A micro-level analysis of corporate income taxation in Portugal

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Abstract
This article analyses corporate income taxation in Portugal. It provides an encompassing description of the Portuguese corporate income tax system. In addition, firm-level effective tax rates (ETR) are computed using a micro database, and their relation with several firms' characteristics is examined in the period 2010-2019. In terms of results, Portugal stands out as one of the countries with higher top statutory tax rates amongst OECD countries. Although the general rate was cut over time, progressivity increased substantially and collection is very concentrated on a small number of large firms. Regression estimates suggest the existence of non-linear relations between firms' effective taxation and their size and productivity, and negative associations between ETR and both financial leverage and capital intensity. (JEL: H25, H26, L25)

1. Introduction

In the last decades the increasing digitalisation of the economy and the wide-ranging effects of globalisation have been posing challenges to corporate income tax systems worldwide. Typically, corporate tax receipts are not the main source of government's revenue and their underlying tax base is extremely sensitive to legal conditions in jurisdictions all over the world.[1] Indeed, firms frequently engage in tax planning strategies by exploiting gaps and mismatches in legislation to reduce their tax burden, often implying shifting profits to low tax locations. The resulting increase in tax competition between countries has led to a general declining trend of corporate

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1. According to the classical theory of optimal taxation, capital income taxation is undesirable because it becomes very distortive over long time horizons. Equity and efficiency arguments may, however, justify taxing capital income. In the case of the corporate income tax, the major constraint is the possibility for firms to relocate their activities abroad but practical arguments may favour its existence (like complementing personal income taxation, as difficulties subsist in taxing all types of household's income, and making less attractive to shift income between the two taxes). For a recent survey on how capital should be taxed, see Bastani and Waldenström (2020).

tax rates and to the establishment of preferential regimes at the national level. With regard to international taxation, efforts to protect corporate income tax bases against profit shifting and to promote coordination on tax collection have been implemented. In this context, a deep understanding of the design and functioning of corporate tax systems is of utmost importance to assess the different policy options on the table.

Tax research has a multidisciplinary nature, often analysing relevant questions from the viewpoint of accounting and corporate finances, law and/or economics. As a result, the empirical literature on corporate taxation is very diverse. In terms of data, this field of research either relies on macroeconomic aggregates or is based on micro databases, which allow for a more detailed analysis.

Corporate tax systems are typically complex and subject to numerous modifications over time. Besides the structure of statutory rates, corporate tax rules usually encompass various other elements relevant for the calculation of a firm's tax burden, like benefits, incentives and deductions, with both domestic and international dimensions. Given this diversity, statutory rates do not perfectly reflect the tax burden of firms. An indicator of a firm's tax burden commonly used in the literature is the observed effective tax rate (ETR), defined as the ratio of income tax expenses to a metric of pre-tax income.

The aim of this article is to analyse corporate income taxation in Portugal. With recourse to a large and detailed micro database, it derives backward-looking ETRs for the period from 2010 to 2019. In addition to describing developments over the last decade, the article investigates the relation between effective income taxation and several firms' characteristics, like sector of activity, size, leverage, capital intensity and productivity. The main patterns and relations highlighted in an exploratory analysis are further examined with simple multivariate regressions. Results are put into context with legislation and the use of macro-based indicators, also from the perspective of an international comparison.

Presently, Portugal stands out as one of the countries with higher corporate income tax top statutory rate amongst OECD countries. Indeed, the international trend of reduction of statutory tax rates was not followed in the last decade. The general rate was cut substantially but its overall impact appears to have been offset by the introduction of a State surcharge in 2010, stepped up subsequently both in terms of reference rates and underlying progressivity. In the same period, total receipts as a ratio to GDP have remained broadly constant, as the collection is very concentrated on a low number of large non-financial firms. The average ETR in the sample, measured using earnings before taxes (EBT) as a proxy for taxable income, stood relatively stable at 25% since 2014. Even if some caution is warranted when comparing to statutory rates, this value stands well bellow the top statutory rate (31.5% in 2019) and slightly below an average statutory rate computed using as weights the EBT from the micro data.

Although evidence in the literature is not consensual, we find several statistically significant associations between firms' features and their ETRs, using earnings before interest, taxes, depreciation and amortisation (EBITDA) in the denominator. Estimates point to the existence of non-linear relations between firms' effective taxation and their size and productivity. The results also support the expected negative association between ETRs and financial leverage, given that interest expenses are deductible for tax

purposes while dividends are not. Moreover, capital intensity is negatively associated with ETR, confirming the hypothesis that the tax framework is favourable for firms that invest more in fixed assets. Finally, even if ETR levels differ by sector of activity, the signs and magnitudes of the estimated coefficients of firms' characteristics do not vary considerably. It is important to note, however, that these multivariate regressions have no intention to establish causality.

The article is organised as follows. Section 2 discusses some of the related literature that frames this study. Section 3 provides a general overview of corporate income taxation in Portugal, including an international comparison. Section 4 describes the database and the main variables used. A detailed descriptive analysis of the evolution of the effective income taxation of Portuguese firms is reported in Section 5. Section 6 complements the previous section by estimating some multivariate regressions. Section 7 concludes.

2. Related literature

The review of the vast literature on the several aspects of taxation is beyond the scope of this article. Instead, this section offers a non-exhaustive list of references that are related to this article and provide a framework for the analysis, with a particular focus on studies using firm-level data.

Corporate income taxation has been an important area of research over the last decades and a number of new methods and techniques have emerged in distinct areas of the literature. A first thoughtful review of the empirical tax research in the accounting literature until 2000 is presented by Shackelford and Shevlin (2001). Hanlon and Heitzman (2010) provide a valuable summary of more recent developments in the literature and an extended discussion of the various measures of tax avoidance. More recently, a survey of the literature on corporate tax planning over the previous decades is provided by Wilde and Wilson (2018), while Wang *et al.* (2020) synthesise the major findings of the research on tax avoidance from the accounting and finance literature. Beer *et al.* (2020) review the rapidly growing empirical research on international tax avoidance by multinational corporations. As defined in this literature, tax avoidance ranges from the reduction of the corporate tax burden by legitimate use of tax rules to, on the other extreme, violation of tax laws (tax evasion). Thus, aggressive corporate tax strategies do not necessarily indicate that the firm uses illegal procedures in tax reporting. The most common metric for tax avoidance is the observed ETR: firms that are more tax aggressive have lower ETRs.

There are several definitions of ETRs in the literature. In general, we can identify two broad types of firm-specific ETRs: forward-looking and backward-looking (see Nicodème (2001) for a detailed discussion of the pros and cons of these two concepts).

Forward-looking studies do not compute observed ETRs, but rely on theoretical features of the tax system to obtain implicit tax rates. These studies calculate the net present value of an hypothetical potential investment using specific sources of financing both in the presence and in the absence of taxes. The implicit taxation is derived from

this difference, under several calibrated assumptions. The method was formalised at the country-level by Devereux and Griffith (1998, 2003) and extended to firm-level data by Egger *et al.* (2009).

The approach of micro backward-looking ETRs, followed in this article, uses firms' financial statements to derive effective taxation, usually as ratios of tax expenses on other accounting items such as pre-tax profit or gross operating profit. These ETRs are central to the research on corporate taxation and, as mentioned above, regularly appear as a proxy for the tax burden of a firm. An advantage of this methodology is that it uses observed data, thus allowing all elements of taxation to be taken into account. A second advantage is that it facilitates studying effective taxation at sectoral level and for groups of firms, being useful to examine the relation between tax liabilities and firms' characteristics. It is, however, a backward looking measure of taxation as it is determined by past decisions of the firm, including tax planning. Hence, it cannot be used to assess firms' behavioural reactions.

There are several methodological contributions in the accounting literature on the details of the computation of observed ETRs from firms' financial statements (see Omer *et al.* (1991) or Plesko (2003) for reviews). Regardless of the specificities of the metrics, observed ETRs are incapable of isolating the effects of specific features of national tax systems. The measure is encompassing, capturing all forms of tax reduction relative to pre-tax income, whether through tax sheltering, location decisions, income shifting, tax preferences within the tax code, or changes in legislation (e.g., Dyreng *et al.* 2017).

Irrespective of the specific metric of a firm's tax burden, there is ample evidence in the literature of a relation between corporate income taxation and different firms' characteristics. Gupta and Newberry (1997) was one of the first studies on effective income taxation with longitudinal firm-level data. Most of the subsequent research follows the covariates identified therein. Firm attributes like size, financial debt and capital intensity are used in most studies but the results are not consensual, in particular concerning the relation between firms' size and effective taxation (a review of this literature can be found in Delgado *et al.* 2014).

Several studies investigate the relation between effective taxation and firm characteristics in European countries. For Romania, Lazăr (2014) finds that capital intensity and leverage negatively affect firms' ETRs, while firm size has no effect. Janssen (2005) concludes that ETRs do not differ much from statutory tax rates in the Netherlands, even if capital intensity is negatively associated with ETRs. Stamatopoulos *et al.* (2019) show that larger firms in Greece face higher ETRs than smaller ones and that firm's capital intensity is negatively associated with ETRs. For Germany, using a quantile regression approach, Delgado *et al.* (2018) find positive estimates for the relation between ETRs and firm size in the first quantiles and negative ones in the upper end of the distribution. The opposite result is found for leverage: the sign of the relationship goes from negative to positive. Nicodème (2002) computes firm-level ETRs for eleven European countries, the US, and Japan, and shows that tax burdens are more favourable for large firms and for specific sectors.

For a sample of Chinese listed firms, Hsieh (2012) detects a negative relation between firm size and effective taxation, but Liu and Cao (2007) find no significant effects

of firm size and capital intensity on ETRs, while the impact of leverage is negative and significant. For Australia, the results of Richardson and Lanis (2007) indicate that corporate ETRs are negatively associated with firm size, leverage and capital intensity. Using data for Ethiopia, Mascagni and Mengistu (2019) show that small firms face a higher effective tax burden than larger firms, while middle-sized firms face the lowest burden. They also find evidence of a negative relation between leverage and capital intensity and ETRs. Fernández-Rodríguez *et al.* (2021) study the determinants of ETRs in nine emerging countries and find that firm size and inventory intensity positively affect the ETR, while leverage and capital intensity have a negative effect. In a different vein, Bartolini (2018) uses firm-level data for six OECD countries from 1998 to 2014 and documents the existence of a tax burden gap alongside the productivity gap: firms at the productivity frontier enjoy lower effective taxation.

There are some studies on effective taxation using micro-level data for Portugal, mostly made as master's dissertations, but using relatively small databases (e.g., Costa *et al.* 2012, Bessa 2016, Praça 2018, Topa 2018). Their conclusions are broadly similar even if the periods and samples examined differ. There is evidence of a reduction of the ETR after the corporate income tax reform in 2014. Leverage was found to have a negative relation with effective taxation, while the sign of the other covariates varied with the specific ETR measure used. Our article contributes to this literature by studying the effective income taxation of Portuguese firms, using a large and detailed database in the period 2010-2019. It also presents an encompassing description of the Portuguese CIT framework, alongside a characterisation based on macro indicators and an international comparison.

3. The Portuguese Corporate Income Tax System

3.1. Information for Portugal

The reform of direct taxation implemented in 1989 in Portugal laid down the foundation of a modern tax system. In a nutshell, several schedular taxes on different types of income and an encompassing income tax were replaced by two taxes structured according to the nature of different groups of taxpayers: the personal income tax (PIT, Portuguese acronym: *IRS*) and the corporate income tax (CIT, Portuguese acronym: *IRC*). Since then, corporate taxation has been subject to changes but the initial underlying structure still prevails.

The CIT is generally levied on all corporate entities that are resident or have a permanent establishment in Portugal. These companies are taxable on their worldwide income. Taxes paid abroad on foreign-source income may be credited against CIT liability. The taxable income is based on the profit and loss accounts made under the applicable accounting framework, whose result is adjusted according to the rules set forth in the CIT code. Afterwards, eligible tax losses from previous years and tax benefits may be deducted from the taxable income. This is the so-called direct method for the

determination of taxable income.[2] Figure 1 schematically represents the determination of the amount to be paid under CIT in Portugal.

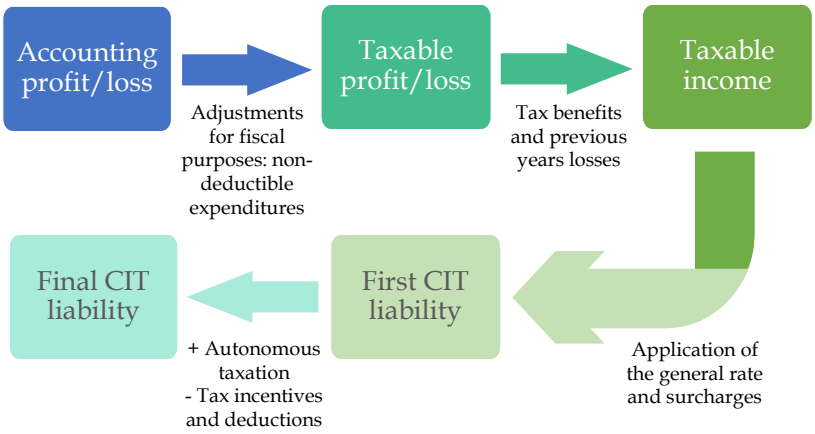


FIGURE 1: Determination of the corporate income tax in Portugal

Expenses are deductible for CIT purposes if they are documented and incurred by a company in order to generate or guarantee taxable income, but there are also non-deductible expenses. All fixed assets, except land, can be amortised for tax purposes. As a general rule, fixed assets are depreciated under the straight line method and the maximum and minimum rates are set in legislation. Since 2014, interest expenses are deductible up to the highest of (i) €1 million or (ii) 30% of EBITDA. Worldwide capital gains are regarded as regular income and subject to CIT. Losses considered for tax purposes generated as of tax year 2017 may only be carried forward for 5 years, but those incurred between 1 January 2014 and 31 December 2016, or after that year in case of small and medium-sized enterprises (SMEs[3]), may be carried forward for the next 12 years.[4] Such losses may only be offset up to a maximum of 70% of the taxable income. Tax losses carry-back is not allowed.

Tax incentives and deductions are considered in the determination of the final CIT liability, but the tax due cannot be less than 90% of the CIT a company would pay in

2. If the application of the direct method is not possible, the tax base is determined on the basis of circumstantial evidence - indirect method.

3. According to the Decree-Law 372/2007, the definition of micro, small and medium-sized enterprises (SMEs) is made according to the official EU classification by size categories, as described in the Recommendation 2003/361/EC of the European Commission of 6 May 2003. Following this definition, SMEs are firms which employ less than 250 persons and that have an annual turnover not exceeding €50 million or an annual balance sheet total not exceeding €43 million. Within the SME category, a small firm is defined as a firm which employs less than 50 persons and whose annual turnover or annual balance sheet total does not exceed €10 million. A micro-firm is defined as a firm which employs less than 10 persons and whose annual turnover or annual balance-sheet total does not exceed €2 million. All other firms not classified as SMEs are considered as large firms.

4. Due to the pandemic crisis, the supplementary budget of 2020 extended by two additional years the deduction of losses generated between 2014 and 2019 and to 12 years for losses generated in 2020 and 2021, regardless of the type of firm.

their absence. Examples of tax incentives under national legislation are the Madeira free-trade zone regime, contractual incentives granted for big industrial investment projects, tax credits and regimes for investment in general and, in particular, for R&D-related investment, corporate reorganisations, the urban property rehabilitation regime, among others. Firms may also qualify for a notional deduction in case of an equity injection by the shareholders (*Remuneração Convencional do Capital Social*), equivalent to 7% per year during 6 years (up to an injection of €2 million). This is meant to incentivise the financing of firms through equity and reduce the preferential treatment of debt in the CIT context.

To reach the final CIT liability, an autonomous taxation is also imposed separately on certain (listed) expenses. The autonomous taxation was introduced in 2001 with the aim of mitigating tax fraud and evasion and it is levied on expenses considered as not directly related to the companies' activity (undocumented expenses, related to ownership or use of passenger vehicles, bonuses to managers, among others).

In 2021, the general CIT rate in mainland Portugal is 21% (Table 1). A State surtax (*derrama estadual*) is levied on companies with higher taxable profits. A reduced rate of 17% applies to the first €25,000 of taxable income earned by SMEs. Also, if companies have a turnover smaller than €200,000 and a total balance sheet not exceeding €500,000, and fulfil other requirements, they can opt for a simplified taxation regime. Lastly, it is worth mentioning that the Autonomous Regions of Madeira and Azores have reduced general rates: currently, they stand at 20% and 16.8%, respectively.

		Rate (%)
General rate		21
SMEs (taxable income up to €25,000)[a)]		17
State surcharge ('*derrama estadual*') for companies with taxable income:[b)]	€1.5 million to €7.5 million	3
	€7.5 million to €35 million	5
	above €35 million	9
Local surcharge[c)]		1.5

TABLE 1. Corporate income tax rates in mainland Portugal, 2021 | Percentage

Notes: a) The reduced rate is applicable to the first €25,000 of taxable income, while for the amounts in excess the general rate applies.
b) For taxable income exceeding €1.5 million: i) when taxable income is higher than €7.5 million and up to €35 million, a rate of 3% is applied to the following €6 million taxable income, while a 5% rate applies to taxable income in excess of €7.5 million; ii) when taxable income is higher than €35 million, a rate of 3% is applied to the following €6 million taxable income, 5% to the next €27.5 million taxable income and 9% to taxable income above €35 million.
c) The maximum rate is 1.5% but the municipalities are allowed to levy a lower surtax on companies with a turnover not exceeding €150,000.

Although the architecture of CIT has remained stable since its inception, several changes were introduced over the years (Figure 2). The main changes stemmed from arguments of tax competition, the incorporation of rules approved at the EC/EU level, the general goal of promoting investment and the fight against tax evasion and fraud. Concerns over a possible loss of tax competitiveness as other economies decreased their rates justified successive reductions in the general tax rate from 36.5% in 1990 to 21% in 2021. However, a national surcharge was introduced in 2010, at that time as part

of a fiscal consolidation package aiming at accelerating the reduction of the excessive deficit and curbing public debt growth. Since then, progressivity increased substantially both through brackets and rates.[5] Progressivity in CIT may also stem from tax benefits, incentives and deductions. Given their high number and frequent changes, their overall impact is very difficult to assess. According to the report by the group mandated to analyse tax benefits in Portugal in 2019 (*Grupo de Trabalho para o Estudo dos Benefícios Fiscais* 2019), the number of tax benefits in force in the legal system exceeds 500[6], of which 121 refer to CIT. Further, the group concludes that, for more than 50% of these benefits, there is no quantified expenditure or it is not possible to quantify it on the basis of available information.

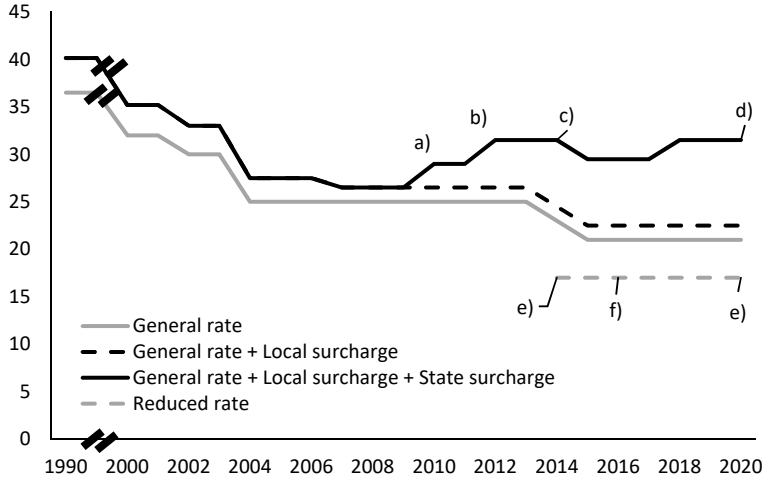


FIGURE 2: Evolution of statutory corporate income tax rates in mainland Portugal | Percentage

Notes: Regarding the State surcharge, the details in each legislative change were the following:
a) 2010 - 2.5% for taxable income above €2 million;
b) 2012 - 3% from €1.5 to €10 million taxable income and 5% above €10 million;
c) 2014 - 3% from €1.5 to €7.5 million taxable income, 5% from €7.5 to €35 million taxable income and 7% above €35 million;
d) 2018 - 3% from €1.5 to €7.5 million taxable income, 5% from €7.5 to €35 million taxable income and 9% above €35 million. No additional changes until 2021.
The reduced rate was introduced in 2014 and applies only to SMEs:
e) to the first €25,000 of taxable income in 2014-2015 and 2020-2021.
f) to the first €15,000 of taxable income in 2016-2019.

5. A tax system is progressive when the marginal tax rate is greater than the average tax rate. In this case, it is assessed at firm-level, having as reference taxable income. The progressivity of the Portuguese CIT system can be illustrated with some simple examples using the rates of Table 1. Consider that firm A is a SME and has a taxable income of €100,000 euros at the end of 2021. Up to €25,000 the applicable rate is 17% and the remainder of that limit will be taxed at 21% (general rate). Now, consider that firm B is a large firm with a taxable income of €40 million at the end of 2021. The general rate of 21% applies up to the limit of €1.5 million euros. The excess of that limit is divided in three parts: one equal to €6 million to which a State surcharge of 3% applies; another equal to €27.5 million to which a surcharge of 5% applies, and another equal to the taxable income exceeding €35 million to which a surcharge of 9% applies. For the sake of simplicity it was excluded in these examples, but a local surcharge is added at the aforementioned rates (0% to 1.5% of taxable income depending on the municipality where the firm is located).

6. This high number does not include benefits related to municipal taxes or decided by local authorities, nor preferential non-standard VAT rates (reduced and intermediate rates).

Regarding CIT administration, the accounting and tax periods coincide with the calendar year. Corporate taxpayers must electronically file a tax return for a given year in the first half of the following year. The tax liability is computed by the taxpayer (self-assessment). Companies must make a prepayment of CIT during the tax year. The prepayment is 80% of the preceding tax year's CIT liability for companies whose turnover does not exceed €500,000. For companies with a turnover in excess of this amount, the prepayment is 95% instead. The prepayments must be done in three instalments: July, September and December. In addition, companies must make a special prepayment which is meant to function as a minimum tax and is gradually being eliminated. An additional prepayment applies to firms subject to the State surcharge, made in three instalments and simultaneously with the ordinary prepayments. All the prepayments are creditable against the taxpayer's final CIT liability.

In terms of revenue, CIT is the third biggest tax in Portugal. On average, over the last two decades, it represents 8.7% of the tax burden, which compares to 23% and 16.9% in the cases of VAT and the personal income tax, respectively. Its weight as a ratio to GDP is relatively small when compared with the two other main taxes, 3% on average over 2000-2020, and it has been fairly stable, in spite of the several changes to the tax code, in particular regarding rates. The relative stability of the CIT revenue to GDP ratio over time is also observed for the EU average (Nicodème *et al.* 2018).

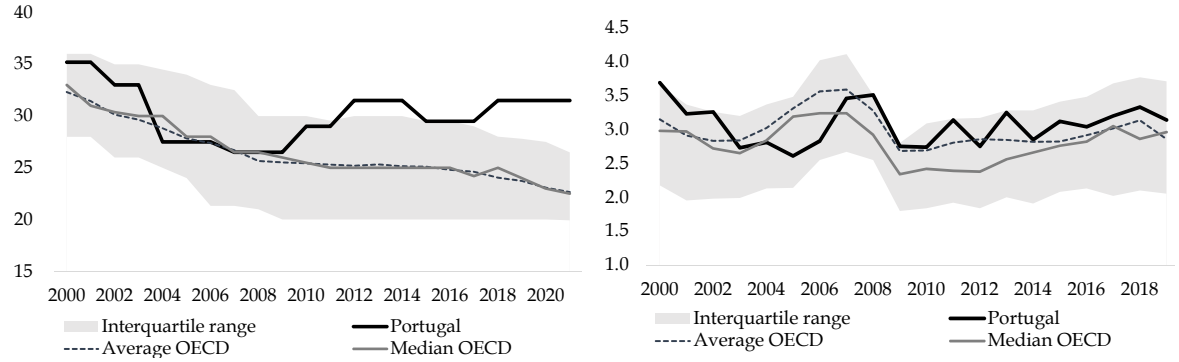
3.2. International comparison

In OECD countries, the decline in CIT rates has been a steady and widespread trend in the last two decades (Figure 3 - Panel A). For countries with lower tax rates (percentile 25), the bulk of the adjustment seems to have occurred up to the onset of the 2008/2009 financial crisis. The same happened for countries with higher rates (percentile 75), although in this case there is also a noticeable acceleration in the reduction after 2015, leading to further convergence in CIT rates across countries. Portugal emerges as a different case. The reduction in the general rate gained momentum after 2000 but it was more than offset by the introduction and further increase in the State surcharge for higher taxable income brackets. As a result, Portugal stands out as one of the countries with higher CIT top statutory rate: above or equal to percentile 75 since 2012 and in the top 3 since 2018.

In terms of CIT receipts as a percentage of GDP, Portugal stood in the last decade systematically above the OECD average, but below percentile 75 (Figure 3 - Panel B). This difference was even widening in the more recent period, which contrasts with tax rates' developments. The fact that the Portuguese CIT system became more progressive with the introduction and increased importance of the State surcharge may partly explain this result. Another possible explanation may be related to the relative generosity of tax benefits, incentives and deductions. Other reasons can be connected to differences in taxable bases and in the size of the corporate sector among countries (Nicodème *et al.* 2018).

For the euro area countries, it is possible to have an estimate on the magnitude of the joint effect of the rates' progressivity and tax benefits, incentives and deductions.

The European Commission regularly publishes an implicit tax rate on corporate income based on National Accounts data. It essentially uses as a proxy for taxable income the net operating surplus of financial and non-financial corporations, adding net interest, rents, dividends and insurance property income. The results for 2019 are depicted in Figure 4. For all countries except Slovenia, the implicit tax rate is smaller than the top statutory corporate income tax rate. Portugal has one of the highest values in both measures, but the difference between them is relatively small: around 25%, the seventh smaller in this group of countries.



(A) Top statutory CIT rate, 2000-2021 | Percentage (B) CIT receipts, 2000-2019 | Percentage of GDP

FIGURE 3: Top statutory CIT rate and CIT receipts - Portugal and OECD countries

Source: OECD - Tax database.
Notes: The shaded area corresponds to the interquartile range, i.e., to the difference between 75th and 25th percentiles of the respective distributions of OECD countries. The reported top statutory rate is labelled as "combined CIT rate" by the OECD. It takes into account the basic combined central and sub-central government statutory CIT rates. Sub-central government CIT rate shows the representative municipal rate. The State surtax is included.

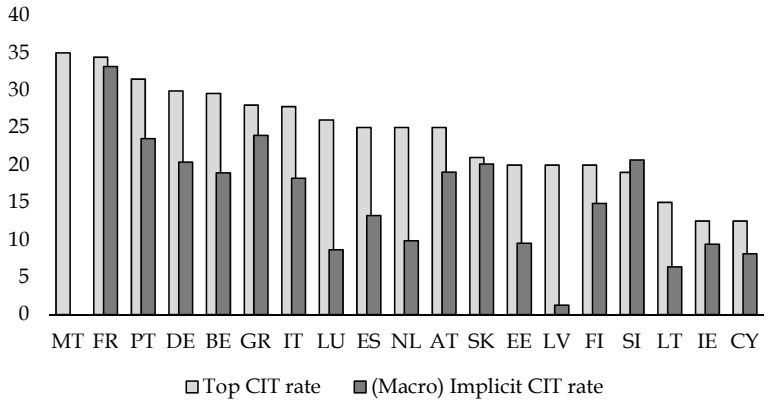


FIGURE 4: Top statutory corporate income tax rate (including surcharges) and (macro) implicit tax rate on corporate income - Euro area countries (2019) | Percentage

Source: European Commission - Taxation data.
Note: Data for the implicit tax rate in Malta are not available and for Luxembourg the last available year is 2018.

4. Database and variables definition

4.1. The measure of effective tax rate (ETR)

As stated in Section 2, the micro backward-looking methodology of ETRs is especially useful to examine differences in effective taxation for distinct types of firms. These ETRs are broadly defined as the ratio of income tax expenses to pre-tax income. However, the choice of the most appropriate indicator is not obvious and there are several alternatives in the literature, regarding both the numerator and the denominator.

Firms disclose income tax expenses split into two components: current and deferred. The latter relates to past events, like losses or the revaluation of assets, which have an impact on future tax liabilities. As such, we chose not to consider the deferred component and focus only on the current portion of tax expenses. Regarding autonomous taxation, in our database it is separately reported by some firms, while others include it in the current component of tax expenses. Thus, we chose to consider it in the numerator of our metrics of ETRs.

Regarding the denominator, the literature presents numerous alternatives that range from turnover to income before taxes (see, for instance, Lazăr 2014 for a discussion). The most commonly used denominator is EBT, resulting in an ETR that allows some comparison with statutory tax rates and with the implicit tax rate on corporate income based on National Accounts. At the margin and for a firm without preferential tax treatments, using EBT in the denominator should result in an ETR equal to the statutory tax rate. However, to investigate the relation of firm-specific characteristics with their tax burden, the informational content of a ratio with EBT may not be the most appropriate. If both the numerator (income tax expense) and the denominator (income) reflect behavioural responses related to tax preferences, then any systematic variation in ETRs because of firms' tax planning activities will not be properly detected. For instance, *ceteris paribus*, a higher amount of debt leads to higher interest expenses, resulting in lower tax expenses but also in a lower EBT, which, in turn, may lead to an increase in the ETR of that firm. Therefore, the economic literature using micro data tends to include also other indicators in the analysis.

An alternative denominator that excludes several tax planning–induced distortions is gross operating profits, i.e., EBITDA. A ratio computed with EBITDA has the advantage of isolating in the numerator the tax-minimising effect of deductible items, as interest expenses and depreciations. Consider, for example, the situation in which a firm relies more heavily on debt financing rather than equity financing. Given that interest expenditure is tax deductible while dividends are not, firms with higher leverage are expected to pay relatively lower taxes. An ETR computed with EBITDA will adequately capture this effect. Thus, focusing on EBITDA enhances comparability across firms and sectors with different financing structures and capital intensity.[7] A caveat of using the

7. Using EBITDA as the denominator does not completely account for all tax planning–induced distortions. For instance, it does not take into account more sophisticated tax planning-strategies developed by multinational firms in order to lower their effective tax burden, such as changes in transfer pricing or

EBITDA is that the corresponding ETR levels will be lower that those computed using EBT and should not be compared with statutory rates. If we define a firms' income as the residual value available to remunerate shareholders, after remunerating all other productive factors, then EBITDA does not correspond to this definition of income and tends to introduce a downward bias in the levels of the resulting ETRs.

Driven by these considerations, we follow Nicodème (2002) and Lazăr (2014) and favour using EBITDA in the denominator (ETR2) when comparing sectors and firms and in the regression analysis. We also present selected evidence based on EBT (ETR1), particularly as it is more comparable to statutory rates. However, some caution is still warranted in the comparisons of ETR1 with statutory tax rates. First, EBT is merely a proxy for taxable income, which is not reported in firms' financial statements. Second, two additional factors that work in opposite directions are worth mentioning: tax incentives and deductions, which reduce the ETR *vis-à-vis* statutory rates, and autonomous taxation, which increases it.

4.2. Description of the database

Our firm-level balance sheet data is based on annual information for Portuguese firms reported under Simplified Corporate Information (*Informação Empresarial Simplificada*, Portuguese acronym: IES). The IES follows the new accounting standards system from 2010 to 2019, and it covers virtually the universe of Portuguese non-financial corporations.[8] The universal coverage of IES emerges from its nature, as it is the system through which corporations report mandatory information to the tax administration and statistical authorities. Tax-related information is, however, less encompassing than that provided through other reporting mechanisms (e.g., *Modelo 22*). Under IES, firms provide detailed annual balance sheet, profit and loss accounts. It further contains information on firms' characteristics such as number of employees, age and main sector of economic activity according to the Portuguese industrial classification Revision 3 – *Classificação Portuguesa das Actividades Económicas* (CAE).

Some filters were imposed on the data to eliminate erroneous, inconsistent or missing observations. Firstly, the analysis was restricted to firms for whom there was information available for a set of key variables, such as age, regional location and sector of activity. Secondly, we further restricted the sample to firms with strictly positive values for production, intermediate inputs, gross value-added, employment, labour costs and total assets. Moreover, the analysis focuses only on firms located in mainland Portugal. The Autonomous Regions of Madeira and Azores have distinct statutory tax rates and the existence of the Madeira free trade zone could influence the results.

Further sample restrictions emerge from the definition of our main variable of interest: the ETR. As detailed above, we define the ETR as a ratio between tax expenses and a pre-tax income metric. Negative figures in either the numerator or

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the strategic choice of location of intangible assets (e.g., Beer *et al.* 2020). The information available in our database does not allow to control for these practices.

8. IES registry takes firms individually, regardless of whether they are part of an economic group or not.

the denominator result in measures of ETR that lack a proper economic interpretation. Hence, as often done in this strand of literature, these observations were excluded from the analysis, even if restricting the sample to firms with positive income and taxes may induce some selection issues. In addition, very small values of the denominator can result in ratios of ETR of unreasonable magnitudes, so only firms that display profits larger than their tax liability are included. In practice, we limited our sample to firms whose ETR lies between 0% and 100% and have strictly positive pre-tax profits and tax expenses. This restriction implies dropping around 37.5% of observations in the whole period, of which 87.5% refer to micro firms. However, we still retain information representing approximately 70% of total assets, turnover, gross value-added and employment. Moreover, in each year, firms in the final sample account for an average of 90% of total CIT paid by non-financial corporations in Portugal and 70% of overall CIT collected by the government (Figure 5).

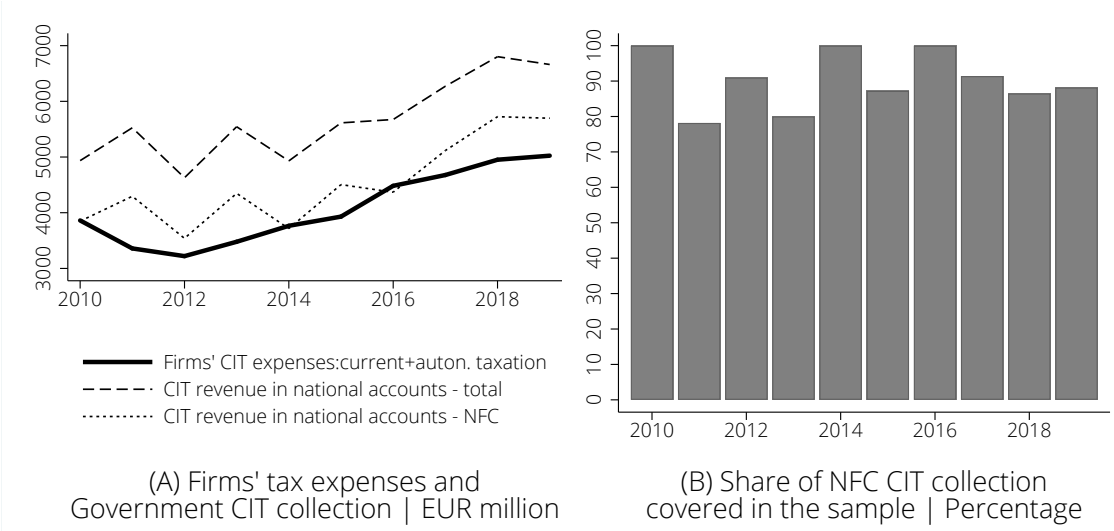

FIGURE 5: Final sample firms' tax expenses and government revenue from the CIT

Sources: Own calculations based on IES and Statistics Portugal.
Note: NFC stands for non-financial corporations.

The final sample is an unbalanced panel of 369,526 distinct firms with 1,564,579 observations. On average, firms show up in the sample 4.2 times over 2010-2019. Approximately 23.7% of firms show up only once, whereas 6.7% are followed throughout the ten years. The number of firms in the final sample ranges from 123,217 in 2012 to 193,465 in 2019.

A preliminary analysis of our IES sample highlights a number of well-known features of the Portuguese economy. The sample is clearly dominated by micro firms[9], which represent more than 80% of observations in 2010-2019, but account for less than 16% of total income tax expenses (Figure 6). In contrast, large firms account for only 0.5% of the sample but are the most relevant taxpayers when it comes to CIT, making up for

9. For more details on the definition of the size categories, see footnote 3.

almost 45% of total income taxes paid in the period. Regarding sectoral classification[10], the majority of observations refers to firms in the services' sector (more than 70%). Manufacturing and construction represent around 13% and 11% of total observations, respectively. In terms of age, the average stands at 14.4 years. Firms with up to 5 years of activity represent 27% and firms with more than 20 years account for 23% of the total sample. These features remained virtually unchanged throughout the 2010-2019 period.

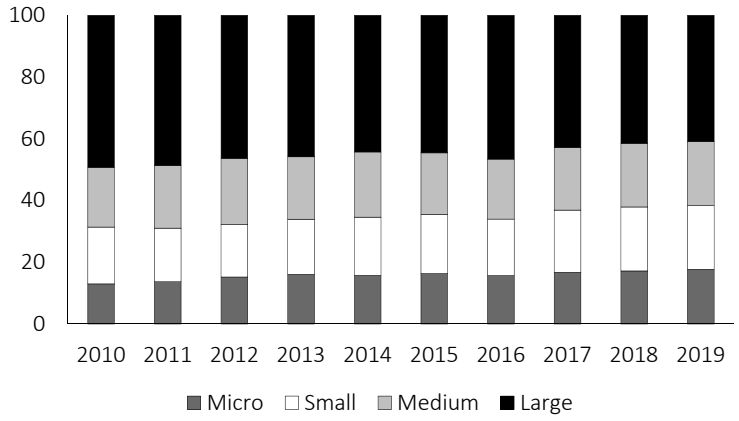

FIGURE 6: Percentage shares in total income tax expenses, by firm size category
Note: For more details on the definition of the size categories, see footnote 3.

There is wide variability across firms and sectors as regards important dimensions from a tax perspective (Figure 7). Firms operating in the utilities' sector feature the highest levels of profits (measured as EBITDA to total assets) and of labour productivity (proxied by gross value-added per worker). Along with firms in the primary sector, utilities' firms rank the highest as regards the leverage ratio (financial debt as a percentage of total assets) and capital intensity (share of tangible assets in total assets). In contrast, firms in the construction sector feature the lowest leverage ratio (following a sharp deleveraging process in the early 2010s) and are considerably less capital-intensive than their counterparts in other sectors. Further differences can also be noted across size categories and age groups. Micro firms feature the lowest leverage ratio and their share of tangibles in total assets is also the smallest across size categories. Regarding age, more mature firms appear to have, on average, lower profitability (scaled by total assets) and comparatively higher debt and capital intensity ratios.

10. The broad sectors are defined according to the sections of CAE rev.3. The primary sector comprises sections A (agriculture, forestry and fishing) and B (mining and quarrying) of CAE. Manufacturing refers to section C. The sector of utilities includes sections D and E and construction refers to section F. Services comprise all sections of CAE from G onwards.

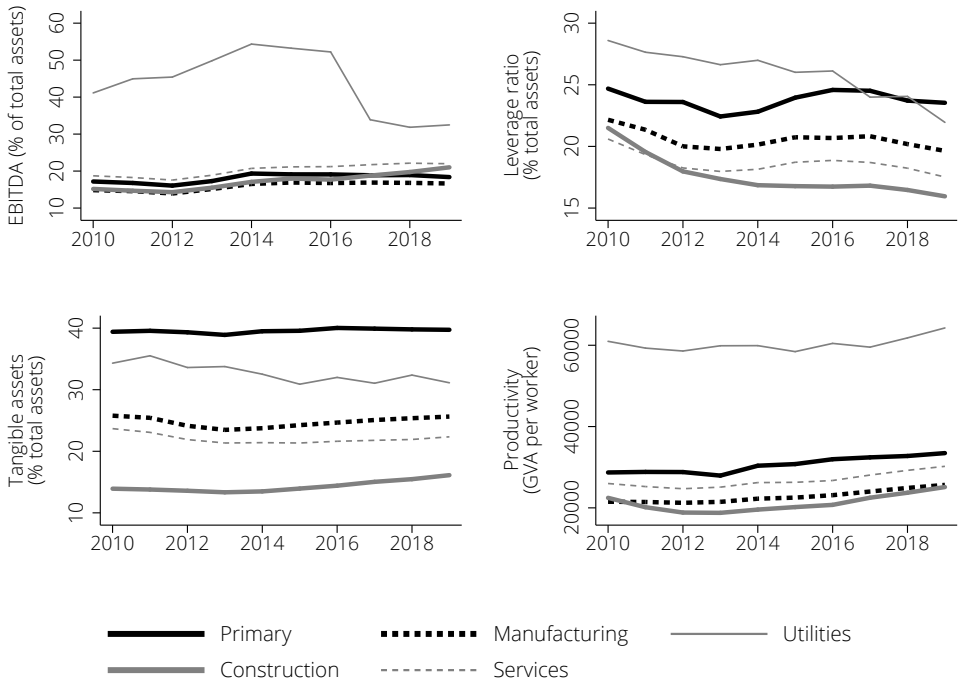

FIGURE 7: Characterisation of firms by sector of activity, 2010-2019
Note: For a definition of the sectors of activity, see footnote 10.

5. Exploratory analysis

This section provides an initial descriptive analysis of corporate effective income taxation using the database and metrics described in the previous section. In 2010, the average ETR1 (as measured on the basis of EBT) was 23.6%, and its distribution was fairly concentrated at relatively low levels (Figure 8). It stood below an average "weighted" statutory rate obtained by weighting the existing rates by the share of firms to which they apply. In 2012, the average ETR increased, coinciding with the lowering of the threshold for income subject to the State surcharge, together with an increase in the rates applicable to higher profits. In 2014, the general statutory rate was cut from 25 to 23%, while a reduced rate applicable up to a certain taxable income threshold was introduced for SMEs. Since then, the general rate was further brought down, to 21%, but the progressivitiy via the State surcharge increased. Hence, there was a gradual reversal of the previous increase in the effective tax burden and the average ETR broadly converged to the "weighted" statutory rate, standing at around 25% in recent years. Overall, the changes implemented in the last decade led to an increase in firms and taxable income subject to special rates and the distribution of ETR1 shifted to the right.

Panel C of Figure 8 provides a comparison of the "weighted" statutory tax rate and ETRs as computed on the basis of EBT and EBITDA. The ETR1 and ETR2 measures exhibit essentially the same evolution over time, though the former was more volatile in 2012-2014 reflecting the fact that firms' EBT dropped to a greater extent than EBITDA in 2012.

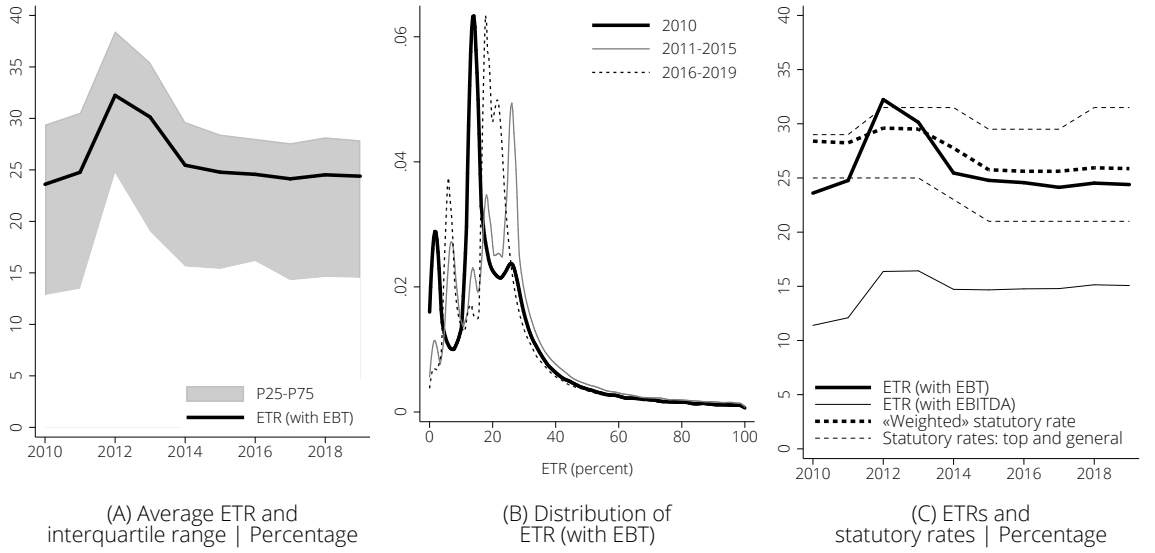

FIGURE 8: Effective tax rates: levels and distribution

Notes: The "weighted" statutory rate corresponds to an average of the different statutory rates (reduced, general, and general plus surcharges) weighted by the share of firms subject to each bracket in each year. EBT was used as a proxy of taxable income in the computations. Both the top and the "weighted" statutory rates include the representative local surcharge of 1.5%.

Taking EBITDA as the denominator when computing ETRs (ETR2) improves comparability across firms and sectors that feature distinct financing structures and capital intensity. ETR levels computed as such differ considerably across sectors and firms mirroring differences in various dimensions (Figure 9). Firms operating in services and in construction (which together make up for over 80% of the firms in our sample) face the highest tax burden along 2010-2019. In contrast, the lower levels of effective income taxation are observed in the primary sector. However, over the last decade, the evolution of the average ETR2 was essentially similar across sectors. Differences in the tax burden across size and age categories are less prominent[11] (Panels B and C of Figure 9). Still, it is worth highlighting that micro firms and those in the lowest age cohort seem to have been more affected by the 2012-2014 developments. Younger firms also feature, on average, a higher ETR than their older counterparts.

All in all, combined evidence in this and the previous sections suggests that the effective tax burden tends to be higher in sectors, size categories and age groups in which the shares of financial debt and tangible assets in total assets are lower. Similarly, higher debt and capital-intensity ratios appears to be associated with lower ETR as measured taking EBITDA in the denominator (ETR2). Indeed, our data suggests a decline in the effective tax burden as one moves up along the distributions of the leverage and

11. The results of a simple regression of firms' ETR2 on a set of broad sector dummies reveals that the average differences in effective taxation between sectors over this period are statistically significant. The same result applies to firms' size categories and age groups but the magnitude of the estimates is much smaller.

capital intensity ratios (Figure 10). The relation between the ETR and firms' assets or productivity is less clear-cut and the inspection of Figure 10 suggests the possibility of non-linear effects. These associations are further explored in the next section.

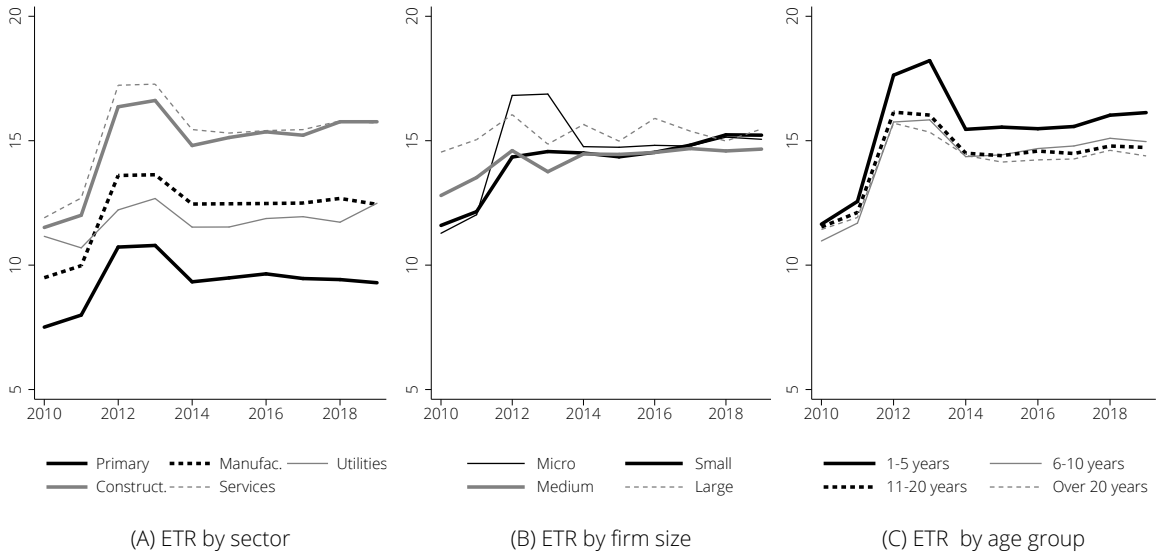

FIGURE 9: Effective tax rates (ETR2) across sectors, size categories and age groups | Percentage

Notes: Effective income taxation measured as the ratio of current income tax expenses (including autonomous taxation) to EBITDA (ETR2). For more details on the definition of the size categories, see footnote 3. For a definition of the sectors of activity, see footnote 10.

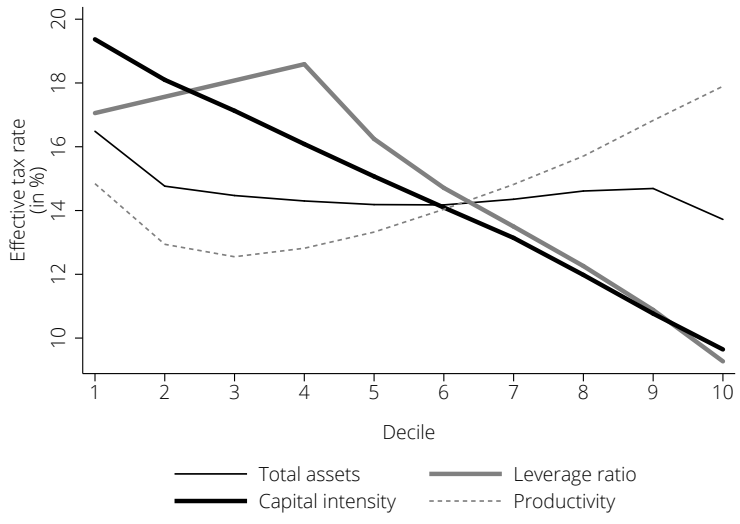

FIGURE 10: Effective tax rates (ETR2) across the distributions of some firms' characteristics

Notes: ETR2 is the ratio of current income tax expenses (including autonomous taxation) to EBITDA. The leverage ratio is measured as financial debt over total assets, capital intensity is computed as the book value of tangible assets in percentage of total assets, and labour productivity is defined as gross value-added per worker.

6. Regression analysis

The exploratory analysis of the previous sections is strongly suggestive of the key results emerging from the data. In this section, we further test differences in ETRs among Portuguese firms in a multivariate framework to isolate several aspects considered before. As mentioned, regression results are obtained only for firms with both strictly positive pre-tax incomes and tax expenses. Moreover, these regression estimates result from a simple empirical model, thus no causal inference can be drawn from them and extrapolation for the whole economy and for other ETR metrics should be avoided.

Motivated by the related literature on corporate effective taxation and by the descriptive analysis of the previous sections, we estimate the following equation at the firm-year level for the period 2010-2019:

$$Y_{it} = \beta_0 + \beta_1 size_{it} + \beta_2 size_{it}^2 + \beta_3 lever_{it} + \beta_4 capint_{it} + \beta_5 prod_{it} + \beta_6 prod_{it}^2 + \gamma_i + \gamma_t + \varepsilon_{it},$$

where Y_{it} is the dependent variable of interest, the effective tax rate of firm i in year t. $size$ is firm size proxied by total assets, $lever$ is the leverage ratio measured as financial debt over total assets, $capint$ is capital intensity defined as the book value of tangible assets scaled by total assets, and $prod$ is labour productivity measured as gross value-added per worker. $size^2$ and $prod^2$ are the quadratic terms of size and productivity, respectively, which were included to capture possible non-linear relations. All covariates were logarithmised. γ_i are firm fixed effects and γ_t are year fixed effects. ε_{it} is the error term. Robust standard errors are clustered at the firm-level. As an outlier treatment, we winsorised the top and bottom 1 percentiles of the covariates.

Table 2 presents our baseline results using ETR2 as the dependent variable, i.e., the ratio of current tax expenses (including autonomous taxation) over EBITDA. Including deferred income taxes expenses in the numerator makes almost no difference in the estimated relations between effective income taxation and firms' characteristics in Portugal.[12] The measure ETR1, which uses EBT in the denominator, does not take fully into account to what extent firms can minimise their tax liabilities with actions that operate through the tax base, given that interest payments and depreciations are considered in the denominator. Hence, we opted to focus the regression analysis of this section on ETR2. However, the point estimates of these regressions should not be interpreted as the causal effect of the covariates in a firm´s tax burden, as they represent only correlations with this specific ETR metric.

Our baseline estimates for the total economy are reported in column (1) of Table 2. The results suggest the existence of a non-linear relationship between firms' size and effective taxation: as firms grow, they experience an increase in the ETR but at a decreasing rate and, after a certain point, a further increase in size can even be associated with smaller ETRs. The turning point of the marginal effects occurs at the 60th percentile of the size distribution. The positive linear effect probably reflects the progressivity

12. All regressions were also run using vectors of firm, sector (at a 2-digit level), district and year fixed effects and the estimates remain unchanged. The full set of detailed results is available from the authors upon request.

of the Portuguese CIT system as described in Section 3. A rational for the negative quadratic coefficient is that the largest firms are likely to have greater scope for tax planning and for the adoption of accounting practices that minimise their effective taxation.

The opposite results are found for labour productivity: a negative linear coefficient and a positive quadratic coefficient, with a turning point at the 40th percentile. For the negative association at the lower part of the productivity distribution, it can be argued that as firms become more productive they have greater resources to engage in tax planning and organise their activities to achieve optimal tax savings. The positive quadratic term may reflect the fact that there is a limit for what firms can do to reduce their tax burdens, no matter how productive they are.

Firms' financing and investment decisions are likely to be correlated with their ETRs because the tax code stipulates a differential treatment to equity versus debt financing and to current versus non-current assets. Given that interest expenditure is tax deductible up to certain threshold, while dividends are not, and capital injections by shareholders benefit only from a limited notional deduction, firms with higher leverage are expected to have lower effective taxation. The negative and significant relation of $lever$ with ETR2 confirms this hypothesis. For the capital intensity measure ($capint$), the results also indicate that it has a negative association with ETR2. This finding is consistent with the preferential tax treatment for firms that invest in their fixed assets, given the deductibility of assets' depreciation and the tax incentives for investment provided by law.

There is evidence in the literature that firms' effective taxation can also depend on their sector of activity (e.g., Nicodème 2002). First, specific sectors may benefit disproportionately from some preferential tax treatments. Second, some attributes of firms, like size or capital intensity, can vary systematically by sector. In fact, the analysis of the previous two sections revealed important differences in terms of both firms' characteristics and ETR levels by sector. Hence, individual regressions were estimated by broad sectors in order to better understand if the associations obtained for the total sample are still observable. The results are reported in columns (2) to (6).

In general, the signs and magnitudes of the estimates do not vary considerably across sectors. The coefficients associated with leverage and capital intensity are always negative and statistically significant for all sectors. The estimates of the other covariates change more by sector of activity. In the primary sector, the relation of ETR2 with firms' dimension is not statistically significant, but both coefficients of productivity are sizeable. The effective taxation of firms in the utilities' sector has a strong association with size and productivity. However, the sample of firms in this sector is small, which can make the estimates more sensitive to extreme observations. On the contrary, in the construction sector, the linear coefficient of size is statistically non-significant. Comparing the estimates of the regressions for the manufacturing industry and for services, there is a higher association of ETR2 with firms' size and productivity in the manufacturing industry.

	Total (1)	Primary (2)	Manufacturing (3)	Utilities (4)	Construction (5)	Services (6)
$size$	1.445***	-0.958	3.939***	8.317***	-0.735	0.994***
	(0.197)	(0.853)	(0.500)	(3.185)	(0.588)	(0.244)
$size^2$	-0.058***	0.009	-0.172***	-0.354***	0.062**	-0.039***
	(0.008)	(0.035)	(0.020)	(0.125)	(0.025)	(0.010)
$lever$	-0.578***	-0.548***	-0.680***	-0.569***	-0.659***	-0.546***
	(0.010)	(0.038)	(0.026)	(0.132)	(0.031)	(0.012)
$capint$	-1.202***	-1.493***	-1.472***	-1.024***	-1.112***	-1.172***
	(0.014)	(0.071)	(0.042)	(0.260)	(0.039)	(0.016)
$prod$	-5.672***	-11.875***	-9.975***	-10.548**	-4.346***	-4.878***
	(0.310)	(1.018)	(1.024)	(4.500)	(0.908)	(0.366)
$prod^2$	0.294***	0.661***	0.568***	0.596***	0.223***	0.242***
	(0.016)	(0.051)	(0.052)	(0.219)	(0.046)	(0.018)
N	1,477,125	55,234	196,268	6,181	164,058	1,052,860
Adj. R^2	0.519	0.515	0.523	0.573	0.452	0.519

TABLE 2. Effective income taxation (ETR2) and firms' characteristics, total and by broad sector of activity, 2010-2019

Notes: The dependent variable is ETR2 defined as the ratio of current income tax expenses (including autonomous taxation) over EBITDA. For a definition of the sectors of activity, see footnote 10. All regressions include a constant and the vectors of firm and year fixed-effects. All covariates are in log form. See the main text for more details. Standard errors in parenthesis are clustered at the firm level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

7. Concluding remarks

This article analyses corporate income taxation in Portugal. The top corporate income tax (CIT) statutory rate in Portugal is very high when compared to international peers, particularly in the most recent period: Portugal stood in the top 3 amongst OECD and euro area countries in 2019. Presently, the top statutory rate is 31.5% and the degree of progressivity of CIT increased substantially in the last decade with the introduction and further reinforcement of a State surcharge. This offset the reduction of the general rate that was aligned with the international trend. Based on macro data, the implicit tax rate obtained using a National Accounts proxy for taxable income reached 23.5% in 2019. This value is around 25% below the top statutory rate, which provides a broad estimate for progressivity stemming from both the rate structure and tax benefits, incentives and deductions. Their overall impact in collection is very difficult to assess, given their high number and frequent changes. In terms of revenue, although CIT is the third biggest tax in Portugal, its weight in total tax burden or GDP is relatively small and rather stable, as, on average, in other EU countries (8.7% and 3%, respectively, over the last two decades).

The recourse to a large micro database allows a more detailed characterisation of CIT in Portugal in the 2010-2019 period. The analysis is based on the observed firm-level ETR, broadly defined as the ratio of income tax expenses to a metric of pre-tax profits. In this article we compute two measures of firms' ETR: using either EBITDA or EBT in the denominator. The first measure is more appropriate when investigating the relation with firms' characteristics as it isolates the effects of preferential tax treatments related to debt and investment in the numerator. The second measure is more suitable for benchmarking against statutory tax rates and macro implicit tax rates. Still, as EBT is merely a proxy for taxable income, caution is warranted in such comparisons. In the

more recent period, the average micro-based ETR (using EBT) supported by Portuguese non-financial firms hovers around 25%, slightly below a weighted average of statutory rates. Some well-known features of CIT collection in Portugal are also evident in our results. Micro firms, which represent more than 80% of observations, account for less than 16% of total tax expenses in the sample. In contrast, large firms, which account for only 0.5% of the sample, are the most relevant taxpayers, making up for almost 45% of total income taxes paid.

In the literature, there is ample evidence of a relation between effective corporate income taxation and different firms' characteristics but results are not consensual. Our regression estimates, which have no intention to establish causality, suggest the existence of a negative association between ETRs and both financial leverage and capital intensity. This confirms expectations, given that interest outlays and depreciation of fixed assets have a favourable tax treatment. Regarding firms' size and labour productivity, the results point to the existence of non-linear relations with ETR. The fact that the largest firms may have more capacity to tax planning that minimises their tax burden can work as a rationale for this result. In spite of the different levels of ETRs across sectors, the estimates do not vary considerably by sector of activity.

Understanding the functioning of CIT systems is crucial in a world marked by globalisation and digitalisation, where tax competition and firms' tax planning practices have been gaining prominence. A major step towards limiting international tax avoidance was taken in 2013 by the OECD with the Base Erosion and Profit Shifting (BEPS) initiative. The BEPS process was an enormous effort and culminated with a multilateral convention signed by 89 countries between July 2017 and August 2019 (with the notable exception of the United States). Many of the OECD BEPS proposals have been implemented at the EU level through the Anti Tax Avoidance Directive (ATAD), with some concrete application to Member States from 2019 onwards. Very recently, an historical agreement on a minimum tax deal was adopted at the G7 and G20 meetings. The proposal is anchored in two pillars: i) The largest and most profitable multinationals will be required to pay CIT in the countries where they operate and not just where they have their headquarters (based on formulary apportionment); ii) A global minimum rate will be set that ensures multinationals pay corporate taxes of at least 15% in each country they operate. The actual implementation of this deal will certainly limit tax avoidance and reduce tax competition and the associated race to the bottom, but ensuing negotiations and extension to all firms will most likely be a lengthy process. Still, a minimum CIT rate of 15% is rather low and illustrative of the sort of challenges that Portugal's corporate taxation will face in the near future.

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