Tariffs and Growth: Heterogeneity by Economic Structure*

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Abstract

A strand of the trade literature suggests that the relationship between trade policy and growth may depend on economic structure. Using cross-country data from 1960 to 2019, I provide evidence of such heterogeneity: tariff reductions are followed by higher levels of GDP per capita for manufacturer countries, but lower levels for nonmanufacturers. I use a local projections difference-in-differences (LP-DiD) approach to provide dynamic medium-term estimates and, since tariff reductions are preceded by a surge in GDP, to address the selection bias from pretrends. The heterogeneity is confirmed by several robustness checks that control for drivers of tariff changes (coming from endogenous trade policy literature) and for other potential confounders, a clean controls analysis aimed to address biases from heterogeneity as highlighted by recent difference-in-differences literature, and the use of dynamic panel estimators. Testing for mechanisms, I find that the heterogeneity appears to be linked to changes in productivity, capital accumulation, and 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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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 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).

An important strand of the theoretical literature suggests that the relationship between trade policy and growth may vary with economic structure. By opening up to trade, countries that are relatively better at producing in more dynamic economic sectors increase their specialization in those sectors and end up growing faster. Conversely, countries that are disadvantaged in dynamic sectors are driven by trade opening to reduce their specialization in those sectors and end up growing more slowly. This sharp heterogeneity might even be reinforced through heterogeneous changes in human capital accumulation following trade specialization, as suggested by Galor and Mountford (2008). According to Atkin, Costinot, and Fukui (2021), "a recurrent theme of this earlier literature on the dynamic effects of trade, as reviewed for instance by Grossman and Helpman (1995), is that there are good sectors, with opportunities for learning, and bad sectors, without them. For countries with a static comparative advantage in the latter sectors, free trade therefore slows down productivity growth, opening up the possibility of welfare losses from trade liberalization" (p. 5). In other words, the impact of trade liberalization on growth could be positive or negative depending on comparative advantage, on economic structure.

In this paper I provide empirical evidence consistent with this view: I demonstrate that the relationship between trade policy and growth is characterized by a sharp heterogeneity by economic structure. I do this by studying the dynamic medium-term relation between tariffs and GDP per capita using a panel of 161 countries from 1960 to 2019[1]. I provide evidence that after tariff reductions GDP per capita for nonmanufacturer countries falls, while GDP per capita for manufacturers increases. The estimates suggest that a one-standard-deviation reduction in tariffs (i.e., 3.65 percentage points) is associated to a fall (increase) of more than 2 percent in GDP per capita fifteen years later for nonmanufacturer (manufacturer) countries. The

[1] Trade policy is also composed by nontariff barriers, export taxes, among others. Although I focus on tariffs, I nonetheless control for nontariff barriers changes in a robustness check.

heterogeneity is significant even after twenty years from tariff reductions. I further show that the heterogeneity appears to be linked to changes on productivity and capital accumulation, in turn linked to changes on the manufacturing share of GDP.

To establish the baseline results, I address the selection bias stemming from pretrends, a first in the tariff-growth empirical literature. I first show, consistent with endogenous trade policy literature, that tariff reductions are endogenous to GDP dynamics, meaning that countries reducing (raising) tariffs do so after a relative period of economic success (crisis). More specifically, as shown in Figure 1, countries reducing tariffs (treatment group) are on a different trajectory ex ante as compared to countries not changing them (control group): GDP of the former is increasing in relative terms before tariff reductions (treatment). Then, to avoid biased dynamic estimates, I use the local projections difference-in-differences (LP-DiD) estimator, that provides a flexible semiparametric approach to control for pre-treatment values, as in conditional parallel trends (Dube, Girardi, Jordà, & Taylor, 2023). In other words, I model the endogeneity of tariffs to GDP by controlling for lags in growth rates, following the application first made by Acemoglu, Naidu, Restrepo, and Robinson (2019).

I then demonstrate that the baseline heterogeneity is extremely robust. First, I check the validity of the estimates after accounting for important confounding variables that have been shown to be relevant determining changes in tariffs, coming from the endogenous trade policy literature. Second, I check the validity to variables that are potentially related to both tariff changes and growth, as well as for some common trends for different groups of countries. Third, 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), I provide a robustness exercise aimed to address these problems. I use LP-DiD to implement 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 finally, I show that the heterogeneity also holds using dynamic panel estimators, especially the debiased Arellano-Bond estimator through sample splitting, recently proposed by Chen, Chernozhukov, and Fernández-Val (2019).

The results for theoretically grounded mechanisms further support the story of heterogeneity in the tariff-growth nexus by economic structure. I show that after tariff reductions nonmanufacturer countries experience lower productivity levels and capital accumulation falls. For manufacturer countries, on the other hand, after tariff reductions both productivity and capital accumulation increase. These results seem to be driven in turn by changes in the manufacturing share of GDP: after tariff reductions the manufacturing shares of GDP for nonmanufacturer (manufacturer) countries fall (increase). The evidence thus suggests manufacturing seems to be the more dynamic economic sector, as depicted in theory, which might be in line with the evidence by Rodrik (2013) that it is the only broad economic sector characterized by unconditional convergence. In the case of nonmanufacturer countries, the evidence can also be interpreted to support the premature deindustrialization story by Rodrik (2016), according to which developing countries deindustrialized after globalization.

Although this paper does not claim causality, a couple comments on identification in macroeconomics and cross-country regressions, as they relate to this paper, are in order. In the first place, identification in macroeconomics is extremely challenging, which is an important reason of why the trade empirical literature has shifted towards more micro settings. Causal estimates have been provided at the industry and firm levels[2], on the one hand, and a more recent literature has started providing evidence at the cross-sectional local level with shift-share methods (e.g., the China shock related-literature). Although these strands of the literature provide causal estimates and can even inform the macro mechanisms that might be under play, they do not provide answers on the aggregate general equilibrium response (Nakamura & Steinsson, 2018). In the second place, cross-country regressions, if exogeneity was guaranteed, do identify causal effects of the aggregate, general equilibrium impact of macro policy, including trade policy[3]. The serious challenge in cross-country regressions therefore is to identify episodes of exogenous variation that may allow causality claims.

What about using some methods from the micro focused literature in the cross-country setting? A recent contribution at the product-level uses changes on most-favored nation tariff rates as exogenous variation for minor trading partners to estimate trade elasticities (Boehm, Levchenko, & Pandalai-Nayar, 2023), but coming to the aggregate impact of tariffs on growth this strategy would not work because this source of variation is very likely to be endogenous to the aggregate income. A shift-share strategy using average global industry tariff reductions and sectoral employment would be an attractive alternative, but the tariff data I use does not provide sectoral variation and cross-country sectoral employment data is not widely available[4]. Given these limitations, without claiming causality, in this paper I stick to the simpler but clearer exercise possible: compare countries experiencing large reductions in tariffs with those experiencing minor changes, controlling for the relevant selection bias from pretrends, and control for all potential confounders as possible. The heterogeneity story proves to be extremely robust under this setting.

This paper provides three specific contributions to the cross-country tariff-growth

[2]See the paper by Goldberg and Pavcnik (2016) for a review of this literature.

[3]An example of this is the recent work by Fukui, Nakamura, and Steinsson (2023), where they study the aggregate impact of exchange rate depreciations with cross-country data.

[4]The best sectoral employment dataset available is the Economic Transformation Database, at the Groningen Growth and Development Centre, which covers only 51 economies and from 1990 onwards.

nexus empirical literature. First, the paper establishes that the relationship between tariffs and growth is characterized by a sharp heterogeneity by economic structure. Second, the analysis in the paper provides medium-term dynamic estimates (i.e., twenty years after tariff reductions) while also addressing the selection biases from pretrends, given that tariff reductions are preceded by a surge in GDP. And third, as mentioned above, the paper also provides evidence of potential theoretically-grounded mechanisms by which the heterogeneity by economic structure might exist.

As compared to the previous empirical cross-country literature studying the trade policy-growth relationship, this paper takes seriously the heterogeneity with regard to comparative advantage, or economic structure. On the one hand, most empirical contributions to date have focused on studying the *average* relationship between trade liberalization and economic growth, thus in some sense hiding potentially relevant heterogeneities. The seminal paper by Rodríguez and Rodrik (2001) reviewed the most important contributions from the 1990s. The authors criticized that most of this first-generation literature used independent variables capturing phenomena other than trade policy[5] and argued that the effect of trade policy on growth was not statistically significant other than zero[6]. More recent contributions, as revised recently by Goldberg and Pavcnik (2016) and Irwin (2019), seem to confirm the existence of an *average* positive relationship between trade liberalization and growth. Compared to recent contributions like those by Wacziarg and Welch (2008), Billmeier and Nannicini (2013) and Estevadeordal and Taylor (2013) I here show that the positive *average* relationship they document might mask important heterogeneity, particularly a significant negative relationship for nonmanufacturer countries .

On the other hand, although the previous literature has studied other heterogeneities in the tariff-growth nexus, none of them has focused on the one that may come from the economic structure. Yanikkaya (2003) first studied the relationship between growth and several different trade policies. His results showed that trade restrictions encourage growth, especially in developing countries. DeJong and Ripoll (2006) then explicitly studied the heterogeneity of tariffs in relation to income per capita. They found that trade restrictions may encourage growth in developing countries but negatively impact growth in developed countries. Galor and Mountford (2008) also provide evidence consistent with the view of heterogeneous effects of trade (more than policy) by income. Finally, Nunn and Trefler (2010) argued

[5]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.

[6]The authors actually conclude that the literature should study the heterogeneous effects of trade policy on growth, instead of focusing exclusively on a general, unambiguous relationship. For example, they suggest studying heterogeneous effects in relation to comparative advantage in manufacturing, what I call here economic structure.

that what really mattered was the skill bias of tariffs: higher tariffs in skill-intensive sectors are robustly linked to higher growth. In contrast to these papers, I argue here that the force driving the heterogeneity is economic structure more than income, which is in a sense consistent with the evidence found in Nunn and Trefler (2010).

Finally, this paper also provides dynamic medium-term estimates of the tariff-growth nexus, which in turn allow me to address the selection bias of tariff reductions to GDP dynamics. Although the previous literature generally focused on small samples of 5-, 10- or 15-year averages, trying to capture medium-run effects, the recent studies by Furceri et al. (2020, 2022) do provide dynamic medium-run estimates. The authors study annual changes in average tariffs rates from 1960 to 2014 on growth and other macroeconomic variables through a local projections method[7]. They make use of a new dataset compiled by IMF researchers documenting tariff rates for 161 countries, the longest coverage to date, which is the data I use here. Nevertheless, those papers did not test for pretrends, which is crucial 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. Additionally, the authors restricted the analysis to 5 years after tariff changes, while my analysis considers a longer window, going up to twenty years after tariff reductions.

The paper has six sections in addition to this introduction. In section 2, I provide a theoretical discussion to motivate the empirical investigation and explain why I use the manufacturing share of exports as the measure of economic structure. In section 3, I present the data used and some descriptive statistics. In section 4, I present the baseline results, demonstrating the existence of heterogeneity in the tariff-growth nexus based on economic structure. In section 5, I present several robustness checks. In section 6, I show the analysis on potential mechanisms underpinning the heterogeneity. Finally, in section 7, 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

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

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 on medium-term dynamic effects.

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 increased production, so that as time goes on, producers become more productive simply by being involved 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), Redding (1999), and the more recent paper by Greenwald and Stiglitz (2006). Afterwards, with the emergence of endogenous growth theory, the analysis of trade and innovation gained new traction in the 1990s, especially due to the seminal work by Grossman and Helpman (1991)[8]. Feenstra (1996) provides another important example in this second strand of the literature, an analysis of trade, endogenous innovation, and growth.

Although the theoretical details in these traditions may differ, they both convey the message that the effects of trade policy vary with economic structure. The idea is that trade leads economies to specialize in economic sectors they are relatively more productive, but where those sectors may have now a differential impact on technological progress and thus on 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). Moreover, this sharp heterogeneity could be reinforced if we add that sectors may have different skill-intensities. If that is the case, trade then also leads to heterogeneous effects in the same direction on human capital accumulation, as emphasized by Galor and Mountford (2008). Because of the effect it has on the specialization patterns according to comparative advantage, obstructing or facilitating their materialization, trade policy therefore has a significant effect on growth, in turn mediated by economic

[8]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 work.

structure (Greenwald & 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 works by 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) shows that manufacturing, unlike other sectors, experiences unconditional convergence. 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[9]. Recent work by Blanchard and Olney (2017) and Ekanayake, Madsen, and Bharati (2023) also show that the composition of exports have differential implications for growth, thus suggesting that alternative trade specialization patterns after trade opening may deliver different growth results.

A recent article by Atkin et al. (2021) provides both theory and evidence that support the idea that qualitative sectoral differences do exist and that trade can therefore lead to dynamic welfare losses for countries specializing in traditional sectors. The authors construct a model of trade and development where sectors differ in their economic complexity, which in turn exerts positive effects on the growth of the countries producing them. The authors demonstrate theoretically that if international competition is tougher in more complex goods, then trade leads to dynamic welfare losses for most countries in the globe, only excluding a few ones that remain specialized in the production of complex goods. They then 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. And they show crucial evidence that suggests competition is indeed tougher in more complex goods. They conclude that "[t]hrough 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

[9]This can be interpreted as evidence supporting the model by Stiglitz (2015), where international knowledge spillovers exist, but they only materialize through the more dynamic sector.

to capture it. In other words, I assume that countries with high manufacturing exports have a comparative advantage in more dynamic 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 dynamic sector and that the share of manufacturing exports captures comparative advantage in manufacturing. 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[10].

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 2017 dollars taken from the Penn World Table (PWT) 10.0. The tariff 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 tariff data is lower than that of the GDP data, so I end up using approximately 4,700 observations in the regressions.

To capture economic structure, I gather information on shares of manufacturing exports from COMTRADE data, cleaned 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 exports in 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[11]. 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 dataset has country-year data on the trade share on GDP and investment as a share of GDP, taken from the World Development Indicators (WDI); the economic growth forecast, the net exports terms of trade, and the real effective exchange rate, taken from the IMF; the Gini index, taken from the Standardized World Income Inequality Database by 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

[10] 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, Figure B29, are virtually the same as the baseline results, presented in Figure 3.

[11] Another important goods classifications is the one by Lall (2000), based on technological categories. I use this classification in a robustness check, Figure B28, and results remain basically the same.

of nontariff barriers, recently published by Estefania-Flores, Furceri, Hannan, Ostry, and Rose (2022). In a robustness check, 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 North 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 and 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. 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, capital accounts have also moved towards liberalization, as captured by the Chinn-Ito index. 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 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 tariff reductions are associated to lower (higher) GDP per capita for nonmanufacturer (manufacturer) countries.

4.1 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. (2023) has advanced an estimator based on the seminal LP contribution but addressing the recent challenges of the new difference-in-differences literature, the LP-DiD estimator. LP-DiD is specifically useful for the question on the tariff-growth nexus as it allows to estimate medium-term dynamic correlations and also capture pretrends by flexibly controlling on observables to avoid potential biases coming from clear violations of the parallel trends assumption. I explain these advantages in more detail below.

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.

First, LP-DiD, although this applies for LP in general, provides a simpler form of estimating dynamic associations that arguably performs better in terms of biases as compared to VARs. LP capture the effect of a shock 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 shock 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[12].

This ability to estimate medium-term dynamic relations is advantageous with respect to previous estimates in the empirical literature. The literature has usually captured only instantaneous relations (as in Wacziarg and Welch (2008)) or captured medium-term ones by doing regression analyses 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 the instantaneous correlation does not actually reflect the mechanisms derived from the reviewed theory on trade and growth, which point to a relocation of factors of production and technological changes, mechanisms that take time to emerge. The second operationalization, although arguably capturing medium-term correlations, does not in fact capture dynamics and leads to regressions with small samples, ranging from 47 observations to a maximum of 260.

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., 2023). Simple LP estimates allow to observe the trajectory of the outcome variable both after and before the shock. 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, essentially the same to what Acemoglu et al. (2019) do. Particularly, the LP-DiD specification proposed by Dube et al. (2023) consists on modelling those pretrends through the inclusion of lags of first differences of the outcome variable (i.e., here, lags of growth rates). By doing this, they show that biases coming from pretrends can be effectively

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

eliminated, so that in the case here I might be able to model the surge and eliminate the potential selection bias arising from it[13]. The advantage of LP-DiD is essentially driven by its flexibility that allows it to control for pretreatment outcome dynamics, which is not straightforward in traditional and recent DiD estimators. The authors provide Montecarlo evidence showing that, in presence of selection biases like the one mentioned before, the flexibility of LP-DiD proves to be superior addressing pretrends biases in comparison to recent estimators like those by Callaway and Sant'Anna (2021) and Sun and Abraham (2021).

How does the LP-DiD estimator relates to the problem of biases after pretrends testing? According to Roth (2022), conditioning the analysis on pretrends testing may introduce biases on the estimates. More specifically, the draws of data that pass the pretrends test is a selected sample of the data, and therefore might exacerbate biases. Instead of trusting on pretesting only, Roth (2022) argues that one solution, proposed by Freyaldenhoven, Hansen, and Shapiro (2019), is to use a covariate affected by the unobserved confound but not the treatment to tackle the endogeneity. More specifically, Freyaldenhoven et al. (2019) propose to use the trends in the covariate to net out the effect that is not due to the confound. After identifying clear parallel trends violations, the authors show that directly controlling for the covariate works perfectly in theory if the covariate is a perfect proxy for the confound and that it performs pretty well in relevant empirical applications where this might be less true.

The way the LP-DiD estimator deals with violations of the parallel trends assumption is not subject to biases after pretesting. On the contrary, the LP-DiD essentially amount to tackle the pretrends biases by exploiting covariates, as in Freyaldenhoven et al. (2019). In other words, controlling for covariates is not subject to the biases of sample selection that arise after pretesting, as signaled by Roth (2022). As will be shown below, and has been demonstrated previously in the literature (Bohara & Kaempfer, 1991a, 1991b), tariffs are endogenous to GDP growth, which in turn is interpreted as a proxy for self-interested political pressure. By controlling for pretreatment growth rates, the LP DiD estimator either controls directly for the source of endogeneity (as in Panel A in Figure 2 in Freyaldenhoven et al. (2019)), if we think that source is precisely previous growth dynamics, or controls as a proxy for the source of endogeneity (as in Panel C in Figure 2 in Freyaldenhoven et al. (2019)), if we think that source is political pressure.

4.2 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 tariff-growth

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

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

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

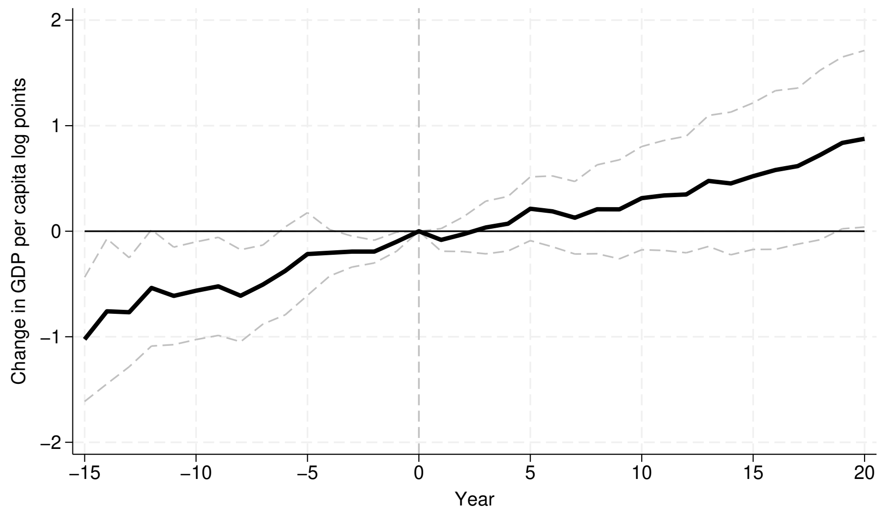
where $y_{c,t+h}$ stands for (log) GDP per capita in country c in year $t+h$ and $\Delta TA_{c,t}$ refers to the change in the tariff level in year t with respect to year $t-1$, the variable of interest. To observe both the trajectory of GDP per capita before and after tariff changes, I estimate this regression equation separately for each $h = -15, -14, ..., 0, ..., 19, 20$. 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. The cumulative change in GDP per capita in $t+h$ related to a one-percentage-point increase in tariffs is captured by β_h. Following Dube et al. (2023), I include only time fixed effects, as the equation is already in differences[14].

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 in Figures A1 and A2, by separating the estimates of both increases and decreases I only find significant results for tariff reductions. This means that the average correlations 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 relative surge in GDP before tariff reductions as compared to the latter. In other words, tariff changes are endogenous to the evolution of GDP, such that countries that decide to reduce tariffs do so after GDP has been on a relative increase, also consistent with the findings by Bohara and Kaempfer (1991b). Failure to control for this surge constitutes a clear violation of the parallel trends assumption and may lead to biases in the estimates.

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

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



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.

How to deal with this violation of the parallel trends assumption? As mentioned before, following the approach by Dube et al. (2023) I model pretrends through lags of growth rates of GDP per capita.

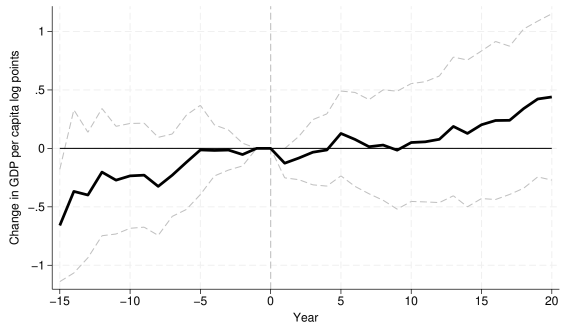
Formally, the LP-DiD equation to control for pretrends is:

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

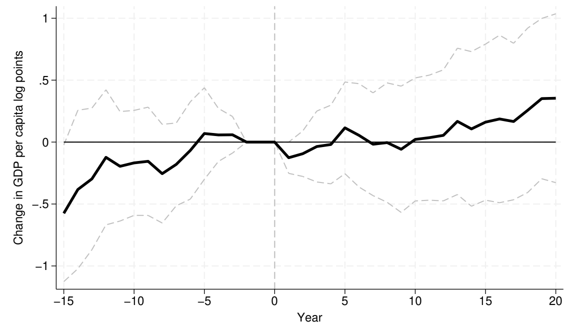
where, unlike in equation 1, I also include lags of the growth rate of GDP per capita to capture the surge in GDP preceding tariff reductions. The growth rate, $g_{c,t}$, is calculated simply as $y_{c,t} - y_{c,t-1}$, given that y already represents (log) GDP per capita. I use 1, 2, 4 or 8 lags of the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

The results of the estimates of equation 2 are presented in Figure 2. Only in the case with 8 lags am I able to obtain equal trajectories for countries reducing tariffs and countries not changing them. More importantly, the estimates change substantially when controlling for pretrends. While Figure 1 shows that GDP significantly increases twenty years after tariff reductions, Figure 2, with 8 lags, effectively modeling pretrends, shows that the estimates are less than half in magnitude and no longer significant. Therefore, from here onward, I add 8 lags of growth rates to avoid selection biases from the surge in GDP. If the researcher were to stop at this point, tariff changes and growth would appear to be uncorrelated, but that result would mask important heterogeneity, as I proceed to show below.

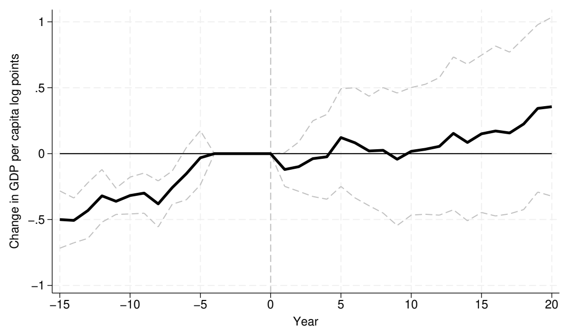
Figure 2: Modeling the surge in GDP per capita before tariff reductions through lags in growth rates



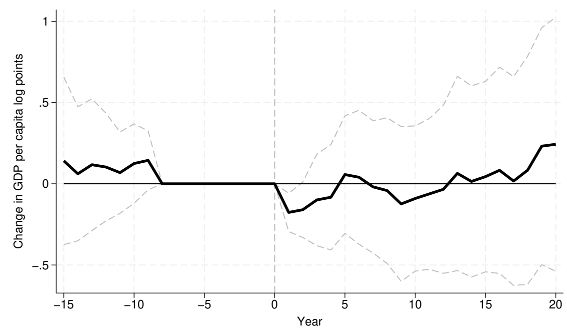
(a) 1 lag



(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.

4.3 Baseline heterogeneity

I now return to the main question of interest: does the tariff-growth nexus vary according to the economic structure of the countries? More precisely, is there suggestive evidence that trade liberalization may operate differently in manufacturer and nonmanufacturer countries?

To capture the heterogeneity in the relationship between tariffs and growth in relation to economic structures, I have to change the regression equation. The new LP-DiD equation is as follows:

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

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 tariff reductions, to avoid contemporaneous endogeneity that may run from GDP to manufacturing exports. With this specification, the relation between tariff changes and 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 display the significance of the heterogeneity, I plot the estimates for the 10th and the 90th percentiles of the share of manufacturing exports. In other words, I present the estimate associated to one-standard-deviation reduction 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[15]. From now on, I refer to the former estimates as those of nonmanufacturer countries and to the latter as the estimates of manufacturer countries[16].

Figure 3 reveals the results associated to equation 3, capturing the coefficients of tariff reductions reductions for manufacturer and nonmanufacturer countries. The crucial result is that there is a significant heterogeneity of tariffs on GDP per capita associated with the initial share of manufacturing exports. For nonmanufacturer countries, the relation is negative, meaning that the liberalization of trade policy has been followed by a fall in GDP. For manufacturer countries, on the other hand, liberalizing their trade regimes has been followed by higher GDP levels. Both subfigures in 3 also reveal that the pretrends are not different, which is reassuring on the specification with 8 lags of growth rates to avoid selection biases.

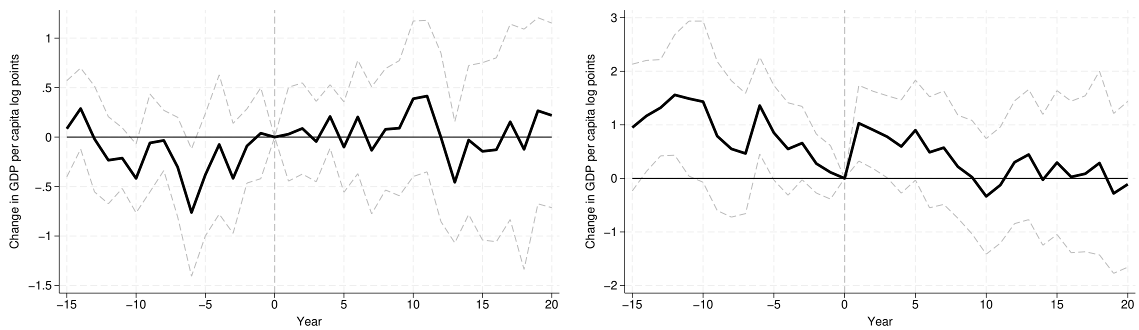
The heterogeneity of the tariff-growth nexus by economic structure is both statistically and economically meaningful. A one-standard-deviation reduction in tariffs is associated to an average decrease of 2.31 percent in GDP per capita after 15 years for nonmanufacturer countries. For manufacturer countries, on the contrary, a one-standard-deviation decrease in tariffs is linked to an average increase in GDP after 15 years of approximately 2.32 percent. The change in GDP seems to stabilize after ten years, but the difference in levels persists 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.

[15] The reader may recall that the Appendix shows separate estimates for tariff increases and tariff reductions, only the latter being significant.

[16] In Figures A3 and A4 in the Appendix, I show that for only two deciles—the 50th and 60th—I obtain results with no significant association. The association is thus stronger for nonmanufacturer countries.

Assuming a constant marginal relation, a 25-percentage-point reduction in tariffs would be linked to 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 estimate that I obtain.

Figure 3: Heterogeneity in GDP per capita after tariff reductions



(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.

4.4 Nonlinear heterogeneity and heterogeneous pretrends

Throughout the rest of the paper, I use the specification of heterogeneity 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 tariff-growth nexus is a linear function of the share of manufacturing exports, but this is not guaranteed a priori. In other words, it could be the case that the baseline results are the outcome of extrapolation from assumed functional forms. To test for a nonlinear relationship, I change the regression specification by introducing dummies for six quantiles of observations according to their economic structure and the interactions between these dummies and the change in tariffs. The new equation is as follows:

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

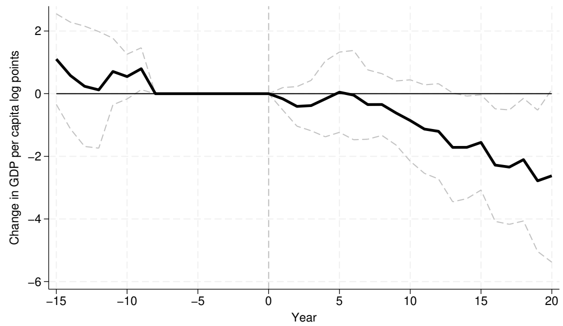
where k now refers to quantiles of manufacturing exports, so that $k = 1$ refers to observations in the bottom 16.6 percent of that variable. Also, $md_{c,t}^k$ refers to the manufacturing dummy taking value 1 if the observation belongs to the quantile k or zero otherwise. Finally, $intd^k_{c,t}$ represents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

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. For the first quantile of manufacturing exports, GDP per capita is lower in all the 20 years after tariff reductions, although only statistically significant after 15 years. For the second quintile, GDP per capita is lower in all the 20 years after tariff reductions, with the relation being significant all 15 years after the reduction but not afterwards. 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 is indeed heterogeneity in the relationship between tariffs and GDP per capita based on economic structure, and that this relationship is not the outcome of the linearity assumption in the baseline results[17].

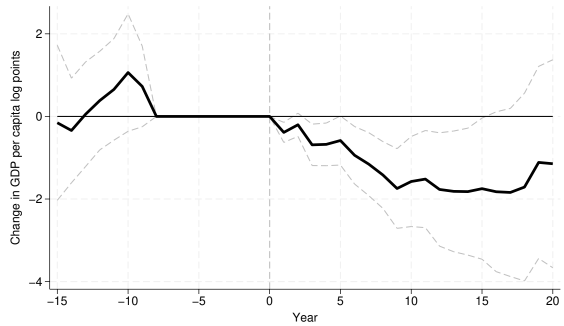
Second, the underlying identification assumption of the baseline results, if these estimates were to claim causality, is that, conditional on eight lags of growth rates, tariff reductions are as good as random. However, given that the main focus of the empirical exercise is to establish the existence of heterogeneity in the tariff-growth nexus by economic structure, the crucial aspect becomes that countries reducing tariffs are not in a different trajectory before reducing tariffs as compared to countries not changing them, in each of the groups, nonmanufacturers and manufacturers. In the same way, to potentially accommodate differential pretrends between manufacturers and nonmanufacturers and also relax the assumption based on eight lags it becomes important to check the sensitivity of the results to alternative lag structures.

[17]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.

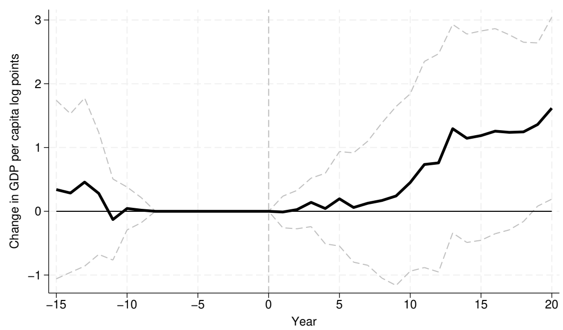
Figure 4: Heterogeneity in GDP per capita after tariff reductions: quantiles of economic structure



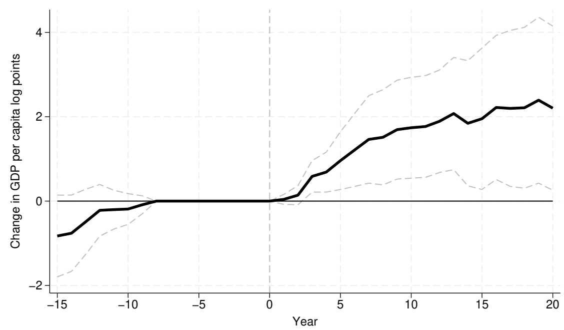
(a) First quantile



(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.

I first check pretrends for each group by presenting heterogeneity results from estimating equation 3 without lags. Results are presented in Figure A5. The pretrends analyzed in Figure 1, according to which tariff reductions are preceded by a surge in GDP, only hold for manufacturers. In other words, while nonmanufacturers reducing tariffs seem not to be in a different trend compared to nonmanufacturers not changing them, manufacturers do experience a significant increase in GDP before reducing tariffs as compared to manufacturers not changing them. Nevertheless, it is good to remind that the statistical power for pretrends testing is low (Roth, 2022), so that even for nonmanufacturers there might be a violation of the parallel trends assumption although not captured empirically. Apart from the pretrends analysis, the Figure still shows a significant association between tariff reductions and GDP per capita, positive for manufacturers and negative for nonmanufacturers. In other words, the significant heterogeneity documented in the paper holds even when I do not include eight lags of growth rates.

I then relax the assumption of the baseline specification related to modelling the selection bias through eight lags of growth rates. Figures A6 and A7 show the results when I include one lag, two lags, four lags and six lags, instead of eight as in the baseline equation 3. As before, significant pretrends only emerge for the case of manufacturer countries. A crucial difference of this heterogeneity analysis of pretrends is that the pretrends for manufacturers are significant even in the case of one or two lags, contrary to the homogeneous average case depicted in Figure B1. In fact, even when we include six lags, although pretrends become insignificant, a visible positive pretrend for manufacturers still exists. By looking again at Figure 3, compared to these ones, it becomes evident that only when I include eight lags the pretrend stop being clearly positive. Given that pretrends testing may not be enough to cure estimates from biases emerging from violations of parallel trends (Roth, 2022), the specification with eight lags is much better to address potential biases from pretrends as it really captures the pretrend (beyond significance). Nonetheless, it is reassuring to find that the heterogeneity documented in the paper is not driven by the specific lag structure adopted to model the pretrends biases.

5 Robustness

So far, I have shown that the relationship between tariffs and GDP per capita is different for manufacturer than for nonmanufacturer countries. I have also used LP-DiD so the estimates may not be affected by selection biases from the surge in GDP that precedes tariff reductions. However, the validity of the baseline results still depends critically on the nonexistence of time-varying economic and/or political factors that relate both to changes in tariffs and changes in GDP (i.e., omitted variable biases). Therefore, in this section I first investigate the validity of the results to important confounders in the tariff-growth nexus. I first investigate the robustness of the heterogeneity to variables that have been found to explain tariff changes, coming from the endogenous trade policy literature, and then I investigate further other potential confounders. The results of these two set of exercises are summarized in Figure 5, which represents the average percent change in GDP between 13-17 years after a tariff reduction. For these exercises, I simply add four lags of changes in the covariates, as done recently by Acemoglu et al. (2019)[18]. 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[19]. Individual LP-DiD graphs for each robustness exercise can be found in Appendix B.

Additional sources of potential concern are the biases that come from heterogeneity within two-way fixed effects regressions, as highlighted by recent difference-in-differences literature, and the exclusive use of the LP-DiD estimator.

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

[19] 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.

Recent difference-in-differences literature has demonstrated that two-way fixed effects estimates under heterogeneous effects capture terms beyond the causal effect of interest, so they might be severely biased (de Chaisemartin & d'Haultfoeuille, 2020; Sun & Abraham, 2021; Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021; Callaway, Goodman-Bacon, & Sant'Anna, 2021). To address this concern, I follow the recent work by de Chaisemartin et al. (2022) precisely designed for cases where the independent variable of interest is continuously distributed in every time period, as is here. And finally, I make use of three dynamic panel data estimators to show that the heterogeneity is not driven by the reliance on the LP-DiD estimator.

I end this section by providing some additional robustness checks, some of them particularly addressing concerns of endogeneity of the economic structure.

5.1 Endogenous trade policy

As mentioned, in this subsection I show robustness checks related to variables identified as drivers of tariffs, coming from the endogenous trade policy literature. 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) then provided formalization of this argument. These theoretical works triggered empirical work. The first factor identified to explain trade policy empirically was GDP growth. Bohara and Kaempfer (1991b) presented evidence from the US that GDP growth led 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 was 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 baseline estimates might be biased if they fail to account for these 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 capture the driver of tariff changes 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 heterogeneity survives this first exercise, with the average association 13-17 years after a tariff reduction still negative for nonmanufacturer countries but positive for manufacturer countries[20].

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). The results are presented in robustness exercise number 2 in Figure 5. The heterogeneity 13-17 years after the decrease in tariffs is still significant.

Finally, to control for endogeneity that may arise from import penetration, I use 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 holds. 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 tariff reductions are still associated with lower GDP for nonmanufacturer countries[21]. This might mean that the negative relation between tariff reductions and GDP for nonmanufacturer countries might be linked to a mechanism other than trade volume.

5.2 Other confounders

Next, I perform robustness checks on other potential confounders in the tariff-growth nexus in four steps. First, I show robustness checks with respect to other policy changes that might be associated to changes in tariffs. Second, I show the robustness of the results to consideration of economic phenomena that have been found to be important for explaining growth. Third, I investigate the robustness of the heterogeneity to other possible heterogeneous relations in the tariff-growth nexus. Finally, I investigate the robustness of the baseline results to different trends in GDP among groups of countries.

In short, this section confirms the validity of the baseline results after considering important covariates and thus confirms the existence of heterogeneity in the tariff-growth relationship from initial economic structures.

[20] An important thing to note here is that the information on growth forecasts is available only from 1990. This is also reassuring of the validity of the baseline results, as the availability of data by country after 1990 becomes less biased towards developed countries. This also implies that the estimates are essentially driven by the trade liberalization of the 1990s.

[21] This result is actually in line with the finding by Yanikkaya (2003) where both 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 becomes 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[22]. The results are presented in robustness exercise number 4 in Figure 5. The heterogeneity remains similar to that in the baseline results [23].

The second policy change that I test robustness for is capital account openness. Usually, trade liberalization occurs alongside capital account liberalization. The results are presented in robustness exercise number 5 in Figure 5. Reassuringly, the results again point to a significant heterogeneity.

Third, I test the robustness of the results to changes in institutional quality. As shown elsewhere, institutional quality is considered a fundamental to explain long-run economic outcomes (Acemoglu et al., 2019). The results are presented in robustness exercise number 6 in Figure 5. The heterogeneity holds.

Relevant variables that explain growth

Another threat to the validity of the baseline results comes from relevant covariates proven to affect GDP that might also be correlated with tariff changes. To provide reassurance on the validity of the baseline results, I control for each of them in turn.

First, I test for the possibility that the results might be affected by changes in human capital. The results are presented in robustness exercise number 7 in Figure 5. Changes in human capital do not drive the results, such that the heterogeneity

[22] 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 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.

[23] Although not shown here, changes in nontariff barriers have no significant relation to GDP in the whole period studied. 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 heterogeneity from tariffs holds even in that case, as shown in Figure B19.

remains significant.

Second, I test the robustness of the results to changes in population size. The results are presented in robustness exercise number 8 in Figure 5. The heterogeneity remains similar to that found in the baseline.

Third, I test the robustness of the results to changes in trade as a share of GDP. Results are presented in robustness exercise number 9 in Figure 5. The heterogeneity of the tariff-growth relationship conditional on the initial economic structure once again remains significant. Additionally, changes in trade as a share of GDP are positively associated with GDP across the whole period studied, consistent with the causal findings by Feyrer (2019).

Fourth, I consider changes in capital accumulation. 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. The results are presented in robustness exercise number 10 in Figure 5. The heterogeneity remains significant.

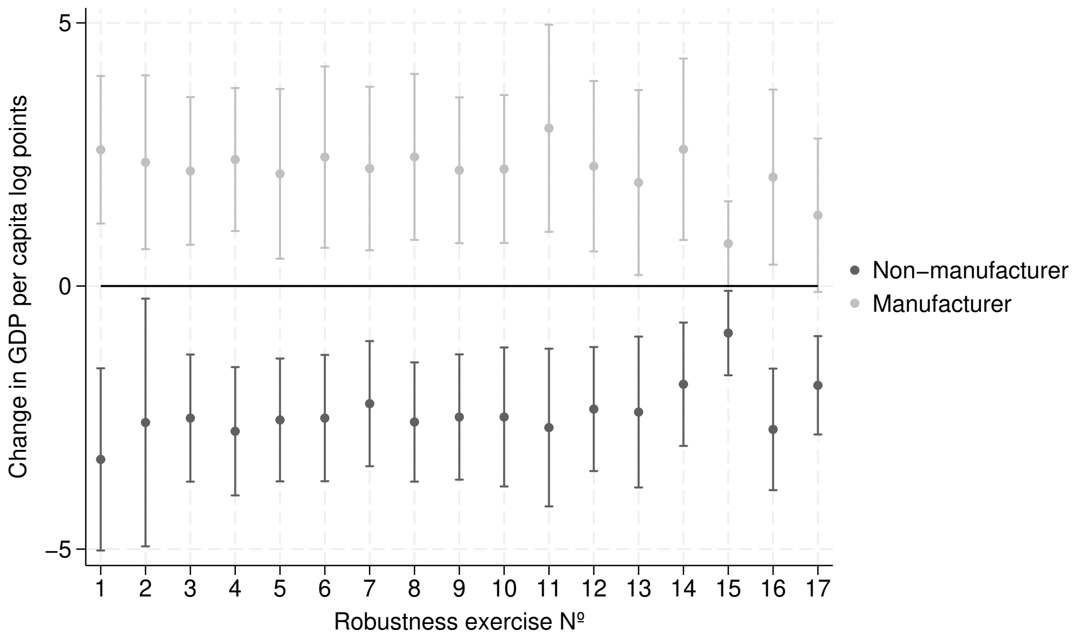
Fifth, I test the results to changes in the real exchange rate. Tariff changes can be related to real exchange rate changes, that have been in turn shown to affect GDP (Rodrik, 2008), such that the baseline estimates might be biased. The results are presented in robustness exercise number 11 in Figure 5. The identified heterogeneity is still significant.

Finally, I test the robustness of the results to changes in the terms of trade. It can be 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. The results are presented in robustness exercise number 12 in Figure 5. The heterogeneity is still significant.

Other heterogeneities

There might be other relevant heterogeneities at play in the tariff-growth nexus that might make the baseline estimates invalid. Two heterogeneities might be important. First, although I interpret the theoretical literature mainly pointing to heterogeneity from economic structures, some works talk about distance to the frontier (see Acemoglu, Aghion, and Zilibotti (2006) for an example) as the source of heterogeneity, which might be more adequately captured by initial income. 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 the source of heterogeneity from tariffs.

Figure 5: Heterogeneity in GDP per capita between 13-17 years after tariff reductions: robustness



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 estimates 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 heterogeneity from income. Exercise 14 is the outcome of estimating equation 3 with heterogeneity 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 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 heterogeneity 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 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 are associated to lower growth, while countries with high levels of human capital will experience gains in GDP after 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 heterogeneity 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 heterogeneity is robust to these checks, as shown in robustness exercises 15, 16 and 17 respectively, in Figure 5.

Overall, the results in Figure 5 are reassuring that there is significant heterogeneity in the relationship betwee tariffs and GDP per capita depending on initial economic structures. Reducing tariffs has been accompanied by lower growth in nonmanufacturer countries but higher growth in manufacturer countries. Although claiming causality in cross-country regressions is difficult, I think these estimates suggest the existence of an extremely robust and economically meaningful heterogeneous relationship between tariffs and GDP based on economic structures. Although there might be other phenomena that could drive both tariff changes and GDP per capita changes, the battery of robustness exercises presented suggest that this is not likely the case. Furthermore, in Figure B19 I also show results of the estimates including all control variables at the same time. Although this exercise is supremely demanding, and I lose a lot of statistical power, the direction of the heterogeneity still holds and is significant around 13 years after tariff reductions. Overall, this further reassures that the heterogeneity is not being driven by correlations between covariates, which were not captured when controlling for each covariate in turn.

5.3 Clean controls analysis

Although the current exercise does not claim causality, there is another source of bias that might be driving the heterogeneity documented. Recent contributions on difference-in-differences have shown that standard estimates based on two-way fixed effects regressions under a parallel trends assumption are not entirely reliable (de Chaisemartin & d'Haultfoeuille, 2020; Goodman-Bacon, 2021). This literature has shown that under treatment heterogeneity and differential treatment timing, estimates might be biased. The biases arise from using units as part of the control group that have been treated before, although they may not receive any treatment in the period of interest. The solutions devised so far thus require the existence of "clean controls", that is, observations never treated or not treated before the time horizon at which the effect is estimated, which is the base for the estimators that have been recently proposed (Callaway & Sant'Anna, 2021; Sun & Abraham, 2021; de Chaisemartin et al., 2022).

My baseline results, therefore, can potentially be biased due to the use of "bad controls", as I used there all available country-year observations. 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. The problem, however, is that tariff changes at the country level occur every year, so variation in treatment timing is pervasive in this setting, and biases stemming from it could be as well. A country-year observation with a relatively low tariff change might be a "bad control" because that country might have experienced a tariff change in previous years (de Chaisemartin & D'Haultfœuille, 2022). This problem is actually pervasive in difference-in-differences analyses with treatments continuously distributed every time period[24].

A solution to estimating treatment effects with treatments continuously distributed every time period has been recently proposed by de Chaisemartin et al. (2022), and I therefore follow it closely. The authors propose to use movers as treatment observations and quasi-stayers as control observations. A quasi-stayer is defined as an observation where changes in treatment intensity (i.e., tariff changes) are almost negligible, so that assuming treatment doesn't change is justifiable. It is actually easy to identify quasi-stayers in the tariff-growth setting. In most years since 1960, countries do not really change their average tariffs, but slight variation still appears in the data, even perhaps in some cases due to errors in the data collection process. More specifically, the 25th percentile of tariff changes is -0.76 percentage points, and the 75th percentile is 0.35 percentage points, so that most tariff changes

[24] The now widely used estimators proposed by Callaway and Sant'Anna (2021) or Sun and Abraham (2021) are not helpful for the tariff-growth cross-country setting studied in this paper, as they are not suited to continuous treatments that might change every time period.

are relatively small. Therefore, to differentiate between movers and quasi-stayers, I propose a definition for *relevant* tariff changes. A tariff change is *relevant* if it is one-standard-deviation separated from the mean tariff change[25]. The implication of this definition is that quasi-stayers are those observations with tariff changes that are not *relevant* and the movers are those with *relevant* ones[26].

The previous definition is not enough to circumvent the problem of "bad controls". For example, an observation of a country in 1995 with no *relevant* tariff change, a quasi-stayer, is still a "bad control" if that country experienced a *relevant* tariff change in 1990. Moreover, tariffs have been in place way before 1960 and countries usually experience more than one *relevant* tariff change in the sample, so having "clean control" observations in this setting becomes almost impossible. Nevertheless, what matters to get a "clean control" country-year observation is not that the country never experienced a *relevant* tariff change before, but that the dynamic treatment effect of that previous treatment has stabilized at the moment of the analysis (Dube et al., 2023). In other words, what matters is that the GDP associated to the *relevant* tariff change of 1990 stabilizes in a new level in 1995, and thus the quasi-stayer observation in 1995 is not in a differential trend as compared to the movers in that year. When have the potential effects of tariff changes stabilized in this setting? By observing Figure 3, it seems treatment effects stabilize approximately ten years after tariff reductions. Based on that, I further assume that a quasi-stayer country-year observation can only be used as a control if the country has not experienced a *relevant* tariff change in the previous ten years, what I call the ten-year rule[27].

I thus implement a clean controls analysis following de Chaisemartin et al. (2022) by relying on the definition of movers and quasi-stayers based on *relevant* tariff changes and on the ten-year rule. In practice, that means estimating the LP-DiD specification from equation 3 but only including both mover and quasi-stayer observations that satisfy the ten-year rule.

The results of this clean controls analysis are shown in Figure 6. They are much noisier than those of the baseline, 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 (quasi-stayer observations are also excluded as some of them might be "bad" by the effect of a previous treatment). Nevertheless, for nonmanufacturer countries reducing tariffs is still negatively associated to GDP

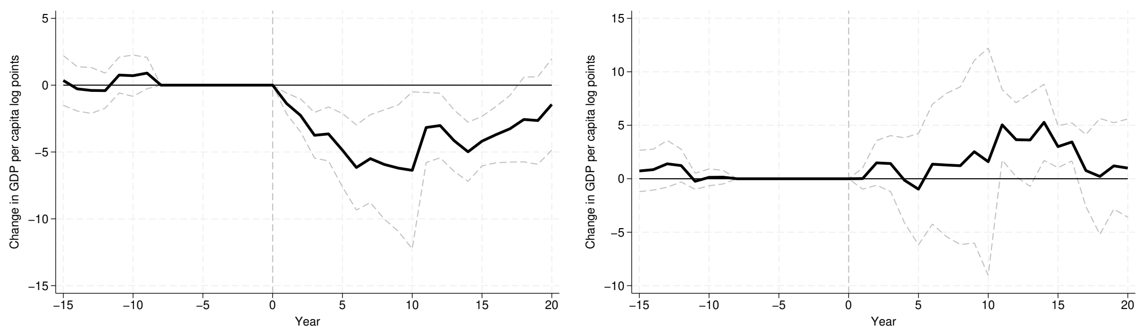
[25]This is in a sense similar to the LP application by Girardi, Paternesi Meloni, and Stirati (2020) analyzing the dynamics of the relation between public spending and GDP.

[26]In Figures B20 and B21 in the Appendix, I verify the robustness of results to the use of different thresholds for defining *relevant* tariff changes, particularly half standard deviation and two standard deviations. The heterogeneity still holds.

[27]In Figure B22 in the Appendix, I relax this assumption, by imposing that a quasi-stayer can only be part of the control group if the unit was not treated in the previous twenty years. Results still deliver the heterogeneity, but significance is only preserved for the case of nonmanufacturer countries.

in the whole period and significant for almost all of it. For manufacturer countries, on the other hand, the association is still positive almost for all the horizon analyzed, and significant from 10 to 17 years after tariff reductions. In short, reassuringly, the baseline results are not driven by the use of “bad controls”.

Figure 6: Heterogeneity in GDP per capita after tariff reductions: clean controls analysis



(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.

5.4 Alternative estimators

A potential concern might be that the results are driven by the use of the LP-DiD estimator. To explore this possibility, I provide dynamic panel estimates, following the application by Acemoglu et al. (2019). To avoid inference problems related to stationarity in a dynamic panel setting, I run a regression of the relation between tariff changes and growth rates. Contrary to the LP-DiD regressions, that estimate the dynamic effect for each time horizon, the regression equation for dynamic panel data estimates is based on a single-equation regression as follows:

$$\Delta y_{c,t} = \beta \Delta TA_{c,t} + \theta int_{c,t} + \phi m_{c,t} + \sum_{j=1}^{8} \sigma_j \Delta y_{c,t-j} + \alpha_c + \alpha_t + \epsilon_{c,t} \tag{5}$$

where coefficients do not depend anymore on the horizon time h.

I present estimates of equation 5 coming from three types of estimators: the within fixed effects, the difference-GMM by Arellano and Bond (1991), and the recent debiased Arellano-Bond through sample splitting (DAB-SS) by Chen et al. (2019). I first perform a within fixed effects panel data estimation as a reference. Then, I perform a difference-GMM Arellano-Bond estimation, which addresses the well-known Nickell bias of the within fixed effects estimates. Finally, following Chen et al. (2019), I also provide estimates using their proposed debiased Arellano-Bond estimator through sample splitting. The difference-GMM estimator has the problem of "too many instruments", that leads to an asymptotic bias when T is at least modestly large (Alvarez & Arellano, 2003). To deal with this problem, Chen et al. (2019) show that by splitting the sample in two parts, dividing along the cross section, this method delivers consistent and unbiased coefficients when both N and T are large.

Results are presented in Table B1. An important thing to note is that, consistent to the rest of results presented in the paper, Table B1 also display coefficient results scaled to one standard deviation of a tariff reduction (for those variables composed of the change in tariffs). The estimates exhibit little persistence, thus confirming that the specification used may not be affected by near–unit root issues. Consistent with the baseline results, the coefficient on the interaction is significant in all specifications and positive as expected, meaning that the marginal association between reducing tariffs and growth rates is higher for manufacturer than for nonmanufacturer countries. More specifically, as displayed in the bottom two rows, nonmanufacturer countries experience a reduction in its growth rate of approximately 0.4 percentage points after tariff reductions, while manufacturer countries do not experience any significant growth change[28].

5.5 Additional robustness

The empirical analysis so far may still be subject to criticism with respect to three issues. First, it might be the case that the heterogeneity documented is driven by the endogeneity of the economic structure, so that baseline estimates are invalid. Second, 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. Third, 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). Fourth, I check if the results are driven by the specific definition of economic structure adopted in the baseline. And fifth, it could be the case that the results are driven by the specific GDP data use or by outliers, so I check for both these possibilities.

[28]An interesting result using DAB-SS is that the impact for manufacturers becomes significant and slightly higher than in the other two estimates, reaching a positive association of about 0.07 percentage points, reaffirming the heterogeneity story.

Endogeneity of economic structure

So far the discussion on potential biases in the heterogeneity has focused on the endogeneity of tariffs. But the identification of the interaction term might be biased due to the endogeneity of economic structure. To address this potential source of endogeneity, I assume that tariff changes are exogenous, based on the results obtained in the robustness exercises in previous subsections. And although Nizalova and Murtazashvili (2016) shows that if the source of heterogeneity, here economic structure, and the omitted source of endogeneity are jointly independent from the change of tariffs, simple OLS identifies the interaction coefficient, I provide an exercise to further relax this assumption.

I pursue an IV identification, following closely the application by Nunn and Qian (2014) in their causal analysis of US aid's impact on conflict. I exploit cross-sectional variation in economic structure, measured as the average economic structure by country in all sample years. I then calculate the interaction of this average of economic structure by country with the change in tariffs and use it as the instrument for the interaction of interest (i.e., the interaction between the time-varying economic structure and the time-varying change in tariffs). To control for the potential direct effect of the average economic structure, which if ignored might bias the estimates, I also include country fixed effects in the specification to purge all time invariant factors by country, as executed by Nunn and Qian (2014). Results of this exercise are presented in Figure B23, confirming the heterogeneity. Following Andrews, Stock, and Sun (2019), since this is a case of one endogenous regressor just-identified, I also report in Table B2 the Anderson-Rubin p-values for the interaction, robust to weak identification, which reassuringly confirm a significant heterogeneity, especially 8-20 years after tariff reductions.

An additional concern is that nonmanufacturers and manufacturers are differentially exposed to and affected by the potential confounders, discussed thoroughly in the first two subsections of Section 5. It could be the case, for example, that both nonmanufacturers are exposed to nontariff barriers differently than manufacturers and that the association between nontariff barriers and growth varies with economic structure. These concerns may generate potential biases in the heterogeneity estimates. To address these concerns, I estimate a slightly modified version of equation 3 where I interact economic structure with each of the variables discussed in subsections 5.1 and 5.2. Results of these exercises are summarized in Figure B24, where the average association between tariff reductions and GDP between 13 and 17 years after tariff reductions is depicted. The heterogeneity still holds.

Heterogeneity in growth persistence and global shocks

Second, 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. 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, controlling for interactions between the initial economic structure and year fixed effects might capture potential biases from it. The results are presented in Figures B25 and B26 and confirm the baseline findings.

Tariff changes after tariff reductions

What if my estimate for period $t+9$ is not really the outcome of the tariff change at t but the change five years later? To check for this, I include in the baseline framework, equation 3, all tariff changes occurring before $t+h$, not only that in time t, following the proposed solution by Teulings and Zubanov (2014). The results of this exercise are presented in Figure B27 in the Appendix. Although the estimates are less precise, as statistical power is lost, the heterogeneous relation holds.

Alternative definitions of economic structure

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 tariff reductions, and following the broad exports classification categories. Reassuringly, Figures B28, B29, B30 B31, B32 and B33 in the Appendix reveal that the 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 alternatives to the lagged five-year average.

Robustness to growth data and outliers

In the Appendix, I further show that the baseline results are not driven by the specific GDP data on constant national prices from PWT that I use or by some leverage observations (or outliers). Figures B34, B35 and B36 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). Figures B37, B38, B39, B40, B41 B42 and B43 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).

6 Mechanisms

In this section, I test the potential validity of the causal mechanisms from theory that may explain the heterogeneity by economic structure in the tariff-growth nexus. Although this exploration is not causal, any coincidence between the baseline results and this exercise seems to me has to be interpreted as establishing an even more robust heterogeneity from economic structure.

I particularly explore the association between tariff reductions and 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:

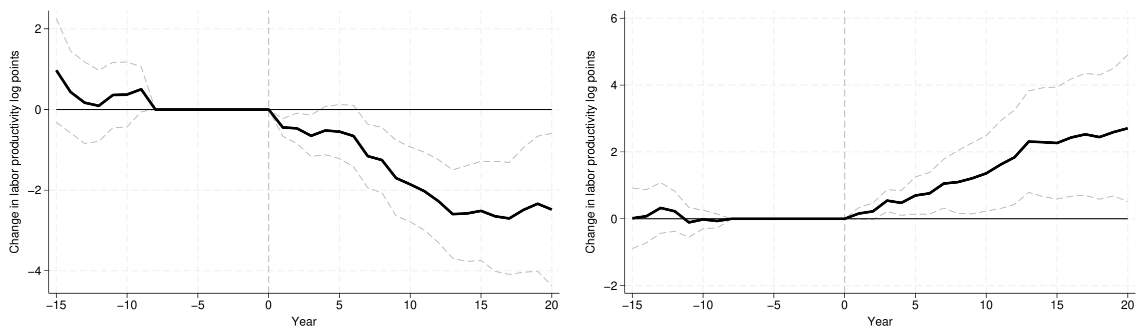
$$y_{c,t+h} - y_{c,t-1} = \beta^h \Delta TA_{c,t} + \theta^h int_{c,t} + \phi^h m_{c,t} + \sum_{j=1}^{8} \sigma_j^h g_{c,t-j} + \sum_{j=1}^{8} \gamma_j^h \Delta y_{c,t-j} + \alpha_t^h + \epsilon_{c,t}^h \quad (6)$$

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

Tariff reductions are associated to lower productivity in nonmanufacturer countries while higher for manufacturer ones, as shown in Figure 7[29]. According to the trade theory reviewed, that's precisely the heterogeneity expected in productivity terms. More specifically, 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 increased specialization in the more dynamic sector. 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).

[29]In Figure C1, I also show estimates of total factor productivity (TFP) dynamics after tariff reductions. The results point to the same heterogeneity for all the horizon of analysis but only significant around 15 years after tariff reductions.

Figure 7: Heterogeneity in labor productivity after tariff reductions



(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.

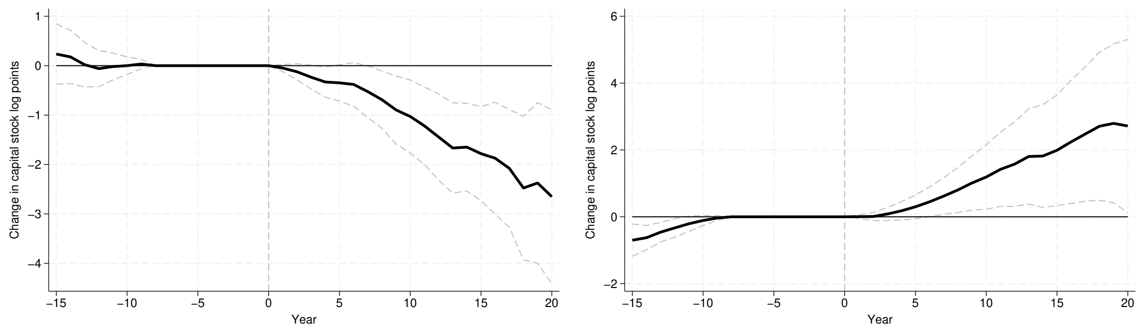
As portrayed in Figure 8, the dynamics of capital accumulation after tariff reductions are also heterogeneous: falling stocks of capital for nonmanufacturer countries while increasing for manufacturers. Results are also statistically significant for all the horizon of analysis. In the same line as the previous results, as production in the more dynamic sector falls (increases) in nonmanufacturer (manufacturer) countries, capital accumulation might also fall (increase), assuming 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)[30].

As mentioned, the heterogeneity is ultimately driven by changes in the pattern of production specialization for each type of country. Figure 9 presents evidence in support of this mechanism. Tariff reductions are associated to lower manufacturing shares of GDP for nonmanufacturer countries, but higher for manufacturer countries. Although the results are not significant, the direction is consistent with the heterogeneity across the whole horizon of analysis. These results suggest that tariff reductions make nonmanufacturer countries to specialize more on nonmanufacturing production, while manufacturer countries to strengthen its manufacturing specialization[31]. This respecialization mechanism can be also thought as the driver of the heterogeneous changes in both productivity and capital accumulation.

[30] 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 C1.

[31] 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 8: Heterogeneity in capital accumulation after tariff reductions

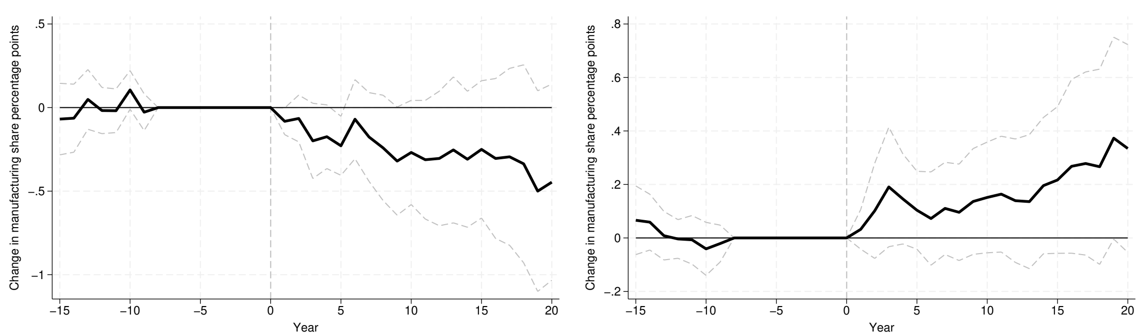


(a) Nonmanufacturer countries **(b)** Manufacturer countries

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.

The heterogeneous relation between tariff reductions and manufacturing shares of GDP also relate to other strands of the literature on macroeconomics of development. First, according to Rodrik (2016) developing economies have experienced premature reductions in their manufacturing shares of GDP in the last thirty years, arguably driven by globalization. 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.

Figure 9: Heterogeneity in the manufacturing share of GDP after tariff reductions



(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.

Finally, I also explore the dynamics of the share of imports in GDP after tariff reductions, as revealed in Figure C2. Results reveal that the share of imports in GDP does not significantly change after tariff reductions, for both nonmanufacturer and manufacturer countries. A priori, an increase in the share of imports is expected for both types of countries, given that imports become cheaper for both. The relocation mechanism discussed above might provide a way to understand why this is not what we observe. 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. Nevertheless, more work is needed to test the validity of these reasonings.

7 Conclusion

In this paper, I establish that the relationship between tariffs and growth is characterized by a sharp heterogeneity by economic structure. More precisely, I show that the widespread reduction in tariffs around the world since 1960, particularly strong in the last 30 years, has been associated to reductions in GDP per capita for nonmanufacturer countries, but increases in GDP per capita for manufacturers. I establish this result by making use of a local projections difference-in-differences (LP-DiD) estimator, by which I am able to study medium-term dynamics of the tariff-growth nexus and also control for the surge in GDP that precedes tariff reductions, to purge the estimates from this selection bias. Overall, the estimates suggest that a one-standard-deviation reduction in tariffs (i.e., 3.65 percentage points) is associated to an average fall (increase) of more than 2 percent in GDP per capita fifteen years later for nonmanufacturer (manufacturer) countries. The heterogeneity is significant even twenty years after tariff reductions.

Several robustness checks point to an extremely solid heterogeneity by economic structure in the tariff-growth nexus. I provide a detailed discussion of variables that might be potentially confounding the heterogeneity documented in the paper, covering variables that have been show to drive tariff changes, among others. Reassuringly, on all these robustness checks the heterogeneity remains significant and economically important. 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 (Dube et al., 2023). This check also confirms the existence of the heterogeneity.

I further show evidence on potential channels underpinning this heterogeneity, that are consistent with the trade theory that motivates the investigation. On the one hand, tariff reductions are associated to lower productivity and capital accumulation for nonmanufacturer countries. On the other, tariff reductions are accompanied 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 related to changes in the manufacturing share in GDP, although results are not statistically significant. This piece of evidence can be interpreted as supporting Rodrik (2016)'s story of premature deindustrialization, according to which developing countries have experienced early reductions—in relation to their status of development—in their manufacturing shares in GDP due to globalization in the last 30 years.

While this paper does not provide a definitive conclusion on the correlation between tariffs and growth, I think it does offer an invitation to keep reflecting about it. The common view in economics that a liberal trade regime is the best policy option is not empirically supported. The evidence suggests that for nonmanufacturer countries trade liberalization has been associated with falling GDP. The paper suggests that trade protection would have impeded deindustrialization and allowed better productivity dynamics in these countries. Although the empirical evidence does not show any discernible relation of increasing tariffs, it might be possible that trade policy, hand in hand with other measures of so-called industrial policy, might encourage production in more dynamic sectors and thus higher productivity levels for nonmanufacturer countries. More work, however, is needed to clarify the validity of this reasoning. More generally, bridging this literature on trade policy with the burgeoning literature on industrial policy provides, in my opinion, an interesting locus for further research.

References

Acemoglu, D., Aghion, P., & Zilibotti, F. (2006). Distance to Frontier, Selection, and Economic Growth. *Journal of the European Economic Association*, *4*(1), 37–74.

Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J. A. (2019). Democracy Does Cause Growth. *Journal of Political Economy*, *127*(1), 47–100.

Alvarez, J., & Arellano, M. (2003). The time series and cross-section asymptotics of dynamic panel data estimators. *Econometrica*, *71*(4), 1121–1159.

Andrews, I., Stock, J. H., & Sun, L. (2019). Weak Instruments in Instrumental Variables Regression: Theory and Practice. *Annual Review of Economics*, *11*, 727–753.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297.

Atkin, D., Costinot, A., & Fukui, M. (2021). *Globalization and the Ladder of Development: Pushed to the Top or Held at the Bottom?* (Working Paper). National Bureau of Economic Research, WP #29500.

Barro, R. J., & Lee, J. W. (2013). A new data set of educational attainment in the world, 1950–2010. *Journal of Development Economics*, *104*, 184–198.

Belsley, D. A., Kuh, E., & Welsch, R. E. (1980). *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*. Hoboken: John Wiley & Sons.

Billmeier, A., & Nannicini, T. (2013). Assessing Economic Liberalization Episodes: A Synthetic Control Approach. *The Review of Economics and Statistics*, *95*(3), 983–1001.

Blanchard, E. J., & Olney, W. W. (2017). Globalization and human capital investment: Export composition drives educational attainment. *Journal of International Economics*, *106*, 165–183.

Boehm, C. E., Levchenko, A. A., & Pandalai-Nayar, N. (2023). The Long and Short (Run) of Trade Elasticities. *American Economic Review*, *113*(4), 861–905.

Bohara, A. K., & Kaempfer, W. H. (1991a). Testing the endogeneity of tariff policy in the US: Further evidence. *Economics Letters*, *35*(3), 311–315.

Bohara, A. K., & Kaempfer, W. H. (1991b). A Test of Tariff Endogeneity in the United States. *American Economic Review*, *81*(4), 952–960.

Bolt, J., & van Zanden, J. L. (2020). *Maddison style estimates of the evolution of the world economy. A new 2020 update* (Maddison-Project Working Paper WP-15). University of Groningen, Groningen.

Callaway, B., Goodman-Bacon, A., & Sant'Anna, P. H. (2021). Difference-in-Differences with a Continuous Treatment. *arXiv preprint arXiv:2107.02637*.

Callaway, B., & Sant'Anna, P. H. (2021). Difference-in-Differences with multiple time periods. *Journal of Econometrics*, *225*(2), 200–230.

Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2011). Robust Inference With Multiway Clustering. *Journal of Business & Economic Statistics*, *29*(2), 238–249.

Chen, S., Chernozhukov, V., & Fernández-Val, I. (2019). Mastering panel metrics: causal impact of democracy on growth. *AEA Papers and Proceedings*, *109*, 77–82.

Chinn, M. D., & Ito, H. (2006). What matters for financial development? Capital controls,

institutions, and interactions. *Journal of Development Economics*, *81*(1), 163–192.
de Chaisemartin, C., & d'Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review*, *110*(9), 2964–96.
de Chaisemartin, C., D'Haultfœuille, X., Pasquier, F., & Vazquez-Bare, G. (2022). *Difference-in-Differences Estimators for Treatments Continuously Distributed at Every Period* (Working Paper). Available at SSRN.
de Chaisemartin, C., & D'Haultfœuille, X. (2022). Two-way fixed effects and differences-in-differences with heterogeneous treatment effects: a survey. *The Econometrics Journal*, *Forthcoming*.
DeJong, D. N., & Ripoll, M. (2006). Tariffs and Growth: An Empirical Exploration of Contingent Relationships. *The Review of Economics and Statistics*, *88*(4), 625–640.
Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change*, *40*(3), 523–544.
Dube, A., Girardi, D., Jordà, Ò., & Taylor, A. M. (2023). *A Local Projections Approach to Difference-in-Differences Event Studies* (Working Paper No. 31184). National Bureau of Economic Research.
Dutt, A. K. (1986). Vertical trading and uneven development. *Journal of Development Economics*, *20*(2), 339–359.
Dutt, P., & Mitra, D. (2002). Endogenous trade policy through majority voting: an empirical investigation. *Journal of International Economics*, *58*(1), 107–133.
Eaton, J., & Kortum, S. (2002). Technology, Geography, and Trade. *Econometrica*, *70*(5), 1741–1779.
Ekanayake, P. N. S., Madsen, J. B., & Bharati, T. (2023). Trade and economic growth: Does the sophistication of traded goods matter? *Journal of Economic Growth*, 1–44.
Estefania-Flores, J., Furceri, D., Hannan, S. A., Ostry, J. D., & Rose, A. K. (2022). *Measurement of Aggregate Trade Restrictions and their Economic Effects* (Working Paper, No. 2022/001). IMF Working Papers.
Estevadeordal, A., & Taylor, A. M. (2013). Is the Washington consensus dead? Growth, openness, and the great liberalization, 1970s–2000s. *The Review of Economics and Statistics*, *95*(5), 1669–1690.
Feenstra, R. C. (1996). Trade and uneven growth. *Journal of Development Economics*, *49*(1), 229–256.
Feenstra, R. C. (2015). *Advanced International Trade: Theory and Evidence*. Princeton university press.
Feyrer, J. (2019). Trade and income—exploiting time series in geography. *American Economic Journal: Applied Economics*, *11*(4), 1–35.
Findlay, R., & Wellisz, S. (1982). Endogenous Tariffs, the Political Economy of Trade Restrictions, and Welfare. In *Import Competition and Response* (p. 223-244). National Bureau of Economic Research. Retrieved from https://EconPapers.repec.org/RePEc:nbr:nberch:6006
Frankel, J. A., & Romer, D. H. (1999). Does Trade Cause Growth? *American Economic Review*, *89*(3), 379–399.
Freyaldenhoven, S., Hansen, C., & Shapiro, J. M. (2019). Pre-event trends in the panel event-study design. *American Economic Review*, *109*(9), 3307–3338.

Fukui, M., Nakamura, E., & Steinsson, J. (2023). *The Macroeconomic Consequences of Exchange Rate Depreciations* (Working Paper). National Bureau of Economic Research, WP #31279.

Furceri, D., Hannan, S. A., Ostry, J. D., & Rose, A. K. (2020). Are tariffs bad for growth? Yes, say five decades of data from 150 countries. *Journal of Policy Modeling*, *42*(4), 850–859.

Furceri, D., Hannan, S. A., Ostry, J. D., & Rose, A. K. (2022). The Macroeconomy After Tariffs. *The World Bank Economic Review*, *36*(2), 361–381.

Galor, O., & Mountford, A. (2008). Trading Population for Productivity: Theory and Evidence. *Review of Economic Studies*, *75*(4), 1143–1179.

Girardi, D., Paternesi Meloni, W., & Stirati, A. (2020). Reverse hysteresis? persistent effects of autonomous demand expansions. *Cambridge Journal of Economics*, *44*(4), 835–869.

Goldberg, P. K., & Pavcnik, N. (2016). The Effects of Trade Policy. In *Handbook of Commercial Policy* (Vol. 1, pp. 161–206).

Goodman-Bacon, A. (2021). Difference-in-Differences with Variation in Treatment Timing. *Journal of Econometrics*, *225*(2), 254–277.

Greenwald, B., & Stiglitz, J. E. (2006). Helping infant economies grow: Foundations of trade policies for developing countries. *American Economic Review*, *96*(2), 141–146.

Grossman, G. M., & Helpman, E. (1991). *Innovation and growth in the global economy.* MIT press.

Grossman, G. M., & Helpman, E. (1994). Protection for sale. *American Economic Review*, *84*(4), 833–850.

Grossman, G. M., & Helpman, E. (1995). Technology and Trade. *Handbook of International Economics*, *3*, 1279–1337.

Grossman, G. M., & Helpman, E. (2015). Globalization and growth. *American Economic Review*, *105*(5), 100–104.

Hsieh, C.-T., & Klenow, P. J. (2010). Development Accounting. *American Economic Journal: Macroeconomics*, *2*(1), 207–23.

Huber, P. J. (1964). Robust estimation of a location parameter. *Ann. Math. Stat.*, *35*, 73–101.

Irwin, D. A. (2019). *Does Trade Reform Promote Economic Growth? A Review of Recent Evidence* (Working Paper No. 25297). National Bureau of Economic Research.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review*, *95*(1), 161–182.

Klenow, P. J., & Rodriguez-Clare, A. (1997). The neoclassical revival in growth economics: Has it gone too far? *NBER Macroeconomics Annual*, *12*, 73–103.

Krugman, P. (1981). Trade, Accumulation, and Uneven Development. *Journal of Development Economics*, *8*(2), 149–161.

Krugman, P. (1987). The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher: Notes on trade in the presence of dynamic scale economies. *Journal of Development Economics*, *27*(1-2), 41–55.

Krugman, P. (1993). The narrow and broad arguments for free trade. *The American Economic Review*, *83*(2), 362–366.

Lall, S. (2000). The technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, *28*(3), 337–369.

Li, D., Plagborg-Møller, M., & Wolf, C. K. (2021). *Local Projections vs. VARs: Lessons From Thousands of DGPs* (Working Paper). Princeton Department of Economics.

Li, G. (1985). Robust regression. In *Exploring data tables, trends, and shapes* (p. 281-343). Wiley.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3–42.

Mayer, W. (1984). Endogenous tariff formation. *American Economic Review*, *74*(5), 970–985.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695–1725.

Melitz, M. J., & Redding, S. J. (2021). *Trade and Innovation* (Working Paper). National Bureau of Economic Research, WP #28945.

Nakamura, E., & Steinsson, J. (2018). Identification in macroeconomics. *Journal of Economic Perspectives*, *32*(3), 59–86.

Nizalova, O. Y., & Murtazashvili, I. (2016). Exogenous treatment and endogenous factors: Vanishing of omitted variable bias on the interaction term. *Journal of Econometric Methods*, *5*(1), 71–77.

Nunn, N., & Qian, N. (2014). US food aid and civil conflict. *American Economic Review*, *104*(6), 1630–1666.

Nunn, N., & Trefler, D. (2010). The structure of tariffs and long-term growth. *American Economic Journal: Macroeconomics*, *2*(4), 158–94.

Ramey, V. A. (2016). Macroeconomic shocks and their propagation. *Handbook of Macroeconomics*, *2*, 71–162.

Redding, S. (1999). Dynamic comparative advantage and the welfare effects of trade. *Oxford Economic Papers*, *51*(1), 15–39.

Rodríguez, F., & Rodrik, D. (2001). Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence. *NBER Macroeconomics Annual 2000*, 261–325.

Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*(2), 365–412.

Rodrik, D. (2013). Unconditional Convergence in Manufacturing. *The Quarterly Journal of Economics*, *128*(1), 165–204.

Rodrik, D. (2016). Premature Deindustrialization. *Journal of Economic Growth*, *21*(1), 1–33.

Roth, J. (2022). Pretest with caution: Event-study estimates after testing for parallel trends. *American Economic Review: Insights*, *4*(3), 305–322.

Sachs, J. D., & Warner, A. (1995). Economic Reform and the Process of Global Integration. *Brookings Papers on Economic Activity*, *1995*(1), 1–118.

Skott, P., & Larudee, M. (1998). Uneven development and the liberalisation of trade and capital flows: the case of Mexico. *Cambridge Journal of Economics*, *22*(3), 277–295.

Solt, F. (2020). Measuring income inequality across countries and over time: The standardized world income inequality database. *Social Science Quarterly*, *101*(3), 1183–1199.

Stiglitz, J. E. (2015). Leaders and followers: Perspectives on the Nordic model and the economics of innovation. *Journal of Public Economics*, *127*, 3–16.

Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, *225*(2), 175–199.

Teulings, C. N., & Zubanov, N. (2014). Is economic recovery a myth? Robust estimation of impulse responses. *Journal of Applied Econometrics*, *29*(3), 497–514.

Thompson, S. B. (2011). Simple formulas for standard errors that cluster by both firm and time. *Journal of Financial Economics*, *99*(1), 1–10.

Trefler, D. (1993). Trade liberalization and the theory of endogenous protection: an econometric study of US import policy. *Journal of Political Economy*, *101*(1), 138–160.

Wacziarg, R., & Welch, K. H. (2008). Trade Liberalization and Growth: New Evidence. *The World Bank Economic Review*, *22*(2), 187–231.

Williamson, J. (1990). What Washington Means by Policy Reform. In *Latin American Adjustment: How Much Has Happened?* (p. 7–20). Washington: Institute for International Economics.

Yanikkaya, H. (2003). Trade openness and economic growth: a cross-country empirical investigation. *Journal of Development Economics*, *72*(1), 57–89.

Young, A. (1991). Learning by Doing and the Dynamic Effects of International Trade. *The Quarterly Journal of Economics*, *106*(2), 369–405.

Appendix

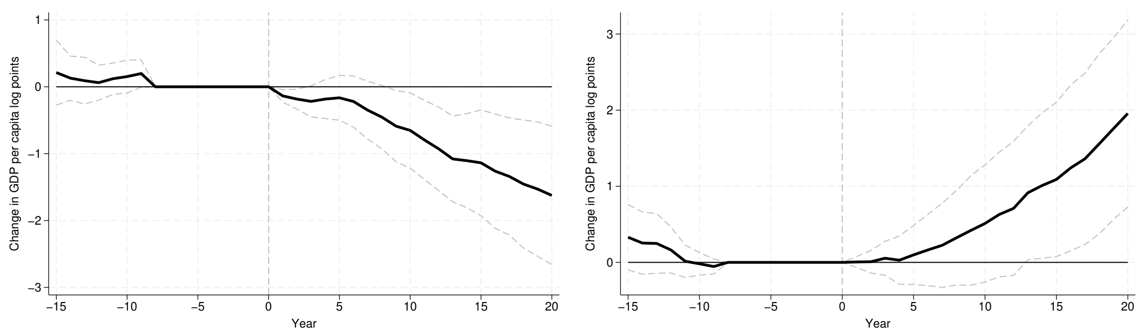
The Appendix is structured using the same section structure of the main text. In other words, each section in the main text has a corresponding one here in the Appendix, and the order is the same as in the main text.

A Baseline results

Increases and reductions of tariffs

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

Figure A1: Heterogeneity in GDP per capita after tariff reductions: excluding tariff increases

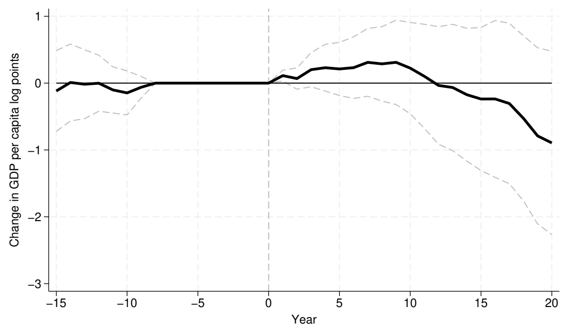


(a) For nonmanufacturer countries **(b)** For manufacturer countries

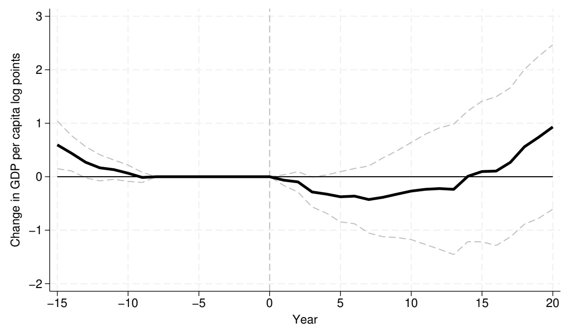
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

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 estimates of tariff increases, show in Figure A2, are not significant across the whole period for both type of countries.

Figure A2: Heterogeneity in GDP per capita after tariff increases: excluding reductions



(a) For nonmanufacturer countries



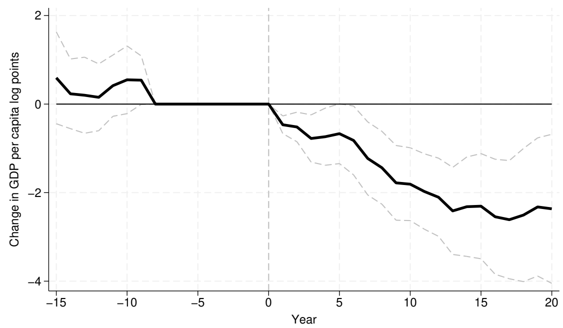
(b) For manufacturer countries

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.

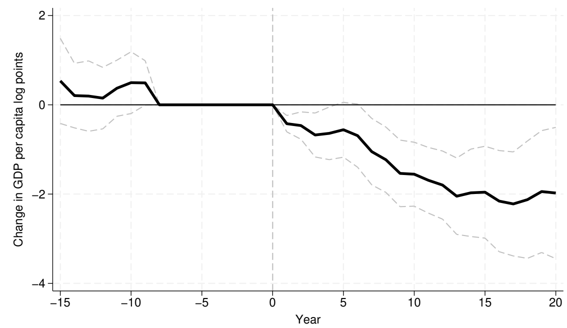
The tariff-growth nexus at different levels of initial economic structure

In the main text, I present the results associated to tariff reductions for countries with two different levels of initial shares of manufacturing exports—what can be called manufacturer and nonmanufacturer countries. Here I show the results for different levels of manufacturing exports, given the linear specification of heterogeneity in equation 3.

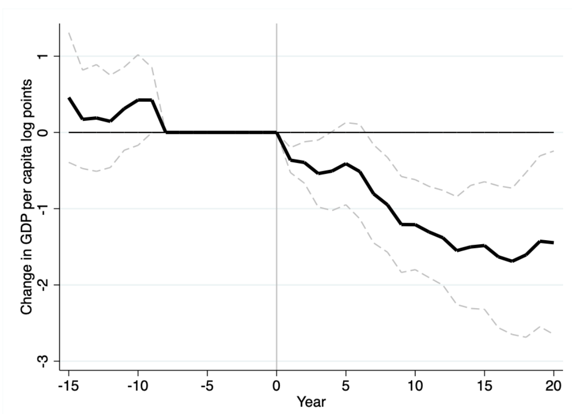
Figure A3: Heterogeneity in GDP per capita after tariff reductions: different levels of economic structure, part 1



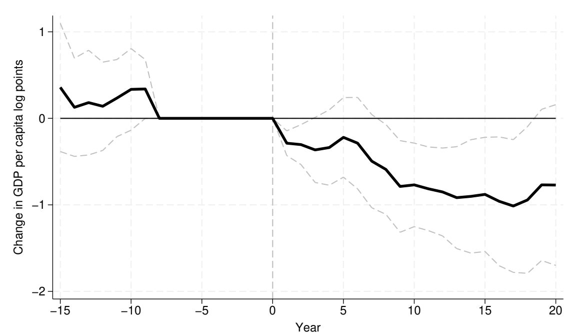
(a) 10th percentile



(b) 20th percentile



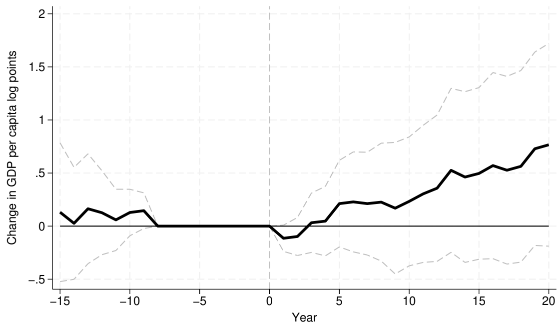
(c) 30th percentile



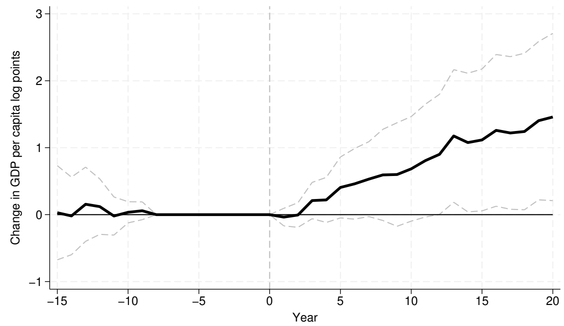
(d) 40th percentile

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.

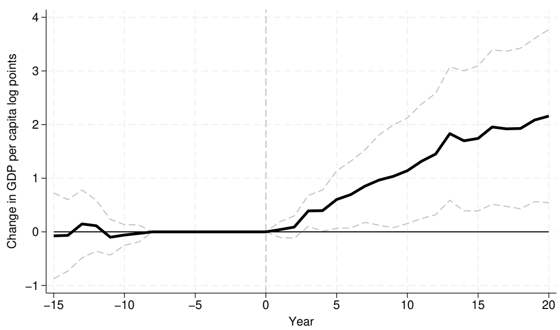
Figure A4: Heterogeneity in GDP per capita after tariff reductions: different levels of economic structure, part 2



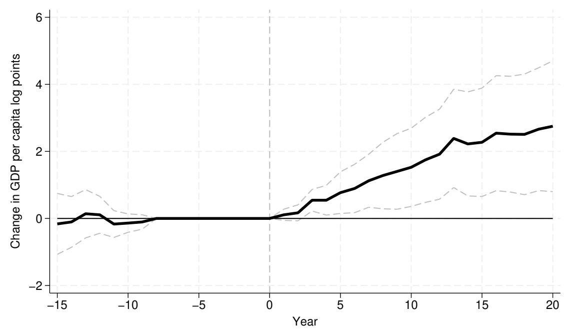
(a) 60th percentile



(b) 70th percentile



(c) 80th percentile



(d) 90th percentile

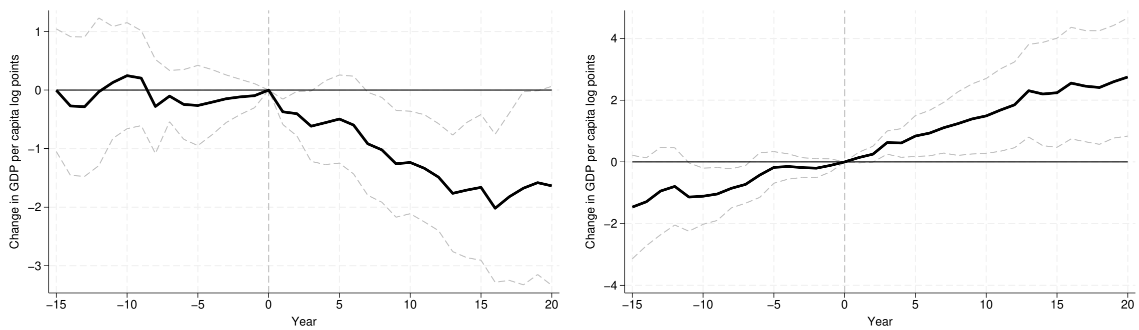
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

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

Heterogeneous pretrends

Here I present the pretrends analysis for each group of countries, nonmanufacturers and manufacturers, to check if they have differences. Then, I present the robustness of the baseline results with respect to the lag structure.

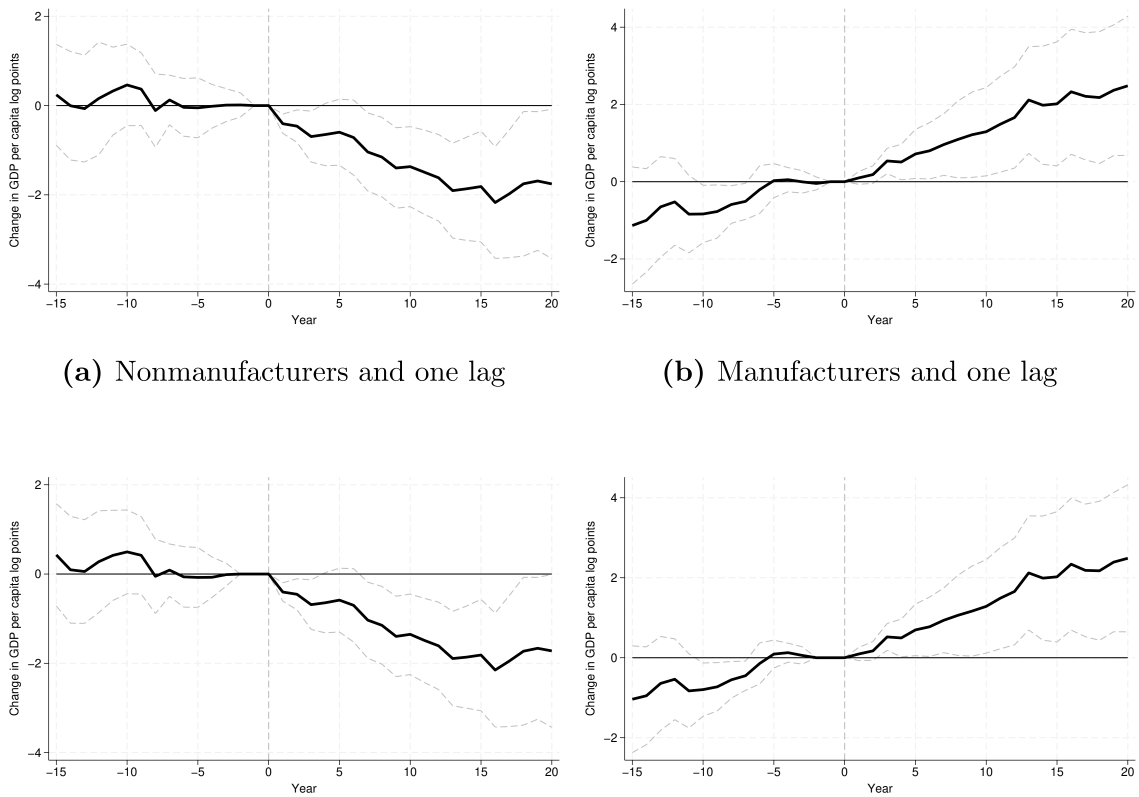
Figure A5: Heterogeneity in GDP per capita after tariff reductions: without controlling for 8 lags in growth rates



(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 A6: Heterogeneity in GDP per capita after tariff reductions: modelling selection with one or two lags of growth rates



(a) Nonmanufacturers and one lag

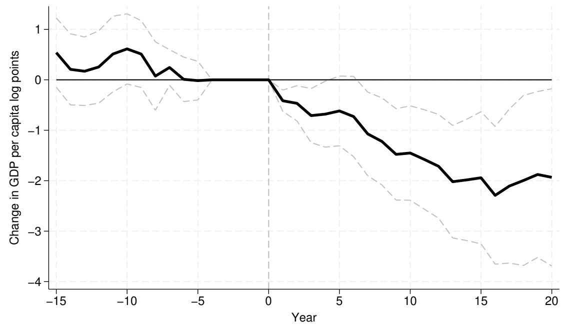
(b) Manufacturers and one lag

(c) Nonmanufacturers and two lags

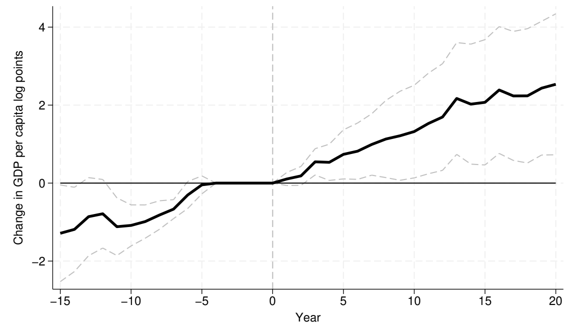
(d) Manufacturers and two lags

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.

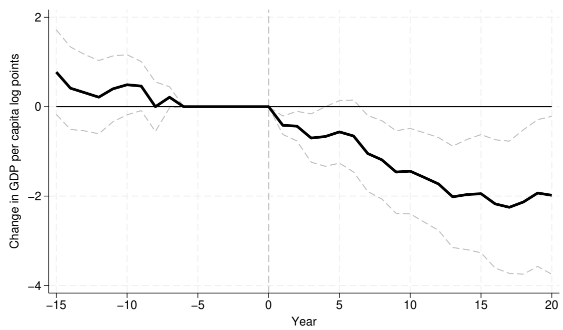
Figure A7: Heterogeneity in GDP per capita after tariff reductions: modelling selection with four or six lags of growth rates



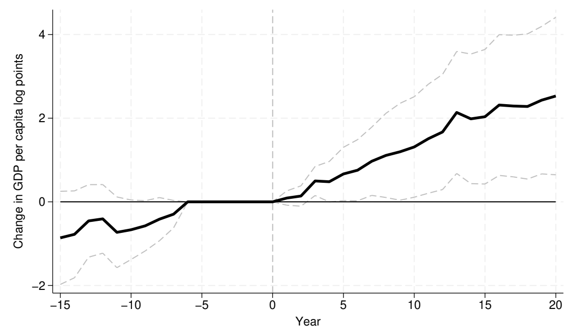
(a) Nonmanufacturers and four lags



(b) Manufacturers and four lags



(c) Nonmanufacturers and six lags



(d) Manufacturers and six lags

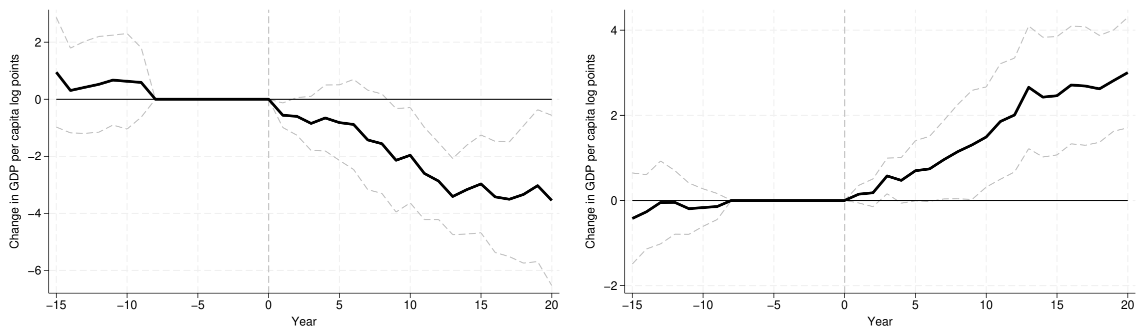
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

B Robustness

The following graphs show results controlling once at a time for all relevant covariates discussed in the main text, and as summarized in Figure 5. The heterogeneity holds in all cases.

Endogenous trade policy

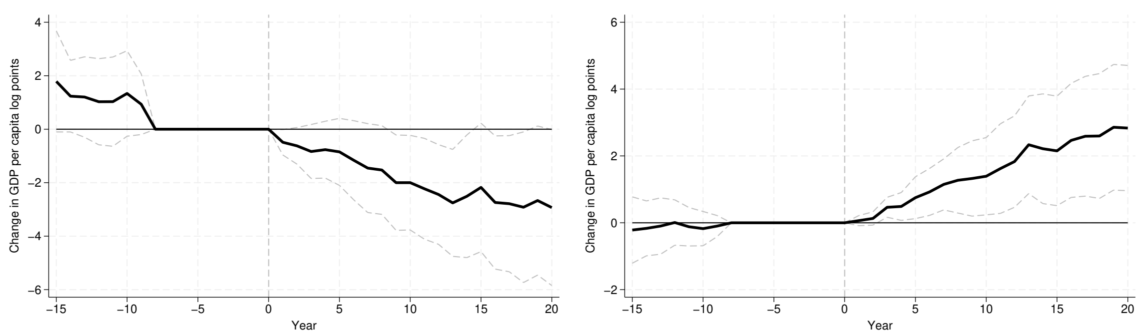
Figure B1: Heterogeneity in GDP per capita after tariff reductions: controlling for the change in the growth forecast



(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.

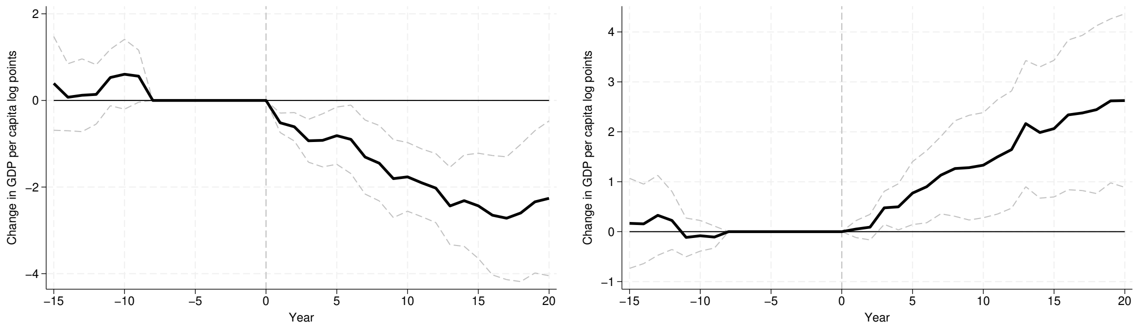
Figure B2: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in the Gini coefficient



(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: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in import penetration



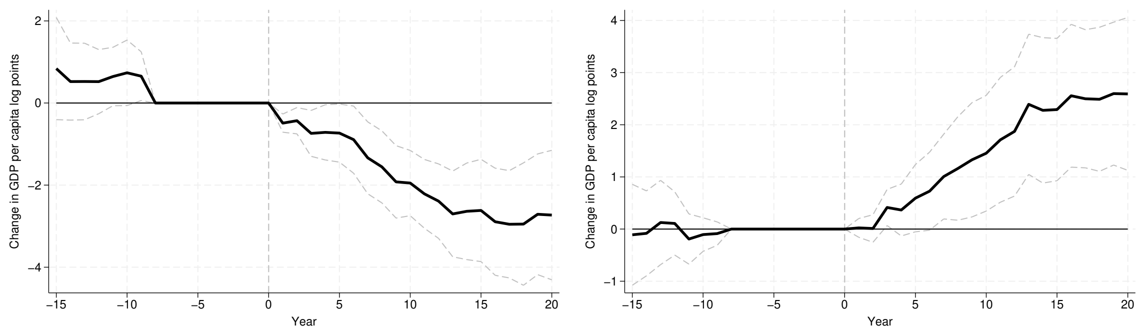
(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 confounders

Other policies

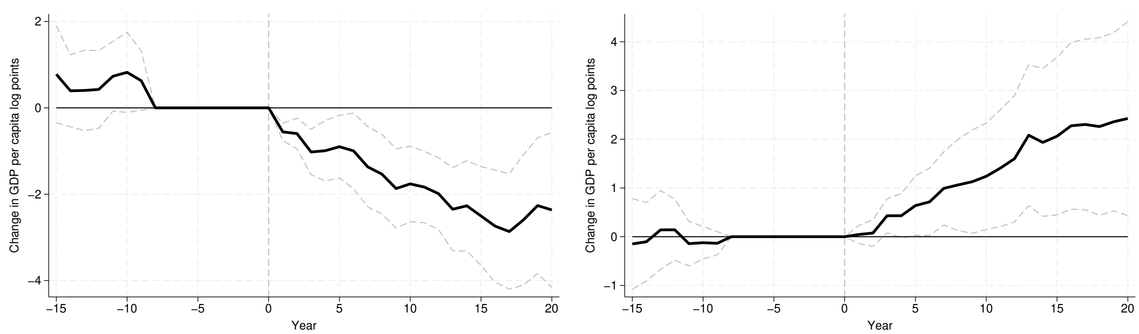
Figure B4: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in nontariff barriers



(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.

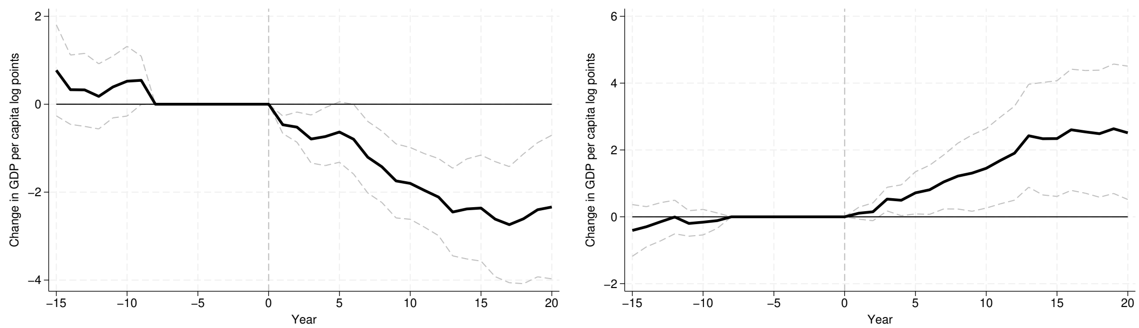
Figure B5: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in capital account openness



(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: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in Polity

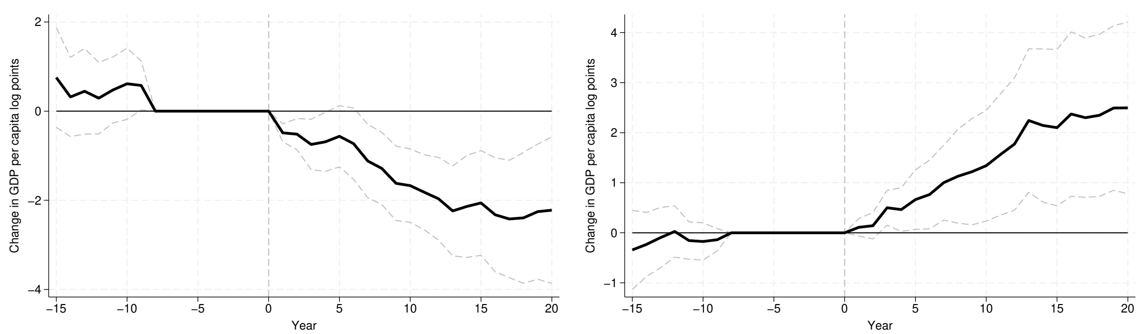


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 variables that explain growth

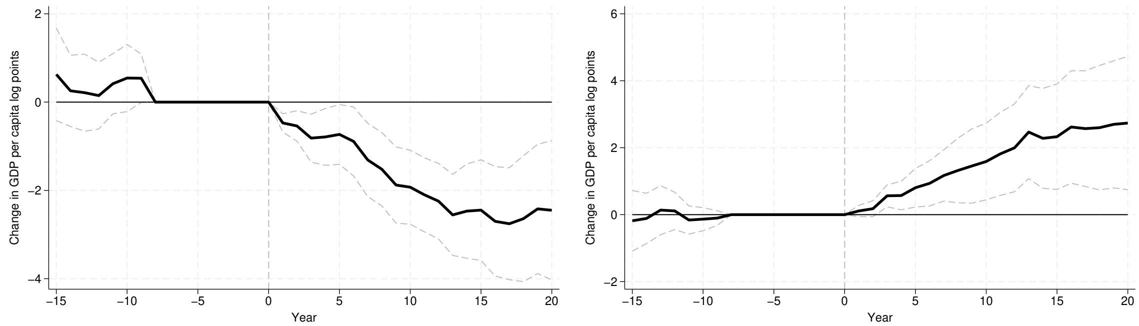
Figure B7: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in human capital



(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.

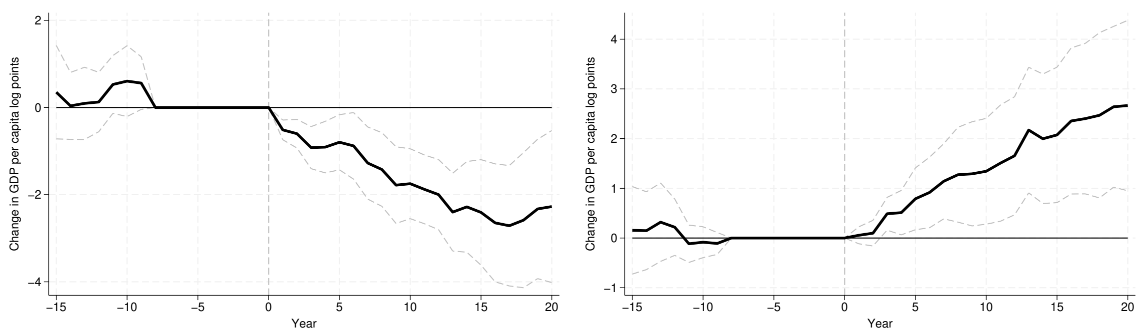
Figure B8: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in population size



(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.

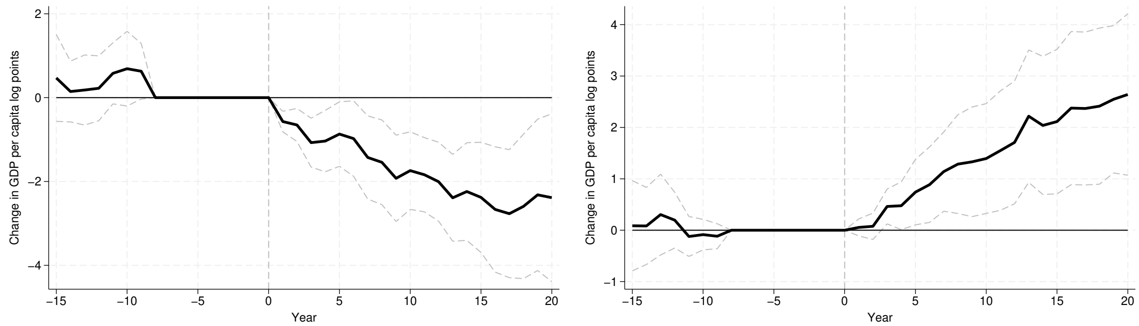
Figure B9: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in trade as share of GDP



(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.

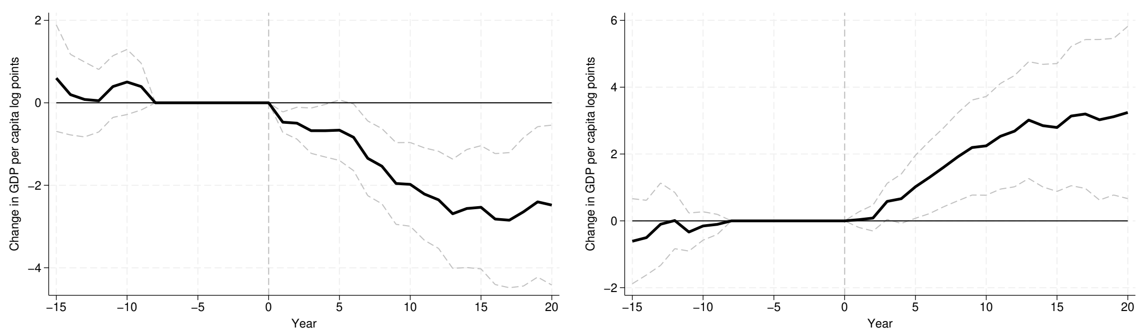
Figure B10: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in investment



(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.

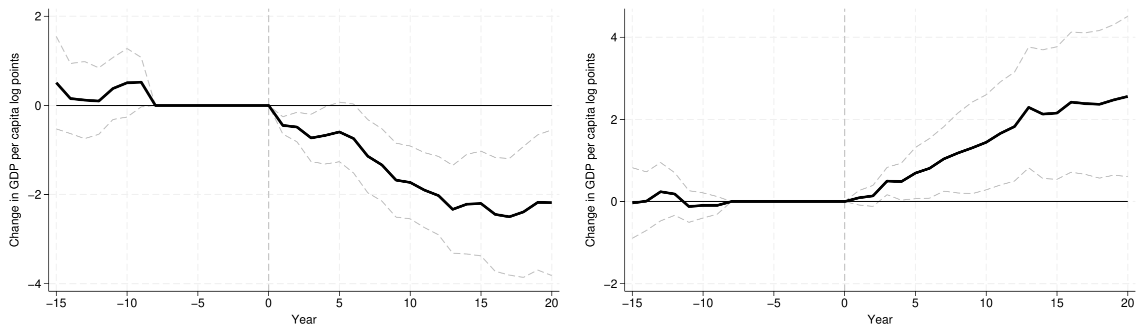
Figure B11: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in real exchange rates



(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: Heterogeneity in GDP per capita after tariff reductions: controlling for four lags of the change in terms of trade

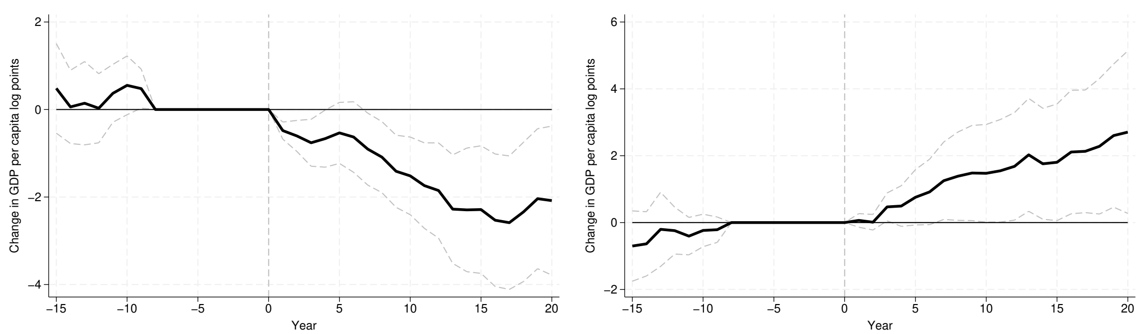


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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

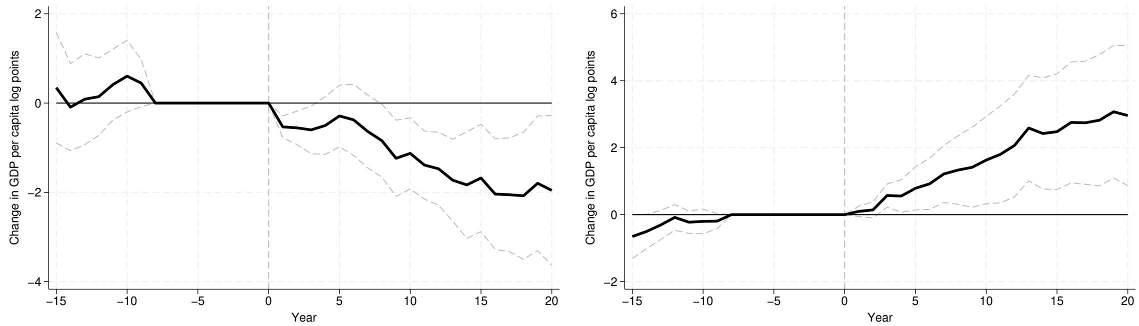
Figure B13: Heterogeneity in GDP per capita after tariff reductions: controlling for a heterogeneous relationship in relation to income



(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: Heterogeneity in GDP per capita after tariff reductions: controlling for a heterogeneous relationship in relation to human capital

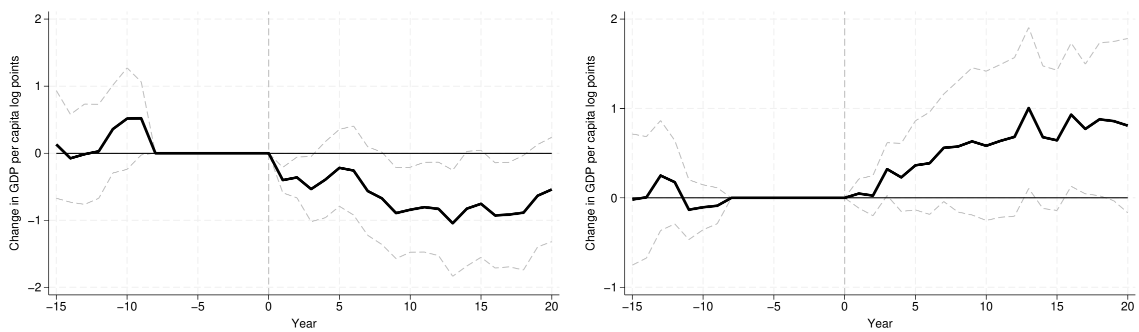


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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

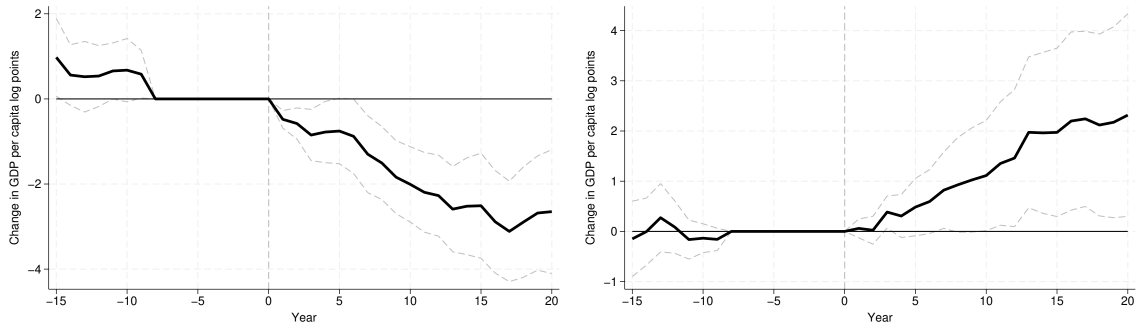
Figure B15: Heterogeneity in GDP per capita after tariff reductions: including country fixed effects



(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.

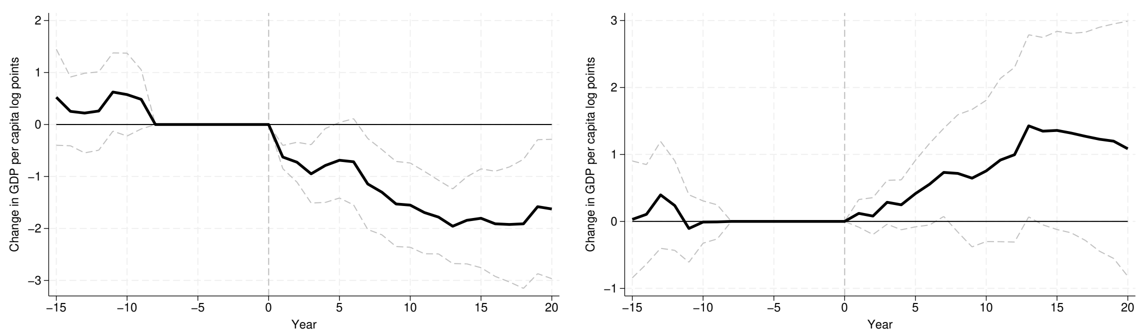
Figure B16: Heterogeneity in GDP per capita after tariff reductions: controlling for trends in different country income groups



(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: Heterogeneity in GDP per capita after tariff reductions: controlling for trends in different regions of countries



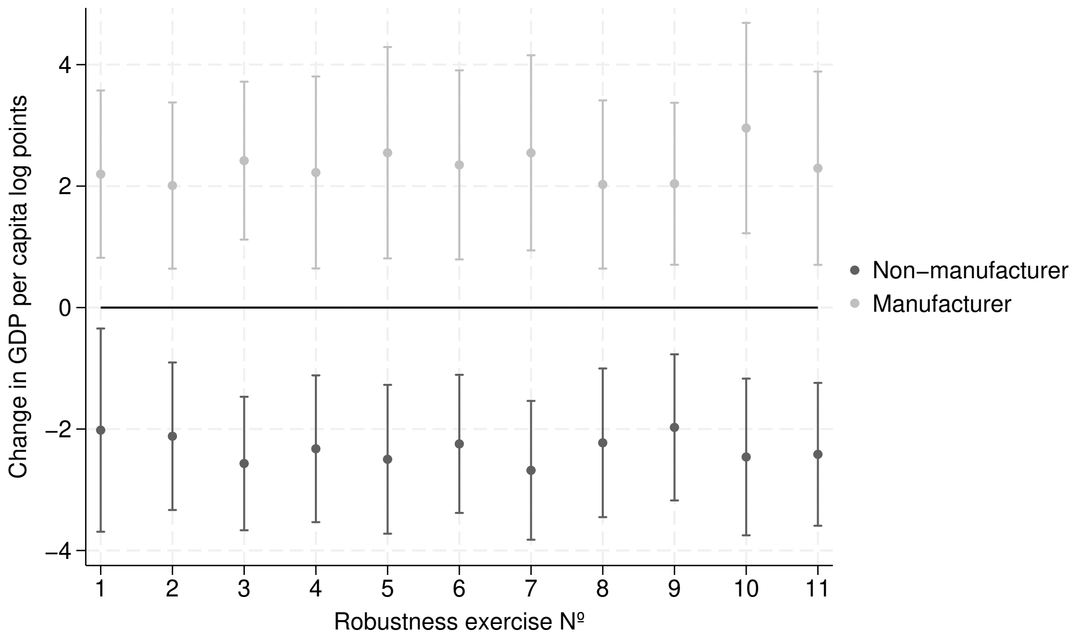
(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 heterogeneity.

Figure B18: Heterogeneity in GDP per capita after tariff reductions: robustness to contemporaneous changes in relevant covariates

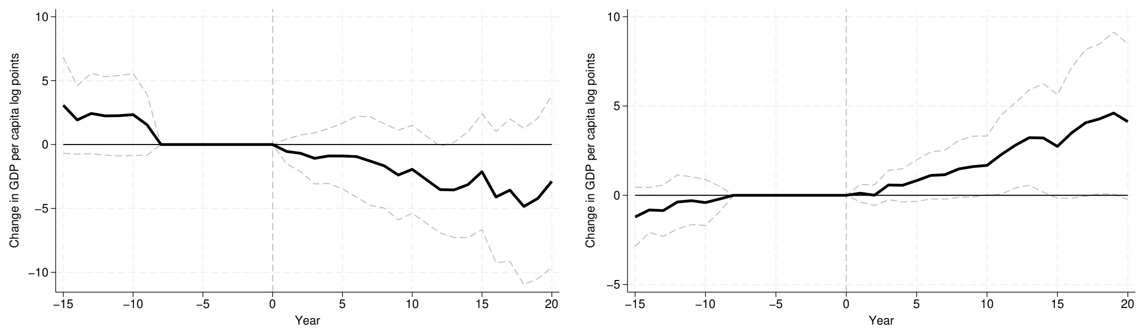


Note: The estimates presented are the predicted values for the 10th and 90th percentiles of the distribution of initial manufacturing exports. The coefficients show the average of the estimates 10-14 years after the change in tariffs. The standard errors used for the figure are two-way robust to heteroskedasticity 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 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 reduced, I still observe a significant relation around 12-13 years after tariff reductions.

Figure B19: Heterogeneity in GDP per capita after tariff reductions: all control variables included at the same time

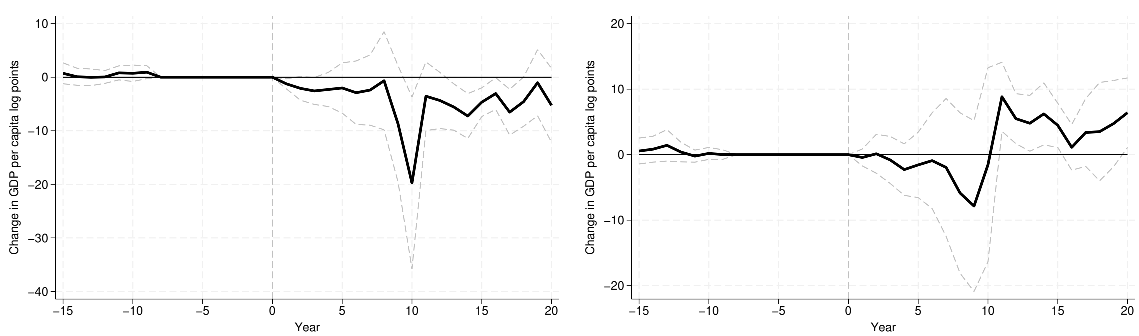


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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

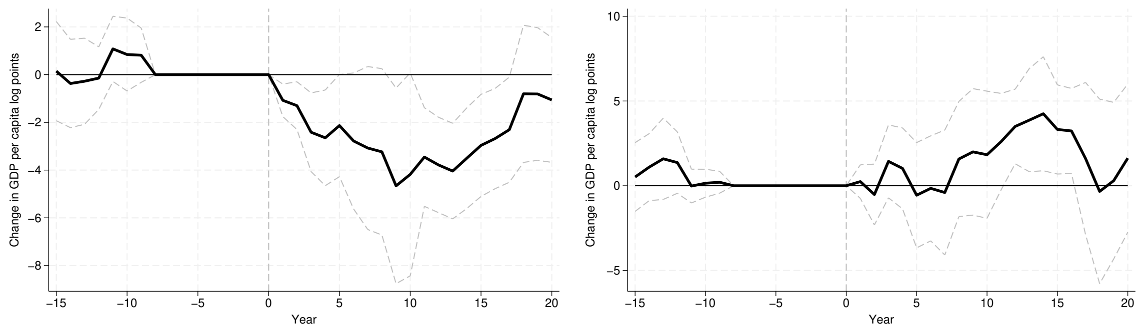
Figure B20: Heterogeneity in GDP per capita after tariff reductions: clean controls analysis with threshold defined as half standard deviation from the mean tariff change



(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.

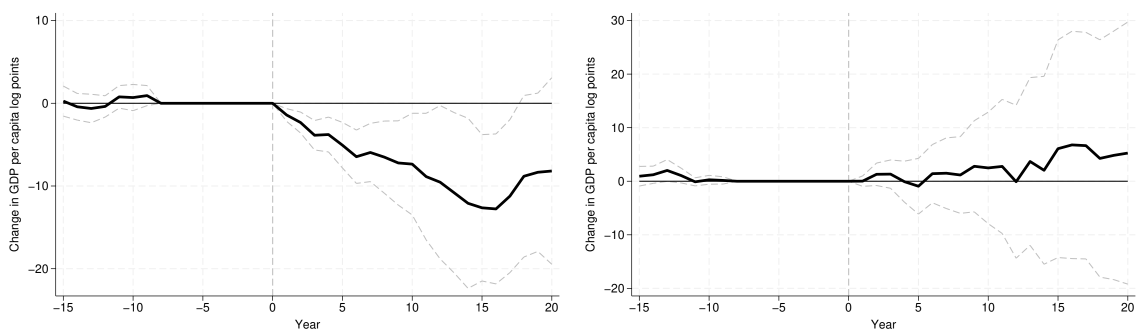
Figure B21: Heterogeneity in GDP per capita after tariff reductions: clean controls analysis with threshold defined as two standard deviation from the mean tariff change



(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 B22: Heterogeneity in GDP per capita after tariff reductions: clean controls analysis with a twenty-year rule for quasi-stayers



(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.

Alternative estimators

Table B1: Heterogeneity in growth rates after tariff reductions: dynamic panel estimates

	Within	Diff-GMM	DAB-SS
	(1)	(2)	(3)
Δ tariffs	-0.423***	-0.440***	-0.423***
	(0.136)	(0.135)	(0.027)
Initial share of man. exports	0.004	0.011	0.013***
	(0.007)	(0.009)	(0.001)
Interaction	0.005**	0.005**	0.006***
	(0.002)	(0.002)	(0.001)
Growth persistence	0.270***	0.213***	0.209***
	(0.050)	(0.051)	(0.008)
Impact for nonmanufacturers	-0.402***	-0.410***	-0.416***
	(0.128)	(0.127)	(0.026)
Impact for manufacturers	0.048	0.042	0.074*
	(0.118)	(0.119)	(0.043)
Observations	4,209	3,973	3,973
Countries in sample	161	161	161

Note: *p<0.1; **p<0.05; ***p<0.01. This table present estimates results of equation 5, scaled to one standard deviation reduction in tariffs. All specifications control for country and year fixed effects, and 8 lags of growth rates. The standard errors reported in parenthesis are robust to heteroskedasticity and serial correlation at the country level. Standard errors in the DAB-SS estimator are based on 100 bootstrap repetitions.

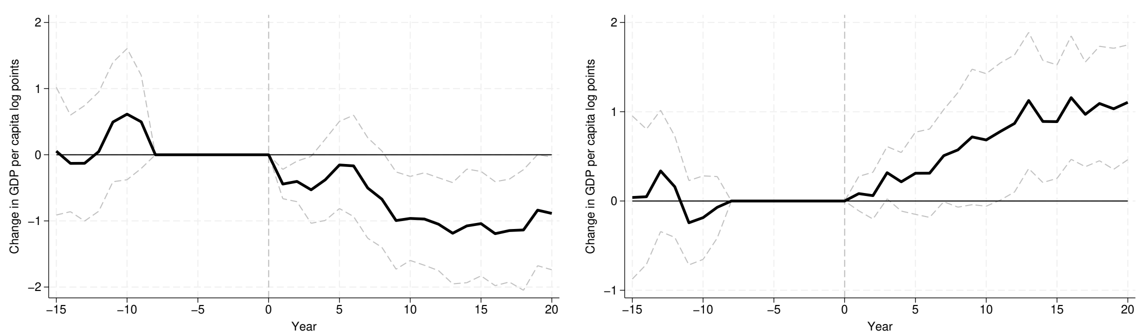
Additional robustness

The following graphs reveal the results associated to the subsection in the main paper called additional robustness. The results presented confirm once again the robustness of the heterogeneity by economic structure.

Endogeneity of economic structure

First, Figure B23 reveals the robustness exercise aimed to tackle the endogeneity of the economic structure. To do so, I instrument the interaction term between tariff changes and economic structure, with an interaction between tariff changes and the average economic structure by country in the whole sample. To control for the potential endogeneity of this average economic structure by country, the specification also includes country fixed effects, following Nunn and Qian (2014). The results confirm the existence of the heterogeneity. To safeguard the estimates with respect to inference problems from weak instruments (Andrews et al., 2019), I report the Anderson-Rubin p-values for the instrumented interaction in Table B2, confirming a significant heterogeneity at least 8-20 years after tariff reductions.

Figure B23: Heterogeneity in GDP per capita after tariff reductions: IV estimates for endogenous economic structure



(a) For nonmanufacturer countries

(b) For manufacturer countries

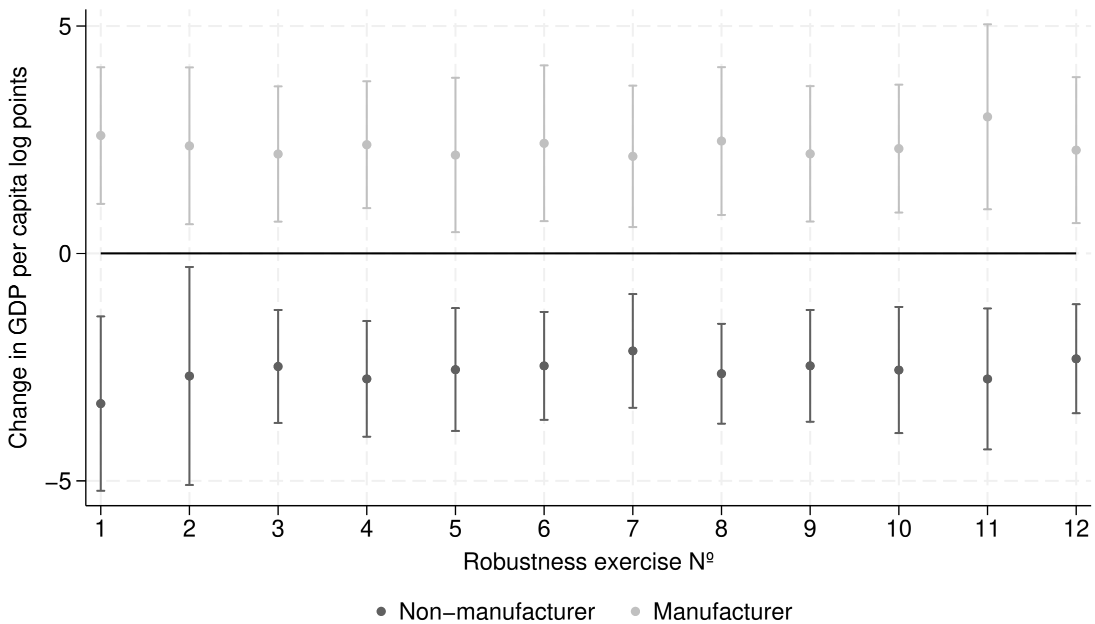
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level. The interaction between tariff changes and economic structure is instrumented with an interaction of tariff changes and the average economic structure by country in the whole sample. To avoid potential additional biases related to a direct effect from this average economic structure, the specification also includes country fixed effects.

Table B2: Anderson-Rubin p-values for the IV coefficient for the interaction

Horizon of analysis	Sign	Anderson-Rubin P-value
-15	+	.988
-14	-	.835
-13	-	.593
-12	-	.891
-11	+	.335
-10	+	.351
-9	+	.354
-8	0	NA
-7	0	NA
-6	0	NA
-5	0	NA
-4	0	NA
-3	0	NA
-2	0	NA
-1	0	NA
0	0	NA
1	-	.050
2	-	.108
3	-	.033
4	-	.221
5	-	.391
6	-	.445
7	-	.110
8	-	.054
9	-	.019
10	-	.017
11	-	.013
12	-	.006
13	-	.001
14	-	.004
15	-	.005
16	-	.002
17	-	.006
18	-	.014
19	-	.028
20	-	.014

And then, I present robustness results for the potential concern that economic structure may be related to the covariates considered and discussed in subsections 5.1 and 5.2. Results are presented below. Each of the robustness exercise refers to the same covariate considered in the same robustness number exercise in Figure 5. As such, for example, robustness exercise 1 controls for changes in growth forecasts.

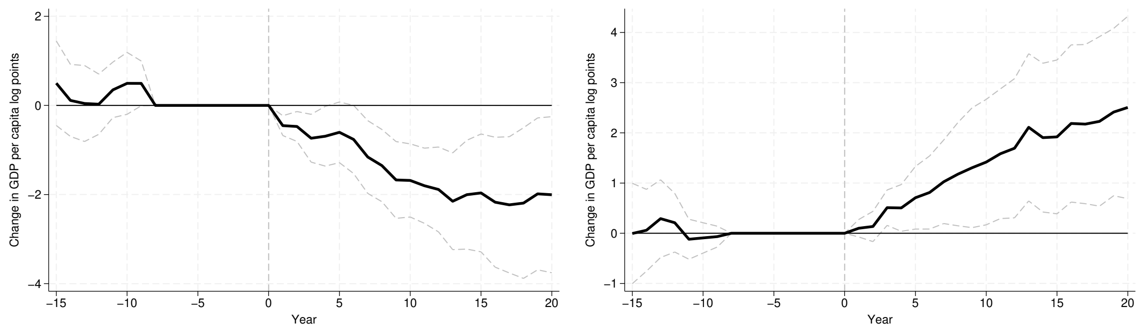
Figure B24: Heterogeneity in GDP per capita between 13-17 years after tariff reductions: robustness to interactions between covariates and economic structure



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 estimates 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 numbers refer to the same ones presented in Figure 5.

Heterogeneity in growth persistence and global shocks

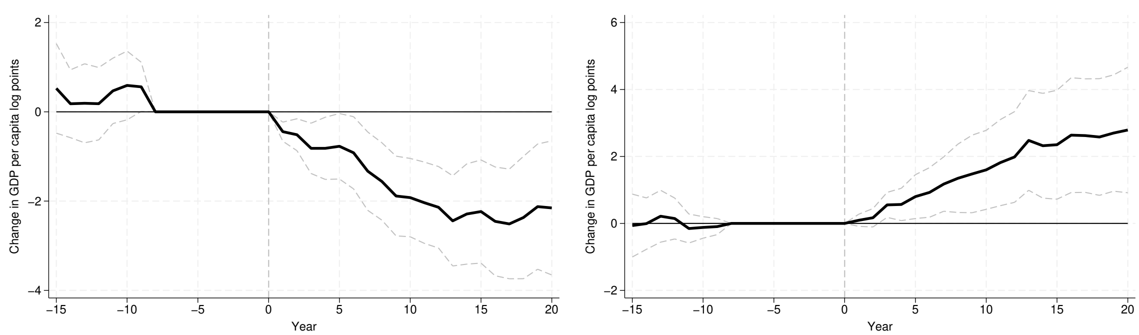
Figure B25: Heterogeneity in GDP per capita after tariff reductions: controlling for interactions between past growth and the initial economic structure



(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 B26: Heterogeneity in GDP per capita after tariff reductions: controlling for interactions between year fixed effects and the initial economic structure

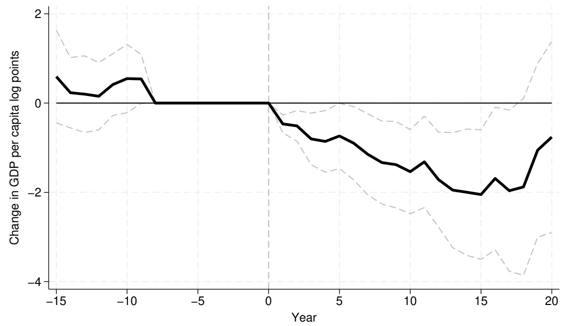


(a) For nonmanufacturer countries **(b)** For manufacturer countries

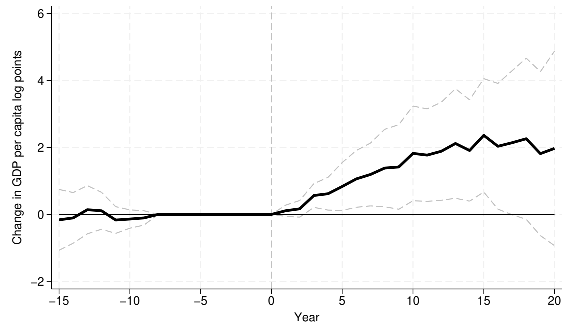
Note: The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Tariff changes after tariff reductions

Figure B27: Heterogeneity in GDP per capita after tariff reductions: controlling for other tariff changes



(a) For nonmanufacturer countries



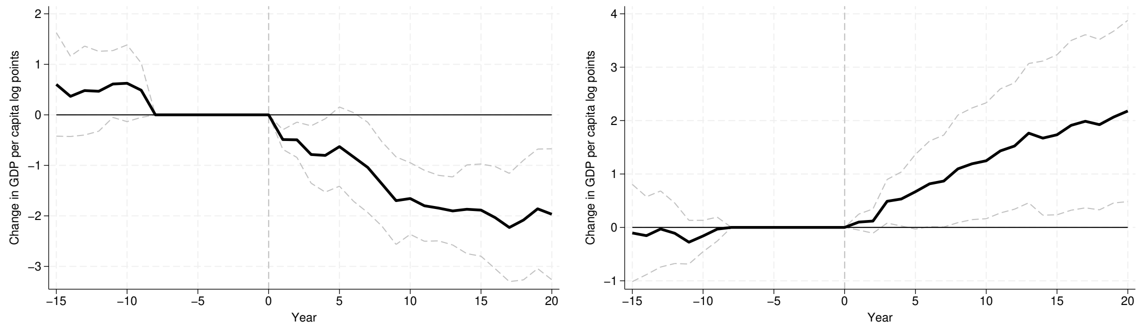
(b) For manufacturer countries

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.

Alternative definitions of 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 B28: Heterogeneity in GDP per capita after tariff reductions: using Lall's (2000) classification

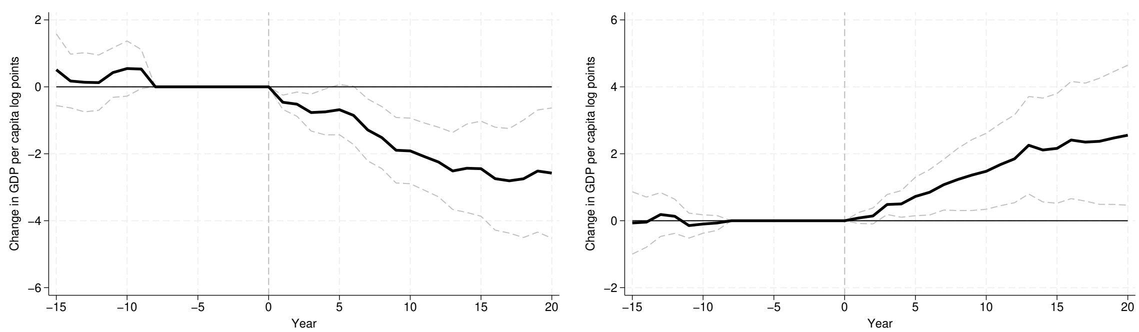


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 B28 reveals the result of using the initial economic structure defined using manufacturing exports with Lall's (2000) classification. The heterogeneity is still significant.

Figure B29: Heterogeneity in GDP per capita after tariff reductions: using revealed comparative advantage

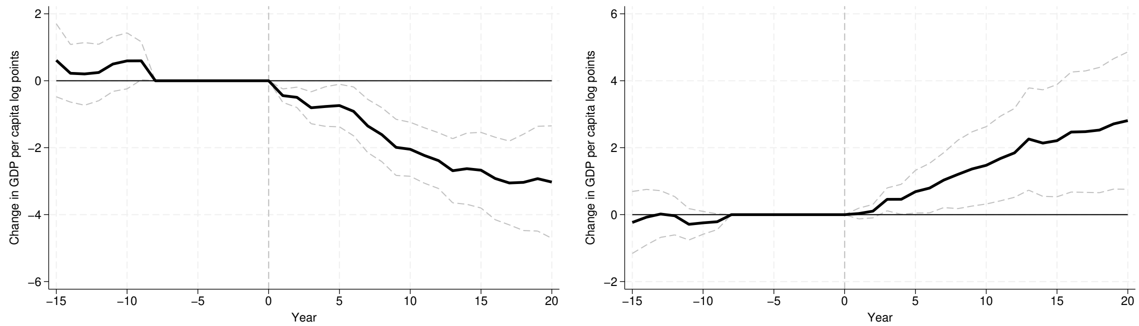


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 B29 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 B30: Heterogeneity in GDP per capita after tariff reductions: 3rd alternative definition of initial economic structure



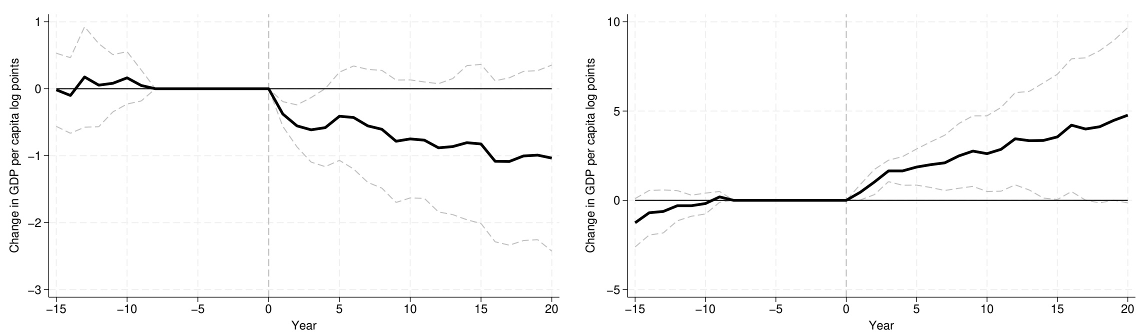
(a) For nonmanufacturer countries

(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 B30 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 B31: Heterogeneity in GDP per capita after tariff reductions: 4th alternative definition of initial economic structure



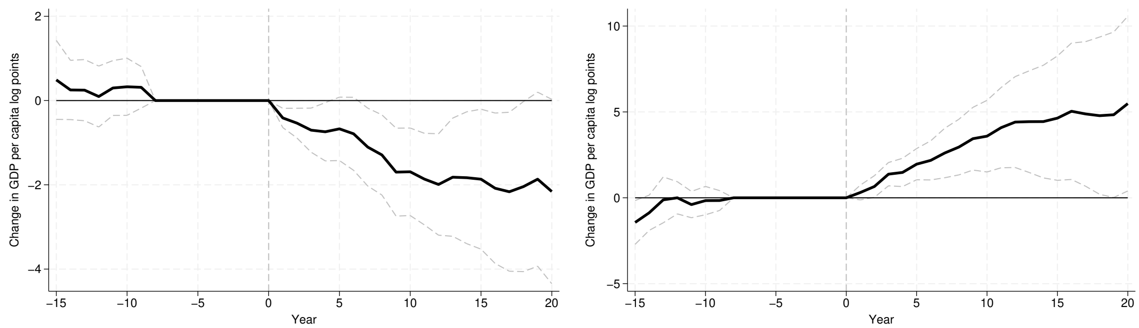
(a) For nonmanufacturer countries

(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 B31 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 B32: Heterogeneity in GDP per capita after tariff reductions: 5th alternative definition of initial economic structure

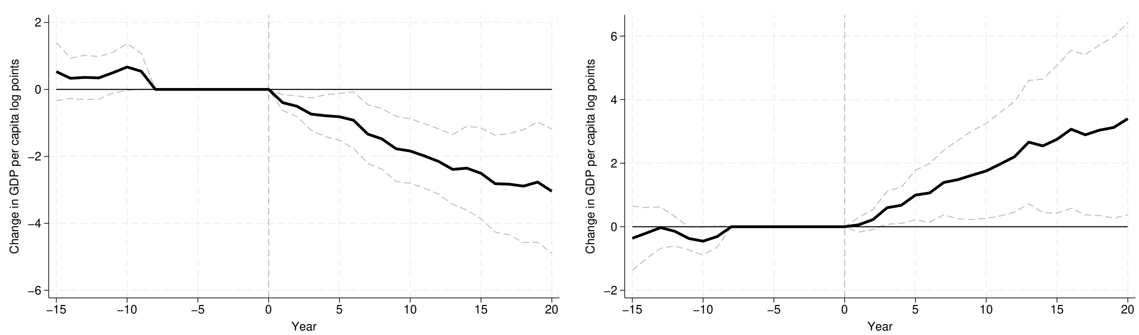


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 B32 reveals the results where the initial economic structure is the value of the share of manufacturing exports in 1970. The heterogeneity still holds.

Figure B33: Heterogeneity in GDP per capita after tariff reductions: 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.

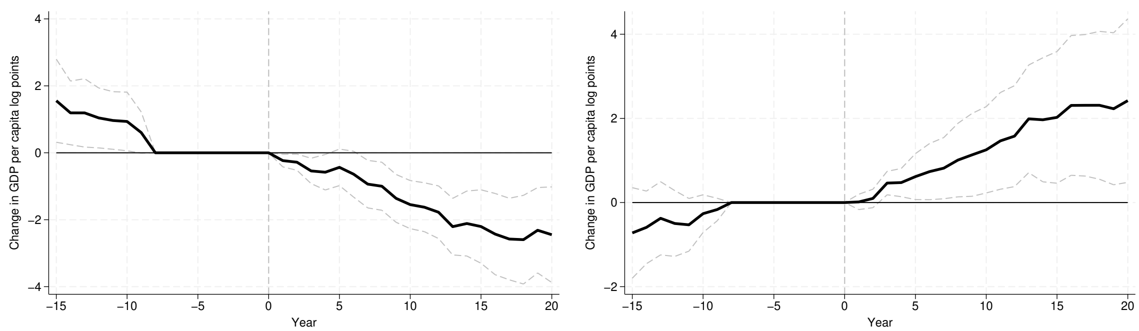
Figure B33 reveals the results where the initial economic structure is given by the value of the share of manufacturing exports in 1980. The heterogeneity in the results is still significant, and the magnitudes are even bigger.

Robustness to growth data and outliers

I show here that the baseline results are robust to alternative GDP data and that the heterogeneity does not rely on the specific data used in the baseline.

Figure B34 reveals the results when I use GDP per capita from the World Development Indicators (WDI) in constant national prices. The correlations are negative and significant for nonmanufacturer countries and positive and significant for manufacturer countries.

Figure B34: Heterogeneity in GDP per capita after tariff reductions: data from WDI

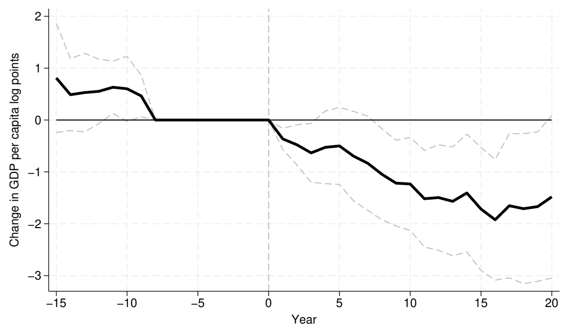


(a) For nonmanufacturer countries **(b)** For manufacturer countries

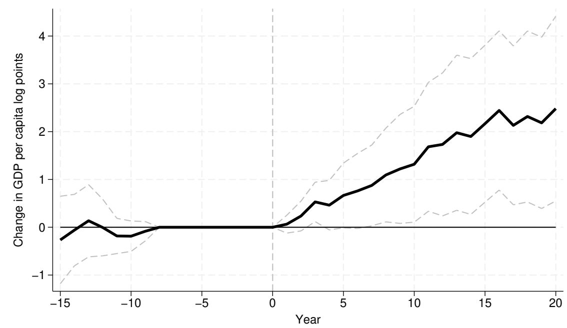
Note: The GDP per capita data used for this figure are in constant national prices from the WDI. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance level.

Figure B35 reveals the results when I use data from the Maddison Project (Bolt & van Zanden, 2020). The estimates are more erratic but still point to a significant heterogeneity.

Figure B35: Heterogeneity in GDP per capita after tariff reductions: data from the Maddison Project



(a) For nonmanufacturer countries

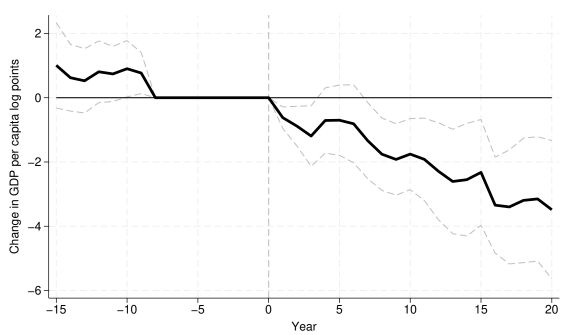


(b) For manufacturer countries

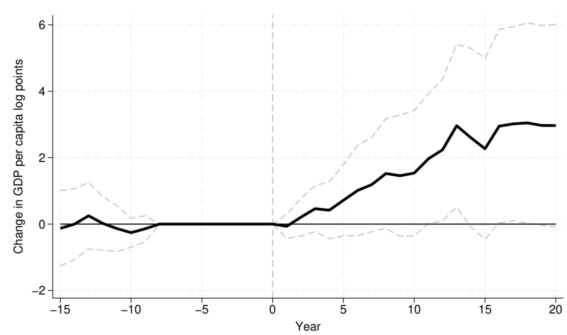
Note: The GDP per capita data used for this figure are in constant national prices from the Maddison Project. The standard errors used for the figure are two-way robust to heteroskedasticity and correlation on the country and year dimensions. Confidence intervals are calculated to the 90% significance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

Finally, in Figure B36 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 B36: Heterogeneity in GDP per capita after tariff reductions: data in PPP from PWT



(a) For nonmanufacturer countries

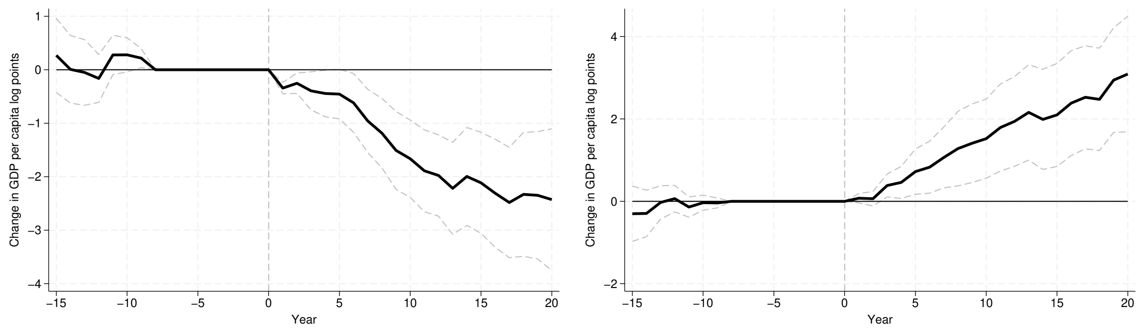


(b) For manufacturer countries

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.

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

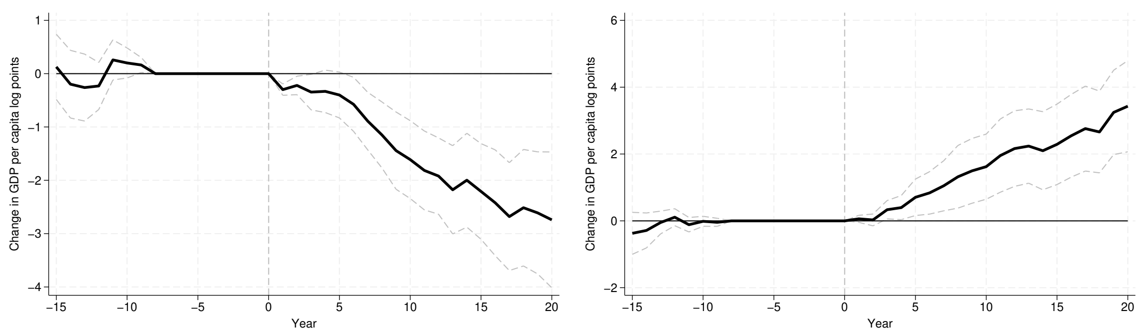
Figure B37: Heterogeneity in GDP per capita after tariff reductions: regressions with Huber weights



(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 B38: Heterogeneity in GDP per capita after tariff reductions: Li's robust regressions

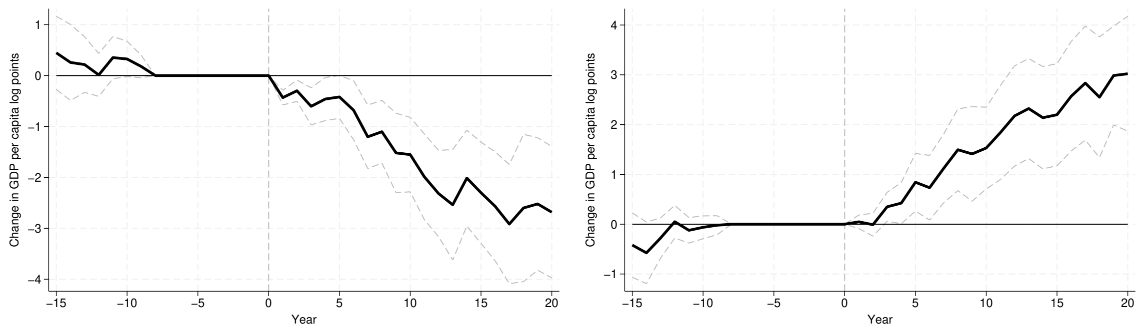


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 B37 reveals the results of using Huber (1964) weights and Figure B38 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 is bigger.

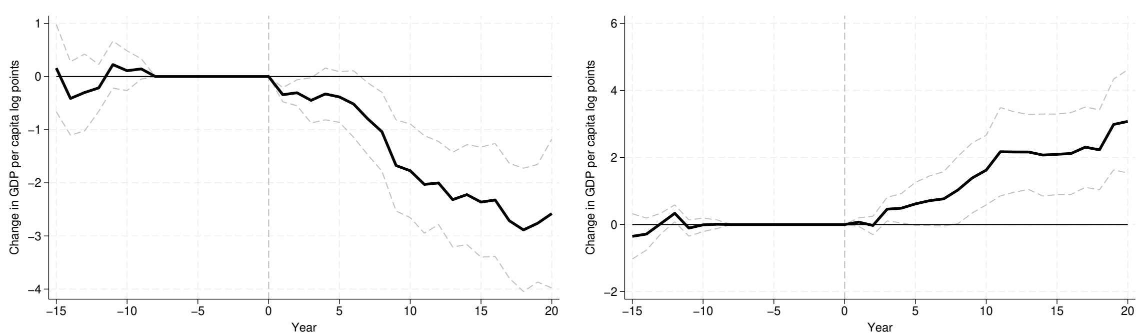
Figure B39: Heterogeneity in GDP per capita after tariff reductions: removing Cook's distance leverage points



(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 B40: Heterogeneity in GDP per capita after tariff reductions: removing R-standardized leverage points

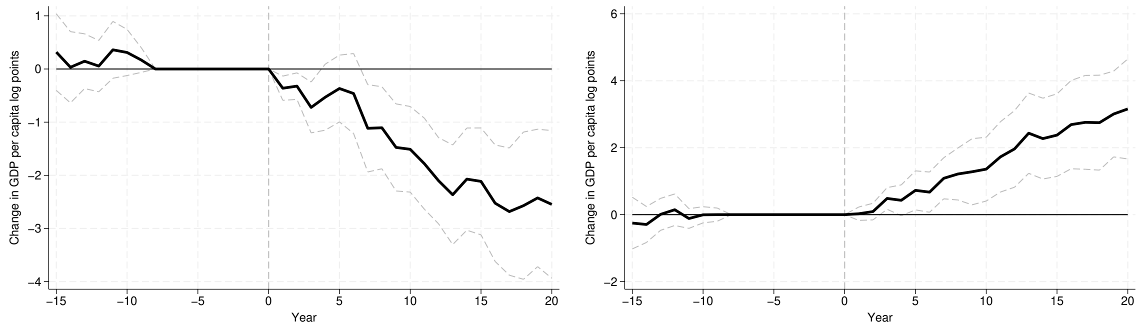


(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 B39, B40, B41, B42 and B43 reveal that the results are robust to deletion of Cook's, R-standardized, Dfits, Hat and Covratio outliers, respectively.

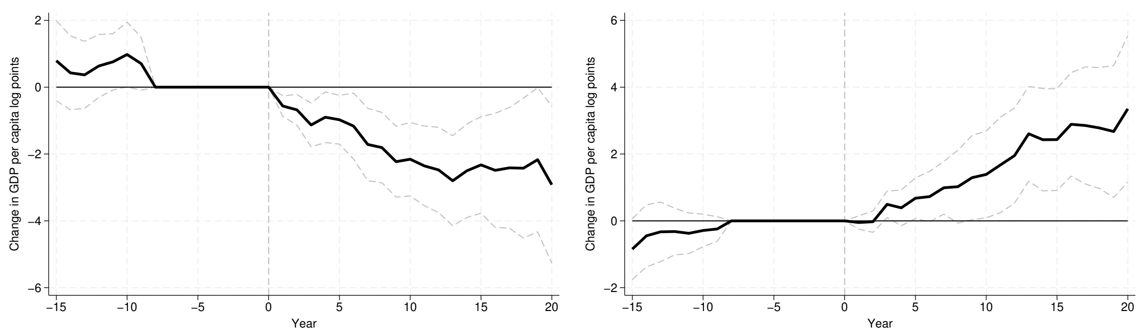
Figure B41: Heterogeneity in GDP per capita after tariff reductions: removing Dfits leverage points



(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.

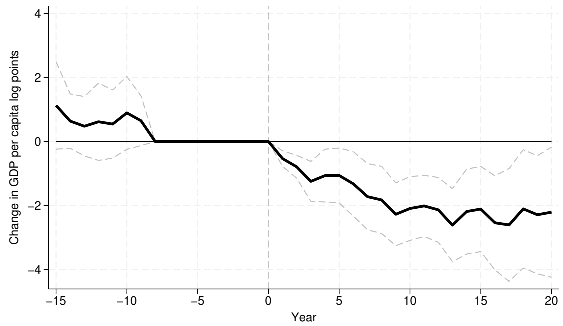
Figure B42: Heterogeneity in GDP per capita after tariff reductions: removing Hat leverage points



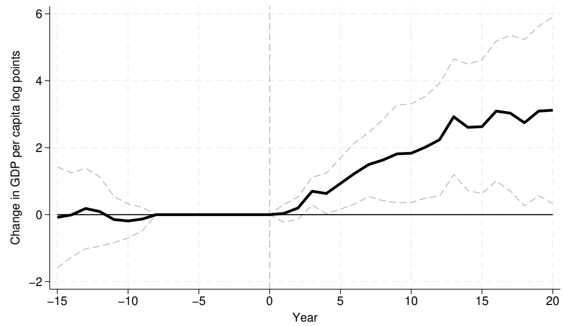
(a) For nonmanufacturer countries **(b)** For manufacturer countries

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 B43: Heterogeneity in GDP per capita after tariff reductions: removing Covratio leverage points



(a) For nonmanufacturer countries



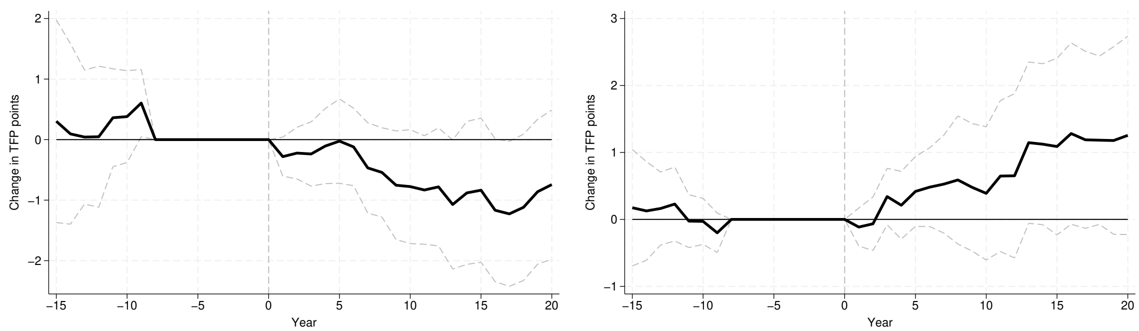
(b) For manufacturer countries

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.

C Mechanisms

Finally, I show results of the relationship between tariff reductions and TFP, as an alternative to labor productivity, and tariff reductions and the share of imports in GDP. Direction of the correlations 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.

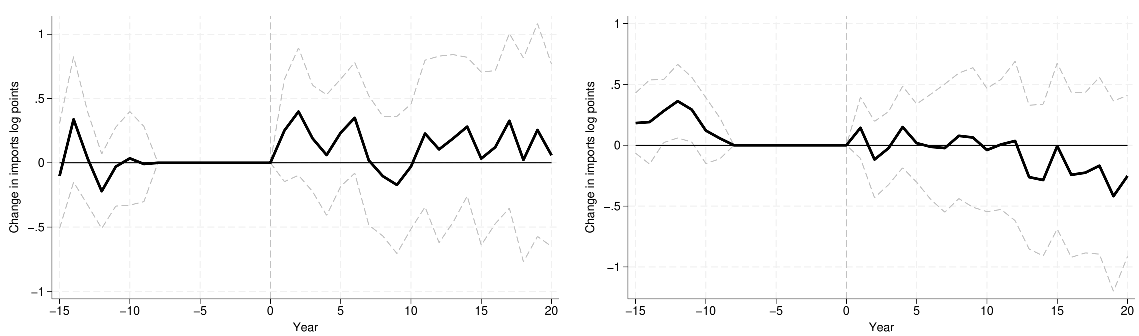
Figure C1: Heterogeneity in TFP after tariff reductions



(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: Heterogeneity in the share of imports in GDP after tariff reductions



(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.