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Corporate taxes and export competition

Tobias Böhm, Antonia Hohmann, Roxanne Raabe, and Nadine Riedel*

May 2025

Abstract: A broad empirical literature examines the impact of corporate taxes on firms' investment, location, and tax avoidance behaviour. Other corporate adjustment margins have received little attention. In this paper, we use administrative customs and tax return data from South Africa to demonstrate that corporate taxes influence firms' export performance and their competitiveness in international product markets. Leveraging a difference-in-differences approach, we find that exports by South African firms decline significantly when foreign competitors—serving the same destination market in the same six-digit product category—experience a corporate tax rate cut. In further analyses, we document that reductions in competitors' tax costs are associated with a decline in the real economic activity of South African exporters.

Key words: corporate tax, export competition, policy evaluation, emerging market

JEL classification: F14, F61, H25, H32

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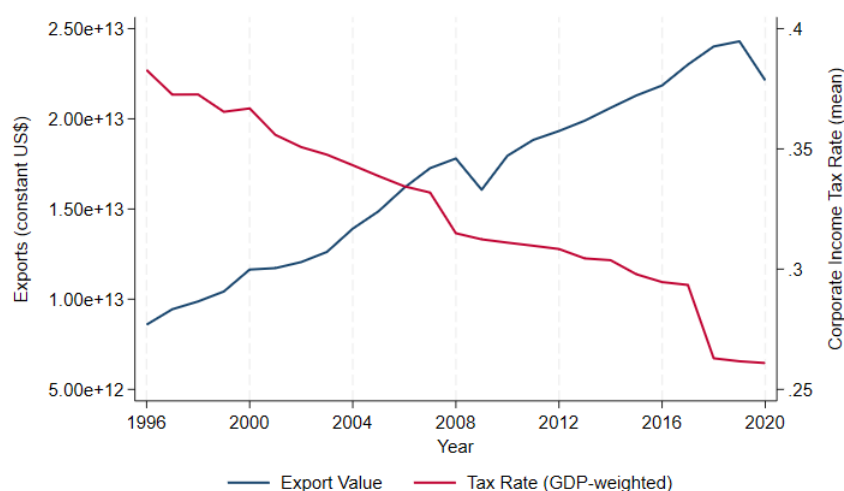
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1 Introduction

Governments worldwide have—often repeatedly—lowered their corporate taxes in recent decades (see Figure 1). This race-to-the-bottom in corporate tax rates is widely attributed to the growing cross-border mobility of firms and profits and to governments seeking to attract the mobile tax base by lowering their corporate tax costs (see, e.g., Devereux et al. 2008, Keen and Konrad 2013). Consistent with this notion, a substantial body of empirical research highlights that corporate tax cuts attract mobile firms, investments, and profits to countries implementing such policy reforms (e.g., Devereux 2007, Feld and Heckemeyer 2011, Heckemeyer and Overesch 2017, Tørsløv et al. 2022).

Alternative explanations for the downward trend in corporate tax rates have received little attention. In this paper, we offer a new perspective by showing that corporate tax cuts also enhance the export performance of firms in the policy-changing country and their competitiveness in international product markets. This implies that recent decades' liberalization of the goods and service trade may have contributed to the observed decrease in corporate tax rates (see Figure 1). Policymakers have for long asserted such a connection. For instance, the first Trump administration's Tax Cuts and Jobs Act (TCJA) aimed to 'make American firms great again', underscoring the belief that a lower tax burden enhances domestic exporters' global competitiveness (White House 2018; Center for American Progress 2019; Wall Street Journal 2018). Empirical studies, which test for this link, are scarce, however.

Figure 1: Global exports and corporate income tax rates



Note: the figure illustrates the development of global exports (left-hand scale) and corporate income tax rates (right-hand scale) over time. The blue line shows the export value in constant 2010 US dollars, whereas the red line shows the GDP-weighted average corporate income tax rate (weighted by GDP in 2009). Export data are taken from the World Integrated Trade Solution (WITS) databank, and CIT rates are taken from the International Tax Institutions (ITI) database.

Source: authors' compilation.

The aim of this paper is to help close this gap. Based on rich tax administrative data from South Africa, we empirically document a statistically and economically significant link between corporate taxes and firms' export performance. Before embarking on the empirical analysis, we develop a simple monopolistic competition model that provides guidance for the empirical work. We model exporting firms, which are located in two countries and sell their products into a third market. If one country cuts its corporate tax rate, exporters located in this country experience a cost shock and, in response, lower their export prices and increase export sales. Intuitively, this has repercussions on competitors in the foreign country that lose market shares and experience a decrease in export sales; competitors' price changes are, in turn, theoretically ambiguous and depend on the shape of the demand function. Under CES preferences, the model predicts that the prices of competitors remain unchanged.

We empirically assess these model predictions using South Africa as a testing ground. The study is based on granular administrative data, which allow us to track all exports by South African firms at the transaction level, including information on the six-digit product category of the traded good and the destination country of the trade. We couple this information with macro-level data on bilateral trade flows that allow us to identify the host countries of *foreign competitors* of South African firms—defined as companies that export goods in the same six-digit product category to the same destination country. While South Africa, during our data period, levied a constant and—by international standards—relatively high corporate tax rate of 28%, many other countries, including economies on the African continent, lowered their corporate tax rates. Our empirical identification strategy levies this variation and compares the export performance across South African exporting firms, which differ in their exposure to competitors' corporate tax cuts, in a difference-in-differences design. In a first step, we account for all corporate tax rate reforms worldwide during our data frame; in a second step, we focus on variation induced by the TCJA enacted in the United States in 2017, which marks the largest corporate tax reduction in the history of the United States and is the largest tax reform worldwide during our data frame. Among others, the US top statutory corporate tax rate was lowered by 14 percentage points, from 35% to 21%.

The main threat to our empirical identification strategy is the violation of the conditional mean independence assumption—or, in the parlance of difference-in-differences design, the violation of the common trend assumption. Export outcomes may have emerged differentially across treated and control firms (i.e. firms with and without exposure to competitors' tax cuts or firms with differential exposure, respectively) for reasons unrelated to treatment. We address this concern along multiple lines. First, our estimation model non-parametrically absorbs potential time-varying destination country confounders. Destination-country year fixed effects non-parametrically control for economic, institutional, or policy changes in destination markets, which may impact the export sales of South African exporters and—if correlated with treatment intensity—might bias our estimates. Empirical identification of the treatment effect of

interest thus relies on variation in the corporate tax costs faced by *exporters from third countries* that sell to the same destination market in the same product category as the considered South African firm (rather than variation in destination country corporate tax rates, which impacts local firms in the destination market but is collinear with the set of destination-country year fixed effects). This strategy aligns with recent findings that show that export status positively correlates with product quality, rendering products sold by exporters closer substitutes than products sold by exporters and domestic firms (see, e.g., Atkin et al. 2015; Crozet et al. 2012; Hallak and Sivadasan 2013).

Complementarily, we non-parametrically control for differential shocks to export sales across industries, firm-size classes, and, even more granularly, across exporting firms. The latter models exploit that South African firms export in different product categories and to different destination markets, allowing us to identify the effect of interest from within-firm variation. We, furthermore, corroborate the validity of the common-trend assumption by estimating dynamic difference-in-differences models, which show that the export sales of firms treated and untreated (or less treated) by foreign competitors' corporate tax rate changes emerge in parallel prior to treatment. Finally, as we rely on a staggered treatment design, we add models that show that our findings prevail when we use estimators that are robust to heterogeneous and dynamic treatment effects.

Our estimates point to a significant effect of competitors' corporate tax rates on the export performance of South African firms. The dependent variable of main interest is the firms' export quantity—that is, the export trade in a particular product category to a particular destination country at a given point in time. Our preferred specifications yield a semi-elasticity of around 0.5. If competitors' corporate tax costs decline by one standard deviation (4.5 percentage points), the volume of South African export trade is predicted to drop by around 2% on average. This finding is robust to the above described specification checks and to a battery of robustness analyses. The estimates remain unchanged when we: i) rely on different tax measures to model firms' corporate tax rate burden; ii) model the effect of corporate taxes on *import* trade and thereby rule out that firms' imports impact the tax-export-performance link of interest; iii) augment the set of regressors by control variables for changes in the economic and policy environment in competitor countries; and iv) restrict the identifying variation to the US TCJA reform. While across all specifications, we find a quantitatively sizeable and statistically significant link between competitors' tax costs and the export quantity of South African firms, the estimates reject significant shifts in export prices of South African traders in response to foreign corporate tax reforms—consistent with our theoretical model's prediction under CES preference structures.

In further analyses, we, moreover, show that our findings prevail when we drop multinational firms from the data. This dampens concerns that our findings might reflect relocation of real

economic activity by internationally mobile firms in response to changes in international corporate tax rate differentials, with export trade just following suit.

Moreover, we show that our estimates are not biased by treatment spillovers on control units—that is, by violations of the Stable-Unit-Treatment-Value Assumption (SUTVA) (see Rubin 1980 and Rubin 1986). This is not clear *a priori*. Exporters might adjust their product portfolio in response to foreign corporate tax shocks. If they are exposed to competitors' corporate tax cuts in one market (i.e. in a specific six-digit product category-destination country-cell) and lose market shares, they may shift sales to other products and markets.¹ Prior evidence suggests that this concern is likely of limited quantitative importance in the context of less developed countries like South Africa, where exporters have been documented to keep export portfolios largely unchanged even when hit by major shocks (see, e.g., Goldberg et al. 2010). Consistent with this evidence, our estimates remain qualitatively and quantitatively unchanged when we absorb potential within-firm spillovers on non-treated trading routes in the empirical analysis to hedge against SUTVA violations.

In a final set of analyses, we shed light on possible repercussions of foreign corporate tax policy changes on the real economic activity of South African exporters. Consistent with our prior findings, we document that exporting firms that are exposed to competitors' corporate tax cuts experience a reduction in profits and local employment. Again, we find negative repercussions on South African firms both when we account for all worldwide corporate tax rate changes during our sample frame and when we solely focus on exposure to US competitors and the TCJA reform. The findings, furthermore, prevail when we granularly absorb industry-, region-, and firm-size trends. Dynamic difference-in-differences specifications further suggest that outcome variables emerge in parallel prior to treatment (exposure to competitors' tax shocks) and gradually decline thereafter. Among others, our estimates suggest that employment of South African exporters dropped by 1%, or around 29,000 workers, in response to the TCJA reform in the United States.

Our paper contributes to a growing empirical literature that studies the impact of corporate taxation on firm behaviour. While effects on firms' investment and profit allocation are well-studied, potential effects of corporate taxes on export behaviour have received surprisingly little attention outside of the theoretical literature (see, e.g., Davies and Eckel 2010; Krauthaim and Schmidt-Eisenlohr 2011; Haufler and Stähler 2013; Bauer and Langenmayr 2013; Bauer et al. 2014). A notable exception is a recent paper by Flach et al. (2021), who document a link

¹ Prior research by Flach et al. (2021) in a broad, worldwide setting shows that firms respond to reductions in competitor tax costs by skewing their export sales towards the better performing varieties. Note that this does not reflect a shift in exports from treated transactions (those subject to a corporate tax cut) to control transactions (those not subject to a corporate tax cut) but rather a reshuffling of export activity within the group of treated transactions.

between corporate taxes and exporting. The paper differs from our work along two lines. First, Flach et al. (2021) document that corporate taxes impact firms' portfolios of exported products. They show that businesses shift sales towards better performing varieties when corporate tax rates in the destination market drop (and they hence face stronger local competition). We, in turn, are the first to show, based on rich tax administrative data, that corporate taxes also impact export *quantities*. A second point of divergence is that Flach et al. (2021) employ changes in destination country corporate tax rates for empirical identification. We, in turn, draw on variation in the corporate tax burden of other exporting firms that serve the same destination market. This allows for weaker identification assumptions (as destination market confounders can be non-parametrically absorbed) and comes with the benefit of focusing on export competitors whose products, as suggested by prior evidence, tend to be closer substitutes than the products of exporting and domestic sellers (e.g., Atkin et al. 2015).

The remainder of this paper is structured as follows. Section 2 presents a simple theoretical model to guide our empirical analysis. Section 3 provides institutional background, and Sections 4 and 5 describe data and estimation strategy. Results are presented in Section 6. Section 7 concludes.

2 A simple model

To fix ideas and obtain guidance for the empirical analysis, we start out with a simple theoretical model. The aim of the model is to illustrate how corporate tax changes in one country affect firm outcomes of competitors in another. Firms are assumed to be located in two countries, denoted by a and b . They export differentiated varieties to a third country. In the following, we first characterize household demand for each variety ω and then model firm behaviour.

2.1 Demand

Households in the destination country are assumed to have CES preferences over the continuum of differentiated varieties imported from countries a and b . Market demand for variety ω is given by

$$q(\omega) = E(p(\omega))^{-\sigma} P^{\sigma-1} \quad (1)$$

where E denotes total expenditure (for the imported varieties), $p(\omega)$ is the price of variety ω , and $P = \left[\int_{\omega \in \Omega} (p_i(\omega))^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$ denotes the price index.²

² See, for example, Feenstra (2016).

2.2 Firm behaviour

Varieties are produced by homogeneous, monopolistically competitive firms using labour ℓ and capital k according to the production function $F(\ell, k)$.³ Profits of firms from country $i \in \{a, b\}$ that face labour and capital cost, w_i and r , respectively, are given by

$$\pi_i = (1 - t_i)(p_i F(\ell, k) - \theta \cdot r \cdot k - w_i \cdot \ell) - (1 - \theta)r \cdot k \quad (2)$$

where t_i represents the corporate tax rate in country i . Consistent with standard assumptions, wage costs are modelled as fully deductible for tax purposes, while capital costs are partially tax deductible at a rate of $0 < \theta < 1$.

The firm's net-of-tax cost function is derived from the following cost minimization problem:

$$\min_{\ell, k} (1 - t_i)w_i \cdot \ell + (1 - \theta t_i)r \cdot k \quad \text{s.t.} \quad F(\ell, k) \geq y$$

and is denoted by $C_i((1 - t_i)w_i, (1 - \theta t_i)r, y)$. The homogeneity of degree one in input prices implies that

$$C_i((1 - t_i)w_i, (1 - \theta t_i)r, y) = (1 - t_i)C_i(w_i, \varphi_i r, y)$$

where $\varphi_i = \frac{1 - \theta t_i}{1 - t_i} > 1$ reflects the unfavourable tax treatment of capital.

The firm's optimal price maximizes firm profits:

$$\pi_i = (1 - t_i)(p_i \cdot y - C_i(w_i, \varphi_i r, y))$$

and is given by:

$$p_i = \frac{\sigma}{\sigma - 1} c_i(w_i, \varphi_i r, y) \quad (3)$$

where $\sigma > 1$ is the price elasticity of demand. CES demand implies that the optimal price is given by a constant mark-up over marginal cost $c_i(w_i, \varphi_i r, y)$, which inversely correlates with σ . It follows that profit-maximizing firm revenue reads:

$$R_i = \left(\frac{\sigma}{\sigma - 1} c_i(w_i, \varphi_i r, y) \right)^{1 - \sigma} EP^{\sigma - 1} \quad (4)$$

³ The total mass of firms is determined by fixed costs. In the following, we treat the total mass of firms as fixed. Furthermore, to simplify notation, we suppress the index ω in the following derivations.

2.3 Comparative statics

How does an increase in the corporate tax rate impact firm outcomes? Without loss of generality, assume that country a increases its corporate tax rate t_a . The tax increase raises the net-of-tax marginal cost $c_a(w_a, \varphi_a r, y)$ of firms in country a because marginal costs increase in input prices⁴ and $\partial \varphi_a / \partial t_a > 0$. As a consequence, firms from country a increase their price when t_a rises. This reduces their export quantity and export revenue (see Equations (1) and (4)).

In the empirical analysis to come, the data structure allows us to identify the *cross-border* effect of corporate tax changes on foreign exporting firms (rather than the own-country effect)—in the context of our model and our illustration, this relates to the effect of t_a on export outcomes of firms in country b .

Our model derives two predictions on this link. First, when t_a increases, the price set by firms in country b , p_b , remains unchanged under the assumption of constant marginal cost. As p_a increases, there is a rise in the price index P , however, which, under the assumption of homogenous firms can be written as

$$P = \left(m_a p_a^{1-\sigma} + m_b p_b^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

where m_i denotes the mass of firms in country $i = a, b$. As can be seen from Equation (1), a higher price index shifts the demand curve outwards and hence increases the quantity and revenue (Equations (1) and (4)) of goods exported by firms in country b .

Note that the zero effect on prices of firms in country b hinges on the assumption of a CES demand structure. To see this, consider an alternative popular demand structure, which is linear demand (see, e.g., Melitz and Ottaviano 2008). With linear demand, an increase in t_a still raises prices of firms in country a , but competitor firms in country b now move into a less elastic part of the demand function, which induces them to raise their prices as well. This illustrates that the cross-border link between corporate taxes and export prices set by foreign firms is theoretically ambiguous and hinges on the demand structure.

Building on these theoretical considerations, we embark on the empirical analysis.

⁴ Technically, this is only true as long as the cost-minimizing capital stock increases in y (i.e. is a normal input), which holds for all commonly used production factors (see, e.g., Gravelle and Rees 2004).

3 Institutional background

Our empirical testing ground is South Africa. South Africa is an upper-middle-income country with a gross domestic product (GDP) per capita of around US\$7,000 in 2023. Its tax-to-GDP ratio exceeds that of other less developed countries but still falls short of developed-country levels. In 2020, South Africa's tax-to-GDP ratio was 25.2% (relative to an average of 16% on the African continent and an average of 33.5% in the OECD).⁵ Similar to most developing countries, South Africa relies relatively strongly on corporate income taxation. In 2019, the country's corporate-tax-to-GDP ratio was 4.34% compared to an OECD average of 2.96% (see International Monetary Fund 2023).

Institutionally, South Africa levied, by international comparison, a high corporate tax rate of 28% throughout our sample frame spanning the years 2012 to 2019, while other countries on the African continent and worldwide decreased their corporate tax rate over the same time period. The United States, for example, cut its statutory corporate tax rate by 14 percentage points in the 2017 Tax Cuts and Jobs Act, next to a number of other tax-related reforms. In this paper, we ask if this differential development of domestic and foreign corporate tax levies deteriorated the position of South African exporters in international product markets and reduced their export sales and market shares.

4 Data

The empirical analysis spans the years 2012 to 2019 and draws on administrative customs data that comprise information on the universe of export transactions of South African firms, including information on transaction value, transaction volume, export destination country, and the six-digit product category (HS6).⁶ The data are provided by the data lab at the National Treasury (for a detailed description, see Appendix A).

We apply standard data cleaning steps (see Table A.1 in Appendix A for details) and aggregate the quantity and (customs) value of exports to the firm-HS6 product-destination country-year level. The data, moreover, are connected to the universe of firms' corporate income tax returns and pay-as-you-earn certificates in the country during our data frame, which allow us to track further firm outcomes, such as wage costs and the number of employees. Table 1 presents basic descriptive statistics. Figure 2, moreover, shows the development of the share of exporters in all incorporated firms and the share of export value in all sales over time. While the value of

⁵ Information on GDP per capita was obtained from the World Bank; information on tax-to-GDP ratios are taken from OECD statistics.

⁶ We exclude the years 2009–11 and 2020–22 due to imperfect coverage in the data and, in the latter case, to avoid potential confounding effects by the COVID-19 pandemic.

exports, normalized by sales, remained rather stable during our data frame, the share of exporters declined. The majority of transactions, moreover, go to other African countries, most importantly to direct geographic neighbours of South Africa. In terms of value, most export trade is with China and developed countries, however, and is dominated by a few transactions and firms.

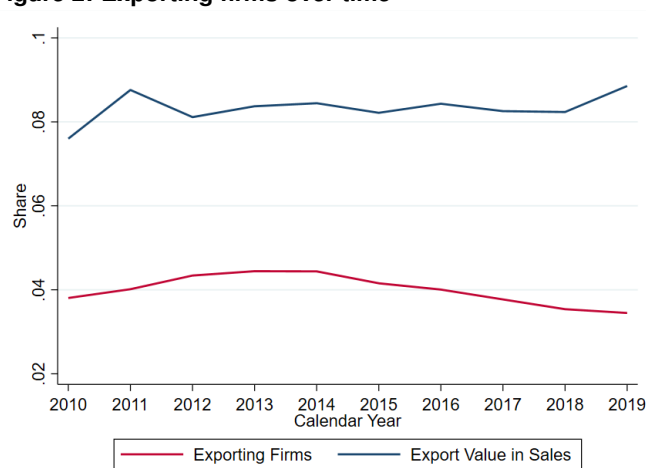
Table 1: Descriptive statistics

	Obs.	Mean	Std. dev.	p25	p50	p75
Customs value	3,930,404	1,580,376	7.03e+07	2,489	13,580	79,461
Quantity	3,930,399	354,999.7	4.62e+07	9	63	560
$\bar{\tau}_{hct}$	3,930,404	0.2594709	0.0450397	0.2391471	0.2571008	0.2846209
\overline{EMTR}_{hct}	2,741,026	0.1434325	0.0279196	0.127862	0.1410076	0.1605173
\overline{EATR}_{hct}	3,929,159	0.2250927	0.0399695	0.2068982	0.2229085	0.2477002
No. firms	26,891					
No. destination countries per firm		12.85492	15.10816	4	8	16
No. dest. countries per firm product		4.643505	7.361346	1	2	5
No. products per firm		281.3508	319.9536	46	146	429

Note: descriptive statistics of important variables. Export data are aggregated at the firm-product-country-year level, where product refers to the HS6 code and country to the country of destination. Customs value is denoted in ZAR. $\bar{\tau}_{hct}$ refers to the competitors' average corporate income tax rate, where competitors are defined as firms from countries that export in the same HS6 code and to the same destination country as the South African firms. \overline{EMTR}_{hct} (\overline{EATR}_{hct}) refers to the competitors' average effective marginal (average) tax rate. The timeframe is 2012–19.

Source: authors' compilation.

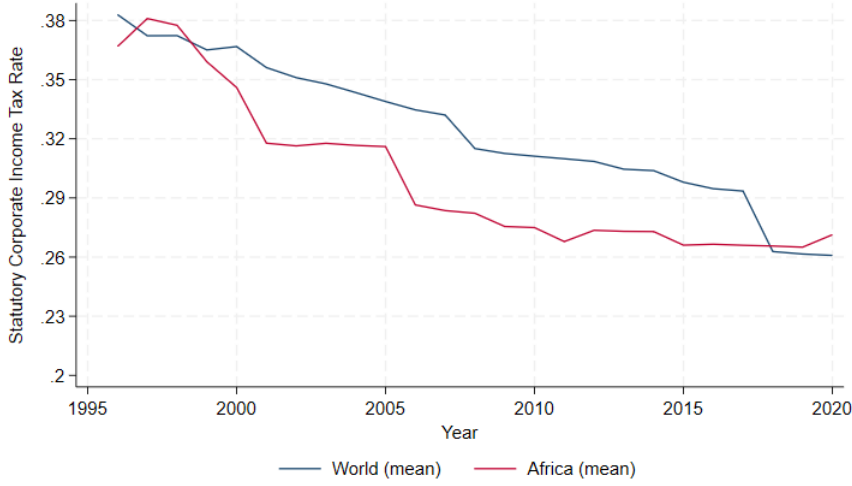
Figure 2: Exporting firms over time



Note: the share of exporting firms in all non-dormant firms (red line) and the share of export value in overall sales (blue line). For this graph, we only look at firms in the so-called Corporate-Income-Tax (CIT) Panel, thereby excluding exporters that are not incorporated.

Source: authors' compilation.

Figure 3: Development of corporate income tax rates



Note: this figure shows the development of global corporate income tax rates over time. We study GDP-weighted CIT averages (weights are GDP in 2009). The blue line shows the worldwide average, excluding South Africa. The red line shows the African average, again excluding South Africa. The major US tax reform is also clearly distinguishable.

Source: authors' compilation.

The treatment regressor of interest is the weighted average of the corporate tax rate faced by competitors of South African exporters—that is, foreign firms that export in a given six-digit product category to the same destination country as the considered South African firm. As specified above, modelling the average corporate tax rate of exporters into foreign destination countries offers important conceptual advantages relative to using the tax burden of potential domestic competitors in destination markets: it allows us to non-parametrically absorb potential time-varying destination-country confounders and focus the analysis on a relevant set of competitor firms (e.g., Atkin et al. 2015). As South Africa levied a constant corporate tax rate of 28% during our data frame, while other countries in Africa and the rest of the world reduced their corporate tax levy (see Figure 3), the strategy is to compare changes in the export performance of South African exporters, which are and are not exposed to foreign competitor corporate tax cuts.

We calculate the average corporate tax rate of competitors of South African exporters in six-digit product category h and destination market c at time t as

$$\tau_{hct} = \sum W_{jhc} \tau_{jt} \quad (5)$$

where τ_{jt} is the corporate tax rate in competitors' host countries—that is, countries other than the destination market ($j \neq c$) and other than South Africa. The weight W_{jhc} reflects the base-year share of aggregate import flows from country j to market c in the six-digit product category h , relative to the total imports into market c in that category, excluding imports from South

Africa. W_{jhc} is calculated based on aggregate bilateral trade data by six-digit product category in the base year, 2013, drawn from the UN's COMTRADE database.

We further obtain information on statutory tax rates from the International Tax Institutions (ITI) database (see Wamser et al. 2024 for details). The average is calculated based on a balanced set of countries, meaning only countries for which we observe corporate tax rate information for all years in our data frame enter the calculation of the average. The variation in τ_{hct} hence solely stems from changes in foreign corporate tax rates, as W_{jhc} is time-constant and calculated based on a single year of import flows. In robustness checks, we assess the sensitivity of our findings by using alternative corporate tax rate measures, namely effective marginal and effective average tax rates levied by host countries of foreign competitors (again drawn from the ITI database). The latter capture the marginal and average burden on firm investments, accounting for both the statutory corporate tax rate and the tax deduction rules (see Wamser et al. 2024 for details on the construction).

Empirical identification in the analysis to come will stem from variation in the host countries of competitors of South African exporters in world markets—by six-digit product category and destination country. South African exporters of rhodium, for example, face competition by firms in the United States, which is the second-largest exporter country of rhodium globally (after South Africa). Country export shares, furthermore, vary across destination markets (in case of rhodium being highest for Germany), giving rise to additional variation in the set of competitors faced by South African firms, which is used for empirical identification. In Table B.1 in the Appendix, we list a selection of the top 50 HS6 export products as ranked by the value of export trade by South African exporters, plus the strongest competitor country—measured by the source country (other than South Africa) with the highest aggregate export share in this product category worldwide in 2013. The table illustrates a wide variation in competitor host countries across product groups.

Finally, we augment our data by a vector of country-level variables to capture the economic background in competitors' host countries, namely the GDP, GDP per capita (both in logs), foreign direct investment, and the unemployment rate, taken from the World Bank's Development Indicator Database.

5 Methodology

In a first step, we quantify the impact of corporate taxes on firms' exporting behaviour. Empirical identification in the base analysis draws on all corporate tax reforms worldwide during our data frame in a difference-in-differences style approach. The estimation strategy compares the export performance of South African firms that are and are not exposed to competitors subject

to corporate tax cuts—or that differ in their level of exposure to competitors' tax rate changes, respectively.

Formally, the estimation model reads:

$$\log(Y_{ihct}) = \alpha + \beta\tau_{hct} + \gamma'X_{hct} + \mu_{ihc} + \delta_{ct} + \epsilon_{ihct} \quad (6)$$

where Y_{ihct} is the exported quantity of South African firm i —or, in additional specifications, the unit price and the export value, respectively—exporting HS6 product h to destination country c in year t . τ_{hct} is the weighted average corporate income tax rate faced by foreign competitors of firm i , which also export in HS6 code h to destination country c in year t , as constructed in the prior section. All empirical models include a full set of firm-product-destination-country fixed effects, μ_{ihc} , which absorb time-constant heterogeneity in export outcomes across firm-product-destination-country cells. The model, furthermore, accounts for a full set of destination-country-year fixed effects, δ_{ct} , which non-parametrically absorb any differences in the evolution of export outcomes across destination markets. X_{hct} is a vector of control variables, and ϵ_{ihct} depicts the error term. In the baseline specification, we cluster standard errors at the firm-product-destination market level, but we present extensive robustness checks where we assess alternative levels of clustering.

The parameter of interest is β , which captures differences in outcome trends across firms with different exposure to foreign competitors' corporate tax shocks. In specifications, where the dependent variable is the quantity of goods exported, we expect a positive sign of β : if foreign competitors experience a tax cost decline, this reduces the quantity exported by affected South African firms. The main threat to our empirical identification strategy and to obtaining an unbiased estimate for β is the violation of the conditional mean independence assumption—or in the parlance of difference-in-differences design, the violation of the common trend assumption. If export trends are shaped by third factors that correlate with the evolution of corporate tax rates faced by competitors of South African exporting firms, conditional mean independence may be violated. We address this concern along two lines.

First, we non-parametrically control for time-varying differences in outcome trends across destination countries. This absorbs any changes in destination markets, which may act as a confounder—economic shocks (e.g., demand shifts in economic downturns), policy changes (e.g., adjustments of subsidies to support domestic producers), or institutional changes (e.g., changes in ruling parties or political regimes). It also implies that the effect of interest is identified from changes in corporate tax rates faced by foreign exporters (rather than changes in destination market corporate tax rates and hence the tax burden on *local* competitors—with the latter being collinear with the destination-country-year fixed effects). This modelling strategy relaxes empirical identification assumptions, relative to specifications without destination-market-year

fixed effects. It, moreover, aligns with prior research that shows that products of exporting firms are characterized by greater substitutability than the products of exporting businesses and local firms, rendering exporters closer competitors in product markets (see, e.g., Atkin et al. 2015; Crozet et al. 2012; Hallak and Sivadasan 2013).

Empirical identification hence stems from comparing export outcomes across firms that export in product category h to market c but whose foreign competitors, who also serve the c -market, do and do not experience a corporate tax rate cut at a specific point in time or are subject to different levels of tax cost changes. To further hedge against potential confounding factors, we run empirical models that additionally absorb differences in outcome trends across two-digit industries, firms of different sizes (as measured by deciles of firms' total sales distribution), and, in some specifications, even across firms themselves (by including full sets of industry-year, firm-size-year, and firm-year fixed effects, respectively). The latter specifications exploit that exporters in our data export goods in various product categories to different destination countries, allowing for within-firm identification.

We, moreover, augment our estimation model by vector X_{hct} , capturing economic fluctuations in foreign competitors' host countries (calculated analogous to Equation (5)). These include $\log(\text{GDP})$, $\log(\text{GDP per capita})$, net inward FDI, and the unemployment rate.

Finally, as explained in more detail below, we will also run dynamic difference-in-differences models, which allow us to track the export performance of treated firms (exposed to competitor tax rate changes) and control firms (unexposed or less exposed to competitor tax changes) prior to treatment. Consistent with the common-trend assumption, we will show that export performance of treated and untreated firms emerged in parallel prior to treatment and only diverge after competitors are exposed to corporate tax rate changes. As treatment is staggered in time, we run model specifications based on the estimator proposed by de Chaisemartin and D'Haultfoeuille (2024), which is robust to heterogeneous and dynamic treatment effects and (contrary to other related estimators proposed in the literature) allows for non-binary treatment.

6 Results

In this section, we present our empirical findings, starting with the baseline estimates in Section 6.1. We then specifically study the impact of the TCJA reform in the United States in 2017 in Section 6.2 and test for repercussions of foreign competitors' tax cost changes on the real economic activity of South African exporters in Section 6.3.

6.1 Baseline results

Our baseline estimates are reported in Table 2. The dependent variable is the log of export quantity sold by firm i in product category h to destination market c in year t . To avoid measurement error, we disregard trade where, within firms and six-digit product categories, the units of export quantity (e.g., kilogram or litre) vary across export transactions (which is the case for 1.4% of transactions in our data). We will show below that similar results emerge when we use the log of the export value as the dependent variable. Furthermore, as zero trade is disregarded by taking the log of export quantities, our base analysis focuses on intensive margin adjustments in response to competitors' corporate tax rate changes. We will present complementary analyses below, where we also account for extensive margin responses.⁷

Specification (1) of Table 2 estimates the model in Equation (6), accounting for a full set of firm-product-destination-country fixed effects and a full set of destination-country-year fixed effects. Standard errors are clustered at the firm-product-country level. Specification (2) adds control variables reflecting the economic context in foreign competitors' host countries. Columns (3)–(5) present models where we additionally control for industry-year, firm-size-year, and firm-year fixed effects, respectively. In all models, the estimates—consistent with our theoretical considerations—suggest a positive and statistically significant impact of competitors' corporate tax costs on the export performance of South African firms. If foreign competitors experience a corporate tax cut in their host country by one standard deviation (4.5 percentage points, cf. Table 1), the export quantity of South African exporters is suggested to drop by around 1.8% on average (cf. Specification (1)).

As described above, we pay close attention to assessing the validity of the common-trend assumption in our empirical context by running dynamic model specifications. As treatment is staggered, we rely on an estimator that was recently proposed by de Chaisemartin and D'Haultfoeuille (2024). Similar to related estimators in the literature, identification is based on comparing outcome trends of units, which are treated by competitors' tax changes to never- or not-yet-treated units—rendering the estimator robust to heterogeneous and dynamic treatment effects. Contrary to other estimators in the literature, de Chaisemartin and D'Haultfoeuille (2024) allow for non-binary treatment. We transform our continuous regressor into a categorical variable, accounting for deciles of competitors' average corporate tax rates, and estimate a model of the following form:

$$\log(Y_{ihct}) = \alpha + \sum_{\ell \neq -1} \delta^\ell \Delta \tau_{hct}^D + \gamma' X_{hct} + \mu_{ihc} + \delta_{ct} + i_{hct} \quad (7)$$

⁷ Also note that disregarding destination-country-year fixed effects in the model and augmenting the specification by economic and policy controls (GDP, GDP per capita, unemployment rate, FDI) for the destination market yields similar estimates as the ones presented in Table 2 (point estimate: 0.345; standard error: 0.114).

where $\Delta\tau_{hct}^D$ is an indicator for time relative to treatment; other variable definitions remain as before. We account for control variables for the economic context in competitors' host countries, as before, as well as country-year fixed effects. In additional specifications, we absorb industry-year, size-year, and firm-year fixed effects.

The results are presented in Figure 4. Two main insights emerge. First, small and insignificant placebos (pre-trends) strengthen the common trend assumption of our identification strategy, showing that export volumes of treated and control firms emerged in parallel prior to treatment. Second, we find a positive treatment effect consistent with the base estimates. The export trend of treated and control firms, moreover, diverges gradually after treatment, consistent with adjustment frictions in trade patterns.

Our estimation strategy relies on a second assumption, which is necessary to retrieve an unbiased estimate for the export competition effect of interest: SUTVA. SUTVA requires that control units—that is, export trade on routes that are unaffected (or less affected) by competitors' corporate tax rate changes—be unaffected by treatment variation. It is *a priori* unclear whether this holds true. In particular, one might be concerned that exporting firms adjust their export portfolio in response to corporate tax shocks and divert trade from treated routes, where they face a loss in sales and market shares when competitor tax rates decrease, to non-treated products or routes. While prior research has shown that firms in lesser developed countries hardly adjust their product strategy even when hit by a major shock (see, e.g., Goldberg et al. 2010), we, nevertheless, assess the relevance of related concerns in our empirical setting.

Precisely, we augment the set of control regressors by the average competitor corporate tax rate faced by firm i at time t on *other* 'routes' than the considered one, which is in other product categories and in trade with other partner countries (denoted by $\tau_{i,-h,t}$). Again, weighting is based on time-constant base-year bilateral trade flows by product category drawn from COMTRADE. The model thereby absorbs potential within-firm spillovers of treatment on untreated trading routes. The estimates are presented in Column (6) of Table 2. The coefficient estimate of interest for the effect of competitors' tax costs on firms' export performance remains positive and statistically significant, while the coefficient estimate for the modelled intra-firm spillover effect carries a negative sign, as expected, but does not gain statistical significance at conventional significance levels.

Table 2: Regression results

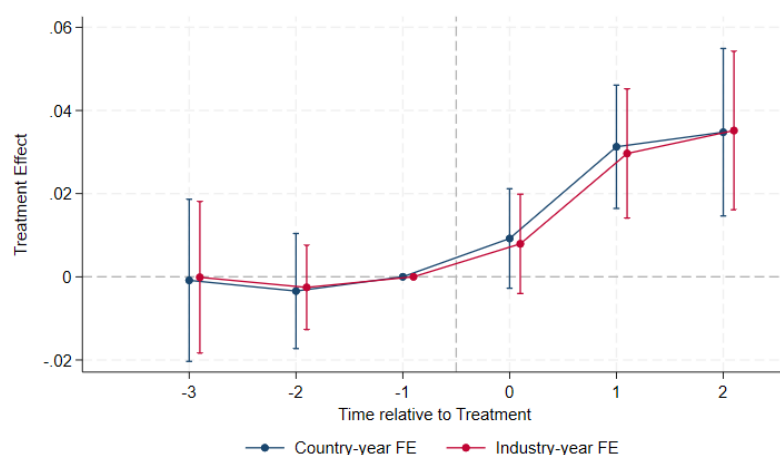
	(1)	(2)	(3)	(4)	(5)	(6)
τ_{hct}	0.404*** (0.104)	0.465*** (0.115)	0.357*** (0.117)	0.523*** (0.110)	0.370*** (0.122)	0.661*** (0.138)
$\tau_{i,-h,t}$						-0.054 (0.073)
Firm-product-country FE	X	X	X	X	X	X
Country-year FE	X	X				X
Firm-year FE			X			
Size-year FE				X		
Industry-year FE					X	
Controls		X	X	X	X	X
Obs.	3,956,821	3,930,399	3,633,350	3,672,957	3,198,723	2,870,650
No. firms	26,925	26,891	21,145	26,758	20,205	21,952

Note: regression results for the data aggregated at firm-product-country-year level, where product refers to the HS6 code and country to the country of destination. Outcome variable is the log of export quantity. We drop observations with zero values. τ_{hct} is the export-weighted average CIT of South African competitors, exporting product h to destination country c in year t . Competitors reside in those countries that export in the same HS6 category to the same destination country as the South African firm. $\tau_{i,-h,t}$ is the average τ_{ht} of all *other* products than h that firm i exports in year t . Weighting is based on base-year trade flows. We include this average to control for potential SUTVA violations in Column (6). All specifications include firm-product-country fixed effects. Specifications (1), (2), and (6) also include country-year fixed effects, which are replaced by firm-year fixed effects in Column (3), by size-year fixed effects in Column (4), and by two-digit industry-year fixed effects in Column (5). Size is determined by deciles of sales in 2013. All columns except for (1) include the competitor average for our control variables (log(GDP), log(GDP per capita), FDI, unemployment). For specifications without country-year fixed effects, we add the same control variables for the country of destination and also control for whether the destination country is in a customs union, regional, or free trade agreement with South Africa. Standard errors are clustered at the firm-product-country level. The timeframe is 2012–19.

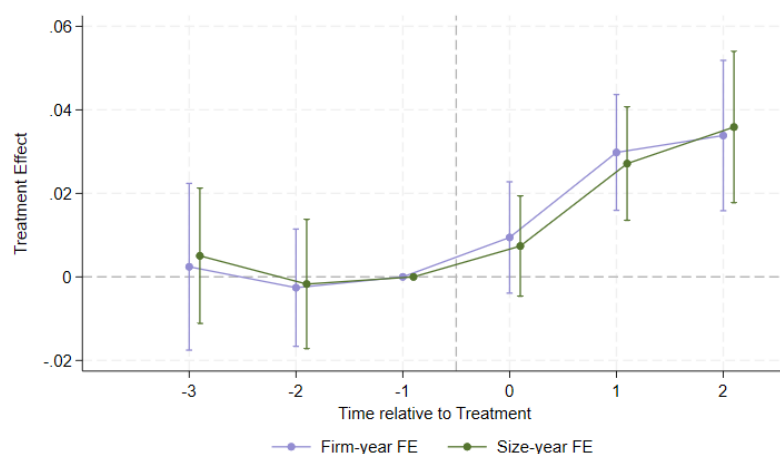
Source: authors' compilation.

Figure 4: Deciles, following de Chaisemartin and D'Haultfoeuille (2024)

(a) Baseline



(b) Other fixed effects



Note: the figure shows the event-study results for $\log(\text{quantity})$ as the outcome variable. We transform the continuous competitor tax rate into deciles and apply the regression method developed by de Chaisemartin and D'Haultfoeuille (2024). Panel (a) shows our baseline specification, where we control for country-year fixed effects (blue) or industry-year fixed effects (red). In robustness checks in Panel (b), we instead employ firm-year (purple) or size-year (green) fixed effects, respectively. All specifications include the competitor averages of our control variables ($\log(\text{GDP})$, $\log(\text{GDP per capita})$, FDI, unemployment).

Source: authors' compilation.

Further checks

Next, we rerun the above baseline models using the log of the unit price levied by firm i in six-digit product category h in trade to destination country c in year t as the dependent variable. The estimates for the impact of foreign competitors' tax rates turns out to be small and statistically insignificant. Rerunning the baseline model in Specification (1) of Table 2 yields a coefficient estimate of -0.013 (standard error: 0.072; p-value: 0.860). This finding aligns with our theoretical prediction that foreign competitors' corporate tax changes leave export pricing unchanged under CES preferences. We furthermore rerun our baseline model using the log of the (deflated) export value as the outcome variable. This yields estimates that qualitatively and quantitatively resemble our baseline findings for export quantities (see the red estimates in Figure 5).

Figure 5 presents a number of further robustness analyses. First, we show that our base estimates remain unchanged when we drop multinational enterprises (MNEs) from the data. This hedges us against concerns that our findings might be driven by cross-border adjustment of *investments* within internationally mobile firms, with trade following suit. The corporate tax return data include various indicators for multinational status of firms, which are consolidated in a 'strict' and 'broad' MNE indicator (see Kilumelume et al. 2021 for details). Figure 5 presents estimates where we drop firms that are classified as multinationals under the strict definition ('No MNEs'); in Columns (1)–(3) of Table C.1 in the Appendix, we show that similar findings emerge when we drop firms that are defined as MNEs under the broad definition.

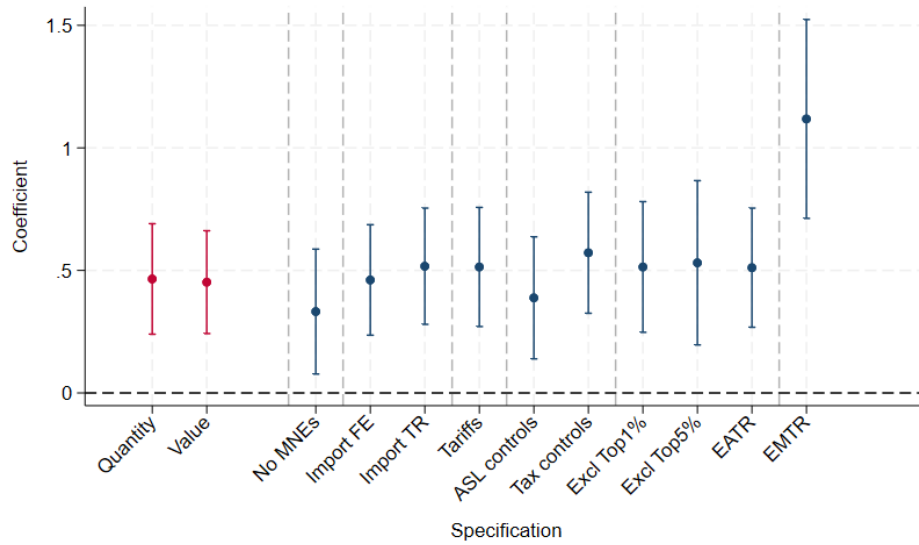
Another concern might be that South African exporters may not only engage in export trade but may also import goods from foreign countries. They may, in consequence, also be affected by corporate tax rate changes on the import side of trading relationships.⁸ We account for this concern twofold. First, we mark South African firms who source their inputs from the same countries they export to and then interact this dummy with a full set of country-year fixed effects to non-parametrically absorb effects of policy changes in these import source countries on South African importers. In a second step, we control for tax rates faced by South African importers by computing firm-specific average import country corporate tax rates. For each firm, we identify the set of countries from which they import (in any product category) goods in the base year. We then determine the distribution of base-year import values across source countries, which serve as weights in the construction of the average corporate tax rate levied by countries from which a given South African firm sources its inputs. Variation in the import tax rate over time again relates to corporate tax rate changes only. The results are presented in Figure 5 ('Import FE' and 'Import TR') and resemble our baseline findings. We furthermore

⁸ If source countries of import trade increase their corporate tax rate, affected traders may partly pass the increased tax costs on to South African importers by charging higher prices, which may, in turn, impact the costs and business strategies of the South African firms.

show that our findings are robust to controlling for tariffs applied by the destination country on trade from South Africa by HS6 product category, as reported in the WITS data bank ('Tariffs'), and to adding further control variables for characteristics of the competitor countries (the share of goods and services tax in tax revenue, the share of income, profit and capital gains taxes in tax revenue, and the share of labour taxes and contributions in commercial profits) and anti-tax avoidance legislation introduced by competitors' host countries (controlled-foreign-company rules, thin-capitalization or earnings-stripping rules, transfer pricing rules, and documentation requirements), drawn from the ITI database and the World Bank's Development Indicator database, respectively ('Tax controls' and 'ASL (anti-profit shifting legislation) controls'). The variables are calculated following Equation (5).

Moreover, we show that our findings are robust to excluding the largest exporters by number of trade routes from the data ('Excl Top 1%/5%' in Figure 5). And we show that similar—quantitatively even somewhat larger estimates—emerge when we model competitors' tax costs by the effective average and effective marginal tax rate in foreign competitors' host countries rather than the statutory corporate tax rate ('EATR' and 'EMTR'). In Table C.1 in the Appendix, we show that similar findings to the ones presented in the main text emerge when we account for extensive margin adjustments (firms' decision to export a particular product to a particular destination country). Figure C.1 in the Appendix shows that our estimates remain statistically significant when we account for clustering of errors at different levels.

Figure 5: Robustness checks



Note: regression results for the data aggregated at the firm-product-country-year level, where product refers to the HS6 code and country to the country of destination. We drop observations with zero values. Our main regressor τ_{hct} is the export-weighted average CIT of South African competitors, exporting product h to destination country c in year t . All specifications include firm-product-country and country-year fixed effects, as well as the competitor average for our control variables (log(GDP), log(GDP per capita), FDI, unemployment). In Specifications (1) and (2), we employ different outcome variables. In Specification (1), the outcome variable is the log of export quantity and repeats the baseline result from Table 2. In Specification (2), it is the log of (deflated) export value. In Specifications (3)–(12), we employ several robustness checks, all using log of export quantity as the outcome variable. In Specification (3), we drop South African exporters that are part of a multinational enterprise as identified by the MNE identifier constructed by Kilumelume et al. (2021). In Specifications (4) and (5), we control for the importing side of firms. First, we add a dummy indicator for import status, i.e. whether a firm receives imports from the same country it exports to, and interact this with the country-year fixed effects. We also specifically control for tax rates faced by South African importers by including τ_{it} , which is the average tax rate over countries from which firm i receives imports in year t . A firm's import structure is fixed at base year 2013. In Specification (6), we add tariffs applied by the destination country towards imports from South Africa as another control variable. In Specification (7), we complement our control variables by anti-shifting legislation in the competitor countries (controlled-foreign-company rules, thin-capitalization or earnings-stripping rules, transfer pricing rules and documentation requirements), whereas in Specification (8), we add control variables on tax measures (share of goods and services tax in tax revenue, share of income, profit and capital gains taxes in tax revenue, share of labour taxes, and contributions in commercial profits). Lastly, for Specifications (9)–(10), we exclude the top exporters (1% or 5%) of our regression sample, i.e. firms with the most trade routes (product-destination cells) in the base year 2013. For Specifications (11) and (12), we replace our main regressor by effective tax measures. We employ $EATR_{hct}$, which is the export-weighted average effective tax rate of South African competitors, exporting product h to destination country c in year t , and $EMTR_{hct}$, which is the export-weighted average effective marginal tax rate of South African competitors, exporting product h to destination country c in year t .

Source: authors' compilation.

As a final check, we shed light on whether the impact of foreign competitor taxes on the export performance of South African firms hinges on their share of overall destination country sales in the considered product category. Theoretically, it is unclear if such a relationship exists. If local firms selling products in the same product category are competitors to South African exporting firms, a larger market share of domestic firms may dampen the effect studied in this paper. If products sold by domestic sellers are, on the contrary, relatively weak substitutes to the goods exported by South African firms, this link might be small or even non-existent (as then only other exporters from foreign countries serve as competitors of the considered South African exporting firm). We draw on data on domestic trade from the International Trade and Production Database for Estimation (ITPD-E) by Borchert et al. (2020) to assess effect heterogeneity in this dimension. Due to low match quality, we lose a significant number of observations. The data are only available at the level of countries and broader industry classes, therefore offering a less granular picture.⁹ The results weakly support the notion that a higher domestic trade share is associated with a smaller effect of foreign export competitor taxes on South African export trade. The coefficient estimate for τ_{hct} is 0.571 (standard error: 0.198), and the coefficient estimate for $\tau_{hct} \cdot own - trade - share_{cd}$ is -0.114 (standard error: 0.087).¹⁰

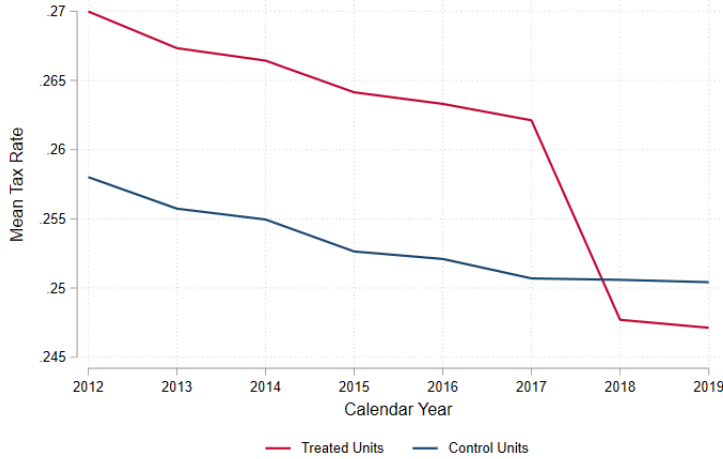
6.2 The Tax Cuts and Jobs Act

As described above, the largest corporate tax reform during our sample frame is the Tax Cuts and Jobs Act in the United States, which the first Trump administration enacted in 2017. The reform brought down the statutory corporate tax rate from 35% to 21%, next to a number of other tax-related changes. In the following, we make explicit use of this variation in a difference-in-differences design. To obtain a better understanding of post-reform dynamics, this part of the analysis uses data that are aggregated at the firm-product-country-*biannual* level (where aggregation at the firm-product-country-year level yields similar results to the one presented in the main text, cf. Table D.1). Treated units are product-destination country cells where firms (based on trade flows in 2013) face foreign export competitors from the United States, which serve the same destination market in the same product category. Figure 6 depicts the average competitors' tax rate over time for treated and control units separately, showing a clear drop in the average competitor tax faced by treated firms when the TCJA was enacted.

⁹ Borchert et al. (2020) provide information for own-trade shares for countries and around 200 industry classes. We manually map the industries to the SIC codes of South African firms in our data and apply own-trade shares for the SIC code of the considered firm and the destination market of the considered export trade.

¹⁰ The modelling strategy follows Specification (2) of Table 2.

Figure 6: Competitor tax rates over time



Note: average competitor tax rates per year for treated units (red line) and control units (blue line). Treated units are those we deem affected by the US TCJA. Specifically, treated units belong to product-destination-country cells, which have a positive share of US trade in our base year 2013.

Source: authors' compilation.

Formally, we estimate a difference-in-differences model of the following form:

$$\log(Y_{ihctb}) = \alpha + \beta(Treated_{ihc} \cdot Post_{tb}) + \mu_{ihc} + \delta_{ct} + \lambda_{tb} + \eta_{ihctb} \quad (8)$$

where Y_{ihctb} is firm i 's export quantity of product h to destination c in half-year b of year t . $Treated_{ihc}$ is equal to one if firm i faces US competition when exporting product h to destination market c , based on base-year global trade flows, and zero otherwise. $Post_{tb}$ is equal to one for all time periods from the beginning of 2018 onward (when the TCJA took effect) and zero otherwise. We further control for year-biannual fixed effects, λ_{tb} . The other control variables resemble our baseline models. Firm-product-country cells with larger drops (-0.02 or more) in their average competitor tax rate before 2018 are, moreover, excluded from the analysis to avoid potential confounding effects by other corporate tax reforms during our data frame. This restriction is not decisive for our results, however. Standard errors are clustered at the firm-product-country level.

The findings are presented in Table 3. The specifications are organized analogously to our baseline estimates and comprise models with different sets of fixed effects. Specification (5), moreover, includes a regressor for the average corporate tax rate faced by firms' competitors on *other* than the considered 'activity route', analogous to Specification (6) in Table 2. This controls for potential intra-firm spillover effects and hence hedges us against a violation of the SUTVA assumption. Throughout all specifications, the coefficient estimate of interest, β , turns out negative, as expected, and statistically significant, suggesting that export sales by South African firms, which face US competitors, dropped by around 3% after the enactment of the TCJA.

We again estimate dynamic difference-in-differences models.¹¹ The results are presented in Figure 7 and corroborate that export quantities across treatment and control groups emerged in parallel prior to treatment. After treatment, export sales in the treated group drop gradually relative to the control entities.

Table 3: US-reform results, biannual level

	(1)	(2)	(3)	(4)	(5)
$Treated_{ihtc} \cdot Post_{tb}$	-0.031*** (0.005)	-0.028*** (0.005)	-0.035*** (0.005)	-0.029*** (0.005)	-0.035*** (0.007)
$\tau_{i,-h,t}$					-0.076 (0.065)
Firm-product-country FE	X	X	X	X	X
Year-biannual FE	X	X	X	X	X
Country-year FE	X				X
Firm-year FE		X			
Size-year FE			X		
Industry-year FE				X	
Destination controls		X	X	X	
Obs.	6,453,347	6,024,008	6,053,143	5,312,823	4,391,890
No. firms	28,166	25,411	28,038	21,312	22,428

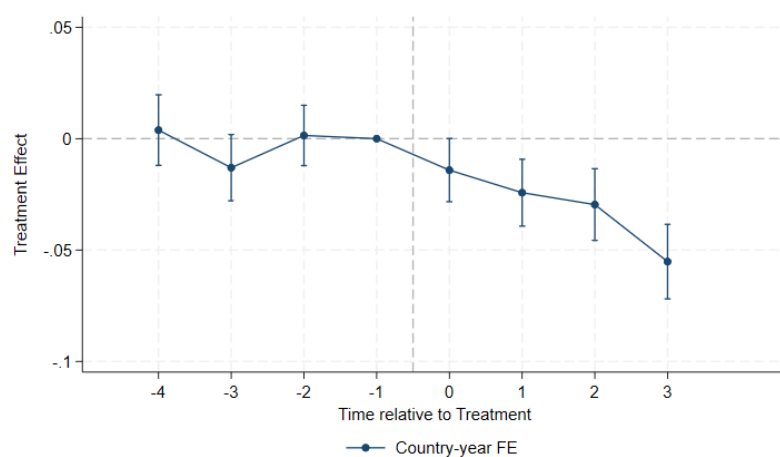
Note: results for our difference-in-differences approach are based on the 2018 US tax reform, where we aggregate the data on a biannual level (i.e. the firm-product-country-biannual level). Treated units are product-country cells in which the US exports as well (based on trade in 2013). We exclude firm-product-country cells that experienced a large drop (-0.02) in the average tax rate before 2018. Dependent variable is log of export quantity. All specifications include firm-product-country and year-biannual fixed effects. For our baseline in Column (1), we add destination-country-year fixed effects, which we replace by firm-year fixed effects in Column (2), by size-year fixed effects in Column (3), and by two-digit industry-year fixed effects in Column (4). Size is defined by deciles of sales in 2013. For these specifications, we include our control variables for the destination country (log(GDP), log(GDP per capita), FDI, unemployment) and also control for whether the destination country is in a customs union, regional, or free trade agreement with South Africa. For Specification (5), we add $\tau_{i,-h,t}$ as a control variable, i.e. the average τ_{ht} of all other products $-h$ at the same firm i in year t . This helps us to control for potential violations of the SUTVA assumption. Standard errors are clustered at the firm-product-country level, where product refers to the HS6 code and country to the country of destination. The timeframe is 2012–19.

Source: authors' compilation.

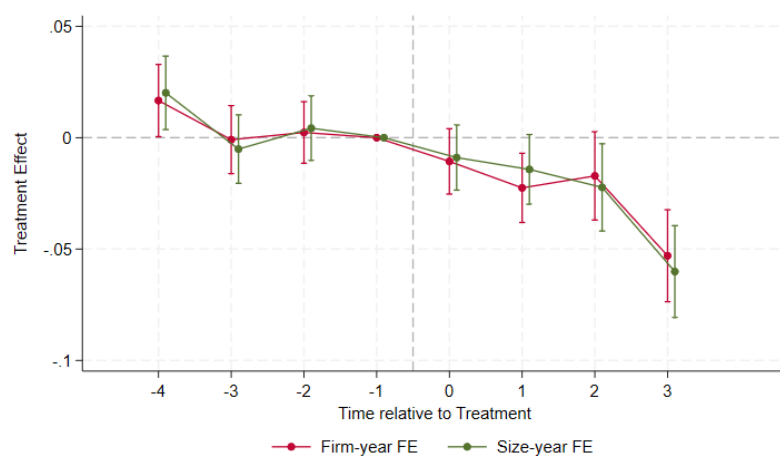
¹¹ Note that the setup in this part of the analysis corresponds to a standard two-by-two difference-in-differences design. Concerns that estimates might be biased by dynamic and heterogeneous treatment effects thus do not apply.

Figure 7: Event study

(a) Baseline



(b) Other fixed effects



Note: the figure shows the event-study results for $\log(\text{quantity})$ as the outcome variable when we aggregate our export transaction data to the firm-product-country-biannual level. Treatment is the US tax reform in 2018. Treated firms (products) are those that are active in product countries in which the United States exports as well (based on trade in 2013). We include firm-product-country and year-biannual fixed effects in all specifications. Panel (a) shows our baseline specification where we additionally include country-year fixed effects (blue). In Panel (b), we substitute these for firm-year (red) or size-year (green) fixed effects as robustness checks. Size is defined by deciles of sales in 2013. Standard errors are clustered at the firm-product-country level.

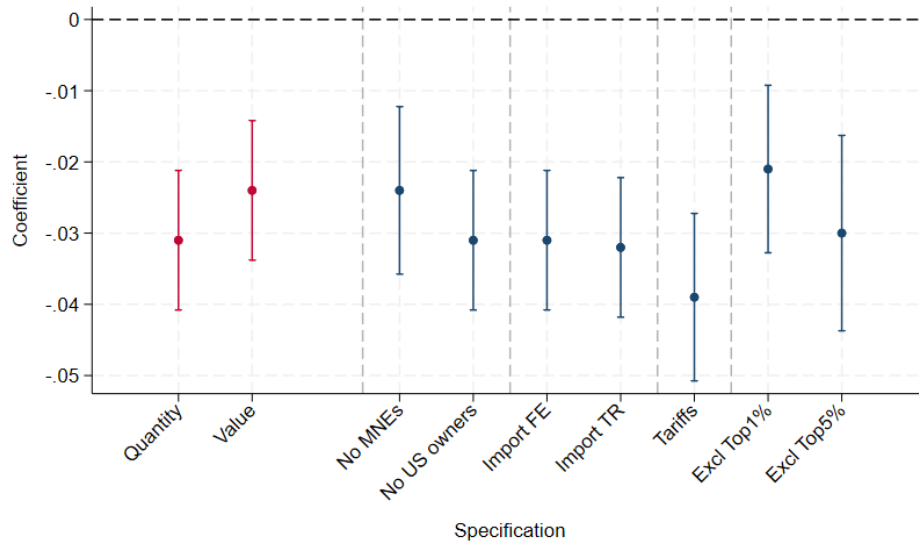
Source: authors' compilation.

Figure 8 presents robustness checks analogous to the previous section, showing that our findings prevail when we rely on the value of export trade ('Value')¹² when we drop MNEs from the data (following the strict definition in Kilumelume et al. (2021), 'No MNEs') or when we disregard South African exporters with ownership connections to the United States ('No US owners').¹³ The findings are, moreover, robust to controlling for potential corporate tax effects on import trade ('Import FE' and 'Import TR') and to modelling the impact of tariffs levied by destination countries on imported products ('Tariffs') and to excluding the largest exporters by number of trade routes from the data ('Excl Top 1%/5%' in Figure 8). See the Appendix for a number of further robustness checks.

¹² We also run specifications where the log of the unit price serves as the outcome variable. This yields a small coefficient estimate of 0.007 (standard error: 0.003).

¹³ Specifically, we exclude exporters whose *global ultimate owner* resides in the United States. The global ultimate owner is the entity that either directly or indirectly owns at least 50% of a firm's ownership shares. We obtain information on the owner's residence country from the CIT panel provided by the South African Revenue Service (SARS).

Figure 8: Robustness checks TCJA



Note: results for our difference-in-differences approach are based on the 2018 US tax reform, where we aggregate the data on a biannual level (i.e. the firm-product-country-biannual level). Treated units are product-country cells in which the United States is an active exporter (based on trade in 2013). We exclude firm-product-country cells that experienced a large drop (-0.02) in the average tax rate before 2018. All specifications include firm-product-year, country-year, and year-biannual fixed effects. Specifications (1) and (2) report baseline results for different outcome variables (in red), namely log(quantity) and log(deflated value), respectively. Specification (1) is the same coefficient as Specification (1) in Table 3. In the remaining specifications, we present a variety of robustness checks, all using log of export quantity as the outcome variable (in blue). In Specification (3), we exclude South African exporters that are part of a multinational enterprise as identified by the MNE identifier constructed by Kilumelume et al. (2021). For Specification (4), we exclude South African firms with potential ownership ties to the United States from the sample. We drop firms whose global ultimate owner is a US resident. Firms for which we cannot merge an owner country are assumed to be non-US owned. In Specifications (5) and (6), we control for the importing side of firms. First, we add a dummy indicator for import status, i.e. whether a firm receives imports from the same country it exports to, and interact this with the country-year fixed effects. We also specifically control for tax rates faced by South African importers by including τ_{it} , which is the average tax rate over countries from which firm i receives imports, in year t . A firm's import structure is fixed at base year 2013. In Specification (7), we add tariffs applied by the destination country towards imports from South Africa as another control variable. Lastly, for Specifications (8)–(9), we exclude the top exporters (1% or 5%) of our regression sample, i.e. firms with the most trade routes (product-destination cells) in the base year 2013.

Source: authors' compilation.

6.3 Repercussions and real effects on the firm level

The prior section established a negative impact of export competitors' tax cuts on the export performance of South African firms. But did the decrease in foreign corporate tax rates during our data frame negatively impact the real economic activity of firms in South Africa? We assess this question relying on measures for firms' real economic activity drawn from the universe of corporate tax returns and Pay-As-You-Earn information. The former provides informa-

tion on the gross profits and labour costs of firms; the latter provides information on employment numbers, where we define the firms' number of workers following Pieterse et al. (2018).¹⁴

Exposure to corporate tax rates is now modelled at the firm level. Specifically, we draw on the average competitor tax rates per route (i.e. product-destination-country-cell), as calculated in Equation (5), and aggregate them to the firm level by weighting routes by their importance for the South African exporter, measured by their export value in the base year. The data frame is again 2012–19, and we run models of the following form:

$$\log(Y_{it}) = \alpha + \beta \bar{\tau}_{it} + \gamma' \bar{X}_{it} + \mu_i + \delta_t + \epsilon_{it} \quad (9)$$

where Y_{it} refers to firm activity (gross profit, labour cost, and employment). $\bar{\tau}_{it}$ is the firm-specific foreign competitor average tax rate in year t . \bar{X}_{it} are control variables for the economic context in competitors' host countries (log(average GDP), log(average GDP per capita), average FDI, and the average unemployment rate in year t). All specifications include firm (μ_i) and year (δ_t) fixed effects. Standard errors are clustered at the firm level.

The estimation results are presented in Table 4. Consistent with our prior findings, the estimates suggest that decreases in foreign competitors' corporate tax burden are indeed associated with a decrease in profits, wages, and employment in South Africa. This implies that shareholders and workers share the costs of increased export competition induced by reductions in foreign competitors' tax costs. The findings are, moreover, again robust to accounting for industry-year, province-year, and size-year fixed effects (see Figure 9).¹⁵

¹⁴ Relying on the employment definition by Kerr (2020) yields similar results, however. Note that the corporate tax return panel provides data on the firm-tax year level. In South Africa, tax years start in March of the previous year and end in February of the current year. The tax year 2017, for example, started in March 2016 and ended in February 2017.

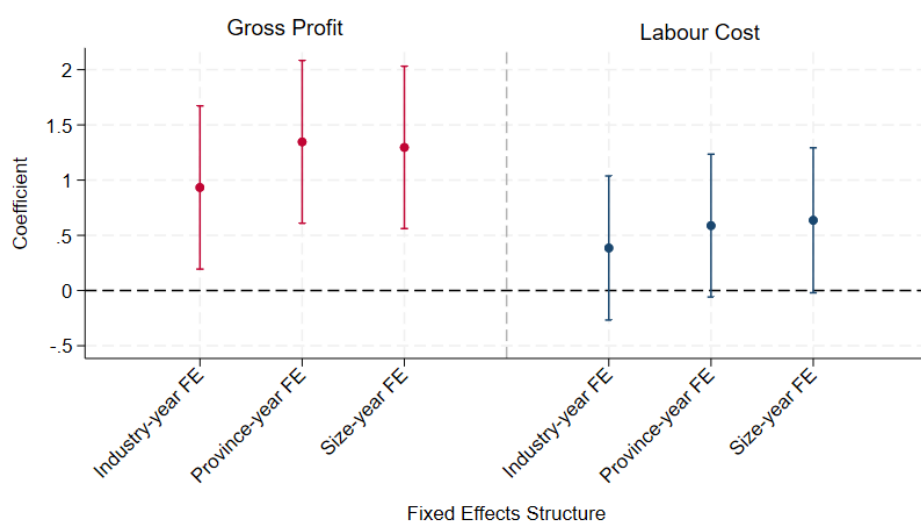
¹⁵ The Appendix presents a number of further robustness checks. In Columns (1)–(2) of Table E.1, we, for example, show that the findings are robust to dropping control variables altogether.

Table 4: TWFE—regression results at the firm level

	Gross profit	Labour cost	Employment
	(1)	(2)	(3)
$\bar{\tau}_{it}$	1.468*** (0.376)	0.729** (0.331)	0.521* (0.296)
Firm FE	X	X	X
Year FE	X	X	X
Controls	X	X	X
Obs.	154,312	149,746	137,864
No. firms	22,262	21,691	20,260

Note: regression results for the data are aggregated at firm-year level. The dependent variable is log(gross profit) in Specification (1), log(labour costs) in Specification (2), and log(employment) in Specification (3). $\bar{\tau}_{it}$ is the volume-weighted average of τ_{hct} on the firm level, where τ_{hct} is the average CIT of South African competitors, exporting product h to destination country c in year t . Competitors reside in those countries that export in the same HS6 category to the same destination country as the South African firm. All specifications include the firm-level average of our control variables (log(GDP), log(GDP) per capita, FDI, and unemployment). All specifications also include firm and year fixed effects. Standard errors are clustered at the firm level. The timeframe is 2012–19.

Source: authors' compilation.

Figure 9: Firm level—different fixed effects

Note: regression results for the data are aggregated at the firm-year level. The dependent variable is log(gross profit) in Specifications (1)–(3) (in red) and log(labour costs) in Specifications (4)–(6) (in blue). The figure depicts the coefficient for our main regressor, $\bar{\tau}_{it}$, i.e. the volume-weighted average of τ_{hct} on the firm level, where τ_{hct} is the average CIT of South African competitors, exporting product h to destination country c in year t . Competitors reside in those countries that export in the same HS6 category to the same destination country as the South African firm. All specifications include the firm-level average of our control variables (log(GDP), log(GDP) per capita, FDI, and unemployment). All specifications also include firm fixed effects. Specifications (1) and (4) include industry-year fixed effects, which are replaced by province-year fixed effects in Specifications (2) and (5) and by size-year fixed effects in Specifications (3) and (6). Size is defined by deciles of sales in the base year. Standard errors are clustered at the firm level. The timeframe is 2012–19.

Source: authors' compilation.

Complementarily, we investigate the effect of the TCJA in the United States on our firm-level outcomes. Panel A of Table 5 presents results where treatment is defined in a binary way—indicating if the considered firm faces US competitors on at least one trading route. In Panel B, we define treatment intensity as the base-year share of a firm’s exports that is exposed to US competition. The estimates in both panels point to a negative impact on the real activity of firms with exposure to US competitors after the TCJA. Specification (4), for example, suggests that exposure to US competitors decreased employment in the post-period by around 1% relative to control entities. This translates into a drop in employment numbers at affected South African exporters by 29,491.¹⁶

Table 5: TCJA—regression results at the firm level

	Gross profit	Labour cost	Employment
A: Binary treatment	(1)	(2)	(3)
Treatment	-0.059*** (0.005)	-0.029*** (0.005)	-0.010** (0.004)
Firm FE	X	X	X
Year FE	X	X	X
Obs.	2,847,672	2,484,655	1,484,884
No. firms	555,319	482,849	272,647
B: Treatment intensity	(4)	(5)	(6)
Treatment	-0.234*** (0.008)	-0.166*** (0.007)	-0.120*** (0.006)
Firm FE	X	X	X
Year FE	X	X	X
Obs.	2,847,672	2,484,655	1,484,884
No. firms	555,319	482,849	272,647

Note: regression results for the data aggregated at the firm-year level. The dependent variable is log(gross profit) in Specifications (1) and (4), log(labour costs) in Specifications (2) and (5), and log(employment) in Specifications (3) and (6). In Panel A, we employ a binary firm-level treatment indicator. That is, *Treatment* is equal to one for all treated firms, i.e. those who face US competition on any of their export routes, after the introduction of the TCJA reform. In Panel B, we replace this with firms’ treatment intensity, calculated as the base-year share of exports with US competition in all exports. In this case, *Treatment* is the interaction of the treatment intensity with a post-reform indicator. We set the reform at tax year 2018 (i.e. March 2017 to February 2018). All specifications include firm and year fixed effects. Standard errors are clustered at the firm level. The timeframe is 2012–19.

Source: authors’ compilation.

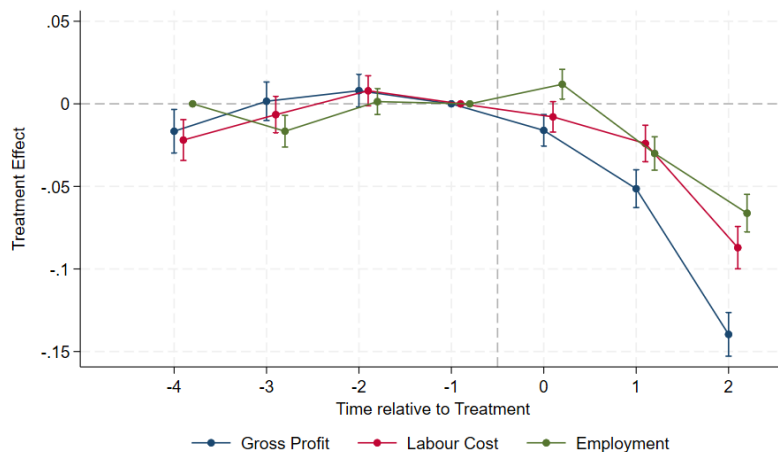
Figure 10 presents dynamic difference-in-differences estimates studying the effects of the US tax reform (left picture) and generally larger declines in competitors’ average corporate tax rates (right picture, $\Delta \bar{\tau}_{it} \leq -2.5$ percentage points). Both analyses again support the common trend assumption: prior to treatment, firm activity (as measured by profits, labour costs, and employment) evolved in parallel. After competitors started benefiting from tax declines, firms’ activity in South Africa started declining gradually, consistent with export adjustments trans-

¹⁶ In the pre-reform year, i.e. tax year 2017 (March 2016 to February 2017), total employment in treated firms amounted to 2,949,137. A drop in employment by 1% hence translates into a reform-driven employment reduction of 29,000 jobs.

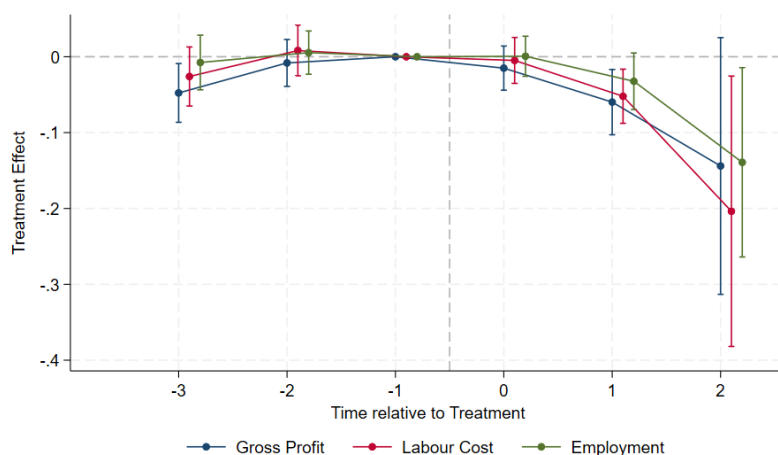
lating into lower economic activity, which is partly borne by shareholders (through lower profit) and by workers (in the context of reductions in employment and wage sum).

Figure 10: Dynamic estimation—firm level

(a) US reform



(b) Tax rate cut



Note: panel (a) shows dynamic estimation results for the US tax reform for our different dependent variables: log(gross profit) in blue, log(labour cost) in red, and log(employment) in green. Treated firms are those who face US competition in any of their export products. Time of treatment is tax year 2018 (March 2017 to February 2018). We include firm and year fixed effects. Standard errors are clustered at the firm level. Panel (b) of this figure shows dynamic estimation results using event study regressions for our different dependent variables: log(gross profit) in blue, log(labour tax cost) in red, and log(employment) in green. Treatment is defined as a binary shock where the firm's average tax rate drops by at least 0.025. We include firm and year fixed effects as well as our control variables (firm-level competitor-averages of log(GDP), log(GDP per capita), FDI, unemployment). Standard errors are clustered at the firm level.

Source: authors' compilation.

7 Conclusion

In this paper, we establish that corporate taxes impact firms' competitiveness in international product markets. If foreign competitors benefit from corporate tax cuts, firms' export sales are documented to decline.

The testing ground is South Africa, and our analysis relies on rich customs data, which comprise a panel of the universe of export transactions of South African firms, including comprehensive information on six-digit product categories and destination markets in which the product is sold. The data are coupled with macro-information on bilateral trade flows across countries in six-digit product categories to identify the host countries of foreign competitors that export in the same product category to the same destination market. Based on these data, we identify a significant impact of corporate tax rate reductions on the export sales of affected South African exporters: a drop by one standard deviation (by 4.5 percentage points) lowers export sales of affected firms by around 2%, on average. This finding is robust to a battery of robustness checks and also emerges when the identifying variation is restricted to the US TCJA. In additional analyses, we furthermore show that cuts in competitors' corporate tax burden translate into lower real activity of exporting firms in South Africa.

Our findings thus confirm anecdotal evidence and widespread policy presumptions, suggesting a link between corporate tax cuts and local exporters' competitiveness in international product markets. Corporate tax policy, through shifts in export sales, thus induces externalities on foreign economies. It follows that governments not only have incentives to engage in strategic interaction in corporate tax-setting behaviour in order to attract mobile profits and investments to their borders—but also in order to enhance the export performance and real economic activity of local exporters. The findings thus underscore the relevance of ongoing efforts for international coordination in the corporate tax policy domain—with the aim to avoid a detrimental race-to-the-bottom in corporate tax rates. The global minimum tax, as endorsed by more than 130 countries in the Inclusive Framework of the OECD, might (if ratified by a critical mass of countries and if tightened in key provisions) potentially serve as an effective means to limit corporate tax competition.

The cross-country externalities of corporate taxes identified in our work, moreover, carry particular relevance with regard to lesser developed nations. Countries around the world spend billions of dollars in development aid, but the effectiveness of such support schemes remains unclear (see, e.g., Burnside and Dollar 2000, Easterly 2007). Our paper highlights that the domestic corporate tax policy choices of developed nations can have important economic repercussions on less developed nations, too, which policymakers may want to account for in their policy design.

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Appendix

A Data

This data appendix follows UNU-WIDER requirements for users of the National Treasury Secure Data Facility (NT-SDF). We report data accessed through the NT-SDF that was used to generate results presented in this paper but do not include other datasets and variables used.

Data access

The data were accessed via the NT-SDF. Access was provided under a non-disclosure agreement. Output was checked by the NT-SDF data team to guarantee uncompromised anonymity of firms and individuals. Our results do not represent any official statistics by NT or SARS. The views expressed in this paper are not necessarily the views of NT or SARS. Data used: Customs Transaction-Level Data version 5.1 (National Treasury and UNU-WIDER 2023c), CIT Firm-Level Panel version 5.1 (National Treasury and UNU-WIDER 2023a), and CIT-IRP5 Panel version 5.0 (National Treasury and UNU-WIDER 2023b). Date of first access for this project: 05 September 2023. Last accessed: 13 February 2025.

Software

The analysis was conducted using Stata 18. User-written commands include `reghdfe` (Correia 2023) and `did_multiplegt` (de Chaisemartin and D’Haultfoeuille 2020).

Variables

Variables used from the raw Customs Transaction Data include: `taxrefno`, `hs6`, `countryofdestination`, `calendaryear`, `customsvalue`, `statisticalquantity`.

Variables used from the raw CIT data include: `taxrefno`, `taxyear`, `ITR14_c_foreign_broad`, `ITR14_c_foreign_strict`, `ITR14_c_forhold`, `g_grossprofit`, `x_labcost`, `imp_mic_sic7_2d`, `c_province`.

Variables used from the raw CIT-IRP5 data include: `taxrefno`, `taxyear`, `irp5_ptrс_daysweight_b`, `irp5_ptrс_idaysweight_b`, `irp5_kerr_daysweight_b`.

Cleaning and sample notes

We append the Customs Transaction data on exports for the calendar years 2012–19. We only keep transactions identified as South African trade (via the `sa_trade_dummy`). We restrict the data to observations with South Africa as the country of origin and drop insensible year values. We drop observations where the firm identifier (`taxrefno`) is either missing or 'NULL'. We drop observations where the HS6 code has fewer than six digits and exclude HS6 codes in which we observe a change in the statistical unit. Moreover, we exclude transactions where the country of destination does not refer to a valid two-digit country code (codes ZN, ZZ, and UC). Table A.1 shows the data-cleaning process for the export data.

For the CIT panel, we drop observations with missing firm identifiers (*taxrefno*) as well as dormant firms. We restrict the data to tax years 2013–20 (approximating calendar years 2012–19).

For the CIT-IRP5 panel, we drop observations with missing firm identifiers (*taxrefno*) and limit the data to calendar years 2012–19 (tax years 2013–20).

Table A.1: Data-cleaning process—customs data

Step	Cleaning
0	Raw data
1	Restrict to South African trade (dummy provided by the data team)
2	South Africa as country of origin
3	Non-numerical year values
4	Firms where firm identifier is missing or 'NULL'
5	Five-digit HS6 codes
6	Non-existing country of destination
7	HS6 code shows change in statistical unit

Note: the table shows the data-cleaning steps and order in which we apply them to the raw export transaction-level data at the National Treasury Secure Data Facility.

Source: authors' compilation.

B Identifying variation

In this section, we aim to illustrate the source of our identifying variation. Table B.1 shows a selection of South Africa's top 50 export products in our estimation sample—that is, those with the largest average export value over the years 2012–19. For each of these, we look at global trade flows in our base year to identify South Africa's strongest competitor country. South Africa faces the strongest competition from firms residing in the country with the highest export value for each product, or—in case South Africa is the world's leading exporter of a given product—the second-largest export value. As the table shows, South African exporters compete with firms from different countries for different products. Note that in our regressions, we exploit an even finer level of aggregation by studying competitors not per product but rather per product-destination-country cell.

Table B.1: Competitors of South Africa's best performing export products

	Top HS6 code	Code description	Strongest competitor
1	270112	Coal	Australia
2	260112	Iron ores and concentrates	Brazil
3	720241	Ferro-alloys	Kazakhstan*
4	711019	Metals: platinum (semi-manufactured)	Germany*
5	870421	Vehicles: combustion engine, for transport of goods	Thailand
6	870323	Vehicles: spark-ignition internal combustion reciprocating piston engine	Japan
7	711011	Metals: platinum (unwrought or in powder form)	Switzerland*
8	260200	Manganese ores and concentrates	Australia*
9	260111	Iron ores and concentrates	Australia
10	842139	Machinery: for filtering or purifying gases	Germany
...			
14	710231	Diamonds	Belgium
15	760110	Aluminium	Russia
16	470200	Wood pulp	United States
17	271600	Electrical energy	Germany
...			
22	220421	Wine (still)	France
...			
25	290129	Acyclic hydrocarbons	United States
...			
28	100590	Cereals, maize (corn)	United States
...			
30	390210	Propylene	Saudi Arabia
...			
34	510111	Wool	Australia
...			
37	870899	Vehicles: parts and accessories	South Korea
38	730890	Iron or steel, structures and parts thereof	China
...			
43	300490	Medicaments	Germany
...			
46	330499	Cosmetic and toilet preparations	France
...			
50	440122	Wood, in chips or particles	Vietnam

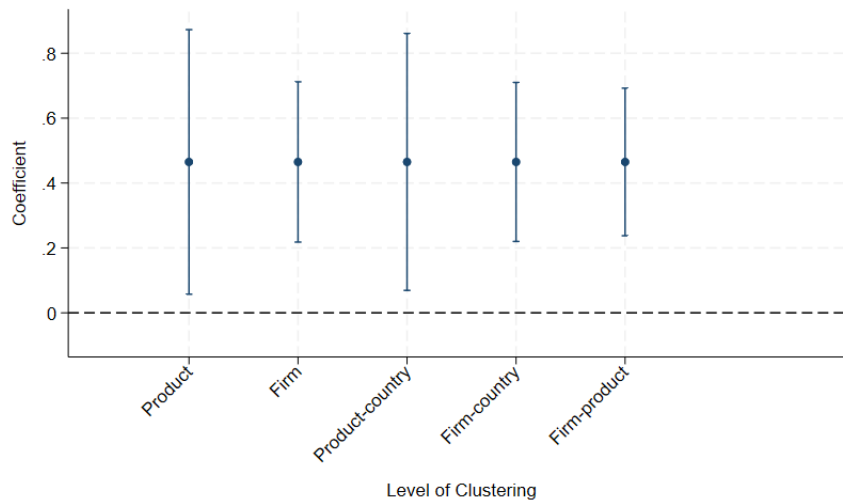
Note: the table shows South Africa's leading export products (HS6 codes), where the first row refers to the product with the largest average value over the time period 2012–19. We apply the same cleaning steps as for our estimation sample. The right-hand side column shows the strongest competing country for South African firms for each HS6 product group. In most cases, this is the country with the highest export value in 2013. In some cases, South Africa is the globally leading exporter of the HS6 code, and we refer to the 'strongest competitor' as the runner-up country. These cases are denoted by *.

Source: authors' compilation.

C Two-way fixed-effects model

We employ different levels at which we cluster standard errors, compared to our baseline specification where we cluster standard errors at the firm-product-country level. Namely, we employ clusters at the product, firm, product-country, firm-country, and firm-product level, respectively. Results are shown in Figure C.1. Our coefficient remains significant at 5% or less throughout this exercise.

Figure C.1: Clustering of standard errors



Note: we repeat our baseline estimation but employ different levels at which we cluster the standard errors. Standard errors are clustered at the product level in Specification (1), at the firm level in Specification (2), at the product-country level in Specification (3), at the firm-country level in Specification (4), and at the firm-product level in Specification (5).

Source: authors' compilation.

For our next set of specifications, we employ other definitions of MNEs. Kilumelume et al. (2021) create several indicators to identify foreign firms and MNEs in the CIT panel. The authors categorize firms into four categories (domestic stand-alone, locally held group, (ultimately) foreign-held, and other) based on two questions from firms' tax returns: (i) is the company part of a group of companies that prepares consolidated financial statements, and (ii) is the ultimate holding company resident outside South Africa? The 'strict' MNE indicator identifies firms that responded 'yes' to the second question and hence captures foreign firms' subsidiaries. The broad MNE identifier additionally makes use of other fields in the tax return forms, which may imply foreign ownership, such as non-residency, for income tax purposes or being an establishment of a foreign company.

First, we use a very wide definition and exclude firms that are (i) identified as part of a multinational group based on the strict MNE identifier in the SARS CIT Panel, as constructed by Kilumelume et al. (2021), (ii) identified as part of an MNE based on the broad MNE identifier, and (iii) identified as belonging to a foreign parent. Our baseline results also hold in this stricter, combined definition (see Column (1) of Table C.1). For Columns (2) and (3), we sep-

arately employ the broad MNE identifier and foreign-parent indicator, respectively. Results remain quantitatively similar and statistically significant. Moreover, we investigate the extensive margin. We restrict our sample to large exporters, as defined by a median split of export value in 2013 (in order to exclude incidental exporters) and balance our sample on the firm-product-country-year level from the first observed trade onwards, replacing missing outcome variables with zero values. Results are presented in Column (4) of Table C.1. The coefficient is slightly smaller than in the baseline but statistically significant. Lastly, we split our sample according to the destination country's tax rate and look at exports to countries with lower tax rates than South Africa's 28% (Column (5) of Table C.1) versus destination markets with larger tax rates (Column (6)). As the results show, effects are more pronounced for exports to high-tax destination markets.

Table C.1: Further robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
τ_{hct}	0.304** (0.154)	0.304** (0.154)	0.332** (0.130)	0.365** (0.176)	0.391* (0.212)	0.491*** (0.136)
MNE def.	Combined	Broad	Non-foreign			
Margin				Extensive		
Destination tax rate					Smaller	Larger
Firm-product-country FE	X	X	X	X	X	X
Country-year FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Obs.	2,092,838	2,092,838	2,930,820	3,419,746	1,369,880	2,554,084
No. firms	13,316	13,316	20,866	13,028	18,169	22,884

Note: regression results for the data are aggregated at the firm-product-country-year level, where product refers to the HS6 code and country to the country of destination. Outcome variable is the log of export quantity. τ_{hct} is the export-weighted average CIT of South African competitors, exporting product h to destination country c in year t . Competitors reside in those countries that export in the same HS6 category to the same destination country as the South African firm. In Specifications (1)–(3), we drop South African exporters that are part of an MNE but use other definitions that the strict one employed in the main text. In Column (1), we combine several indicators (MNE strict identifier, MNE broad identifier, and non-foreign parents) to obtain a wide definition of MNEs. In Column (2), we only rely on the broad MNE identifier and exclude said firms. In Column (3), we employ a weaker definition and only exclude firms with non-foreign parents. Indicators on MNE status are taken from the CIT Panel, as defined by Kilumelume et al. (2021). Observations with zero values are excluded in Columns (1)–(3) and (5)–(6). In Column (4), we include the extensive margin, i.e. we include observations with zero values. Due to restricted computing power, we can only undertake this exercise for large firms, which we identify via a median split of export sales in 2013. For Columns (5) and (6), we split our sample along the statutory tax rate in the destination country c in 2013, depending on whether it is smaller (Column (5)) or larger (Column (6)) than the South African tax rate of 28%. All specifications include firm-product-country and destination-country-year fixed effects, as well as the competitor average of our control variables (log(GDP), log(GDP per capita), unemployment, FDI). Standard errors are clustered at the firm-product-country level. The timeframe is 2012–19.

Source: authors' compilation.

D TCJA analysis

Column (1) of Table D.1 shows the standard difference-in-differences results for the data aggregated at the annual level—contrary to our baseline, where data are aggregated at the finer, biannual level. Next to our preferred specification presented in the main text, we also run specifications with year and product-year fixed effects, respectively. In these cases, we include $\log(\text{GDP})$, $\log(\text{GDP per capita})$, FDI, and unemployment of the destination country. Regression results are shown in Columns (2)–(3) of Table D.1. Our coefficients remain quantitatively similar to the baseline. In a next step, we interact the treatment dummy with the share of US trade in the destination country's import (based on trade data in our base year) as an additional regressor. In particular, we interact the treatment dummy with quartiles of the US trade share, with the first quartile as the baseline. Results are presented in Column (5) of Table D.1. They support the notion that firm-product-country cells, which face fiercer competition from the United States, are more strongly affected by the TCJA in the United States. We also explore the effects for differentiated goods solely. In order to identify differentiated goods in our HS6 codes, we follow the classification by Rauch (2013).¹⁷ As this leaves many of our product codes unmatched, we do not implement this analysis as our baseline and use it for a robustness check only. Column (6) of Table D.1 shows the results for differentiated goods. Our coefficient of interest slightly decreases in size but remains statistically significant. According to Rauch (2013), a differentiated good is one that does not have a reference price.

¹⁷ The Rauch (2013) classification is for SITC codes. Hence, we apply correspondence tables by the UN Statistics Division (2023) to map the SITC classification to CPC codes.

Table D.1: Effects of the US tax reform—further robustness

	(1)	(2)	(3)	(4)	(5)
Treatment	-0.038*** (0.005)	-0.032*** (0.005)	-0.019 (0.007)	-0.018*** (0.007)	-0.025** (0.010)
Treatment*Quart2				-0.021*** (0.008)	
Treatment*Quart3				-0.023*** (0.008)	
Treatment*Quart4				-0.007 (0.009)	
Aggregation	annual	biannual	biannual	biannual	biannual
Firm-product-country FE	X	X	X	X	X
Country-year FE	X			X	X
Year-biannual FE		X	X	X	X
HS6-year FE			X		
Destination controls		X	X		
Obs.	4,486,008	6,053,143	6,051,152	6,453,347	1,842,590
No. firms	27,489	28,038	28,032	28,166	19,107

Note: results for our difference-in-differences approach are based on the 2018 US tax reform. Treated units are product-country cells in which the United States is an active exporter (based on trade in 2013). We exclude firm-product-country cells that experienced a large drop (-0.02) in the average tax rate before 2018. The dependent variable is the log of export quantity. In Column (1), we aggregate the data at the firm-product-country-year level instead of the firm-product-country-year-biannual level. All specifications include firm-product-country fixed effects. Specifications at the biannual level, i.e. Columns (2)–(5), also include year-biannual fixed effects. Specifications (1) and (4)–(5) include destination-country-year fixed effects, which we replace by product-year fixed effects in Column (3). For Specifications (2)–(3), we can moreover include destination country control variables (log(GDP), log(GDP per capita), FDI, unemployment, and whether there are trade agreements between the destination country and South Africa). For Column (4), we interact the treatment dummy with quartiles of the US trade share (in 2013) of the product-country cell, where the first quartile serves as the baseline. In Column (5), we only look at differentiated goods, following the definitions by Rauch (2013). Standard errors are clustered at the firm-product-country level, where product refers to the HS6 code and country to the country of destination. The timeframe is 2012–19.

Source: authors' compilation.

E Firm-level effects

Columns (1) and (2) of Table E.1 show the baseline effect in the CIT sample without control variables. We then re-run our baseline estimation in a balanced sample of firms. That is, we only keep firms that we observe in our data for every year during 2012–19. Results are presented in Columns (3) and (4) of Table E.1. Coefficients are quantitatively similar to our baseline. The coefficient for labour costs now becomes statistically significant at 5%.

Table E.1: Firm level—robustness

	Balanced sample			
	Gross profit (1)	Labour cost (2)	Gross profit (3)	Labour cost (4)
τ_{it}	0.623* (0.341)	0.376 (0.306)	1.228*** (0.325)	0.789** (0.319)
Firm FE	X	X	X	X
Year FE	X	X	X	X
Controls			X	X
Obs.	154,460	149,886	114,864	111,800
No. firms	22,285	21,713	14,358	13,975

Note: regression results are for the data aggregated at the firm-year level. The dependent variable is log(gross profit) in Columns (1) and (3) and log(labour cost) in Columns (2) and (4). τ_{it} is the volume-weighted average of τ_{hct} on the firm level, where τ_{hct} is the average CIT of South African competitors, exporting product h to destination country c in year t . Competitors reside in those countries that export in the same HS6 category to the same destination country as the South African firm. All specifications include firm and year fixed effects. For Columns (1)–(2), we do not include firm-level competitor average control variables. In Columns (3)–(4), we include firm-level averages of our control variables (log(GDP, log(GDP per capita) FDI, unemployment). Moreover, for Columns (3)–(4), we employ a balanced sample, i.e. we exclude firms that we do not observe in the data for every year of the sample frame. Standard errors are clustered at the firm level. The timeframe is 2012–19.

Source: authors' compilation.