

Consumption Taxes and Corporate Income Taxes: Evidence from Place-Based VAT*

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Abstract

Using a quasi-experimental setting, we document that corporations decrease declared profits and corporate income taxes in response to an increase in the VAT rate. In an attempt to raise tax revenue during the Greek economic crisis, a 16% VAT rate, which existed for historicopolitical reasons in Greek islands, was harmonised to the national 24% rate. We combine tax filings with Orbis and ICAP data that enable us to geolocate corporations and to construct comparable groups based on locations in or out of the preferential rate. Counteracting the reform's intended effect, declared profits decreased by 28% and corporate income taxes by 34% on a permanent basis. Macroeconomic factors and a fall in reported revenue cannot fully explain this decrease. Pervasive tax evasion in the Greek islands, where corporations might have an opportunity to adjust profits, offers a plausible explanation of the magnitude of responses.

JEL Classification: H25, H26, H32, H61, L83

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1 Introduction

Value-added taxes (VAT) and corporate income taxes (CIT) are large sources of government revenue. Almost all modern economies operate some form of both: the VAT levies an incremental tax on each stage of production, distribution and final consumption, while CIT applies an annual tax on corporate profits. Since corporations apply and attribute the VAT to the government, there is an inherent link to their profits and, ultimately, to corporate income taxes paid. Both CIT and VAT constitute a great part of the tax obligations when operating a business. Despite their co-existence, the responsiveness of CIT to changes of the VAT has not been studied before in the economic literature. In this paper, we fill this gap by documenting and quantifying a large negative response of corporate income taxes to a VAT increase.

To identify this effect we exploit a unique quasi-experimental setting: the existence of place-based VAT rates in Greek islands combined with the unanticipated repeal of this regime during the Greek economic crisis. For historicopolitical reasons (which we describe in detail in Appendix B), lower VAT rates applied to Greek islands in the Aegean sea. An increasing need for tax revenue to close a ballooning budget deficit forced the Greek government in 2015 to harmonise the VAT rate in six touristic islands to the rate of the mainland. Santorini, Mykonos, Rhodes, Skiathos, Paros, and Naxos, that traditionally formed the flagship of Greek tourism, experienced a large VAT increase from 16% to 24%. By contrast, islands in the Ionian sea (overlooking Italy), with also significant touristic activity, were never part of the preferential rate. This setting allows us to form comparable control and treatment groups of corporations to examine responses to the VAT increase along a number of dimensions.

We examine how corporations respond by combining three datasets. Firstly, we draw from the universe of corporate tax returns for the years 2011 to 2018, before and after the VAT change. The data include declared information by corporations during tax filing on revenues, profits and, corporate income taxes for each year, as well as, the sector of their economic activity. Secondly, using their unique tax identification number, we match this information to the Orbis and ICAP databases, which collect annual financial statements. Matching allows us to geolocate the postcode of corporations and assign them into treatment and control groups; a VAT increase group is formed by corporations located in the Aegean islands that experienced the VAT increase and, a VAT constant group by corporations located in the Ionian islands. After a basic cleaning to form a balanced panel with complete entries, we end up with 1,152 corporations in the former and 1,042 corporations in the latter, over the 8-year period we examine. The corporations operate predominantly in the tourism industry and are directly comparable.

A third dataset accounts for factors that might affect the economic activity of corporations. Drawing from official public information from Hellenic Statistics, we control for fluctuations in the tourist sector by incorporating the annual number of accommodation nights booked and, the annual room capacity in each island. Combining the three datasets, we implement a difference-in-differences approach with corporation, postcode, and year fixed-effects, as well as, controls for time-varying factors in corporations and islands.

The main result of the VAT increase is a large negative response in corporate income taxes. We identify that in years 2016, 2017, and 2018, corporations based in VAT-increase islands reduced their corporate income taxes by 16.8%, 34.7% and 34.1% respectively, compared to the control group and after accounting for fixed-effects and time-varying factors. Parallel-trends between the two groups hold before 2015, without any statistically significant difference. This result is driven by a response of corporations in declaring less profits. For the years 2016, 2017, and 2018, profits decrease by 12%, 28.2% and 28.5%.

The second finding is a response in gross revenues, which fall by a lesser extent and cannot fully explain the drop in profits and corporate income taxes. Whilst, parallel-trends are maintained, the difference in revenues between the two groups in 2016 is not statistically significant. In 2017 and 2018, corporations respond along the revenues margin, reducing them by 9% and 15.9% respectively. This result suggests that gross revenue is maintained, at least in the first years after the change, and the lower profits must reflect an increase in declared costs.

By examining further the responses to corporate income taxes and profits, we document that, partly, these originate from an increase in corporations declaring zero profits or losses after the VAT increase. The percentage of these corporations is about 5% and, despite its economic significance, it cannot fully explain the drop in profits and corporate income taxes. By considering corporations that declare non-negative profits in our regression specification, we note that results hold, hence the responses originate from the majority of firms and not only those that switch to declaring zero profits or losses. This result is important as it provides evidence of economy-wide implications of the VAT increase.

In a further check, we examine the responses in a more restricted sample: corporations in tourism, the majority of which offers short-term accommodation such as hotels and rentals. This check ensures that a) we compare corporations with similar economic activity between the two groups and b) time-varying factors such as accommodation nights per island and accommodation capacity, account closely for macroeconomic fluctuations. We find that our results hold and are even reinforced in both statistical and economic significance: corporate income taxes and profits exhibit a larger decrease.

One explanation of the accentuated findings is pervasive tax evasion in the Greek islands where corporations might have an opportunity to adjust declared profits and gross revenues. Previous studies have highlighted the extent of tax evasion in Greece and the attempts of correcting this during the economic crisis (Artavanis *et al.*, 2016; Hondroyiannis and Papaoikonomou, 2017; Danchev *et al.*, 2020). Concurring with the evidence we present, Artavanis (2018) documents that reported sales by corporations in Greece respond inversely to changes of the VAT rate. Similarly, in a self-assessment tax compliance programme analysed in Al-Karablieh *et al.* (2021), Greek firms were found to substantially manipulate reported revenues to meet the required profit targets, suggesting the existence of profit under-reporting. We add to this evidence by quantifying the impact that such responses can have on corporate income taxes. That is, changes in VAT rates, combined with the ease to manipulate profits and sales by corporations, can lead to reduced corporate income taxes.

This effect has important revenue implications for governments. The combined contribution of both VAT and CIT on government budgets is economically large at about 14% of GDP. For OECD countries, for example, this percentage is split between 3.3% in corporate taxes and 10.7% in consumption taxes every year. Introducing a VAT has a large fiscal out-turn for government budgets (Keen and Lockwood, 2006, 2010). Even a mere 1% increase in VAT can be translated to multi-billion revenues for governments each year. Our analysis sheds light on a link that might lessen the expected revenue of a VAT rate increase: corporations respond to the VAT increase by adjusting declared profits downwards, thus reducing corporate income taxes.

A strand of literature we contribute to is that of real responses to VAT changes, with the majority of studies focusing predominantly on tax incidence and price pass-through. Kosonen (2015) finds evidence of hairdressers in Finland cutting their prices only by a half in response to a large VAT decrease. Similarly, Benzarti *et al.* (2020) find evidence of asymmetry in pass-through; prices respond more strongly to increases than to decreases in the VAT. In further evidence from a VAT reduction in French restaurants, Benzarti and Carloni (2019) document that firm owners benefit most by pocketing more than 55% of the tax cut.

Such effects have also been examined in the context of temporary tax cuts during COVID, for instance, in Montag *et al.* (2020); Fuest *et al.* (2021) and, in food prices in Benzarti *et al.* (2023). Despite a significant number of findings in recent years, the literature remains particularly slim on real economic responses with a notable exception being Benzarti and Tazhitdinova (2021), who investigate the effects on trade flows. This paper complements these findings by, firstly, focusing on small isolated economies as defined by the Greek islands, thus offering a more general equilibrium effect of the VAT change than one focusing on a particular good or service. Secondly, by documenting real effects in corporations.

An additional area we contribute to is that of the elasticity of corporate income taxes in response to changes in consumption taxes. A significant body of literature has examined the elasticity of corporate income taxes, mainly in response to changes in the CIT rate (Mooij and Ederveen, 2008; Dwenger and Steiner, 2012; Devereux *et al.*, 2014; Kawano and Slemrod, 2016). Yet, the elasticity of corporate income taxes in response to changes in other taxes, that might affect corporations directly, has neither been documented before in theory nor in an empirical setting. We provide evidence of the existence of an elasticity between CIT and VAT. Our study highlights that responses of CIT to VAT changes might not only originate from price effects in the demand of products and services due to a new VAT rate. But rather, a new VAT rate can have first-order effects in the behaviour of corporations who respond by adjusting profits, revenues and corporate income taxes. From a policy perspective, any changes to VAT rates should consider the direct implications to corporate income taxes.

The remaining sections are structured as follows. Section 2 describes the institutional framework of the VAT reform. Section 3 describes the data we use. Section 4 documents corporate responses to the VAT change and, lastly, Section 5 concludes.

2 Institutional Background

From 1937 and until very recently, Greece operated place-based VAT rates. The mainland, islands in the Ionian sea, and Crete, operated a common VAT rate (at 24% today). Islands in the Aegean sea had a preferential VAT rate on products and services, with national law requiring a 30% reduction compared to the rate in the mainland.¹ The main reason for the reduced rate was historicopolitical, described in more detail in Appendix B. Yet, more contemporary arguments in favour of maintaining the regime included the remoteness of the islands from the mainland, which might have incurred additional costs for transport and shipping to island residents and businesses, as well as, maintaining price competitiveness in the tourism industry.

The Greek economic crisis began in 2009 and brought an end to the place-based VAT rates. The crisis unfolded in the aftermath of the global financial crisis and marked one of the most significant economic depressions faced by a country in recent economic history. GDP in current market prices collapsed from a peak of €242 billion in 2008 to a trough of €175 billion in 2016, resulting in an acute fiscal situation for the state. Total revenue fell from €98 billion in 2008 to €84 billion in 2015; a decrease of 8% as a percentage of GDP in 2016.

Faced with a dire situation, in April 2010, Greece became the first country in the EU to seek financial assistance in the form of an economic adjustment programme from other European countries and with the

¹For instance, if the VAT rate in the mainland was 21% and the reduced rate (on basic and pharmaceutical products) was 9%, the place-based VAT applicable in the islands was 14% and 6% respectively.

contribution of the International Monetary Fund. This first programme covered the period of 2010 - 2013 and foresaw bilateral loans to Greece in exchange for reforms. The extent of financial needs and the reforms that needed to be implemented led to a second programme being negotiated in February 2012, covering the period 2012 to 2014. A third (and final) bailout programme was agreed in the summer of 2015, for the period 2015 - 2018.

Due to an urgent need to expand the tax base and produce new tax revenue, the place-based VAT rate found itself on the negotiating table during the third bailout programme. A single harmonised rate was agreed to align the islands to the mainland's rate and the repeal of the regime saw the day of light in an omnibus law in August 2015. The negotiations were dramatic; they took place in Brussels behind closed doors, with banks closed and capital controls in place. As a result, the conditions for the agreement were fast, whilst it was near-impossible to predict the outcome of the agreed policies. Neither the repeal of place-based VAT rates nor the specific islands included in the final omnibus law were common knowledge before August 2015.

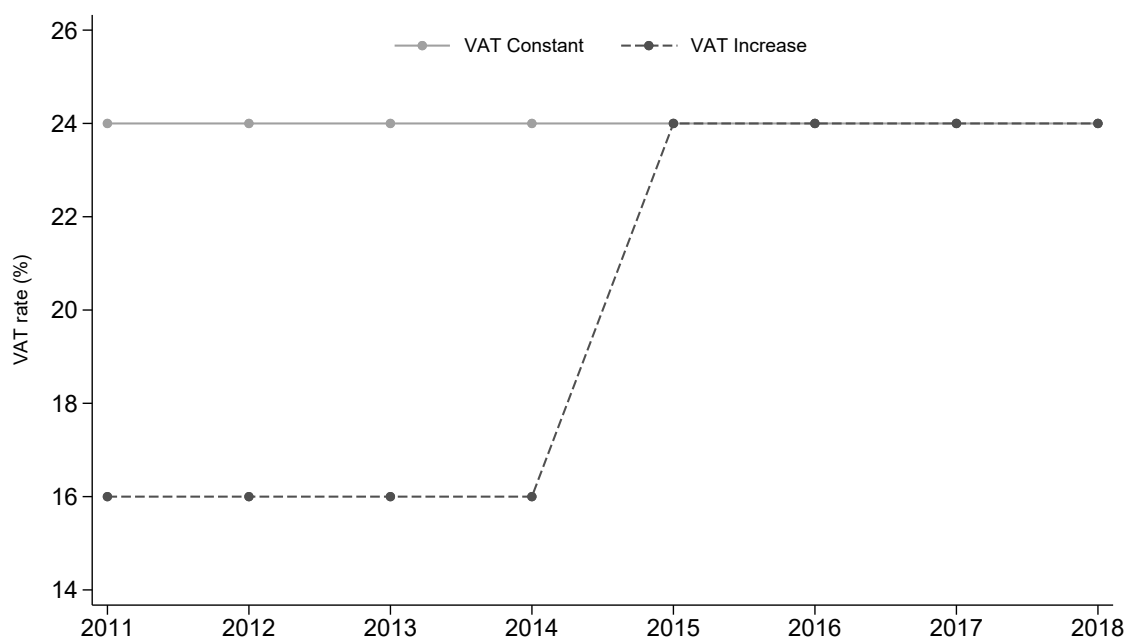
Fig. 2.1 Islands



Notes: This map of Greece illustrates islands used in to form comparable groups of corporations. Islands that maintained a constant VAT rate aligned with that of the mainland (at 24%) are shown in dark colour and islands that experienced a VAT increase from 16% to 24% are shown in grey. These groups form our control and treatment respectively. Islands in black include Cephalonia, Zakynthos, Lefkada, Meganisi, Corfu, Paxoi, Kythira, and Ithaki. Islands in grey include Rhodes, Santorini, Mykonos, Naxos, Skiathos, and Paros.

The omnibus law was voted on the 14th of August 2015 and harmonisation with the mainland took place on the 1st of October 2015. Six islands (*VAT-increase islands* hereafter) were included in the VAT change as shown in grey in Figure 2.1: Santorini, Mykonos, Rhodes, Skiathos, Paros and Naxos. By contrast, islands situated in the Ionian sea, as indicated in black in Figure 2.1 (Cephalonia, Zakynthos, Lefkada, Meganisi, Corfu, Paxoi, Kythira, and Ithaki), were never included in the preferential regime, thus they maintained the same rate as the mainland (*VAT-constant islands* hereafter). The VAT rate that was applied to the two groups is illustrated in Figure 2.2. The solid line represents the 24% VAT rate of the VAT-constant islands, whilst the dashed line shows the change in VAT rate from 16% to 24% for the VAT-increase islands. The VAT change resulted in an particularly large increase of 8 percentage points in the VAT-increase islands.

Fig. 2.2 VAT Rates



Notes: This figure presents the evolution of the VAT rate in VAT-constant islands that are used as control (solid line) and VAT-increase islands that are used as treatment (dotted line). The control group maintained a constant VAT rate of 24%. In contrast, the treatment group experienced a rise in its VAT rate from 16% to 24% on the 1st of October 2015.

In the same year a corporate tax rate increase took place, which applied for all corporations. In the 1990's and until 2000, the corporate income tax rate stood at 40%. This was gradually reduced in the 2000's and up to 20% in 2011, then increased to 26% in 2013 and to 29% in 2015. The rate remained stable until 2018, where it was gradually reduced again to 22%. For the years we examine, corporations experienced the change in 2015 (from 26% to 29%) contemporaneously with the change in VAT. However, the change in the corporate income tax rate applied to all the firms. Evidence of the corporate income tax rate is illustrated in Figure A.2 in Appendix A.1, where we calculate the effective tax rates. The taxes paid as a percentage of taxable profit, increase gradually from 20% to 26% in 2013 and to 29% in 2015 for both groups we examine.

A characteristic of the Greek economy, and of the islands in particular, before and during the economic crisis has been pervasive tax evasion. The informal economy was estimated to be about 30% of GDP during

crisis years (Vasardani, 2011). Unreported income amongst the self-employed was estimated at about 45% Artavanis *et al.* (2016). The VAT gap in 2015 was estimated at 28% (Poniatowski *et al.*, 2021). Tax increases during the economic crisis have had a significant effect on compliance with firms switching to the informal sector to avoid insolvency (Pappada and Zylberberg, 2015). At the same time a number of digitisation policies were implemented in 2017 to increase tax compliance with mixed results (Nicolaidis, 2022, 2023).

These two groups of islands we examine have served as the flagship of the Greek tourist industry with multi-billion revenues produced every year. In 2015, 23.6 million (non-resident) tourists visited Greece (an amount double Greece's population), with revenues estimated at € 13.7 billion.² Based on the nights in hotels by foreigners in Greece, 24.5% were recorded in islands of the south Aegean (the majority of which include the VAT-increase islands) and 10.9% in the Ionian islands. According to Hellenic Statistics, the contribution of tourism to these groups' GDP corresponds to 71.8% and 62.5% respectively for each group of islands, making it the predominant economic activity.

Corporations based on VAT-increase islands form a "treatment group" in our study and, corporations based on VAT-constant islands a "control group". We utilise corporations based on these groups of islands for our comparison because their economic activity is broadly similar. Figure A.3 in Appendix A.1 presents the sector percentage of corporations as per Nace Rev. 2 classification.³ The primary sector (Accommodation and food services), closely associated with the tourism industry, represents the majority of corporations in both VAT-increase (53% of corporations) and VAT-constant islands (51% of corporations). Following closely is the wholesale and retail trade sector, with comparable percentages between the two groups of islands. Figure A.4 in Appendix A.1 breaks down the top 9 activities with the highest number of corporations using the Nace Rev.4 classification.⁴ Specifically, corporations classified under "Hotels and similar accommodation" are by far the most populous in both groups of islands, with 454 and 359 firms in VAT-increase and VAT-constant islands, respectively. The prominence of categories such as renting of real estate, travel agency activities, renting and leasing of cars, as well as restaurants and mobile food services, further emphasizes the orientation in tourism for both groups of islands. The similarity in the breakdown is reassuring for the groups of corporations we are comparing.

There are a number of factors that make this setting ideal for our study. Firstly, the size of the change in VAT (8 percentage points) is large enough to tease out responses by corporations, compared to other VAT changes which are usually incremental. Secondly, by focusing on groups of islands we ensure a similar sample size and economic activity. Macroeconomic conditions affecting the Greek economy and seasonal fluctuations in tourism can be controlled for by utilising the conditions in the VAT-constant islands. Thirdly, the comparison focuses on isolated groups which are separate from each other. Moving a hotel, a restaurant, or a travel agency from one island to the other would have been difficult in practice. This ensures isolation of treatment and control subjects. Lastly, the fast-pace of negotiations and voting of the VAT change in parliament in August 2015, combined with a fast implementation in 1.5 months limit any anticipation effects by corporations. This creates an "as-if random" allocation of treatment on the corporations situated in the VAT-increase islands. Overall, these factors provide a unique quasi-experimental setting with similar corporations based in distinct geographical locations to assess how they respond to a large change in the VAT rate.

²The Hellenic Statistical Authority runs a survey on arrivals and hotel accommodations available at <https://www.statistics.gr/en/statistics/-/publication/STO04/->.

³The Nace Rev.2 classification is a detailed statistical classification used by Eurostat to standardise economic activity across the EU. Details on the Nace Rev.2 classification can be found in the following link: <https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF>.

⁴More details on all codes can be found in <https://nacev2.com/en>.

3 Data

For our analysis we combine three data sources. Firstly, we utilise the universe of corporate tax returns in Greece for the financial years 2011 to 2018.⁵ We focus our analysis for the years 2011 to 2018 for three reasons: a) the dataset is more complete due to the implementation of electronic filing during crisis years; b) this period covers the crisis years, thus we avoid periods where the Greek economy was in a healthier state, such as the 2000's; c) the period covers the change in VAT, which happened in 2015, thus allowing for a comparison 4 years before and 3 years after the change. The dataset contains most filing fields and for all types of corporations. Crucially, the postcode and address of the firms is not contained in the administrative dataset, which does not allow the identification of the corporations in the islands they operate.

The methodological challenge we face is to identify the location of corporations in the islands so as to form comparable groups. To address this, we utilize two datasets containing information on corporations: Orbis and ICAP.⁶ We collect financial records and location details for more than 1,362,000 Greek firms from the Orbis web platform. The financial data encompass profits, sales and, corporate income taxes paid. Additionally, the firm location information includes details such as address, city, and postcode. The ICAP dataset complements this by providing location details for over 146,000 Greek firms, covering information on address, city, and postcode.

By matching financial information from these databases to the administrative database, we are able to obtain information on the location of corporations. Matching takes place through observable variables (sales, taxes, profits and economic activity).⁷ Through this process we obtain an exact address and we use the postcode to locate the corporations on the islands of interest. The matching narrows down the firms we analyse from the universe of Greek corporations to firms located on the islands. This allows us to form a control group of corporations located in VAT-constant islands and a treatment group of corporations located in VAT-increase islands.

As a final step, we clean out entries that contain incomplete information, such as corporations that did not file or did not operate for a few years during the period we examine. Essentially, this leaves us with complete entries for the years 2011 to 2018 (including entries of 0 income, profit or taxes declared). The final groups we form contain about the same number of corporation: 1,042 in VAT-constant islands and 1,152 in VAT-increase islands. Tax administration data indicate that there were about 6 to 7 thousand corporations for each group of islands. The reduced sample we examine results from the fact we cannot locate smaller firms. The number of small firms are not included in the Orbis and ICAP databases, since these gather data from larger firms that publish financial statements. Moreover, a number of firms are excluded as a trade-off for having a complete panel for the years 2011 to 2018. While these are limitations in our study, the resulting sample we compare is large enough (about 1/6th) to make an assessment and does not contain gaps in the panel. Inherently the effects we examine apply to larger firms in the islands (hotels, restaurants, travel agencies), which are equivalent to small and medium enterprises by statistical classification.

⁵The procedure for filing takes place through a unified tax filing form called Form N. It is announced in April every year and must be completed by the end of June. The financial year in Greece begins on the 1st of January and end on the 31st of December.

⁶Orbis is a commercial product provided by the Bureau van Dijk company, encompassing data on over 450 million companies. ICAP is a company that offers credit risk and business information solutions in Greece, Romania, Bulgaria, and Cyprus.

⁷We implement a number of checks to ensure true matching based on the information in the two databases and by comparing their unique tax identification numbers.

Basic summary statistics for the year 2015 and for each of the two groups are shown in Table A.1 in Appendix A.2. Corporations in VAT-increase islands register significantly more gross revenue than those in VAT-constant islands. The mean [median] across companies in 2015 stood at € 1.7 [0.4] million for the former and € 1 [0.2] million for the latter. The divergence in revenues is not a surprising fact. Aegean sea islands have been particularly successful in attracting luxury tourism (Santorini and Mykonos for instance), while the median difference being significantly smaller than the mean, indicates a large variance of revenues across companies. The distribution of revenues in both groups of islands is presented in Figure A.1 in Appendix A.2.

Revenue differences are reflected also in the mean differences in taxable profits and attributed corporate income tax for 2015. For VAT-constant islands mean taxable profits stand at € 74.4 thousand compared to € 166.6 thousand for VAT-increase islands. The median values for both groups are particularly low, indicating that the majority of the firms declare zero to very low taxable profits. As a result the mean attributable corporate income tax is low too (since the CIT rate was 29% at the time).

Figure A.2 in Appendix A.1 illustrates the effective tax rates for the companies we examine per group of islands. The lines at the upper part show the effective tax rates as a percentage of taxable profits (which reflect the nominal tax rate), while the lines at the lower part, show the taxes paid as a percentage of gross profit (after costs have taken into account). Firstly, note that both follow similar trends, indicating a comparable pattern between the two groups. Secondly, the final attributed tax (as a percentage of gross profit) is particularly low at about 5 to 8%. There is a 2 to 3 percentage point difference between the two groups, yet it is evident that companies in both groups pay particularly low corporate income tax.

Lastly, we utilise data on tourist arrivals in the Greek islands to control for macroeconomic fluctuations. Hellenic Statistics publishes the absolute number of accommodation nights booked per island per year, as well as, the percentage of accommodation capacity that remained full per island per year. These data are useful in accounting for time-varying factors that might have affected economic activity beyond the increase in the VAT rate.⁸ They form a good proxy of economic activity in the islands and we explain in more detail how time-varying factors are important for our econometric specification in Section 4.1.

The combined dataset forms a panel of directly comparable groups of corporations. For each of these, we observe their gross revenue, profits and corporate income taxes for the years 2011 to 2018. We also observe the postcode, which enables us to determine treatment. Since these corporations are operating predominantly in the tourism industry, we control for macroeconomic fluctuations using annual accommodation data. Controlling for these factors enables us to perform a direct comparison between the two groups in order to examine how corporations respond to the VAT increase.

4 Responses by Corporations

4.1 Identification Strategy

In this analysis we quantify how corporations respond to the increase in the VAT rate along three dimensions: gross revenues, profits and corporate income taxes. Recall that corporations we have identified in VAT-increase islands experienced a rate increase of 8 percentage points compared to corporations in

⁸One example for such an activity could be a drop in tourism demand or a shift in preferences away from the Greek islands.

islands where VAT remained constant. Recall also, that the choice of which islands to increase VAT was unanticipated due to the fast evolution of economic crisis negotiations. These conditions create an "as-if random" treatment setting in which to examine responses.

The specification we use takes the form of a difference-in-differences regression. For each corporation i , in year t and based in postcode z , let $Y_{i,z,t}$ represent an independent variable of interest (revenues, profits, corporate income taxes). Let also $VAT_{i,z}$ be a binary variable taking the value of 1 for corporations i located in postcodes z that belong to VAT-increase islands, and 0 otherwise. Interacting $VAT_{i,z}$ with time before and after the VAT reform, creates a VAT-increase indicator. The difference-in-differences comparison for the two groups of firms allows us to examine the effect of the change along several dimensions. The regression equation takes the following form:

$$\underbrace{Y_{i,z,t}}_{\text{Outcome variable}} = \alpha + \overbrace{\beta Post_t \times VAT_{i,z}}^{\text{VAT increase indicator}} + \underbrace{X_{i,t}}_{\text{Time-varying corporate variables}} + \overbrace{W_{z,t}}^{\text{Time-varying island variables}} + \delta_i + \lambda_z + \zeta_t + \epsilon_{i,z,t} \quad (1)$$

We seek to identify the parameter $\beta_{i,z,t}$, which represents change in the outcome variable in response to a change in VAT. By using corporations in VAT-constant islands, the regression captures the difference vis-à-vis revenues, profits and corporate income taxes and what these variables would have been had the VAT increase not taken place. Invariant factors (fixed effects) for corporations, postcodes and time are captured by δ_i , λ_z and ζ_t , respectively.⁹

One explanation for differences between the two groups we might observe, could be due to changes in company or island characteristics over time. For instance, an increase in the number of tourism in one island over another after 2015 could explain changes in profits. We account for time-varying changes that could bias the results of our specification through a number of variables. Corporate time-varying variables are denoted by $X_{i,t}$ and include cash deposits, net fixed assets (after depreciation), and dividends distributed during the year.¹⁰ Island time-varying characteristics are denoted by $W_{z,t}$ and include the annual total number of hotel nights booked and the percentage of hotel capacity in that island during the year. This allows us to control for time-varying changes in economic activity per island per year.

The estimation is implemented by fitting a pseudo-Poisson maximum likelihood (PPML hereafter) with high-dimensional fixed effects (corporations, postcode and time). For the majority of regressions we utilise the methodology developed by Correia *et al.* (2020).¹¹ This approach is preferred than using an ordinary least squares estimator with a log-linear transformation of the variables for a number of reasons. Firstly, recall that our sample inherently contains a large number of 0 values as were seen the median values of Table A.1 in Appendix A.2. These observations would had been dropped. By contrast, the PPML estimator can be applied to variables with non-negative values. Secondly, we avoid the need to specify distributional assumptions on the dependent variables; this is especially important in the presence of heteroskedasticity in the data, in which the ordinary least-squares estimates could be inconsistent (Silva and Tenreiro, 2006). Lastly, the PPML point-estimates are given in log-point form which have a direct interpretation of interest

⁹These factors include, for example, specific characteristics of companies (such as closeness to the sea, facilities, amenities etc.) or of postcodes (natural attractions, rural/urban setting, having a port or airport) or of time (increasing trend of tourism).

¹⁰An increase of fixed assets for instead could enable a hotel to increase the capacity of hotel room, and thus increase its revenues.

¹¹The latest version of the ppmlhdf estimator can be found here: <http://scoreia.com/software/ppmlhdf/>.

and can be converted in percentages. Overall, the PPML estimation is better justified given the large number of 0's and its ability to be consistent without the need of distributional assumptions on the variables.

4.2 Parallel-trends

The first check we implement is one of parallel trends between corporations in VAT-increase islands and VAT-constant islands. Figure A.5 in Appendix A.1 presents unconditional mean values of log revenues in years 2011 to 2018. The dashed line represents corporations in the VAT-increase islands and the solid line corporations in the VAT-constant islands. Note firstly, that a level difference exists between the two groups, which was also reflected in Table A.1 and been explained in Section 3. Secondly, notice that trends are roughly parallel in all the years, with a small convergence visible in unconditional mean differences from 2016 to 2018, after the VAT increase.

Secondly, consider the unconditional mean differences in profits and corporate income taxes as illustrated in Figures A.6 and A.7 in Appendix A.1. The graphs are plotted on the same scale and show a lower level of mean log-profits and mean log-taxes compared to the revenue (consisted with summary statistics). Similar to the revenue pattern, the level differences in profits and taxes are maintained between the two groups of islands. In addition, the trends before the VAT change in 2015 are parallel and increasing. After a small drop in profits and taxes in 2012 in both groups, there is a small stable increase from year to year. This pattern is reassuring in regards to the difference-in-differences approach we implement. Recall that as described in Section 2, corporations are similar in their economic activity. The graphs indicate that revenues, profits and corporate income taxes followed a similar trend prior to the reform.

Importantly, note that a large drop in both profits and corporate tax revenue is visible from 2016 onward. The parallel trends converge in year 2016 and stabilise for the subsequent year. This is indicative of the effect we will estimate in Section 4.3.

4.3 Results

The objective of this analysis is to estimate the effect of the VAT increase on corporate responses along three dimensions: corporate income taxes, revenues and profits. We begin first with the effect on corporate income taxes, which is an effect with considerable fiscal importance. Results from Regression 1 are shown in the Column (1) of Table 4.1. The estimation includes both time-varying corporate and island characteristics; and postcode, year and corporation fixed effects. The interaction term between year and VAT-increase indicates the log-point difference between companies based in VAT-increase islands and companies based in VAT-constant islands; this is the main variable of interest.

It can be observed that the difference between the corporate income taxes paid by corporations in the two groups is not statistically significant for the financial years 2011 to 2014, before the VAT change. This is reassuring as it indicates that parallel trends are maintained before 2015, after controlling for both fixed effects and time-varying characteristics. From 2016 to 2018, we estimate a statistically significant decrease in corporate income taxes in corporations located in VAT-increase islands. Recall that the regulation is implemented in October 2015. During the first year of implementation in 2016, the decrease is -0.156 log-points, followed by -0.298 log-points in 2017 and -0.293 in 2018. Note that the decrease is economically large (16.8% in 2016, 34.7% in 2017 and 34.1% in 2018) and, importantly, permanent for the three years after the reform.

Table 4.1 Difference-in-Differences Estimates (PPML Regression)

	(1) Corporate Income Tax	(2) Gross Revenues	(3) Declared Profits
2011 \times VAT \uparrow	-0.0863 (0.2101)	0.1090 (0.0795)	-0.0442 (0.2122)
2012 \times VAT \uparrow	-0.1258 (0.2076)	0.1154 (0.0819)	-0.0859 (0.2122)
2013 \times VAT \uparrow	0.0080 (0.0915)	0.0111 (0.0489)	0.0558 (0.0942)
2014 \times VAT \uparrow	0.1236 (0.0954)	-0.0185 (0.0324)	0.1083 (0.0978)
2016 \times VAT \uparrow	-0.1560** (0.0642)	-0.0193 (0.0617)	-0.1139** (0.0568)
2017 \times VAT \uparrow	-0.2983*** (0.0677)	-0.0867* (0.0493)	-0.2487*** (0.0886)
2018 \times VAT \uparrow	-0.2934*** (0.0850)	-0.1483*** (0.0508)	-0.2508*** (0.0933)
Log cash	0.0557*** (0.0059)	0.0329*** (0.0097)	0.0558*** (0.0058)
Log dividends	0.0395*** (0.0067)	0.0011 (0.0013)	0.0389*** (0.0066)
Log net fixed assets	0.0075 (0.0382)	0.1615*** (0.0292)	0.0126 (0.0396)
Log accommodation nights	0.7148* (0.3955)	0.9142*** (0.2674)	0.7009 (0.4740)
Annual hotel capacity	-0.0156** (0.0069)	-0.0119*** (0.0036)	-0.0149* (0.0083)
Corporate t-varying controls	Yes	Yes	Yes
Island t-varying controls	Yes	Yes	Yes
Corporation-Postcode FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of Observations	12798	12798	12798
Number of Postcodes	46	46	46
Ps. R-squared	0.90	0.97	0.88

Notes: The table presents estimates from Regression 1. Year \times VAT \uparrow interactions correspond to changes in the VAT-increase islands versus the VAT-constant islands. All regressions include corporation, postcode and year fixed effects. Robust standard errors clustered at the postcode level are used. The samples include 1,042 corporations from VAT constant islands and 1,152 from the VAT increase islands. Columns (1), (2) and (3) present point estimates of yearly differences in corporate income taxes, gross revenue and declared profits respectively. A pseudo-Poisson maximum likelihood estimator is fitted on absolute values of the independent variables. Cash, dividends and net fixed assets are corporate time-varying controls. Island time-varying controls are accommodation nights and annual hotel capacity. The former includes official statistics on the absolute number of accommodation nights booked per island and, the latter the percentage of hotel rooms that remained occupied per island per year.

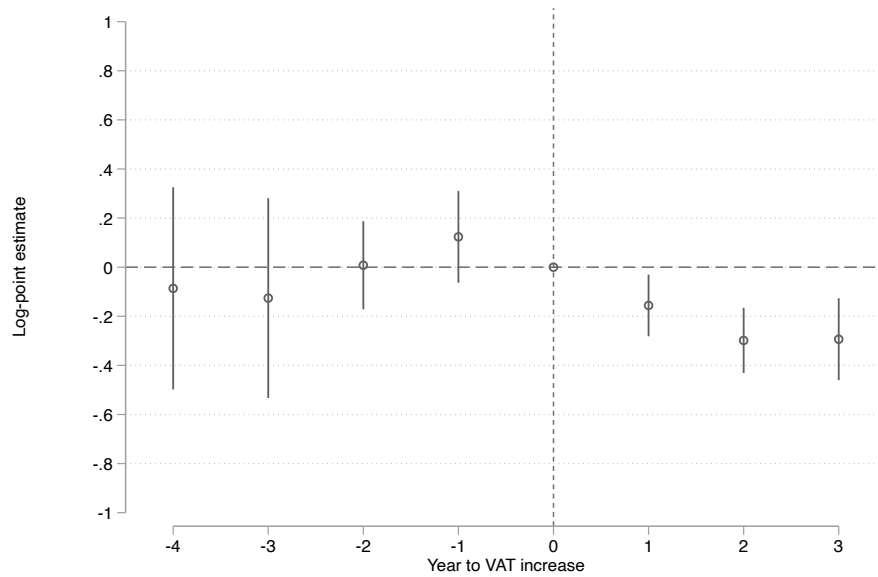
The decrease in corporate income taxes is a direct reflection of the decrease in profits since the former is a percentage of the latter. In Column (3) of Table 4.1, we can observe a similar pattern of statistically insignificant differences from 2011 to 2014, followed by a decrease in declared profits by -0.114 log-points in 2016, -0.249 log-points in 2017 and, -0.251 log-points in 2018. It is evident that this is an important margin of response for corporations that experience an increase in VAT (compared to corporations that remained at a constant VAT level). After the VAT increase, declared profits decrease significantly by 12% in the first year, 28% in the second and 28.5% third year.

Part of the decrease in profits and taxes can be explained by corporations adjusting their gross revenues downwards. Column (2) of Table 4.1 presents estimated differences per year between corporations in the two groups. The decrease in gross revenues in 2016 is not statistically significant. This is different from corporate income taxes and profits, in which the decrease appears in 2016 (yet, at a lower level than in 2017 and 2018). Eventually, gross revenues are adjusted downwards by corporations in years 2017 and 2018, where we observe a -0.087 log-point decrease in 2017 (statistically significant at the 10% level), and a decrease of -0.148 log-points in 2018 (statistically significant at the 1% level). This represents a 16% decrease in gross revenues in 2018.

Note that the decrease in gross revenue cannot be explained by macroeconomic fluctuations in the tourist sector in the years following the reform. This time-varying factor is captured by two variables in the regression; the number of annual accommodation nights and the percentage of annual hotel capacity. Both variables are statistically significant at the 1% level and can explain revenue fluctuations; an increase in accommodation nights is positively associated with a gross revenue increase. A further check that these variables capture macroeconomic fluctuations is to compare revenue results without including time-varying controls. Regression results are illustrated in Table A.2 in Appendix A.2. The point-estimates for gross revenue become statistically insignificant for all the year. Adding time-varying controls makes the coefficients of gross revenue statistically significant after the VAT change, since we condition our estimates on fluctuations in economic activity.

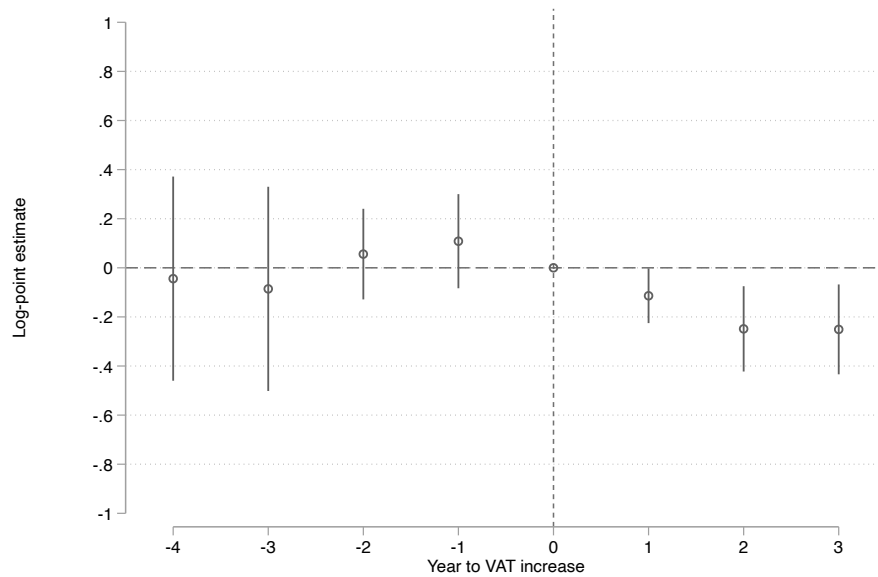
Event studies for corporate income taxes, profits and revenues are presented in Figures 4.1, 4.2 and, 4.3 respectively. These illustrate the effects we estimate in Table 4.1. In all diagrams, the pre-reform differences appear to be statistically insignificant between the two groups. From 2016 onward, corporations in VAT-increase islands experience economically large, permanent, and statistically significant decreases in corporate income taxes and declared profits. As we have indicated above, this decrease can be partly explained by the fall in revenue, which takes place from 2017 onward, but remains at a lower percentage than the fall in profits and taxes.

Fig. 4.1 Effect on Corporate Income Taxes



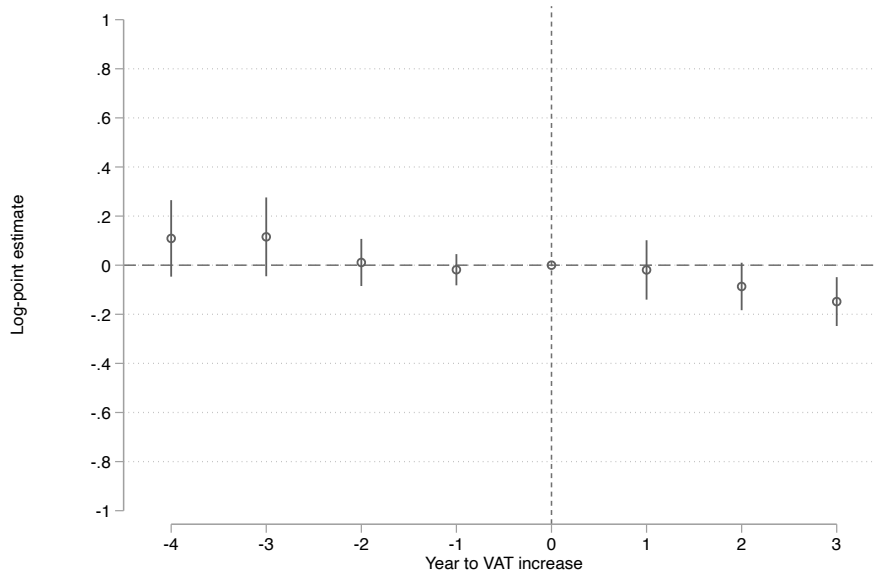
Notes: The figure presents an event study from the regression results of Column (1) in Table 4.1. These illustrate annual differentials in corporate income taxes between corporations in VAT-increase island and corporations in VAT-constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. 4.2 Effect on Profits



Notes: The figure presents an event study from the regression results of Column (2) in Table 4.1. These illustrate annual differentials in declared profits between corporations in VAT-increase island and corporations in VAT-constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. 4.3 Effect on Revenues



Notes: The figure presents an event study from the regression results of Column (3) in Table 4.1. These illustrate annual differentials in gross revenue between corporations in VAT-increase island and corporations in VAT-constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

4.4 Effect of Declaring Zero

An important dimension of responses by corporations we examine is that of declaring zero (profits or taxes) following the VAT change. Existence of evidence in this dimension could explain the decrease we observe. At a first step, we plot unconditional percentages of firms declaring zero along the three dimensions we examine; corporate income taxes, profits and revenue. At a second step we incorporate this dimension of responses in Regression 1 to assess parametrically how much of the decrease in corporate income taxes, profits and revenues it explains.

The percentage of corporations per group of islands per year declaring zero corporate income taxes is shown in Figure A.13 in Appendix A.1. Firstly note that overall, a large number of corporations declare zero corporate income tax. For both groups this percentage is trending downwards from 60-70% in 2011 to about 50% in 2018. Zero corporate income taxes might be the result of zero profits or losses declared during the year. Part of this could also be the effect of tax evasion. Secondly, we can observe a similar parallel trend before 2015 between the two groups. At 2016 the percentage of corporations in VAT-increase islands, declaring zero taxes exhibits a level shift of about 5%, converging to the VAT-constant line. This indicates that the VAT increase coincides with the increase in corporations declaring zero corporate income taxes, which can partly explain the decrease in corporate income tax we observe.

A similar change as to the one observed in taxes, is illustrated in Figure A.12 in Appendix A.1. We plot non-positive profits, meaning the percentage of corporations either declaring zero profits or losses. The trend is downward, reaching 50% in 2018 and a level shift of about 5% in the percentage of corporations declaring non-positive profits is visible in VAT-increase islands from 2016 onward. The margin of responses

for corporations in this case is to declare zero profits or losses. Since we plot the percentage of corporations, the effect we observe is in the extensive margin (more corporations declare non-positive profits).

An additional line-plot of losses (excluding zero profits) is shown in Figure A.14. As can be seen, the majority of corporations we observed in the zero non-profits graph above originate from corporations declaring losses. Consistent with the evidence, we document an increase in loss making corporations in VAT-increase islands from 2016 onward.

The effect on the percentage of corporations declaring zero revenues is shown in Figure A.11. A very important characteristic, in contrast to the previous two graphs of corporate income tax and profits, is that a significantly smaller percentage of corporations declare zero revenues. For corporations in VAT-increase islands, this percentage is about 9% every year, whilst for VAT-constant islands, the percentage is about 12%. This suggests that on average, the majority of corporations register positive revenues, yet profits are adjusted significantly downwards to declare either zero or losses, resulting in very low corporate income taxes being paid.

Both revenue lines trend downward before 2015 and the seasonality in year-to-year fluctuations is similar between the two lines. Following 2015, we observe a trend reversal in corporations declaring zero revenue in VAT-increase islands. The trend goes upwards, whilst for VAT-constant islands, it continues on a downward path.

A final step is to assess this margin of responses parametrically by including an indicator for declaring zero profits in the estimations of Regression 1. The binary variable we utilise assigns the value of 1 in corporations recording positive profits before the VAT reform and non-positive profits for all years after the VAT increase (in 2016 to 2018). All other corporations take the value of 0. Furthermore, we include an interaction of the variable with VAT-increase islands. Point-estimates are shown in Table A.3, after conditioning for time-varying effects and corporations, postcode and time fixed effects. The estimate is negative in all columns for taxes, profits and revenue. This is expected since by declaring non-negative profits for 2016 to 2018, these corporations reduce revenues for both VAT-increase and VAT-constant islands.

Importantly, we observe very little change in the interaction of VAT-increase and year; the main variable of interest. Whilst the pre-2015 parallel trends holds, the decrease in corporate income taxes, declared profits and revenues changes very little. This shows that the effect we observed in Section 4.3, affects a broader number of firms based on the islands and not only those that declare non-negative profits after 2015.

4.5 Results from the Tourism Industry

To check that our results hold, we focus next on a subset of corporations; those operating only in the tourism industry. Since our data include each corporations' sector of operation (according to Nace Rev.2), we can eliminate those operating in other industries. This includes overall 1,409 corporations; 736 from VAT-increase islands and 673 from VAT-constant islands. Whilst being only a subset, it includes a large part of corporations in our sample because most of them operate in tourism in both groups of islands (recall that the sample we compared in Section 4.3 included 1,152 and 1,042 corporations respectively).

Results from Regression 1 without corporate and time-varying effects are shown in Table A.4 in Appendix A.2. It is reassuring to observe that in the more restricted sample the results are maintained. Parallel trends hold since point-estimates before the VAT before remain insignificant for all years and variables. Corporate

income taxes and declared profits record a sharp decrease in all years following the reform at about 24% to 34%, which is very similar and in the range of the full sample results.

The results are maintained and even reinforced when we control for time-varying variables as shown in Table A.5.¹² Similar to the full sample, gross revenues decrease by 13 – 15% in 2017 and 2018, whilst corporate income taxes and declared profits decrease in all years after the reform at about 35% lower than the control group. The results confirm that the responses in all margins we examine are present in corporations in the tourism industry that are based in the VAT-increase islands (even after controlling for time-varying factors and fixed effects). Results from Table A.5 are plotted diagrammatically in event studies for corporate income taxes, declared profits and gross revenue respectively, in Figures A.15, A.16 and, A.17 in Appendix A.1.

5 Conclusion

In this paper, we have provided evidence that changes to VAT rates are not CIT-neutral. Our methodology combined three datasets and exploited a unique setting, where place-based VAT rates in the Greek islands together with the unexpected repeal of this regime in 2015, enabled us to form treatment and control groups of corporations. By comparing the two groups in a difference-in-differences specification, we have analysed responses of 1,042 corporations based in VAT-constant islands and 1,152 corporations in VAT-increase islands. Corporations respond to the 8% VAT increase by permanently adjusting declared profits downwards by 28%. This has a direct impact on the corporate income taxes paid to the government, which decrease by 34%. We find that adjustments to revenue cannot fully explain this change. The results hold after controlling for macroeconomic factors, such as the number of accommodation nights booked in the islands.

The findings have a number of important tax policy implications. Firstly, the economic literature has focused predominantly on the elasticity of corporate income with respect to changes in the corporate income tax rate. We provided evidence of a novel dimension in the corporate income tax elasticity; changes to consumption taxes can also have a direct impact on the responsiveness of the corporate income tax base. To the best of our knowledge, the interaction between consumption taxes and corporate income taxes has neither been documented empirically, nor considered in theoretical models.

Secondly, the responsiveness of CIT with respect to changes in the VAT has direct implications for government revenue. Revenue considerations of VAT changes often focus on the revenue elasticity of VAT (Liu and Lockwood, 2015; Acheson *et al.*, 2018) and the elimination of exemptions (Acosta-Ormaechea and Morozumi, 2021). Our findings shed light on a new channel that might dampen the revenue effect of a VAT change; that of corporate responses through the adjustment of profits. The evidence suggests the existence of an inverse relationship between VAT rate vis-à-vis declared profits and corporate income taxes, the budgetary implications of which might be considerable. Future VAT changes (or introduction of) should consider this form of elasticity to improve budgetary estimations.

Thirdly, the results we presented are inherently affected by the economic setting of the Greek islands, with relatively low tax enforcement and with high opportunities for firms to evade taxes by adjusting their profits and revenues. The existence of isolated markets in the Greek islands has provided a ripe ground for research in recent years (Genakos and Pagliero, 2022; Megalokonomou and Vasilakis, 2023; Dimitrakopoulou *et al.*,

¹²Note that the sample is smaller in this regression than in the regression without time-varying factors, since not all firms contain information on cash, dividends and net fixed assets.

2023). The setting allows us to identify general equilibrium effects of the VAT increase, without focusing on one product or service. Results in this paper corroborate with evidence that firms can manipulate profits with ease to lower their tax liability (Al-Karablieh *et al.*, 2021; Artavanis, 2018; Tørsløv *et al.*, 2023). Such changes have important implications for tax revenue and inequality (Matsaganis and Flevotomou, 2010; Zucman, 2019). From a policy perspective, one explanation of the large responses by corporations we observe, is pervasive tax evasion in the Greek islands, which existed at least during that time (Vasardani, 2011). When corporations can manipulate profits and revenues with ease, one should expect responses of CIT with respect to changes in VAT to be of greater magnitude, thus costing more in lost revenue to the state.

Lastly, VAT changes can lead to real responses that go beyond price effects. The evidence in economic literature has documented the importance of pass-through and tax incidence when assessing changes to VAT. Yet, due to data limitations, real effects have been sparse. Overall, our findings provide additional evidence of real responses to VAT changes, that originate from corporations and which can have revenue and inequality implications.

References

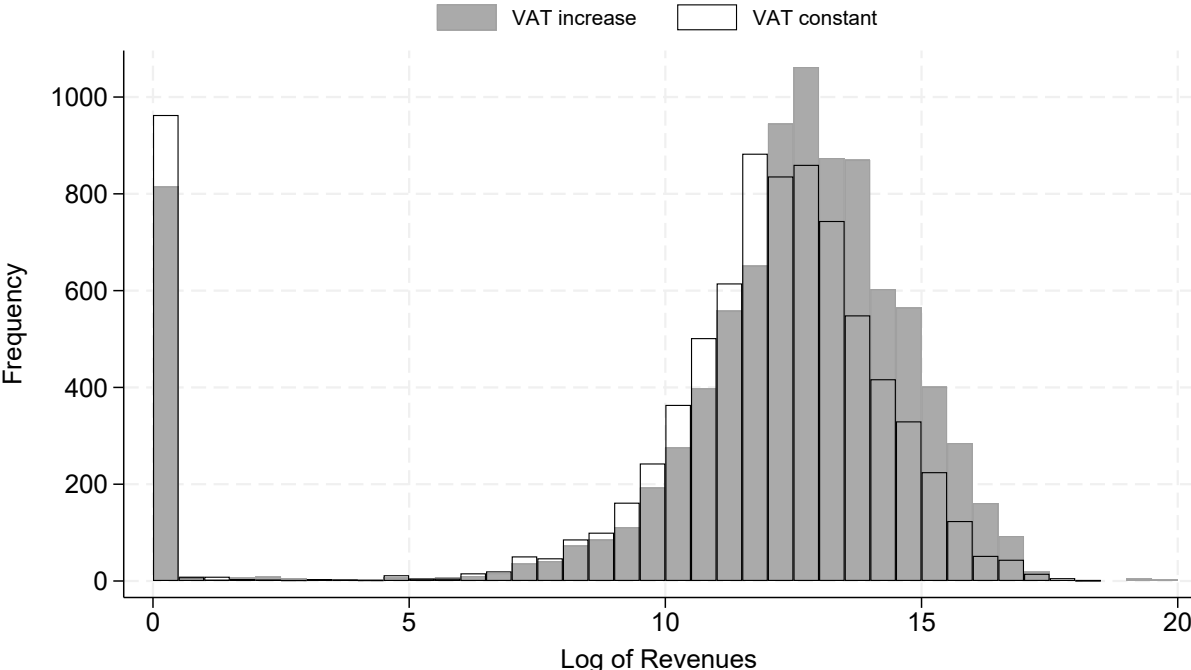
- ACHESON, J., DELI, Y., MORGENROTH, E. L., LAMBERT, D. and MURPHY, M. (2018). *VAT revenue elasticities: an analytical approach*. Tech. rep., ESRI Working paper.
- ACOSTA-ORMAECHEA, S. and MOROZUMI, A. (2021). The value-added tax and growth: design matters. *International Tax and Public Finance*, **28**, 1211–1241.
- AL-KARABLIEH, Y., KOUMANAKOS, E. and STANTCHEVA, S. (2021). Clearing the bar: Improving tax compliance for small firms through target setting. *Journal of International Economics*, **130**, 103452.
- ARTAVANIS, N., MORSE, A. and TSOUTSOURA, M. (2016). Measuring income tax evasion using bank credit: Evidence from Greece. *The Quarterly Journal of Economics*, **131** (2), 739–798.
- ARTAVANIS, N. T. (2018). Vat rates and tax evasion: Evidence from the restaurant industry in Greece. *Available at SSRN 2585147*.
- BENZARTI, Y. and CARLONI, D. (2019). Who really benefits from consumption tax cuts? Evidence from a large VAT reform in France. *American Economic Journal: Economic Policy*, **11** (1), 38–63.
- , —, HARJU, J. and KOSONEN, T. (2020). What goes up may not come down: asymmetric incidence of value-added taxes. *Journal of Political Economy*, **128** (12), 4438–4474.
- , GARRIGA, S. and TORTAROLO, D. (2023). Can VAT Cuts Dampen the Effects of Food Price Inflation? Working Paper.
- and TAZHITDINOVA, A. (2021). Do value-added taxes affect international trade flows? Evidence from 30 years of tax reforms. *American Economic Journal: Economic Policy*, **13** (4), 469–489.
- CORREIA, S., GUIMARÃES, P. and ZYLKIN, T. (2020). Fast Poisson estimation with high-dimensional fixed effects. *The Stata Journal: Promoting communications on statistics and Stata*, **20** (1), 95–115.
- DANCHEV, S., GATOPOULOS, G. and VETTAS, N. (2020). Penetration of digital payments in Greece after capital controls: Determinants and impact on VAT revenues. *CESifo Economic Studies*, **66** (3), 198–220.
- DE LA FERIA, R. (2009). *The EU VAT system and the internal market*, vol. 16. IBFD.
- DEVEREUX, M. P., LIU, L. and LORETZ, S. (2014). The elasticity of corporate taxable income: New evidence from UK tax records. *American Economic Journal: Economic Policy*, **6** (2), 19–53.
- DIMITRAKOPOULOU, L., GENAKOS, C., KAMPOURIS, T. and PAPADOKONSTANTAKI, S. (2023). VAT Pass-Through and Competition: Evidence from the Greek Islands. DIW Berlin Discussion Paper.
- DWENGER, N. and STEINER, V. (2012). Profit taxation and the elasticity of the corporate income tax base: Evidence from German corporate tax return data. *National Tax Journal*, **65** (1), 117–150.
- FUEST, C., NEUMEIER, F. and STÖHLKER, D. (2021). The pass-through of temporary VAT rate cuts: Evidence from German supermarket retail.
- GENAKOS, C. and PAGLIERO, M. (2022). Competition and pass-through: evidence from isolated markets. *American Economic Journal: Applied Economics*, **14** (4), 35–57.

- HONDROYIANNIS, G. and PAPAOIKONOMOU, D. (2017). The effect of card payments on VAT revenue in Greece. *Bank of Greece Working Paper*.
- KAWANO, L. and SLEMROD, J. (2016). How do corporate tax bases change when corporate tax rates change? With implications for the tax rate elasticity of corporate tax revenues. *International Tax and Public Finance*, **23** (3), 401–433.
- KEEN, M. and LOCKWOOD, B. (2006). Is the VAT a money machine? *National Tax Journal*, **59** (4), 905–928.
- and — (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, **92** (2), 138–151.
- KOSONEN, T. (2015). More and cheaper haircuts after VAT cut? On the efficiency and incidence of service sector consumption taxes. *Journal of Public Economics*, **131**, 87–100.
- LIU, L. and LOCKWOOD, B. (2015). VAT notches. In *Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association*, JSTOR, vol. 108, pp. 1–51.
- MATSAGANIS, M. and FLEVOTOMOU, M. (2010). Distributional implications of tax evasion in Greece. Hellenic Observatory, London School of Economics and Political Science.
- MEGALOKONOMOU, R. and VASILAKIS, C. (2023). The effects of exposure to refugees on crime: Evidence from the Greek islands. *European Economic Review*, **160**, 104605.
- MONTAG, F., SAGIMULDINA, A. and SCHNITZER, M. (2020). Are temporary value-added tax reductions passed on to consumers? Evidence from Germany’s stimulus. *arXiv preprint arXiv:2008.08511*.
- MOOIJ, R. A. D. and EDERVEEN, S. (2008). Corporate tax elasticities: a reader’s guide to empirical findings. *Oxford review of economic policy*, **24** (4), 680–697.
- NICOLAIDES, P. (2022). Income Tax Incentives for Electronic Payments: Evidence from Greece’s Electronic Consumption Tax Discount, Working Paper.
- (2023). Winning the Tax Lottery: Evidence from a Superdraw on Christmas Eve, Working Paper.
- PAPPADA, F. and ZYLBERBERG, Y. (2015). Austerity plans and tax evasion: theory and evidence from Greece. Banque de France Working Paper.
- PONIATOWSKI, G., BONCH-OSMOLOVSKIY, M. and ĀMIETANKA, A. (2021). VAT gap in the EU : report 2021, Directorate General Taxation and Customs Union, European Commission.
- SILVA, J. M. C. S. and TENREYRO, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, **88** (4), 641–658.
- TØRSLØV, T., WIER, L. and ZUCMAN, G. (2023). The missing profits of nations. *The Review of Economic Studies*, **90** (3), 1499–1534.
- VASARDANI, M. (2011). Tax evasion in Greece: an overview. *Bank of Greece Economic Bulletin*, (35).
- ZUCMAN, G. (2019). Global wealth inequality. *Annual Review of Economics*, **11**, 109–138.

A Appendix: Figures and Tables

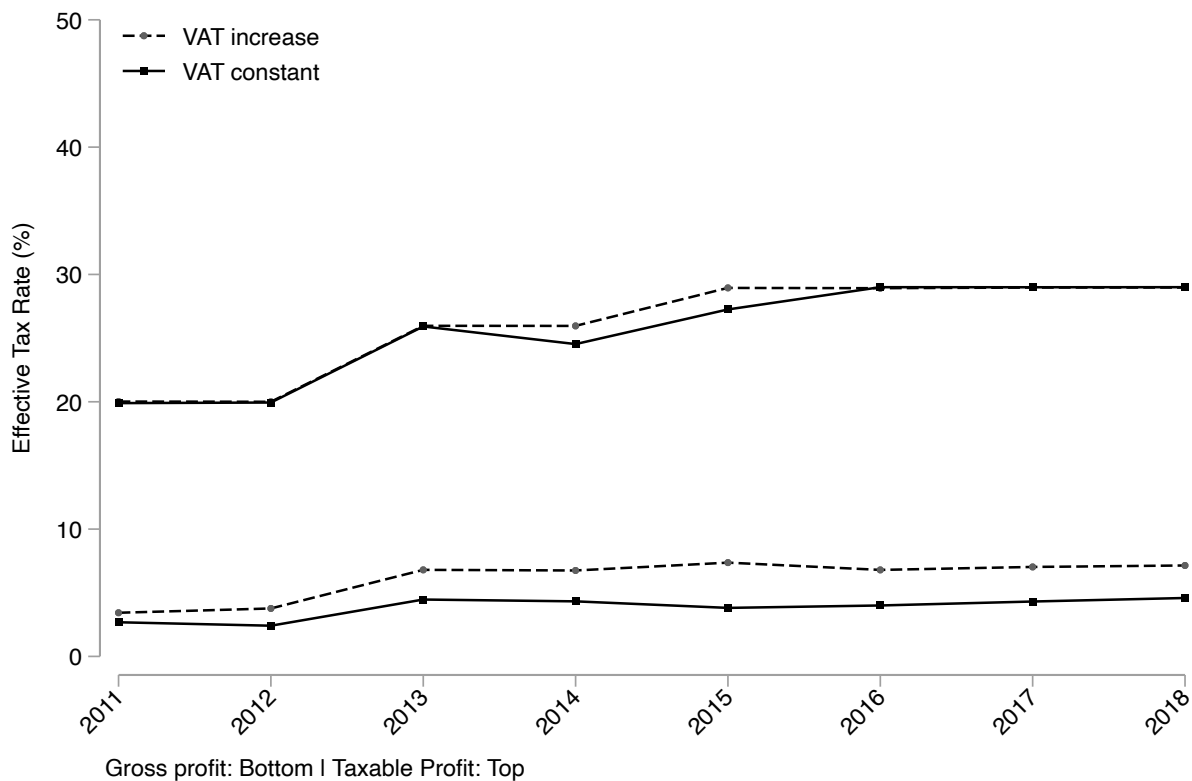
A.1 Figures

Fig. A.1 Distribution of Revenues



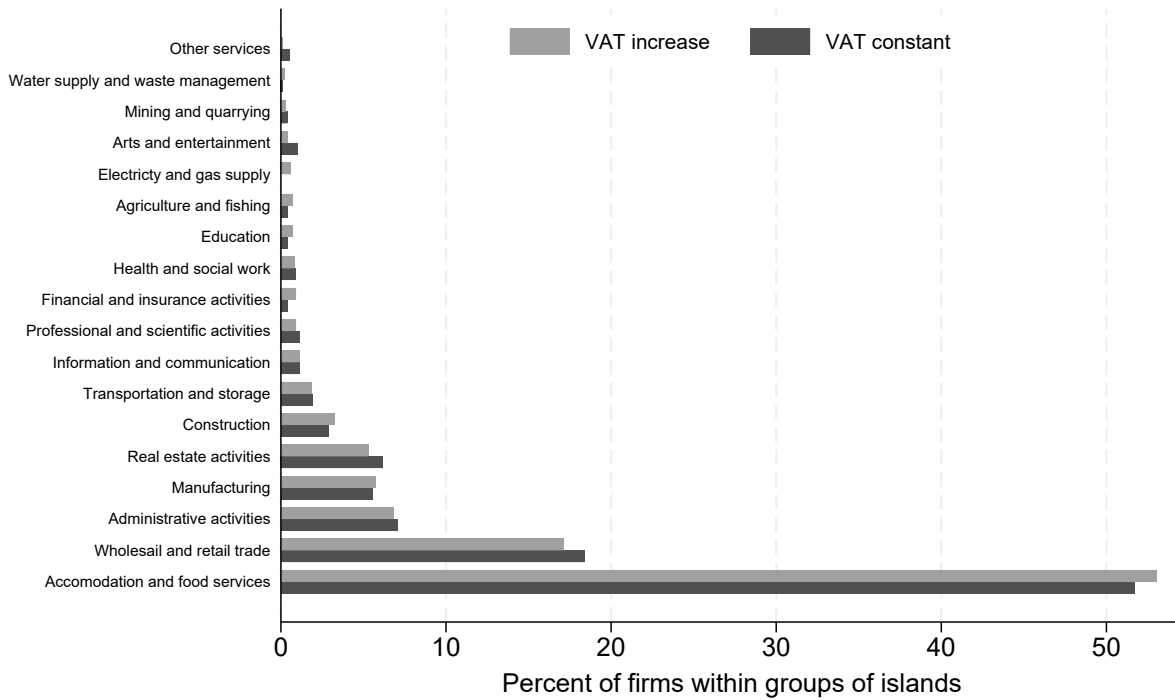
Notes: This figure plots distributions of revenues. Logarithmic form is used to ease depiction of long right-hand tails. Corporations in VAT-increase islands are shown in dark grey and corporations in VAT-constant islands in white. Note that the distribution is bi-modal. A large number of firms declare 0 or very low revenues, whilst the rest declare larger amounts.

Fig. A.2 Effective Tax Rates



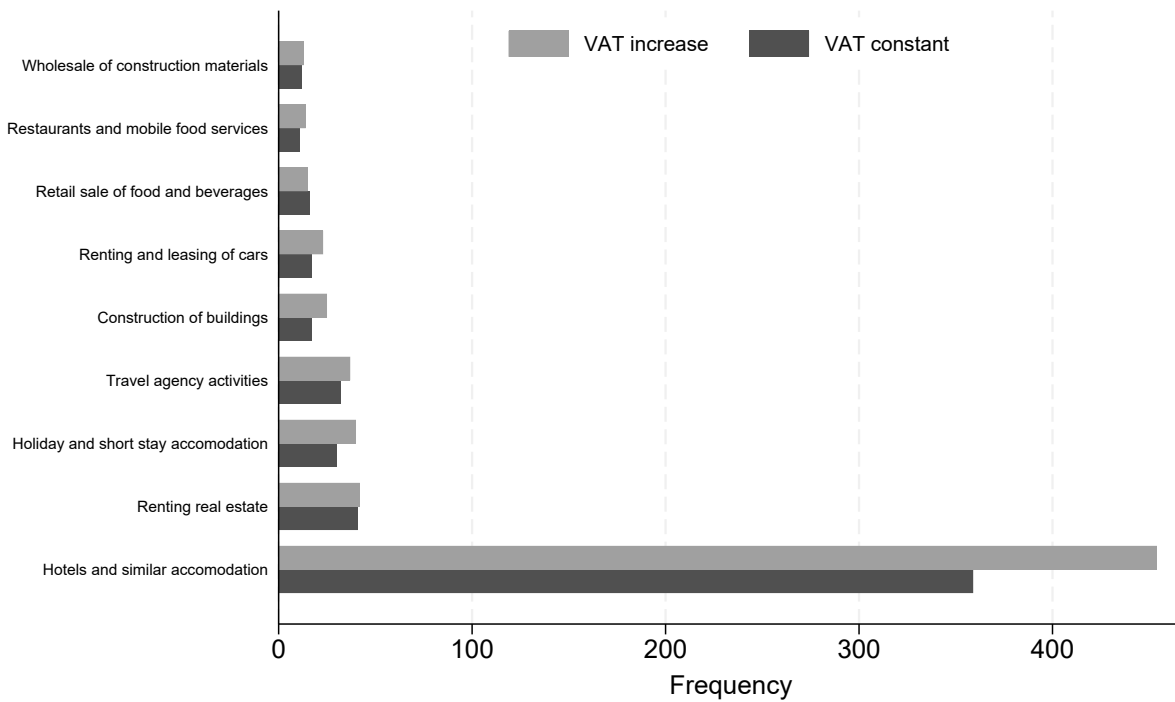
Notes: This figure displays the effective tax rates in both the VAT-increase islands (dashed line) and the VAT-constant islands (solid line). The lines at the upper part correspond to the amount of taxes paid as a percentage of the taxable profits. They reflect the evolution of the statutory corporate income tax rate from 20% to 29%. The lines at the lower part correspond to the amount of taxes paid as a percentage of the gross profits. The attributable tax is particularly low, between 4% and 8%, for both groups of islands.

Fig. A.3 Corporate Type of Activity



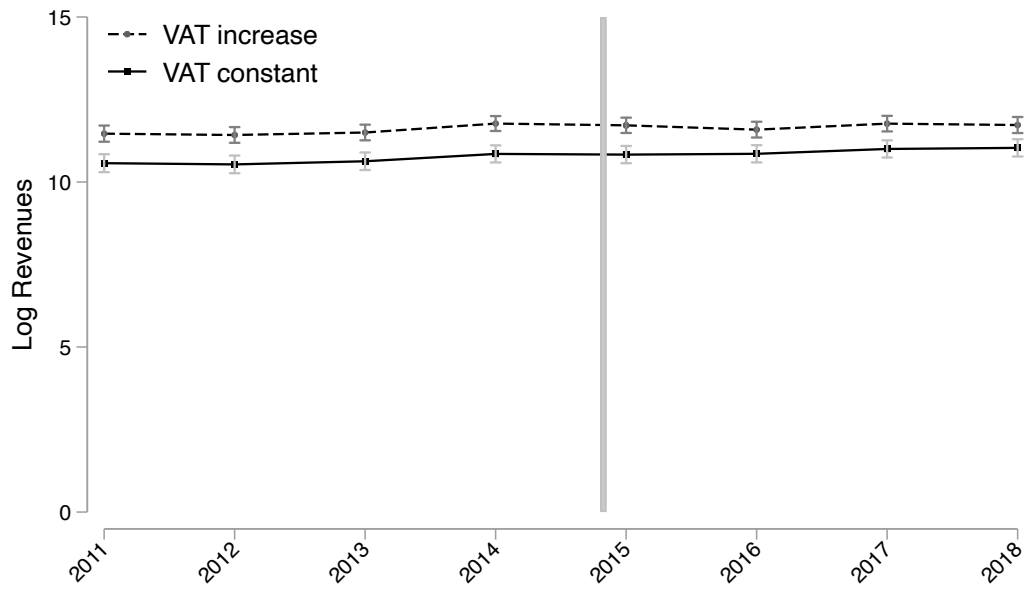
Notes: This figure displays the distribution of corporations by activity percentage, according to the Nace Rev. 2 classification, in both groups of islands. It can be read as follows: in the VAT increase islands, 53% of corporations fall under the category of Accommodation and food services.

Fig. A.4 Top 9 Activities



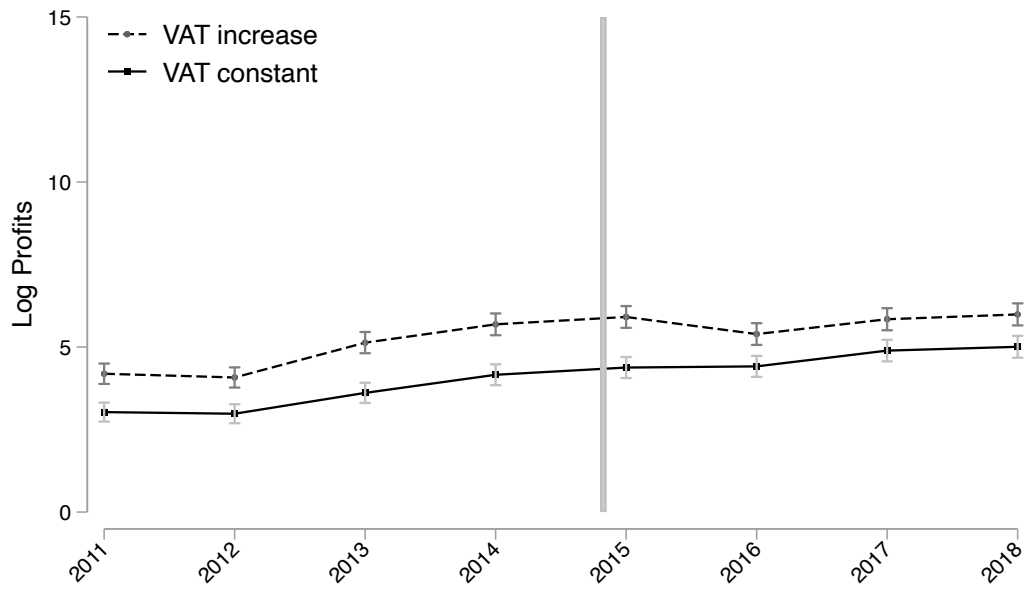
Notes: This figure displays the frequency of corporations by activity, within both groups of islands, using the Nace Rev. 4 classification. It can be read as follows: in the VAT increase islands, 454 corporations are categorized as Hotels and similar accommodations. For illustration purposes the top 9 activities are displayed.

Fig. A.5 Revenue Trends (Unconditional)



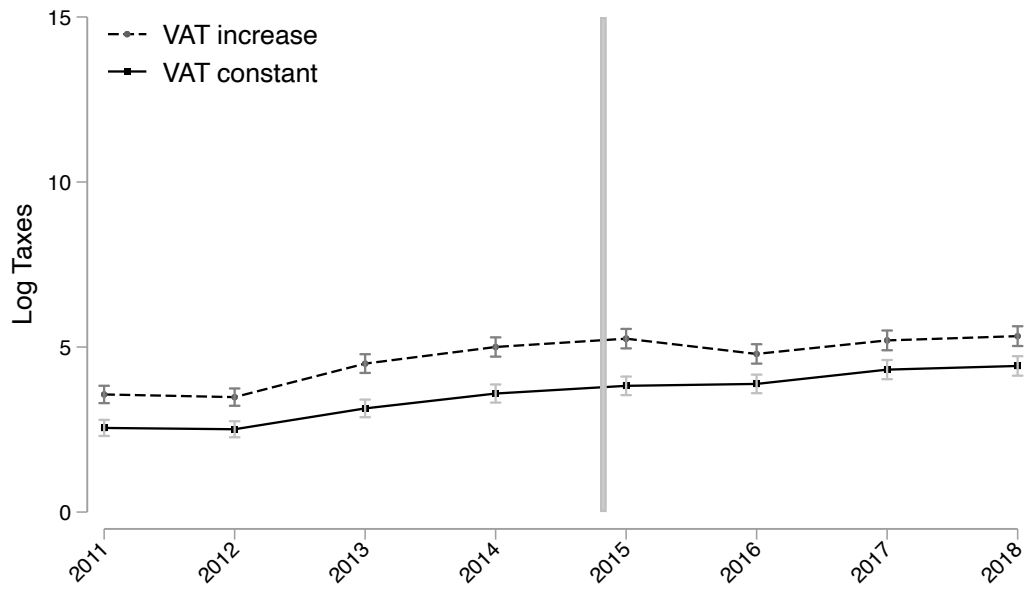
Notes: This figure displays parallel trends in unconditional mean differences of revenues between VAT increase and VAT constant islands. Parallel trends hold before the 2015 VAT increase, marked on the graph by the grey line. Log revenues are plotted. We account for zero revenues by adding the value of 1 before taking the logarithmic value.

Fig. A.6 Profit Trends (Unconditional)



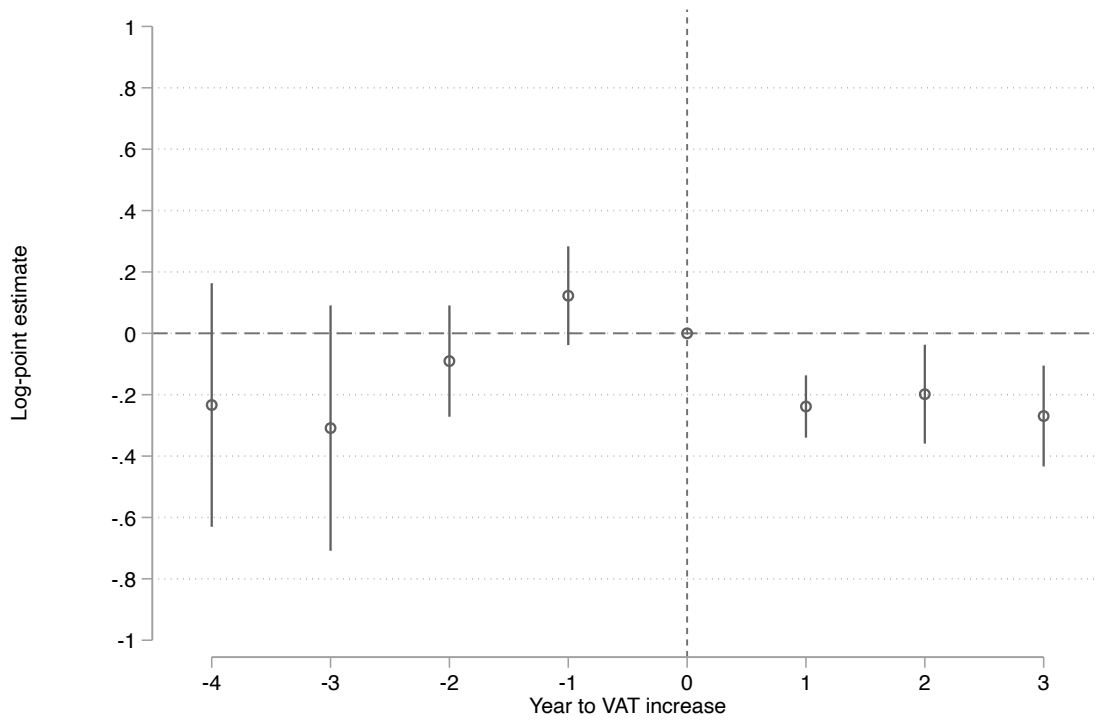
Notes: This figure displays parallel trends in unconditional mean differences of profits between VAT increase and VAT constant islands. Parallel trends hold before the 2015 VAT increase, marked on the graph by the grey line. Log revenues are plotted. We account for zero revenues by adding the value of 1 before taking the logarithmic value.

Fig. A.7 Corporate Income Tax Trends (Unconditional)



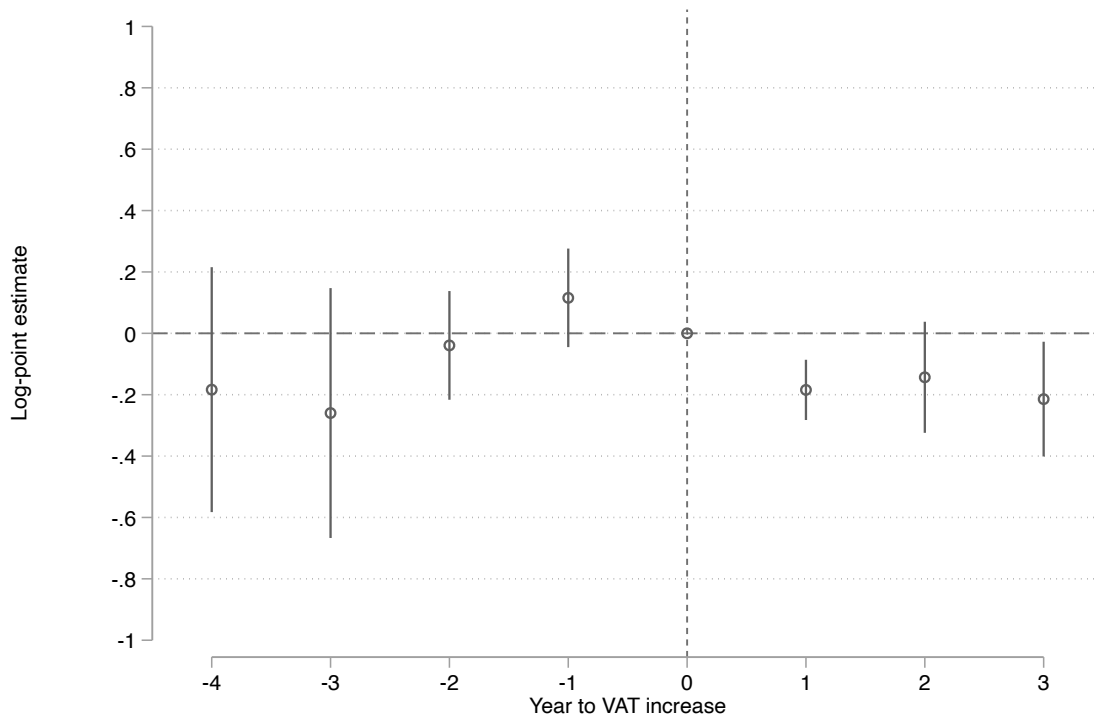
Notes: This figure displays parallel trends in unconditional mean differences of corporate income taxes between VAT increase and VAT constant islands. Parallel trends hold before the 2015 VAT increase, marked on the graph by the grey line. Log revenues are plotted. We account for zero revenues by adding the value of 1 before taking the logarithmic value.

Fig. A.8 Effect on Corporate Income Taxes (without time-varying effects)



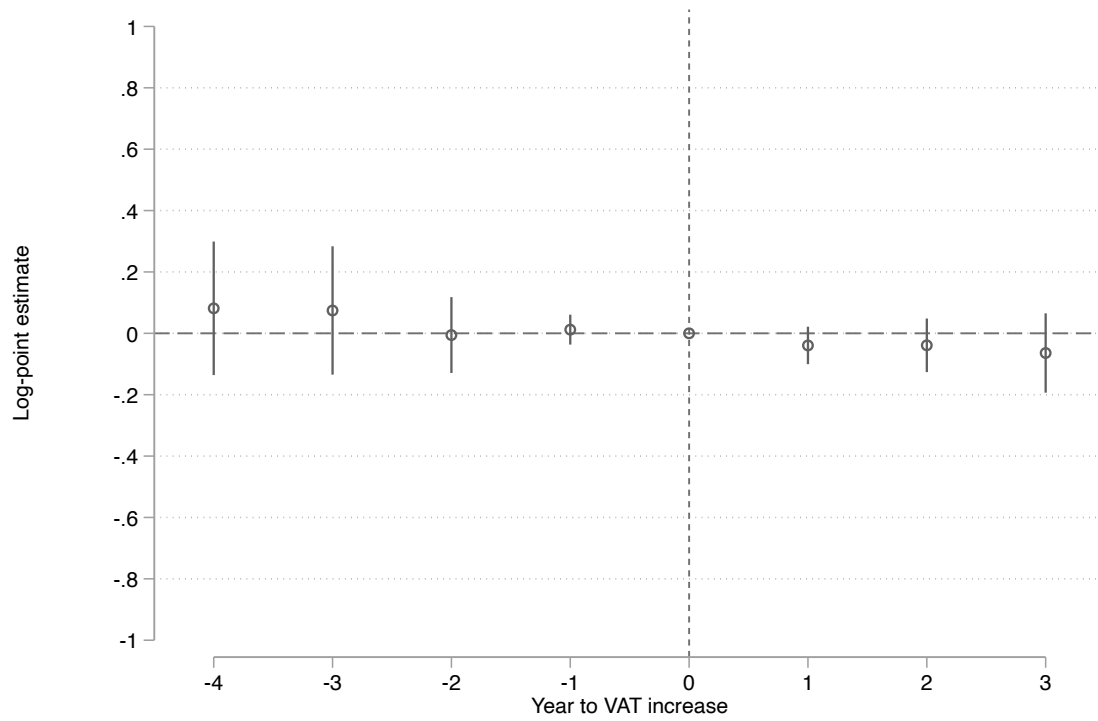
Notes: The figure present an event study from the regression results of Column (1) in Table A.2. In this regression time-varying controls are not included. Point-estimates illustrate annual differentials in corporate income taxes between corporations in VAT increase island and corporations in VAT constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. A.9 Effect on Profits (without time-varying effects)



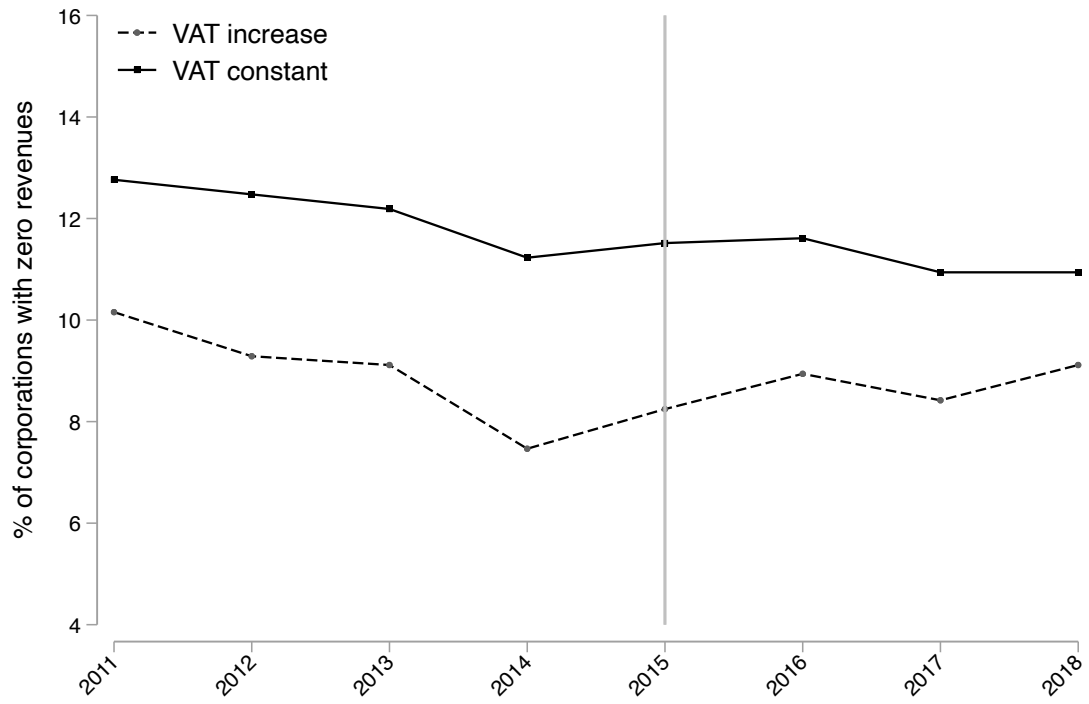
Notes: The figure present an event study from the regression results of Column (1) in Table A.2. In this regression time-varying controls are not included. Point-estimates illustrate annual differentials in declared profits between corporations in VAT increase island and corporations in VAT constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. A.10 Effect on Revenues (without time-varying effects)



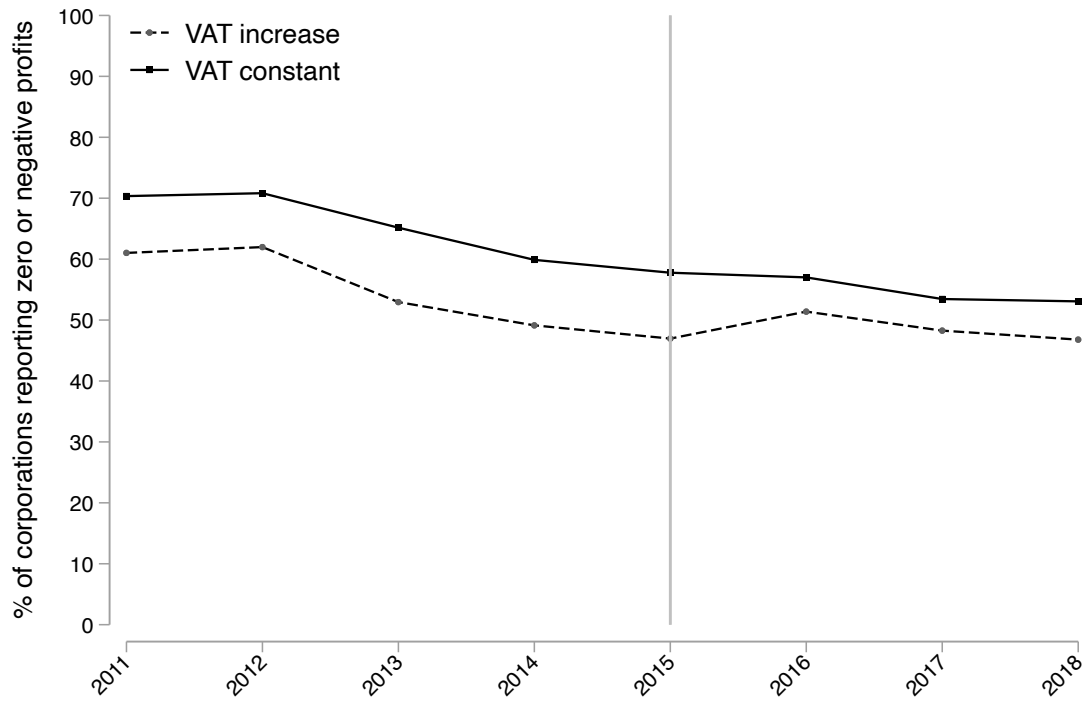
Notes: The figure present an event study from the regression results of Column (1) in Table A.2. In this regression time-varying controls are not included. Point-estimates illustrate annual differentials in gross revenue between corporations in VAT increase island and corporations in VAT constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. A.11 Corporations with Zero Revenue



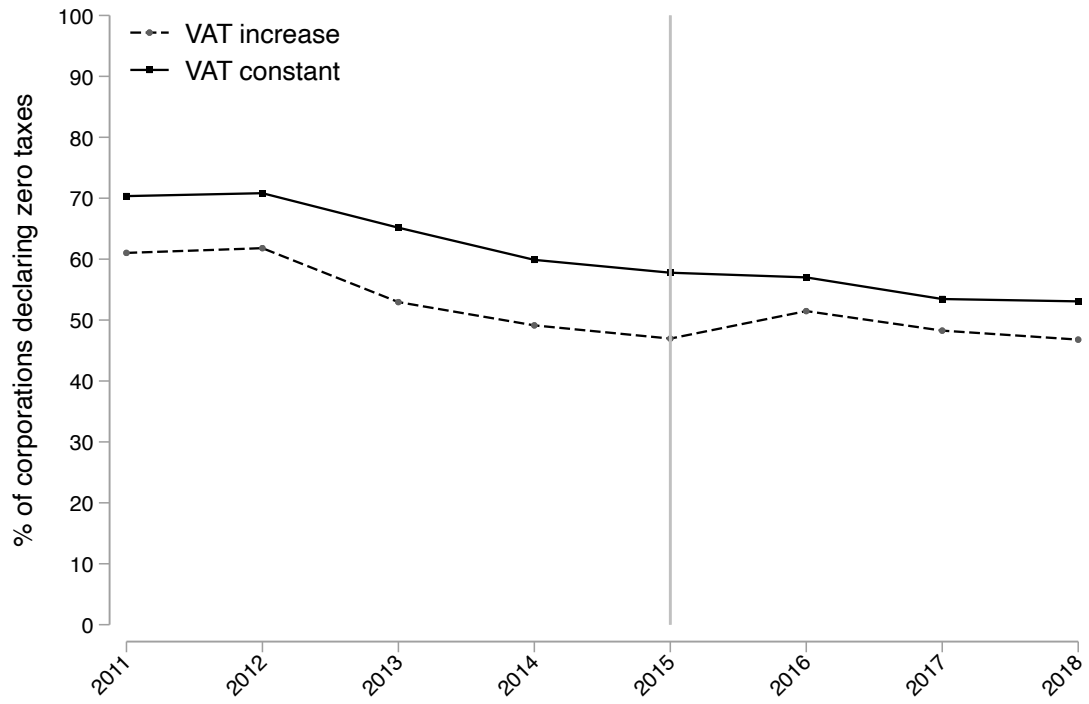
Notes: This figure presents the share of corporations declaring zero revenue in the VAT-increase islands (dashed line) and the VAT-constant islands (solid line).

Fig. A.12 Corporations with Non-Positive Profits



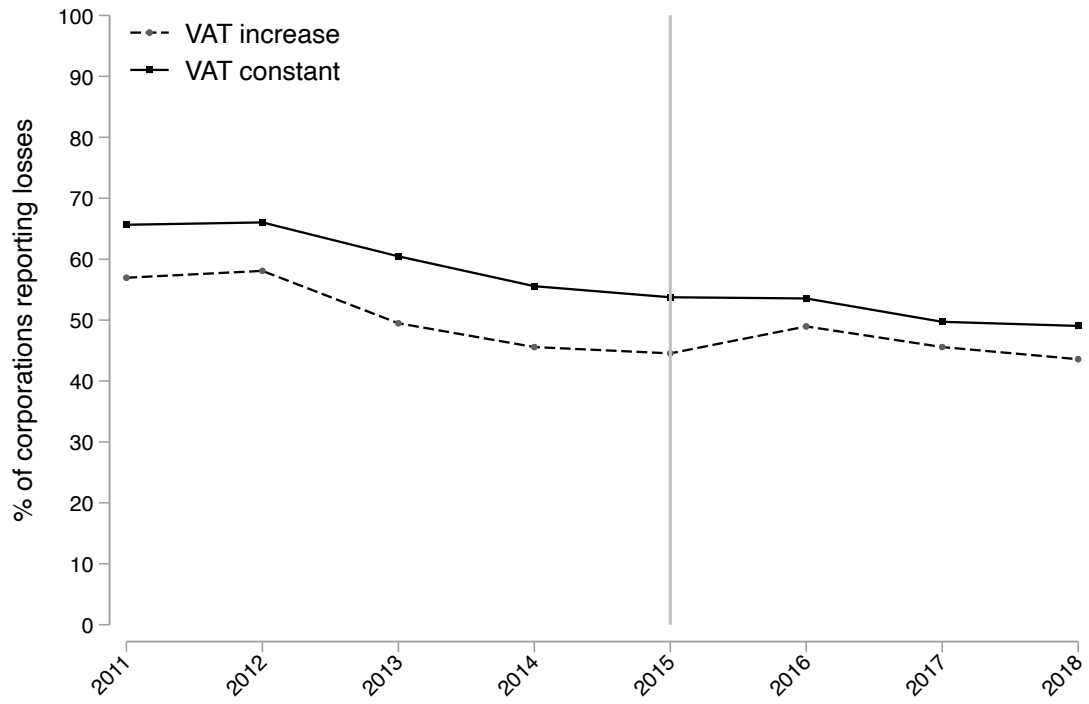
Notes: This figure presents the share of corporations declaring zero profit or losses in the VAT-increase islands (dashed line) and the VAT-constant islands (solid line).

Fig. A.13 Corporations with Zero Taxes



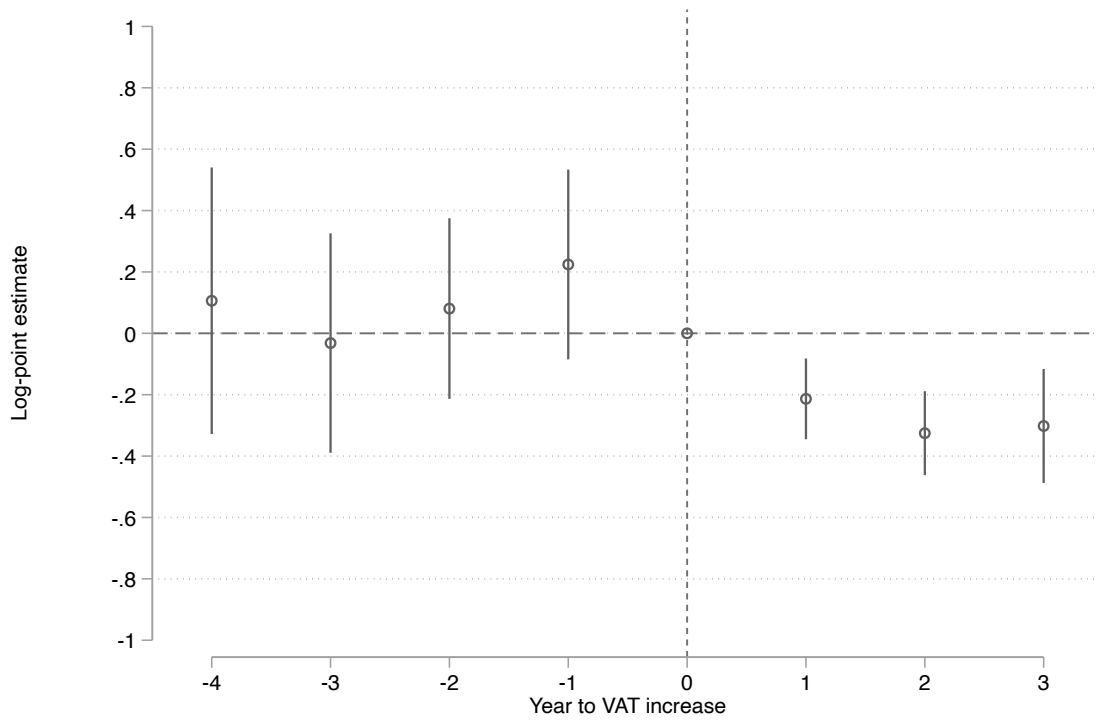
Notes: This figure presents the share of corporations declaring zero corporate income tax in the VAT-increase islands (dashed line) and the VAT-constant islands (solid line).

Fig. A.14 Corporations with Losses



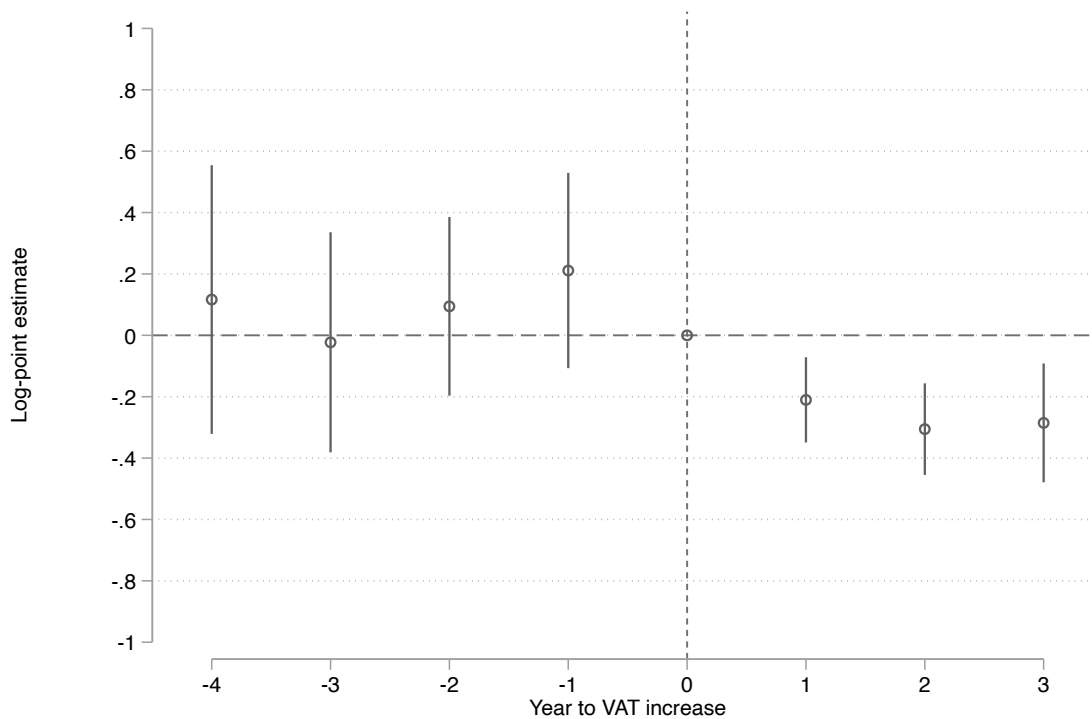
Notes: This figure presents the share of corporations declaring losses in the VAT-increase islands (dashed line) and the VAT-constant islands (solid line).

Fig. A.15 Effect on Corporate Income Taxes (Tourism Industry)



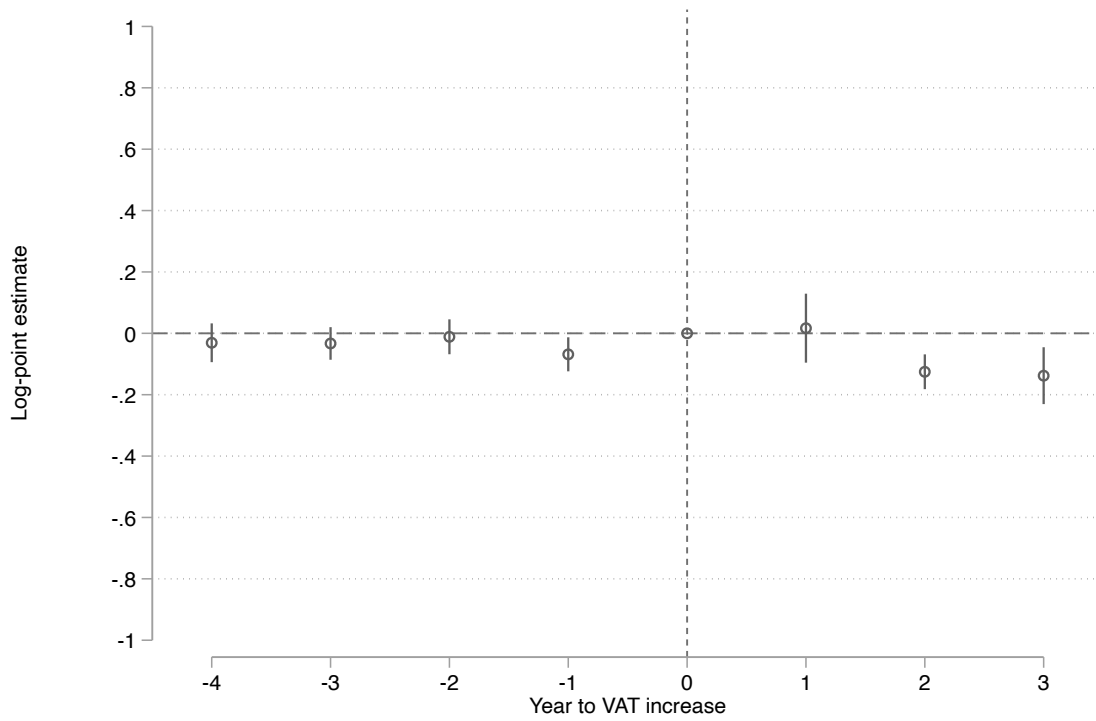
Notes: The figure present an event study from the regression results of Column (2) in Table A.5. These illustrate annual differentials in corporate income taxes between corporations in tourism-related activity in VAT increase island and corporations in tourism-related activity in VAT constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. A.16 Effect on Profits (Tourism Industry)



Notes: The figure present an event study from the regression results of Column (2) in Table A.5. These illustrate annual differentials in declared profits between corporations in tourism-related activity in VAT increase island and corporations in tourism-related activity in VAT constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

Fig. A.17 Effect on Revenues (Tourism Industry)



Notes: The figure present an event study from the regression results of Column (2) in Table A.5. These illustrate annual differentials in gross revenue between corporations in tourism-related activity in VAT increase island and corporations in tourism-related activity in VAT constant islands. Time 0 is 2015; the year of VAT increase. Confidence intervals are at the 99% level.

A.2 Tables

Table A.1 Summary Statistics

	VAT Constant Islands				VAT Increase Islands			
	Gross Revenues	Taxable Profits	Losses	CIT	Gross Revenues	Taxable Profits	Losses	CIT
Mean	971,780	74,441	114,697	21,588	1,726,187	166,564	182,837	48,213
Median	192,022	0	0	0	370,420	3,189	0	924
Sample	1,042	1,042	1,042	1,042	1,152	1,152	1,152	1,152

Notes: The table presents summary statistics for the two groups of corporations that form our treatment and control. The first four columns correspond to statistics for the VAT-constant group of islands and the the last 4 for the VAT-increase islands. Overall we observe a similar number of corporations. Those in VAT-increase islands are more profitable and register more revenue every year. CIT remains particularly low for the two samples when compared to their gross revenues.

Table A.2 Difference-in-Difference Estimates (PPML regression, without controls)

	(1)	(2)	(3)
	Corporate Income Tax	Gross Revenues	Declared Profits
2011 \times VAT \uparrow	-0.2336 (0.2024)	0.0814 (0.1110)	-0.1835 (0.2036)
2012 \times VAT \uparrow	-0.3089 (0.2039)	0.0744 (0.1067)	-0.2598 (0.2077)
2013 \times VAT \uparrow	-0.0905 (0.0925)	-0.0057 (0.0631)	-0.0394 (0.0903)
2014 \times VAT \uparrow	0.1225 (0.0821)	0.0120 (0.0248)	0.1156 (0.0819)
2016 \times VAT \uparrow	-0.2385*** (0.0518)	-0.0395 (0.0312)	-0.1844*** (0.0501)
2017 \times VAT \uparrow	-0.1983** (0.0822)	-0.0391 (0.0445)	-0.1433 (0.0923)
2018 \times VAT \uparrow	-0.2695*** (0.0838)	-0.0642 (0.0660)	-0.2144** (0.0954)
Corporate t-varying controls	No	No	No
Island t-varying controls	No	No	No
Corporation-Postcode FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of Observations	17552	17552	17552
Number of Postcodes	49	49	49
Ps. R-squared	0.89	0.97	0.88

Notes: The table presents estimates from Regression 1. Year \times VAT \uparrow interactions correspond to changes in the VAT-increase islands versus the VAT-constant islands. Time-varying effects are not included. All regressions include corporation, postcode and year fixed effects. Robust standard errors clustered at the postcode level are used. The samples include 1,042 corporations from VAT-constant islands and 1,152 from the VAT-increase islands. Columns (1), (2) and (3) present point estimates of yearly differences in corporate income taxes, gross revenue and declared profits respectively. A pseudo-Poisson maximum likelihood estimator is fitted on absolute values of the independent variables.

Table A.3 Difference-in-Difference Estimates (PPML Regression, controlling for zero declarations)

	(1) Corporate Income Tax	(2) Gross Revenues	(3) Declared Profits
2011 × VAT ↑	-0.0949 (0.2083)	0.1093 (0.0795)	-0.0524 (0.2095)
2012 × VAT ↑	-0.1254 (0.2065)	0.1156 (0.0818)	-0.0857 (0.2103)
2013 × VAT ↑	0.0043 (0.0902)	0.0112 (0.0490)	0.0513 (0.0915)
2014 × VAT ↑	0.1315 (0.0933)	-0.0183 (0.0325)	0.1154 (0.0957)
2016 × VAT ↑	-0.1586** (0.0670)	-0.0273 (0.0612)	-0.1166* (0.0630)
2017 × VAT ↑	-0.2860*** (0.0658)	-0.0956* (0.0492)	-0.2393*** (0.0863)
2018 × VAT ↑	-0.2838*** (0.0819)	-0.1567*** (0.0504)	-0.2425*** (0.0896)
Log cash	0.0519*** (0.0064)	0.0328*** (0.0097)	0.0518*** (0.0065)
Log dividends	0.0382*** (0.0076)	0.0011 (0.0013)	0.0377*** (0.0075)
Log net fixed assets	0.0245 (0.0470)	0.1617*** (0.0292)	0.0281 (0.0474)
Log accommodation nights	0.6576* (0.3939)	0.9164*** (0.2674)	0.6557 (0.4730)
Annual hotel capacity	-0.0139** (0.0069)	-0.0120*** (0.0035)	-0.0135 (0.0083)
Declaring 0 profit after 2015	-1.5283*** (0.1359)	-0.1263* (0.0661)	-1.5871*** (0.1420)
Declaring 0 profit after 2015 × VAT ↑	0.3479 (0.3596)	0.1122 (0.0752)	0.3718 (0.3808)
Corporate t-varying controls	Yes	Yes	Yes
Island t-varying controls	Yes	Yes	Yes
Corporation-Postcode FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of Observations	12798	12798	12798
Number of Postcodes	46	46	46
Ps. R-squared	0.90	0.97	0.89

Notes: The table presents estimates from Regression 1. Year × VAT ↑ interactions correspond to changes in the VAT-increase islands versus the VAT-constant islands. All regressions include corporation, postcode and year fixed effects. Robust standard errors clustered at the postcode level are used. The samples include 1,042 corporations from VAT constant islands and 1,152 from the VAT increase islands. Columns (1), (2) and (3) present point estimates of yearly differences in corporate income taxes, gross revenue and declared profits respectively. A pseudo-Poisson maximum likelihood estimator is fitted on absolute values of the independent variables. Cash, dividends and net fixed assets are corporate time-varying controls. Island time-varying controls are accommodation nights and annual hotel capacity. The former includes official statistics on the absolute number of accommodation nights booked per island and, the latter the percentage of hotel rooms that remained occupied per island per year. The variable "Declaring 0 after 2015" is a binary variable indicating corporations with positive profits before the VAT changes and non-zero profits for all the years after the VAT change.

Table A.4 Difference-in-Difference Estimates (PPML regression, tourism industry only)

	(1) Corporate Income Tax	(2) Gross Revenues	(3) Declared Profits
2011 × VAT ↑	-0.0604 (0.1783)	-0.0506 (0.0512)	-0.0302 (0.1716)
2012 × VAT ↑	-0.2007 (0.1476)	-0.0492 (0.0494)	-0.1715 (0.1381)
2013 × VAT ↑	-0.0252 (0.1239)	-0.0123 (0.0487)	0.0045 (0.1140)
2014 × VAT ↑	0.1791 (0.1212)	-0.0220 (0.0244)	0.1706 (0.1212)
2016 × VAT ↑	-0.2484*** (0.0517)	-0.0023 (0.0296)	-0.2166*** (0.0560)
2017 × VAT ↑	-0.2502** (0.1069)	-0.0670 (0.0478)	-0.2184** (0.1114)
2018 × VAT ↑	-0.2979*** (0.0982)	-0.0867 (0.0703)	-0.2661*** (0.1030)
Corporate t-varying controls	No	No	No
Island t-varying controls	No	No	No
Corporation-Postcode FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of Observations	11296	11296	11296
Number of Postcodes	46	46	46
Ps. R-squared	0.90	0.96	0.89

Notes: The table presents estimates from Regression 1, focusing only on the tourism industry. Year × VAT ↑ interactions correspond to changes in the VAT increase islands versus the VAT constant islands. Time-varying effects are not included. All regressions include corporation, postcode and year fixed effects. Robust standard errors clustered at the postcode level are used. Columns (1), (2) and (3) present point estimates of yearly differences in corporate income taxes, gross revenue and declared profits respectively. A pseudo-Poisson maximum likelihood estimator is fitted on absolute values of the independent variables.

Table A.5 Difference-in-Difference Estimates (PPML, tourism industry, time-varying controls)

	(1) Corporate Income Tax	(2) Gross Revenues	(3) Declared Profits
2011 × VAT ↑	0.1061 (0.2216)	-0.0308 (0.0322)	0.1166 (0.2233)
2012 × VAT ↑	-0.0317 (0.1824)	-0.0330 (0.0271)	-0.0228 (0.1830)
2013 × VAT ↑	0.0805 (0.1501)	-0.0113 (0.0290)	0.0944 (0.1485)
2014 × VAT ↑	0.2243 (0.1577)	-0.0685** (0.0283)	0.2111 (0.1623)
2016 × VAT ↑	-0.2136*** (0.0671)	0.0167 (0.0574)	-0.2104*** (0.0709)
2017 × VAT ↑	-0.3254*** (0.0698)	-0.1253*** (0.0289)	-0.3057*** (0.0761)
2018 × VAT ↑	-0.3019*** (0.0948)	-0.1380*** (0.0473)	-0.2854*** (0.0987)
Log Cash	0.0494*** (0.0093)	0.0137*** (0.0031)	0.0490*** (0.0102)
Log Dividends	0.0382*** (0.0086)	0.0046** (0.0021)	0.0386*** (0.0087)
Log net fixed assets	0.0239 (0.0661)	0.1984*** (0.0494)	0.0322 (0.0642)
Log accommodation nights	0.0725 (0.3592)	0.7538*** (0.0991)	-0.0085 (0.4180)
Annual hotel capacity	-0.0042 (0.0076)	-0.0116*** (0.0019)	-0.0025 (0.0085)
Corporate t-varying controls	Yes	Yes	Yes
Island t-varying controls	Yes	Yes	Yes
Corporation-Postcode FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of Observations	8418	8418	8418
Number of Postcodes	45	45	45
Ps. R-squared	0.90	0.97	0.89

Notes: The table presents estimates from Regression 1 focusing only in the tourism industry. Year × VAT ↑ interactions correspond to changes in the VAT increase islands versus the VAT constant islands. All regressions include corporation, postcode and year fixed effects. Robust standard errors clustered at the postcode level are used. Columns (1), (2) and (3) present point estimates of yearly differences in corporate income taxes, gross revenue and declared profits respectively. A pseudo-Poisson maximum likelihood estimator is fitted on absolute values of the independent variables. Cash, dividends and net fixed assets are corporate time-varying controls. Island time-varying controls are accommodation nights and annual hotel capacity. The former includes official statistics on the absolute number of accommodation nights booked per island and, the latter the percentage of hotel rooms that remained occupied during per island per year.

B Economic History of Place-based VAT Rates in Greece

Place-based VAT rates trace their origin in historical shifts during the 20th century. In the Italo-Turkish War of 1911, the Dodecanese (previously belonging to the Ottoman Empire) were captured and occupied by Italian forces.¹³ They stayed unofficially under Italian administration until all claims were formally renounced by Turkey in 1923 with the Treaty of Lausanne. The islands were eventually set in their current status under Greek administration with the Peace Treaty of Paris in 1947.

The changes in the Dodecanese status coincided with the first attempt to introduce the VAT system in Greece. The first form of VAT was introduced in 1937 and lasted until 1986.¹⁴ Since the Dodecanese were until 1947 under Italian administration, the law was not implemented in their territory. The exception of these islands from VAT continued to apply after they were integrated in Greece and for the next 40 years, when the VAT law was reformed.

Greece joined the European Economic Community in 1981 and a new VAT law was required to align the outdated system with new European Economic Community (EEC) requirements. The EEC adopted the French version of VAT system in 1967 and, in order to establish a common market, it focused on harmonisation of VAT between countries.¹⁵ The importance of harmonisation for the creation of a single market can be seen in European Commission and Member State negotiations at the time (de La Feria, 2009). Certainly, excluding entire geographical areas was not in line with the single market objective. Yet, significant political pressure was exerted from these islands since they were never part of the VAT system. The new law that established a modern VAT in 1987 contained a compromise for a reduced rate at "30% lower rate than the mainland's rate".¹⁶

Subsequent laws extended the preferential VAT rate to other islands in the Aegean. In 1990, the reduced rates were applied in east Aegean islands and in 1992, in Cyclades and North Aegean islands.¹⁷ The lower rate stayed in place until Greece run into financial trouble from 2009 to 2018. Seeking economic assistance from the International Monetary Fund and European partners, the islands' VAT status was brought on the negotiating table, especially since it was hard to argue in favour of a reduced VAT rate in islands that were economically richer than the mainland and were booming in tourist revenue even during the crisis years.

During the negotiations, the Greek side attempted to delay the repeal of the preferential regime. Implementation in all islands would have meant loss of political capital in a period of significant political instability where the balance of political power was hanging by a thread.¹⁸ The Greek side's argument was reinforced by the 2015 European migrant crisis where over 1 million refugees and migrants crossed the Mediterranean from Turkey to the nearby Greek islands of Chios, Kos, Lesbos and Leros. Negotiations yielded the maintenance of the lower VAT rate in some islands overlooking Turkey, which stayed always at

¹³Dodecanese are an island group in the southeastern Aegean Sea. They comprise of 15 main islands Agathonisi, Astypalaia, Chalki, Kalymnos, Karpathos, Kasos, Leipsoi, Leros, Nisyros, Symi, Tilos and Kastellorizo.

¹⁴It was implemented under the dictatorship of Ioannis Metaxas with Compulsory Law 660/1-5-1937.

¹⁵The first Council Directive 67/227/EEC and second Council Directive 67/228/EEC entered into force in 11 April 1967 to harmonise legislation of Member States. In May 1977, the sixth Council Directive 77/388/EEC was agreed, which created a common VAT system with a uniform basis.

¹⁶See L.1676/1986 for application of VAT from 1st of January 1987.

¹⁷See Laws L.1181/1990 and L.2093/1992.

¹⁸Indicative of the political instability is the fact that the Greek government was dissolved and formed 8 times from 2009 to 2015.

the preferential rate ever since, whilst the economically-rich islands of the Cyclades were aligned with the higher rate that applied in the mainland on 1st October 2015.¹⁹

Place-based VAT rates were renegotiated and included in an EU Directive following the COVID pandemic. New VAT rules allowed place-based VAT rates for some countries and were explicitly contained in an EU Council Directive in 2022.²⁰ As can be seen in Figure B.1, the VAT exemption in the new Directive includes the islands of the Aegean sea at a rate of up to 30% lower than the mainland's rate; an almost identical provision as the one which existed before the VAT change in 2015. In addition, Austria and Portugal negotiated their own exemptions. The EU Directive does not necessarily mean that the new place-based rates apply on the day it enters into force. But rather, it allows countries to apply different rates without contravening EU law. In Greece, the provision that allows lower place-based VAT rates, which existed in the Greek islands before 2015, has not been enacted in national law to this day.

Fig. B.1 Place-based VAT in EU Council Directive 2022/542

(13) Article 104 is replaced by the following:

'Article 104

1. Austria may, in the communes of Jungholz and Mittelberg (Kleines Walsertal), apply a second standard rate which is lower than the corresponding rate applied in the rest of Austria but not less than 15 %.
2. Greece may apply rates up to 30 % lower than the corresponding rates applied in mainland Greece in the departments of Lesbos, Chios, Samos, the Dodecanese and the Cyclades, and on the islands of Thassos, the Northern Sporades, Samothrace and Skiros.
3. Portugal may, in the case of transactions carried out in the autonomous regions of the Azores and Madeira and of direct importation into those regions, apply rates lower than those applicable on the mainland.
4. Portugal may apply one of the two reduced rates provided for in Article 98(1) to the tolls on bridges in the Lisbon area.';

Notes: This figure shows an extract from EU Council Directive 2022/542. The specific article was introduced in 2022 and allows for Austria, Greece and Portugal to operate place-based VAT regimes.

¹⁹The reform was voted in the Greek Parliament on the 14th of August with Omnibus Law L.4336/2015. This law contained all the measures of the 3rd Economic Adjustment Programme of Greece with the European Stability Mechanism.

²⁰Council Directive (EU) 2022/542 of 5 April 2022. More information can be found in <http://data.europa.eu/eli/dir/2022/542/oj>.