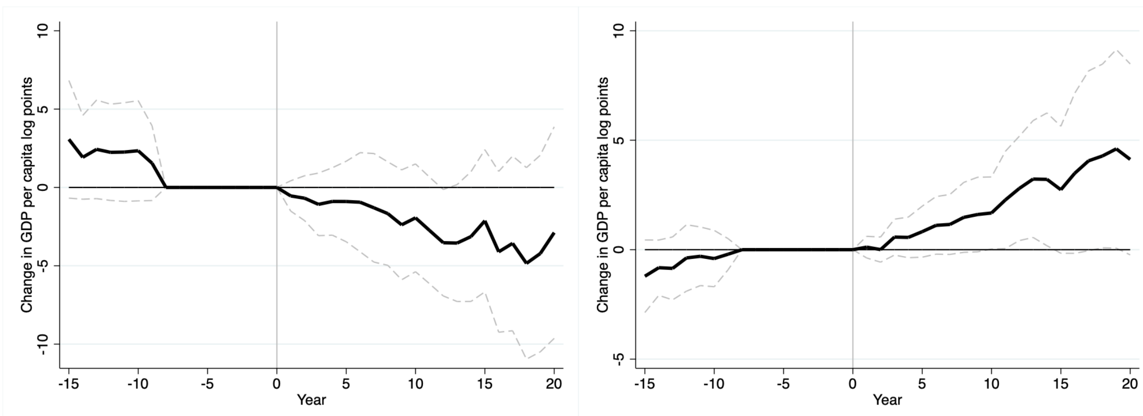
Note: The estimates presented are the predicted values for the 10th and 90th percentiles of the distribution of initial manufacturing exports. The coefficients show the average of the effect 10-14 years after the change in tariffs. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level. Exercise 1 is the outcome of estimating equation 3 with the change in the Gini coefficient. Exercise 2 is the outcome of estimating equation 3 with the change in import penetration. Exercise 3 is the outcome of estimating equation 3 with the change in nontariff barriers. Exercise 4 is the outcome of estimating equation 3 with the change in capital account openness. Exercise 5 is the outcome of estimating equation 3 with the change in Polity. Exercise 6 is the outcome of estimating equation 3 with the change in human capital. Exercise 7 is the outcome of estimating equation 3 with the change in population size. Exercise 8 is the outcome of estimating equation 3 with the change in trade openness. Exercise 9 is the outcome of estimating equation 3 with the change in investment. Exercise 10 is the outcome of estimating equation 3 with the change in the real exchange rate. Exercise 11 is the outcome of estimating equation 3 with the change in the terms of trade.

Robustness with all controls included at the same time

In the main text, I control for several covariates that might affect the validity of the estimates, by including each of them in turn. The validity of the results, therefore, may still be subject to the criticism that it is driven by correlations between covariates, not really captured in the regressions when controlling for each of them in turn.

I now present the results of including all covariates at the same time. This exercise is extremely demanding in terms of statistical power, as the sample is importantly reduced, given that for each covariate I include four lags of first differences and information is not equally available for all countries. Results are presented in Figure B19. The direction of the heterogeneity is still in line with the main findings, and although significance is importantly decreased, I still observe a significant effect around 12-13 years after tariff reductions.

Figure B19: Average effects of tariff reductions on GDP per capita, all control variables included



(a) For nonmanufacturer countries

(b) For manufacturer countries

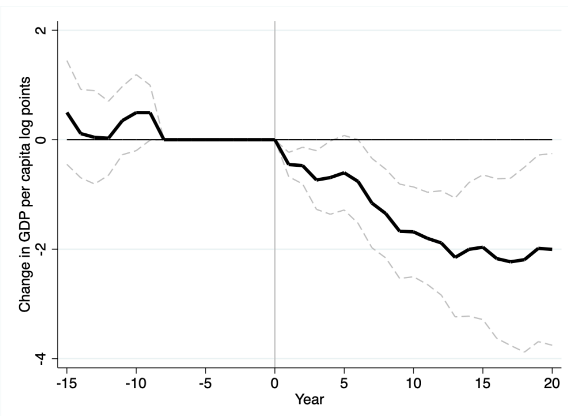
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

C Additional robustness

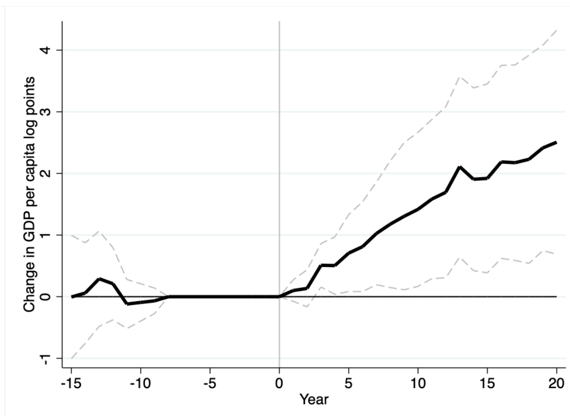
The following graphs reveal the results associated to the section in the main paper called additional robustness. The results presented confirm once again the robustness of the heterogeneous effects of tariffs on growth.

Including interactions of manufacturing exports with i) previous growth rates and ii) year fixed effects

Figure C1: Average effects of tariff reductions on GDP per capita, controlling for interactions between past growth and the initial economic structure



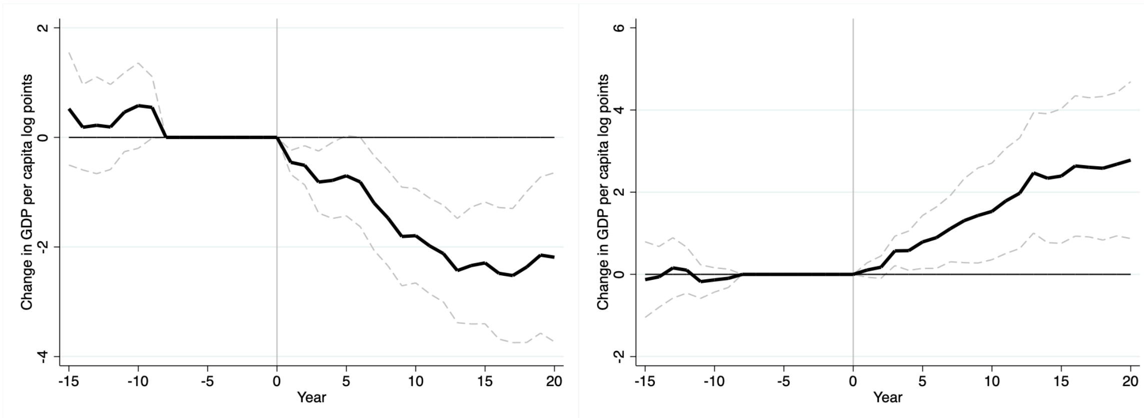
(a) For nonmanufacturer countries



(b) For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure C2: Average effects of tariff reductions on GDP per capita, controlling for interactions between year fixed effects and the initial economic structure

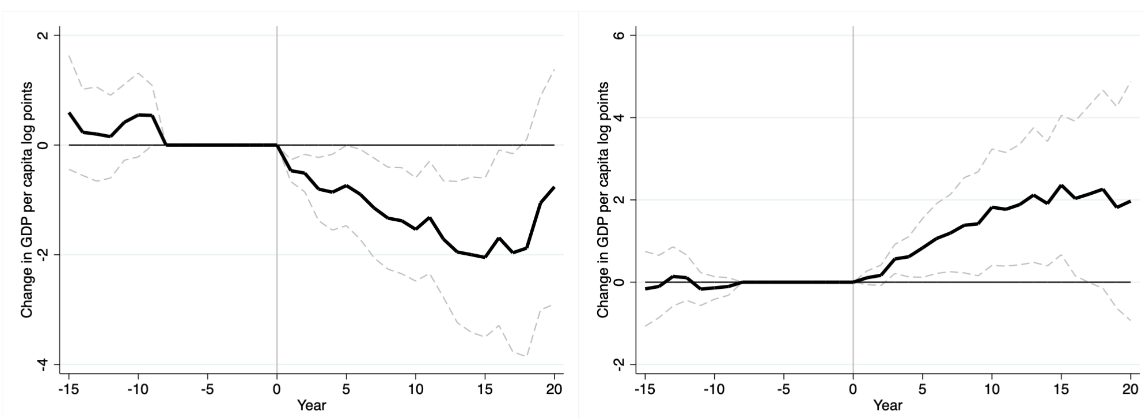


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Including other tariff changes

Figure C3: Average effects of tariff reductions on GDP per capita, controlling for other tariff changes

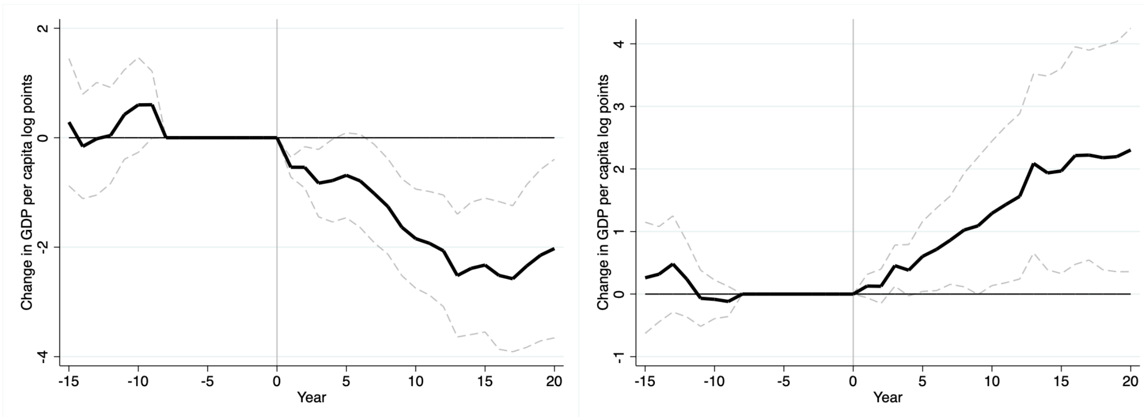


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Analyzing only relevant tariff changes

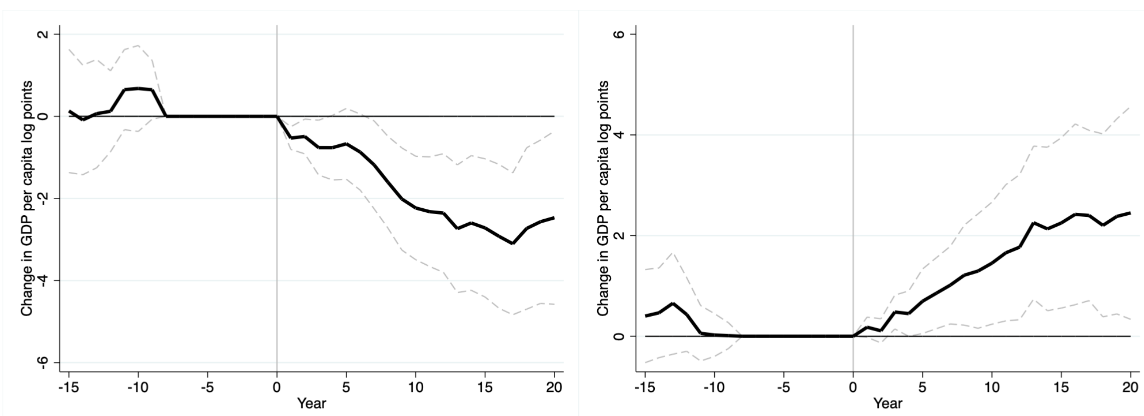
Figure C4: Average effects of tariff reductions on GDP per capita, considering only *relevant* tariff changes (at least one standard deviation from the mean)



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure C5: Average effects of tariff reductions on GDP per capita, considering only *relevant* tariff changes (at least two standard deviations from the mean)

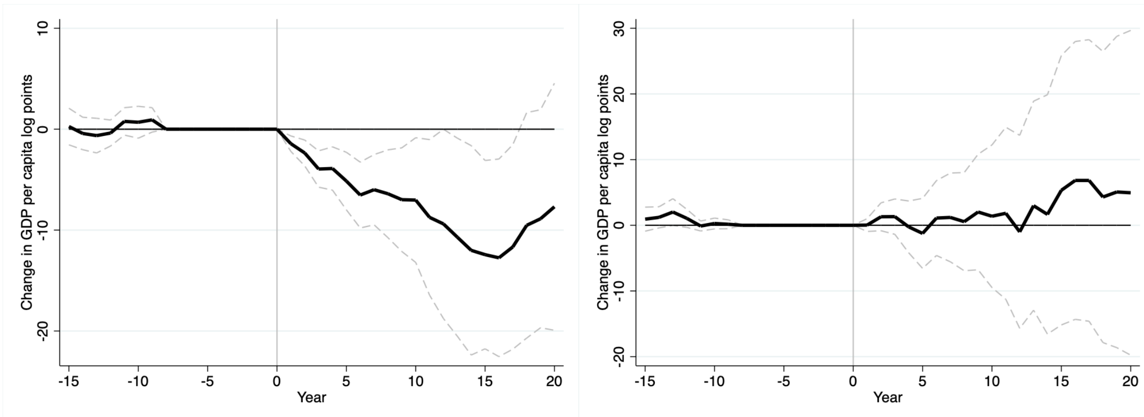


(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Clean controls analysis

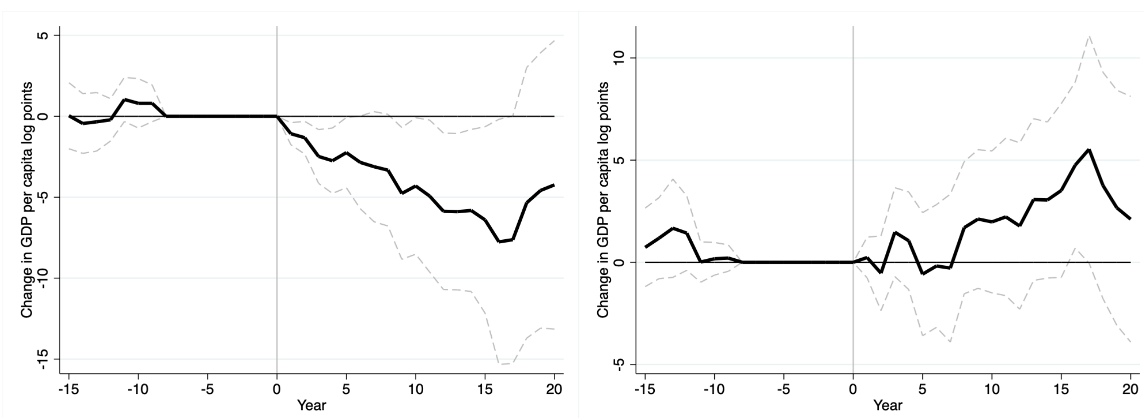
Figure C6: Average effects of tariff reductions on GDP per capita, clean controls analysis (at least one standard deviation from the mean)



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure C7: Average effects of tariff reductions on GDP per capita, clean controls analysis (at least two standard deviations from the mean)



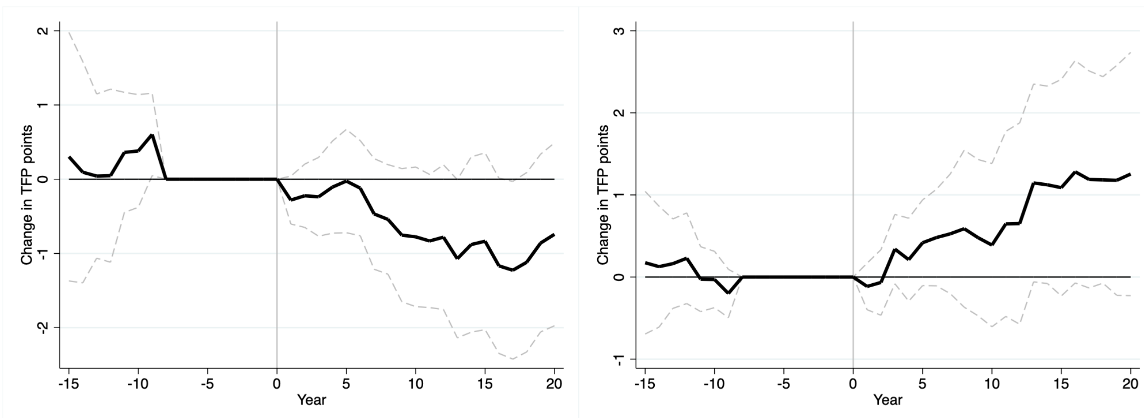
(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

D Mechanisms

Finally, I show results of effect estimates of tariff reductions on TFP, as an alternative to labor productivity, and on the share of imports in GDP. Direction of the effects for TFP go in line with the results documented with labor productivity, although the results are not significant at the 90 percent level of confidence. Results for the share of imports in GDP are not clearly different to zero, as discussed in the main text.

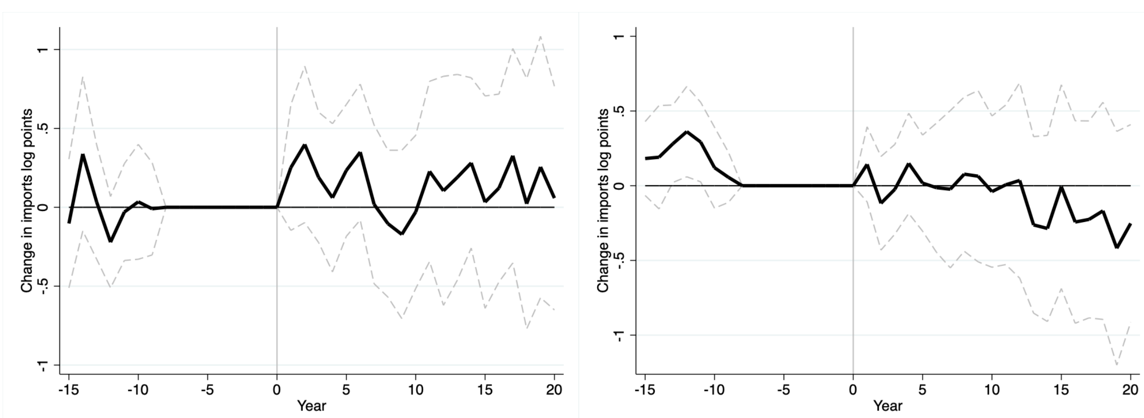
Figure D1: Average effects of tariff reductions on TFP



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure D2: Average effects of tariff reductions on the share of imports in GDP



(a) For nonmanufacturer countries **(b)** For manufacturer countries

Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.